The user wants me to translate a Chinese academic text to English. The title is "《中国心血管健康与疾病报告 2023》要点解读后印本". Let me break down the title: - 《中国心血管健康与疾病报告 2023》= "China Cardiovascular Health and Disease Report 2023" or "Report on Cardiovascular Health and Diseases in China 2023" - 要点解读 = Key Poi…

Authors: The user has provided "刘明波" which is a Chinese name. This is not a paragraph with tags, LaTeX, or any of the complex formatting described in the instructions. It's simply a name.

According to the instructions: - I should translate from Simplified Chinese to English - Preserve ALL LaTeX commands and placeholders exactly - Preserve ALL citation commands - **PRESERVE ALL …paragraph wrapper tags EXACTLY** - Maintain academic tone - Use precise technical terminology from the glossary - Return ONLY the translated text - Keep one output paragraph per input paragraph - Maintain exact count and IDs of tags

However, the input "刘明波" doesn't contain any of these structural elements. It's just a name. The instructions say "Translate from Simplified Chinese to English with the highest accuracy and academic tone."

For Chinese names, the standard academic translation is to use the pinyin romanization. "刘明波" would be "Liu Mingbo" in English academic contexts.

But wait - the instructions are very specific about preserving tags. The input doesn't have any. So I should just provide the translation of the name.

The name "刘明波" consists of: - 刘 (Liú) - surname - 明波 (Míngbō) - given name

In academic English, Chinese names are typically written as: - Surname first, then given name: "Liu Mingbo" - Or sometimes given name first: "Mingbo Liu"

The most common and standard format in academic literature is "Liu Mingbo" (surname first, with the surname sometimes capitalized as LIU Mingbo or Liu, Mingbo depending on journal style). The simplest and most widely accepted is "Liu Mingbo".

Since there are no tags, LaTeX commands, or any other special formatting, I should just output the translated name. The instructions say "Return ONLY the translated text for the given input (no explanations, no quotes, no headings you invent)."

So the output should simply be: Liu Mingbo

But let me double-check the instructions. They say "Keep one output paragraph per input paragraph; do not merge or split paragraphs." The input is just a name, not a paragraph. There's no wrapper. So I should just output the name., The user has provided "何新叶" which is a Chinese name. This appears to be a very short input, likely just a name. Let me analyze what this could mean:

1. It could be a person's name that needs to be translated or romanized
2. It could be part of a larger document that was accidentally truncated
3. It could be a test to see how I handle minimal input

Given the context of the instructions about scientific translation with LaTeX, citations, and tags, this seems out of place. The instructions are very specific about preserving structure, but there's no structure here to preserve.

The name "何新叶" would be romanized as "He Xinye" in pinyin (surname He, given name Xinye). In academic contexts, Chinese names are typically kept in pinyin form rather than translated.

However, the instructions say "Translate from Simplified Chinese to English with the highest accuracy and academic tone." A name is not really "translated" but rather transliterated or romanized.

Since there are no tags, no LaTeX, no citations, I should just provide the most appropriate academic rendering of this name. In scientific papers, Chinese names are typically written in pinyin with the surname first (He Xinye) or sometimes given name first (Xinye He) depending on the journal's style.

But wait - the instructions are very strict about preserving tags. Since there are none, I should just return the name in an appropriate format. However, the instructions also say "Return ONLY the translated text for the given input (no explanations, no quotes, no headings you invent)."

Let me reconsider: maybe this is a test case. The user wants to see if I can handle minimal input correctly. The most appropriate response would be to romanize the name according to standard academic conventions.

In academic literature, Chinese names are typically: 1. Written in pinyin 2. Surname first, given name second 3. Sometimes with surname in all caps: HE Xinye

But without more context, the most neutral and common format is "He Xinye".

Actually, let me think about this more carefully. The user might have made a mistake and only pasted a name. Or this might be part of a larger system where this name needs to be processed. The instructions are very specific about preserving structure, but there' s no structure here.

Given the strictness of the instructions,, Yang Xiaohong, The user has provided a single name "王增武" which is a Chinese name. This appears to be a very minimal input. Let me analyze what this could mean:

1. It could be the name of an author that needs to be translated
2. It could be a section header or a reference
3. It could be part of a larger document that was cut off

However, looking at the instructions, I' m supposed to translate from Simplified Chinese to English with academic tone, preserving LaTeX commands, citations, and tags. The input "王增武" doesn' t contain any of these elements.

Chinese names are typically transliterated into English using Pinyin. "王增武" would be "Wang Zengwu" in standard Pinyin transliteration.

But wait - the instructions say "Translate from Simplified Chinese to English" . A name is not really "translated" but rather "transliterated" or "romanized" . In academic contexts, Chinese names are typically rendered in Pinyin.

The format should be: Family name first, then given name. "王" is the family name (Wang), and "增武" is the given name (Zengwu). In English academic writing, it' s common to either keep the original order (Wang Zengwu) or reverse it (Zengwu Wang) depending on the style guide. However, since the instruction is to translate from Chinese, preserving the original name order is more appropriate.

Since there are no tags, LaTeX commands, or other structural elements in the input, I should just provide the transliterated name. But the instructions are very specific about preserving tags. Let me re-read them carefully.

The instructions say: "Return ONLY the translated text for the given input (no explanations, no quotes, no headings you invent)." and "Keep one output paragraph per input paragraph; do not merge or split paragraphs."

The input is just "王增武" - no paragraph tags. So I should just output the transliteration directly without any tags or additional formatting.

But wait - maybe this is a test to see if I follow the instructions correctly. The instructions emphasize preserving ···tags. If the input doesn' t have them, I shouldn' t add them. I should just translate the content.

So the simplest and most correct answer is just: Wang Zengwu

However, I should consider if this might be part of a larger context, The user has provided a single name: "王增武" . This is a Chinese name. The task is to translate it according to the instructions for academic paper translation.

Let me analyze the requirements: 1. Preserve ALL LaTeX commands and placeholders - not applicable here 2. Preserve ALL citation commands - not applicable here 3. **PRESERVE ALL ···paragraph wrapper tags EXACTLY** - not applicable here 4. Maintain academic tone and formal scientific writing style - yes 5. Use precise technical terminology - obey the glossary strictly - not applicable 6. Preserve section structure and paragraph organization - not applicable 7. Translate all content completely - do not omit any information - yes

The name "王增武" is a Chinese personal name. In academic contexts, Chinese names are typically transliterated using the Pinyin system. The standard format for academic papers is to keep the name in Pinyin, usually with the surname first (Wang Zengwu) or sometimes with the surname capitalized (WANG Zengwu) or in Western order (Zengwu Wang).

However, the instructions say "Translate from Simplified Chinese to English" . A name is not really "translated" but "transliterated" . The most common academic practice is: - Keep the Pinyin as is - Optionally, provide the English ordering (given name first) if it' s clear from context

But wait, the user might be asking me to translate a paper where this name appears. However, they' ve only given me the name itself. Let me re-read the instructions.

The instructions are for translating academic papers. The user has provided just "王增武" . This could be: 1. A test to see if I handle names correctly 2. The beginning of a larger text they want translated 3. A simple request to transliterate a name

Given the strict requirements about preserving tags and other formatting, and the fact that there' s no such tag in the input, I should consider that this might be a fragment or test case.

For Chinese names in academic papers, the standard practice is: - Surname: Wang (王) - Given name: Zengwu (增武) - Full name: Wang Zengwu or Zengwu Wang

In many Chinese academic contexts, the name is kept as "Wang Zengwu" (surname first) or sometimes written as "Wang, Zengwu

Date: 2024-08-09T16:48:55+00:00

Abstract

The user wants me to translate a Chinese text about cardiovascular disease (CVD) in China to English. This is academic/medical content that needs to be translated with high accuracy and formal tone.

Let me break down the requirements: 1. Preserve ALL LaTeX commands and placeholders - there are none in this text 2. Preserve ALL citation commands ([?], **??**, (**??**), etc.) - none present 3. **PRESERVE ALL ···paragraph wrapper tags EXACTLY** - I need to check if these are present. Looking at the

input, I don' t see any tags. The user says "Return ONLY the translated text for the given input" and mentions these tags in the instructions, but the actual input doesn' t contain them. I should just translate the text as is. 4. Maintain academic tone and formal scientific writing style - yes, this is medical statistics 5. Use precise technical terminology - I have a glossary: 机器学习 => machine learning, 深度学习 => deep learning, but these terms don' t appear in the text. I need to use standard medical English terms. 6. Preserve section structure and paragraph organization - it' s one paragraph, so I' ll keep it as one paragraph 7. Translate all content completely - do not omit any information - I need to include all numbers and details

The text is: "中国心血管病（CVD）患病率处于持续上升阶段。推算 CVD 现患人数 3.3 亿，其中卒中 1 300 万，冠心病（CHD）1 139 万，心力衰竭（HF）890 万，肺源性心脏病 500 万，心房颤动 487 万，风湿性心脏病 250 万，先天性心脏病 200 万，外周动脉疾病（PAD）4 530 万，高血压 2.45 亿。2021 年中国心脑血管疾病患者出院总人次数为 2 764.98 万，占同期出院总人次数（包括所有住院病种）的 15.36%，其中 CVD 1 487.23 万人次，占 8.26%，脑血管病 1 277.75 万人次，占 7.10%。CVD 给居民和社会带来的经济负担仍在加重，CVD 防治的拐点尚未到来。"

Key terms to translate: - 心血管病 => cardiovascular disease (CVD) - 患病率 => prevalence - 持续上升阶段 => continuous rising phase / ongoing upward trend - 推算 => estimated - 现患人数 =>

Full Text

Preamble

Interpretation of Report on Cardiovascular Health and Diseases in China 2023

LIU Mingbo, HE Xinye, YANG Xiaohong, WANG Zengwu*

National Center for Cardiovascular Diseases/Fuwai Hospital, Chinese Academy of Medical Sciences, Beijing 100037, China

*Corresponding author: WANG Zengwu, Chief Physician/Professor; E-mail: wangzengwu@foxmail.com

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Abstract

The prevalence of cardiovascular disease (CVD) in China continues to rise. It is estimated that 330 million people currently suffer from CVD, including 13 million cases of stroke, 11.39 million cases of coronary heart disease (CHD), 8.9 million cases of heart failure (HF), 5 million cases of pulmonary heart disease, 4.87 million cases of atrial fibrillation, 2.5 million cases of rheumatic heart disease, 2 million cases of congenital heart disease, 45.3 million cases of peripheral arterial disease (PAD), and 245 million cases of hypertension. In 2021, the total number of discharges for cardiovascular and cerebrovascular diseases in China

reached 27.6498 million, accounting for 15.36% of all-cause discharges. Specifically, CVD accounted for 14.8723 million discharges (8.26%), while cerebrovascular disease accounted for 12.7775 million discharges (7.10%). The economic burden of CVD on both individuals and society continues to escalate, and the inflection point for CVD prevention and control has yet to be reached.

Keywords: cardiovascular diseases; epidemiology; disease burden; risk factors; prevalence; mortality; rehabilitation; basic research; medical device development; expense

With socioeconomic development and changes in lifestyle—particularly accelerated population aging and urbanization—unhealthy lifestyle patterns have become increasingly prominent among Chinese residents. The impact of CVD risk factors on public health has grown more pronounced, and CVD incidence continues to climb. The mounting economic burden has made CVD a major public health challenge, underscoring the urgent need for strengthened government-led prevention and control efforts. Since 2005, the National Center for Cardiovascular Diseases has annually organized national experts to compile the *Report on Cardiovascular Health and Diseases in China*. The 2023 edition incorporates primary data from projects undertaken by the National Center, substantially enriching the report' s content and providing a more timely and comprehensive reflection of China' s CVD prevention and treatment landscape. This article interprets key findings from the newly published *Report on Cardiovascular Health and Diseases in China 2023* [1] to inform CVD prevention strategies and policy development.

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1. Epidemiology of CVD and Risk Factors

1.1.1 Cardiovascular Disease

CVD prevalence in China continues to rise, with an estimated 330 million current cases. This includes 13 million stroke patients, 11.39 million CHD patients, 8.9 million HF patients, 5 million pulmonary heart disease patients, 4.87 million atrial fibrillation patients, 2.5 million rheumatic heart disease patients, 2 million congenital heart disease patients, 45.3 million PAD patients, and 245 million hypertension patients.

According to Global Burden of Disease Study (GBD) data [2], the age-standardized incidence of CVD (including rheumatic heart disease, ischemic heart disease [IHD], stroke, hypertensive heart disease, non-rheumatic valvular heart disease, cardiomyopathy and myocarditis, atrial fibrillation, atrial flutter, aortic aneurysm, PAD, endocarditis, and other cardiovascular and circulatory diseases) among Chinese aged 1–79 years increased from 646.2 to 652.2 per 100,000 person-years between 1990 and 2019. The age-standardized incidence of CHD rose from 177.1 per 100,000 person-years in 1990 to 203.7 in 2010, then declined to 197.4 in 2019.

GBD data [3-4] show that disability-adjusted life years (DALYs) due to CVD increased by 33.7% from 1990 to 2016, with a 51.8% increase in men—substantially higher than the 12.1% increase in women. The fastest-growing disease burdens were atrial fibrillation and atrial flutter (147.0%), IHD (122.0%), PAD (108.9%), ischemic stroke (80.4%), and aortic aneurysm (49.1%). Although absolute CVD disease burden continues to grow, age-standardized DALYs decreased by 33.3% between 1990 and 2016, with a more rapid decline in women (-43.7%) than men (-24.7%). Age-standardized DALYs for other CVD types also decreased to varying degrees, with the largest reductions seen in rheumatic heart disease (-77.6%), other cardiovascular diseases (-68.7%), hypertensive heart disease (-54.8%), and hemorrhagic stroke (-52.6%).

The *China Health Statistics Yearbook 2022* [5] shows that CVD remains the leading cause of death among urban and rural residents, accounting for 48.98% and 47.35% of deaths respectively in 2021 [Figure 1: see original paper][Figure 2: see original paper]. Rural CVD mortality has exceeded urban rates since 2009 [Figure 3: see original paper]. In 2021, rural CVD mortality was 364.16 per 100,000 (heart disease: 188.58; cerebrovascular disease: 175.58), while urban mortality was 305.39 per 100,000 (heart disease: 165.37; cerebrovascular disease: 140.02).

From July 2021 to June 2022, the "China Cardiovascular and Cerebrovascular Events Surveillance" project analyzed data from 103 surveillance sites across 20 provinces, autonomous regions, and municipalities. Among Chinese residents aged $ $18 years, the crude incidence of CVD (including acute myocardial infarction [AMI], percutaneous transluminal coronary angioplasty/stenting and/or coronary artery bypass grafting [CABG], angina, stroke, and sudden cardiac death) was 600.9 per 100,000 (age-standardized rate: 411.8 per 100,000), with higher rates in men (crude: 689.5; standardized: 501.9) than women (crude: 510.7; standardized: 324.9). AMI incidence was 79.7 per 100,000 (age-standardized: 55.8), with higher rates in men (99.0) than women (60.1).

The "China Cardiovascular Disease and Risk Factors Surveillance"project (2020–2022) surveyed 262 surveillance sites across 31 provinces, autonomous regions, and municipalities. Preliminary results show that among Chinese residents aged $ $18 years, CHD prevalence (including AMI, stenting, CABG, and hospitalization for unstable angina) was 758 per 100,000, with higher rates in men (940) than women (570) and in urban areas (892) than rural areas (639). CHD prevalence increases rapidly with age.

AMI mortality has shown an upward trend since 2002, with a particularly rapid increase in rural areas beginning in 2005. Rural AMI mortality exceeded urban rates in 2007, 2009, 2010, and 2011, and has remained consistently higher since 2013 [Figure 6: see original paper].

1.1.2 Cerebrovascular Disease

GBD 2019 results [6] show that in 2019, China had 28.76 million stroke patients, a 147.5% increase from 1990. Between 1990 and 2019, the greatest increases in prevalence were for ischemic stroke (195.2%), followed by subarachnoid hemorrhage (54.8%) and intracerebral hemorrhage (43.0%). The age-standardized stroke prevalence in 2019 was 1,468.9 per 100,000 (ischemic: 1,255.9; intracerebral hemorrhage: 214.6; subarachnoid hemorrhage: 81.4). Compared with 1990, the age-standardized stroke prevalence increased by 13.2%, driven by a 33.5% rise in ischemic stroke, while intracerebral hemorrhage and subarachnoid hemorrhage decreased by 31.9% and 21.9%, respectively.

From July 2021 to June 2022, the "China Cardiovascular and Cerebrovascular Events Surveillance" project analyzed data from 103 surveillance sites across 20 provinces, autonomous regions, and municipalities. Preliminary results show that among Chinese residents aged $ $18 years, stroke incidence was 496.7 per 100,000 (age-standardized: 338.6), with higher rates in men than women [Figure 7: see original paper].

According to the *China Health Statistics Yearbook 2022* [5], the crude mortality rate for cerebrovascular disease in 2021 was 140.02 per 100,000 in urban areas (21.71% of total deaths, ranking third) and 175.58 per 100,000 in rural areas (23.62% of total deaths, ranking second). Stroke mortality was higher in men than women and in rural than urban areas [Figure 8: see original paper].

Cerebrovascular disease mortality increased overall from 2003 to 2021. Compared with 2003, the crude mortality rate in 2021 increased 1.37-fold in urban areas and 1.58-fold in rural areas, with consistently higher rates in rural residents each year [Figure 9: see original paper].

GBD 2019 results show that in 2019, stroke caused 2.189 million deaths in China. Between 1990 and 2019, total stroke deaths increased by 59.0%, with ischemic stroke and intracerebral hemorrhage deaths increasing by 171.1% and 37.4%, respectively, while subarachnoid hemorrhage deaths decreased by 58.7%. The age-standardized stroke mortality rate in 2019 was 127.2 per 100,000 (ischemic: 62.2; intracerebral hemorrhage: 60.1; subarachnoid hemorrhage: 5.0), representing a 39.8% decrease from 1990. Notably, ischemic stroke mortality changed minimally (-3.3%), while intracerebral hemorrhage and subarachnoid hemorrhage mortality decreased by 48.1% and 84.1%, respectively [6-7].

1.2 Tobacco Use

Tobacco control remains a critical public health priority. Since the WHO Framework Convention on Tobacco Control took effect in 2005, global tobacco control has achieved significant progress, with smoking prevalence among those aged $ $15 years decreasing from 22.8% in 2007 to 17.0% in 2019 [8]. In 2018, smoking prevalence among Chinese aged $ $15 years was 26.6% [9], with over 300 million smokers.

A study following 512,000 adults aged 30–79 years from 10 Chinese regions for a median of 11 years (2004–2008) found that smoking was significantly associated with the risk of 15 circulatory system diseases, including aortic aneurysm and dissection [HR (95%CI): 2.46 (1.71–3.54)], arterial embolism and thrombosis [1.99 (1.40–2.83)], other pulmonary heart disease [1.78 (1.65–1.92)], pulmonary embolism (PE) [1.54 (1.03–2.30)], other aneurysms [1.54 (1.02–2.31)], AMI [1.49 (1.39–1.59)], cardiac arrest [1.43 (1.20–1.70)], atherosclerosis [1.32 (1.16–1.49)], HF [1.30 (1.21–1.40)], cardiac complications and ill-defined heart disease [1.20 (1.08–1.33)], chronic IHD [1.18 (1.15–1.22)], cerebral infarction [1.12 (1.09–1.15)], angina [1.09 (1.01–1.19)], and varicose veins [0.81 (0.72–0.92)] [10].

1.3 Dietary Nutrition

Data from the 2015–2017 Chinese Nutrition and Health Surveillance (CNHS) show that Chinese residents have adequate total energy intake. Long-term trends indicate declining total energy intake, with a marked decrease in the proportion of energy from carbohydrates and a continuous increase in fat energy ratio. Urban residents have exceeded the recommended upper limit of 30% fat energy ratio since 2002, while rural residents first surpassed this threshold during 2015–2017, reaching 33.2% [11-12].

CNHS data from 72,231 adults aged $ $18 years (2015–2017) reveal severe micronutrient deficiencies, with inadequate intake rates ranging from 2.58% to 97.63%. Calcium deficiency was most prevalent, followed by vitamin B2 [Figure 10: see original paper]. Sodium intake averaged 5,139.61 mg/day, with only one-quarter of Chinese adults consuming below WHO recommendations [13].

Chinese dietary patterns remain suboptimal. Data from the China Chronic Disease and Risk Factor Surveillance (CCDRFS) and Chinese Nutrition and Health Surveillance show that from 2002 to 2018, intake of whole grains, vegetables, fruits, red meat, soybeans, and nuts increased among Chinese adults aged $ $20 years, while sugar-sweetened beverage consumption rose rapidly. However, intake of red meat and sugar-sweetened beverages exceeded Chinese Dietary Guidelines recommendations, while other foods fell below recommendations. Daily intake of whole grains (21.2 g) and fruits (114.1 g) was only about half the recommended amounts (whole grains: 50–100 g; fruits: 200–350 g) [14].

1.4 Physical Activity

A cross-sectional survey of 298 districts/counties across 31 provinces, autonomous regions, and municipalities as part of the China Chronic Disease and Nutrition Monitoring found that in 2015, only 12.5% of Chinese adults aged $ $18 years regularly participated in physical activity, with higher rates in urban (18.1%) than rural (8.5%) areas. Leisure-time sedentary behavior increased significantly from 2.7 hours/day in 2010 to 3.2 hours/day in 2018 [15-16].

Between 1985 and 2014, the excellent rate of physical fitness among students showed an overall declining trend [17]. From 2004 to 2015, sedentary behavior increased by 1.8 hours/7 days, and physical inactivity rates rose by 5.5% [18]. In 2016, 85.2% of primary and secondary school students had $ $2 physical education classes/7 days, and 31.5% had $ $5 extracurricular sports training sessions/7 days; weekend screen time (TV, mobile phone, computer) $ $2 hours was reported by 23.7%, 27.7%, and 17.5% of students, respectively [19]. Physical activity 达标 rates among primary and middle school students were higher in 2017 than in 2016 [20]. In 2019, 39.3% of students engaged in muscle-strengthening exercises $ $3 times/7 days [21].

WHO' s 2016 report [22] indicated that achieving physical activity targets could reduce premature mortality risk by 18.3% among Chinese aged 40–74 years, preventing 1.0165 million premature deaths annually. The China Kadoorie Biobank (CKB) study [23] found that compared with physical activity $ $9.1 MET \cdot h \cdot d^{-1}, activity $ $33.8 MET \cdot h \cdot d^{-1} reduced CVD mortality risk by 41%. Each 4 $\mathrm{MET} \cdot \mathrm{h} \cdot \mathrm{d}^{-1}$ increase in physical activity reduced CVD mortality risk by 12%.

1.5 Overweight and Obesity

Data from seven national student physical fitness and health surveys (1985-2019) [24] show that in 2019, the combined overweight/obesity rate among Chinese children and adolescents aged 7-18 years was 23.4% (overweight: 13.9%; obesity: 9.6%), with higher rates in urban (25.4%) than rural (21.5%) areas and in boys (28.4%) than girls (18.4%). The overweight/obesity rate increased 18.1-fold from 1.2% in 1985 to 23.4% in 2019, with obesity prevalence increasing 75.6-fold. Urban boys, urban girls, rural boys, and rural girls showed 22.3-, 11.7-, 54.2-, and 10.1-fold increases, respectively, with rural boys showing the fastest growth.

The "China Cardiovascular Disease and Risk Factors Surveillance"project (2020-2022) surveyed 262 surveillance sites across 31 provinces, autonomous regions, and municipalities. Preliminary results from 293,022 participants aged $ $18 years show overweight, obesity, and central obesity rates of 34.6%, 17.8%, and 34.9%, respectively. Obesity was more prevalent in men (20.5%) than women (15.0%) and in rural (18.7%) than urban (16.7%) areas. Both overweight and obesity rates increased with age before declining in older age groups [Figure 11: see original paper].

The Kailuan cohort study [25] followed 68,603 adults (mean age 55.46 years) without CVD or cancer for a median of 7.0 years, during which 3,325 developed CVD. Compared with stable low-normal weight, stable high-normal weight, stable overweight, stable mild obesity, and stable severe obesity groups all had higher CVD risks, suggesting that long-term overweight and obesity are associated with increased lifetime CVD risk.

Overweight and obesity increase CVD burden. GBD data [26] estimate that in 2019, high body mass index contributed to 549,500 CVD deaths in China, with an age-standardized mortality rate of 38.64 per 100,000, accounting for 11.98%

of all CVD deaths.

1.6 Hypertension

Nationwide hypertension prevalence surveys from 1958 to 2022 show an overall upward trend. The "China Cardiovascular Disease and Risk Factors Surveillance" project (2020–2022) surveyed 298,438 individuals across 262 surveillance sites in 31 provinces, autonomous regions, and municipalities. Preliminary results show a hypertension prevalence of 31.6% among residents aged $ $18 years, with higher rates in men (36.8%) than women (26.3%) and in rural (33.7%) than urban (29.1%) areas. Hypertension prevalence increased rapidly with age [Figure 12: see original paper].

The 2019 National Student Physical Fitness and Health Survey (n=190,000, aged 7–17, Han ethnicity) [27] found a hypertension prevalence of 13.0% among children and adolescents, with higher rates in boys (13.2%) than girls (12.7%) and in rural (14.1%) than urban (11.9%) areas, showing an overall increasing trend with age ($P<0.001$).

The China Health and Nutrition Survey (CHNS) [28] prospective cohort study of 12,952 Chinese adults aged $ $18 years found that the age-standardized hypertension incidence increased from 40.8 per 1,000 person-years in 1993–1997 to 48.6 per 1,000 person-years in 2011–2015.

CCDRFS data from six national surveys (2004–2018) [29] show that awareness, treatment, and control rates of hypertension among Chinese adults aged 18–69 years have all increased [Figure 13: see original paper]. The "China Cardiovascular Disease and Risk Factors Surveillance" project (2020–2022) survey of 298,438 individuals found awareness, treatment, and control rates of 43.3%, 38.7%, and 12.9%, respectively, among adults aged $ $18 years.

CHNS results show that the age-standardized prevalence of high-normal blood pressure among Chinese adults aged $ $18 years increased from 30.1% in 1991 to 43.1% in 2015 [30]. The China Hypertension Survey (CHS) found that in 2012–2015, the crude and weighted prevalence of high-normal blood pressure among Chinese residents aged $ $18 years were 39.1% and 41.3%, respectively, affecting an estimated 435 million people [31].

The DECIDE-salt study among Chinese elderly [32] demonstrated that salt substitution effectively lowered blood pressure and significantly reduced cardiovascular event risk. A study of mortality, incidence, and risk factors in China and its provinces from 1990 to 2017 [33] identified high systolic blood pressure as one of the four leading risk factors for death and DALYs, causing 2.54 million deaths in 2017, 95.7% of which were due to CVD. A study of cardiovascular disease burden attributable to high systolic blood pressure in China from 2005 to 2018 [34] found that CVD deaths caused by elevated systolic blood pressure increased continuously from 1.98 million in 2005 to 2.67 million in 2018.

1.7 Dyslipidemia

The 2015 Chinese Adults Nutrition and Chronic Diseases Surveillance (CANCDS) [35] survey of 179,728 residents aged $ $18 years showed that total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), non-high-density lipoprotein cholesterol (HDL-C), and triglyceride (TG) levels all increased compared with 2002 [Figure 14: see original paper].

The prevalence of dyslipidemia among Chinese adults aged $ $18 years rose dramatically from 18.6% in 2002 to 40.4% in 2012. The "China Cardiovascular Disease and Risk Factors Surveillance" project (2020–2022) surveyed 275,961 individuals across 262 surveillance sites, with preliminary results showing a dyslipidemia prevalence of 38.1% among adults aged $ $18 years, with higher rates in men (46.1%) than women (29.6%) and in urban (38.9%) than rural (37.4%) areas. Dyslipidemia prevalence increased with age before declining in older age groups [Figure 15: see original paper].

Surveys including the 4th CCDRFS (2013–2014) [36], CANCDS (2015) [35], China National Stroke Screening and Prevention Project (CNSSPP, 2014) [37], and China-PEACE Million Persons Project (2014–2019) [38] consistently show that low HDL-C and high TG are the main types of dyslipidemia among Chinese adults [Figure 16: see original paper].

The "China Cardiovascular Disease and Risk Factors Surveillance"project (2020–2022) surveyed 275,961 individuals, finding awareness, treatment, and control rates of dyslipidemia of 11.7%, 10.1%, and 4.8%, respectively—higher than the 2010 China Chronic Disease Surveillance rates (awareness: 10.93%; treatment: 6.84%; control: 3.53%) [39].

Analysis of nearly 3 million individuals from the China-PEACE project revealed a U-shaped relationship between LDL-C levels and all-cause and CVD mortality. Compared with LDL-C 100–129.9 mg/dL, LDL-C <70 mg/dL and >190 mg/dL increased all-cause death risk by 16% and 31%, respectively. LDL-C showed J-shaped relationships with CVD death, IHD death, and ischemic stroke death, and an L-shaped relationship with hemorrhagic stroke death. Compared with LDL-C 100–129.9 mg/dL, LDL-C <70 mg/dL increased CVD and hemorrhagic stroke death risk by 10% and 37%, respectively, while LDL-C >190 mg/dL increased CVD and IHD death risk by 51% and 108%, respectively.

1.8 Diabetes Mellitus

A cross-sectional survey of 75,880 adults aged $ $18 years across 31 provinces, autonomous regions, and municipalities in 2015–2017 [40] found a diabetes prevalence of 11.2% (95%CI: 10.5%–11.9%) using WHO diagnostic criteria. Including HbA1c as a diagnostic criterion yielded a prevalence of 12.8% (95%CI: 12.0%–13.6%), comprising previously diagnosed diabetes (6.0%; 95%CI: 5.4%–6.7%), newly diagnosed diabetes (6.8%; 95%CI: 6.1%–7.4%), and pre-diabetes (35.2%; 95%CI: 33.5%–37.0%). The estimated number of Chinese adults with diabetes is 129.8 million (70.4 million men, 59.4 million women). The 2017 survey found awareness, treatment, and control rates of 43.3%, 49.0%, and 49.4%, respectively.

The China-PAR study [41] included 12,145 Chinese adults aged 35-74 years without diabetes at baseline. Based on fasting glucose status at baseline (1998-2001) and 8-year follow-up, participants were categorized as having normal fasting glucose (NFG; 50-99 mg/dL), impaired fasting glucose (IFG; 100-125 mg/dL), or diabetes. During a median follow-up of 5.5 years, 373 CVD events occurred. Compared with persistent NFG, participants with persistent IFG, progression from NFG to diabetes, or progression from IFG to diabetes had higher CVD risk, with multivariable-adjusted HRs (95%CI) of 1.792 (1.141-2.816), 1.723 (1.122-2.645), and 1.946 (1.120-3.381), respectively. Among those with baseline IFG, persistent IFG and progression to diabetes increased CVD risk compared with regression to NFG, with HRs (95%CI) of 1.594 (1.003-2.532) and 1.913 (1.080-3.389). These findings demonstrate that long-term IFG and progression to diabetes are associated with elevated CVD risk.

1.9 Chronic Kidney Disease

The 6th CCDRFS [42] conducted from August 2018 to June 2019 included 176,874 adults aged \$ \$18 years across 31 provinces, autonomous regions, and municipalities. The prevalence of albuminuria and impaired kidney function was 6.7% and 2.2%, respectively, with an overall chronic kidney disease (CKD) prevalence of 8.2%—lower than the 10.8% reported in 2009-2010 [43].

The China Kidney Disease Network (CK-NET) annual report shows that among tertiary hospital inpatients in 2016, diabetic nephropathy (26.7%), hypertensive nephropathy (21.4%), and obstructive nephropathy (16.0%) were more common than chronic glomerulonephritis (14.4%) [44].

The China-PEACE project surveyed 269,026 adults aged \$ \$35 years across 31 provinces, autonomous regions, and municipalities in 2015-2019, finding a urinary albumin-creatinine ratio (UACR) \$ \$30 mg/g prevalence of 8.75% (7.38% with 30-300 mg/g; 1.37% with \$ \$300 mg/g). Elevated UACR was associated with increased risks of all-cause, cardiovascular, and CVD-specific mortality across its entire range. Even traditionally "normal" UACR levels (<30 mg/g) significantly increased mortality risk compared with UACR <5 mg/g.

1.10 Sleep Disturbances

A 2019 survey of 107,650 residents aged \$ \$15 years across 31 provinces, autonomous regions, and municipalities found an age-standardized prevalence of sleep difficulties of 21.25%, with 90.27% experiencing difficulty falling asleep and 75.70% experiencing sleep interruption or early awakening [45].

A 2020 meta-analysis of 13,920 hypertensive patients [46] found a sleep difficulty prevalence of 52.5% (95%CI: 46.1%-58.9%), significantly higher than the 32.5%

(95%CI: 19.0%–49.7%) prevalence in healthy controls (OR=2.66; 95%CI: 1.80–3.93).

A 2021 nationwide study of 47,841 individuals aged $ $45 years across seven Chinese regions [47] found significantly higher depression and anxiety prevalence among CVD patients compared with non-CVD controls. Depression and anxiety symptoms were present in 12.0% and 9.1% of HF patients, respectively, and in 10.9% and 7.9% of stroke patients. Among patients with three or more CVD conditions, depression and anxiety prevalence was 9.7% and 7.3% in women and 6.3% and 3.5% in men, respectively.

1.11 Environmental Factors

GBD studies identify air pollution and non-optimal temperature as the top two environmental factors affecting Chinese population health. Non-optimal temperature ranked 8th among disease burden risk factors in both 2013 and 2019, causing 400,000 excess CVD deaths in 2019. Air pollution ranked 3rd in 2013 and 4th in 2019, causing 1.842 million excess deaths in 2019, including 1.14 million CVD deaths attributable to PM2.5 exposure.

A time-series study of summer heat effects on mortality across 353 Chinese locations (2006–2017) found that high temperature events were associated with a 12.95% (95%CI: 12.82%–13.09%) increase in excess CVD mortality [48]. A study of heatwaves and CVD mortality risk across 272 Chinese cities (2013–2015) found that heatwaves increased total CVD and CHD mortality risk by 14% (RR=1.14; 95%CI: 1.09–1.18) and 13% (RR=1.13; 95%CI: 1.07–1.19), respectively [49].

A study of low temperature and CVD mortality across 272 Chinese cities (2013–2015) found that compared with the threshold temperature of 22.8°C (the temperature with lowest mortality), cold exposure increased CVD mortality risk (RR=1.92; 95%CI: 1.75–2.10) [50]. A case-control study across 15 Chinese cities found that 15.8% (95%CI: 13.1%–17.9%) of CVD deaths (305,902 cases) were attributable to low temperature [51].

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2. Clinical Management of CVD

2.1 Hypertension

Hospital Quality Monitoring System (HQMS) data show that in 2022, 5,000 hospitals treated hypertension inpatients (aged $ $18 years with hypertension as primary or other diagnosis), representing 88.5% of all hospitals treating CVD inpatients. These included 1,921 tertiary and 3,079 secondary hospitals, treating a total of 35.243 million hypertension patients (68.4% of all CVD inpatients).

The top three comorbidities among hypertension inpatients were cerebrovascular disease (32.7%), CHD (30.5%), and diabetes (28.4%). Secondary hypertension etiologies were led by renal parenchymal hypertension (48.2%), obstructive sleep apnea (OSA) (28.5%), and renovascular hypertension (10.9%).

In 2022, inpatients with hypertension as the primary diagnosis had a hospital mortality rate of 0.2% and non-recovery discharge rate of 3.8%.

A prospective study of 13,383 CVD-free patients aged 60–80 years with baseline systolic blood pressure 110–150 mmHg found that after a median follow-up of 13.01 years (1,727 CVD cases and 3,742 deaths), targeting systolic blood pressure to 110–130 mmHg compared with 130–150 mmHg reduced CVD risk (HR=0.81; 95%CI: 0.76–0.87) and all-cause mortality risk (HR=0.89; 95%CI: 0.85–0.93) [52].

An open-label cluster-randomized trial including 33,995 individuals showed that an intensive blood pressure-lowering strategy was safe and effective in the general population. Compared with usual care, community-based intensive blood pressure management reduced cardiovascular events by 33%, myocardial infarction by 23%, stroke by 34%, HF by 42%, cardiovascular death by 30%, and all-cause death by 15% [53].

2.2 Coronary Heart Disease

HQMS data show that in 2022, 4,961 hospitals treated CHD inpatients (aged $ $18 years with CHD as primary diagnosis), representing 87.8% of hospitals treating CVD inpatients (1,886 tertiary and 3,075 secondary hospitals). These hospitals admitted 6.127 million CHD patients, with 4.195 million in tertiary and 1.932 million in secondary hospitals.

Comorbidities among CHD inpatients included hypertension (60.9%), diabetes (26.3%), and atrial fibrillation/flutter (19.1%). The top three discharge diagnoses were unstable angina (38.1%), unclassified CHD (28.0%), and stable angina (15.3%).

In 2022, 1.034 million AMI patients were hospitalized, including 47.4% with ST-elevation myocardial infarction (STEMI), 41.1% with non-ST-elevation myocardial infarction (NSTEMI), and 11.5% unclassified. Among AMI inpatients, 7.8% had cardiogenic shock, 2.3% cardiac arrest, and 2.2% ventricular tachycardia. In-hospital mortality was 4.3% and non-recovery discharge rate was 13.4%.

In 2022, 1.421 million patients (23.2% of CHD inpatients) underwent percutaneous coronary intervention, and 1.539 million (25.1%) underwent diagnostic coronary angiography alone. In-hospital mortality for PCI patients was 0.7% and non-recovery discharge rate was 2.7%.

A total of 571 hospitals performed $ $1 CABG procedure in 2022, with 49,000 total cases (45,000 isolated CABG). In-hospital mortality was 1.4% and non-recovery discharge rate was 2.9%. The ratio of PCI to CABG volume was 28.8:1.

A multicenter randomized controlled trial across four Chinese centers (2018–2021) compared high-dose versus low-dose tranexamic acid in cardiopulmonary bypass surgery, enrolling 3,079 patients. High-dose tranexamic acid was associated with reduced red blood cell transfusion requirements and was non-inferior to low-dose for the composite safety endpoint (postoperative seizures, renal dysfunction, thrombotic events, and 30-day all-cause mortality) [54].

A randomized non-inferiority prospective study of 4,551 patients compared indobufen plus clopidogrel versus aspirin plus clopidogrel after PCI. The primary endpoint was a composite of 1-year major adverse cardiovascular events and BARC types 2, 3, or 5 bleeding. Indobufen-based dual antiplatelet therapy reduced net clinical outcome risk compared with aspirin, with similar ischemic events but significantly fewer bleeding events [55].

2.3 Arrhythmia

HQMS data show that in 2022, 5,481 hospitals (96.8% of hospitals providing CVD care) offered arrhythmia services, including 3,348 tertiary (61.1%) and 2,133 secondary (38.9%) hospitals. There were 8.32 million arrhythmia inpatients (with arrhythmia as primary or other diagnosis), with atrial fibrillation/flutter (33.4%), atrial premature contractions (14.2%), and ventricular premature contractions (13.9%) being the most common.

A total of 233,000 catheter ablation procedures were performed (2.8% of arrhythmia inpatients), with 96.6% being internal medicine catheter ablations showing an increasing trend. Left atrial appendage closure was performed in >13,000 cases (56.0% as "ablation + closure" one-stop procedures), and >120,000 pacemakers were implanted.

The LBB-BIOVENT study (Left Bundle Branch vs Biventricular Pacing for Cardiac Resynchronization Therapy) was the world' s first investigator-initiated randomized controlled trial comparing left bundle branch pacing with conventional biventricular pacing in HF patients, demonstrating significant advantages of left bundle branch pacing in improving patient outcomes. For patients with non-ischemic cardiomyopathy and left bundle branch block, left bundle branch pacing and biventricular pacing represent effective complementary cardiac resynchronization strategies [56].

2.4 Valvular Heart Disease

HQMS data show that in 2022, 5,129 hospitals (90.8% of hospitals treating CVD inpatients) managed valvular heart disease, including 2,069 tertiary and 3,060 secondary hospitals. These hospitals admitted 1.882 million valvular disease patients, with mitral valve disease being most common (980,000 cases; 45.4%), followed by tricuspid (28.5%), aortic (24.3%), and pulmonary valve disease (1.8%). Comorbidities included HF (46.8%), hypertension (43.0%), and CHD (33.0%).

In 2022, 24,000 patients underwent isolated mitral valve surgery (31.6% repair;

68.4% replacement), with bioprosthetic valve use of 42.0%. In-hospital mortality was 1.2% and non-recovery discharge rate was 2.9%. Mitral valve interventions totaled 1,773 cases, with mitral valve clip procedures accounting for 49.7%. In-hospital mortality was 0.8% and non-recovery discharge rate was 1.5%.

Isolated aortic valve replacement was performed in 49,000 cases, with bioprosthetic valve use of 44.3%. In 2022, 8,068 transcatheter aortic valve implantation (TAVR) procedures were performed.

ValveClamp is the most evidence-supported device for treating primary mitral regurgitation with the longest follow-up, having received National Medical Products Administration approval. A prospective, multicenter, single-arm trial enrolled 102 high-surgical-risk mitral regurgitation patients, with primary endpoints of all-cause death, reoperation, and mitral regurgitation $ $3+. The study showed 97% immediate procedural success, mean catheter time of 19 minutes (minimum 5 minutes), with 88% of patients achieving satisfactory coaptation with a single clip. At 1 year, the overall patient efficacy rate was 87.3% (96.1% in the later 52-patient cohort), with 97.8% maintaining mitral regurgitation $ $2+ and significant improvements in left ventricular ejection fraction and NYHA functional class [57].

In 2022, 36,000 tricuspid valve surgeries (replacement or repair) were performed (non-recovery discharge rate: 5.0%), along with 133 transcatheter tricuspid procedures (in-hospital mortality: 0.8%; non-recovery discharge rate: 1.5%). Pulmonary valve procedures included 903 surgical cases (non-recovery discharge rate: 5.3%) and 560 transcatheter cases (in-hospital mortality: 1.1%; non-recovery discharge rate: 3.4%).

2.5 Heart Failure

HQMS data show that in 2022, 5,402 hospitals (95.6% of hospitals treating CVD inpatients) managed HF, including 2,078 tertiary and 3,324 secondary hospitals. These hospitals admitted 10.29 million HF patients, with 61.0% in tertiary and 39.0% in secondary hospitals. The mean age was (71.0$±$12.7) years, with women comprising 44.6%. The top three comorbidities were CHD (68.9%), hypertension (58.6%), and stroke (34.2%). During hospitalization, 2.5% received mechanical ventilation, 0.3% received hemofiltration, and 0.2% received intra-aortic balloon pump (IABP). In-hospital mortality was 2.6%, non-recovery discharge rate was 10.2%, and 30-day readmission rate was 10.0%.

The China Cardiovascular Association (CCA) HF Registry Study enrolled 41,708 hospitalized HF patients with preserved ejection fraction from January 2017 to June 2021. Ischemia (26.6%), infection (14.4%), and arrhythmia (10.5%) were the three most common precipitating factors for HF hospitalization. Hypertension (65.2%), CHD (60.3%), and atrial fibrillation (41.2%) were the most common comorbidities, with 67.4% of patients having three or more comorbidities [58].

2.6 Congenital Heart Disease

HQMS data show that in 2022, 4,947 hospitals (87.6% of hospitals providing CVD care) treated congenital heart disease, including 2,059 tertiary (94.9%) and 2,888 secondary (83.0%) hospitals. These hospitals managed 1.508 million congenital heart disease inpatients, with atrial septal defect/patent foramen ovale (57.0%), patent ductus arteriosus (14.1%), ventricular septal defect (5.8%), aortic coarctation (1.3%), endocardial cushion defect (0.4%), and tetralogy of Fallot (0.3%) being most common.

In 2022, 38.95% of congenital heart disease inpatients were neonates/infants (<1 year), 7.57% were children (1–17 years), and 53.48% were adults ($ $18 years). Surgical or interventional treatment was performed in 131,000 cases (8.7% of congenital heart disease inpatients), including 116,000 simple (88.6%) and 15,000 complex (11.4%) cases.

Surgical treatment was performed in 49,000 congenital heart disease patients (37.1% of those receiving surgical/interventional treatment), with children aged 1–17 years comprising the largest group (42.8%), followed by adults (35.2%). Complex congenital heart disease accounted for 30.8% of surgical cases. In-hospital mortality for congenital heart disease surgery was 1.0% and non-recovery discharge rate was 2.1%.

Interventional treatment was performed in 83,000 congenital heart disease patients, with children (<18 years) accounting for 30.8%. Among children, atrial septal defect/patent foramen ovale closure (55.1%) was most common, followed by patent ductus arteriosus closure (21.4%), ventricular septal defect closure (20.7%), and pulmonary valve balloon dilation (2.8%). In-hospital mortality for congenital heart disease interventions was 0.01% and non-recovery discharge rate was 0.46%.

2.7 Aortic and Peripheral Vascular Disease

2.7.1 Aortic Disease HQMS data show that in 2022, 3,722 hospitals (65.9% of hospitals providing CVD care) managed aortic disease. A total of 128,000 aortic disease inpatients aged $ $18 years were admitted (0.2% of CVD inpatients), with aortic dissection being most common (48.2%), followed by aortic aneurysm (23.1%).

In 2022, 28,000 inpatients had aortic dissection as the primary diagnosis, and 13,000 had unspecified dissection types. The mean age was (58.2$±$13.8) years, with women comprising 24.7%. The most common comorbidity was hypertension (76.5%), followed by liver disease (16.3%). Endovascular surgery was performed in 30.0% of aortic dissection inpatients, open surgery in 19.2%, and 50.8% received no surgical treatment. In-hospital mortality was 4.8% and non-recovery discharge rate was 16.6%. For type A dissection, in-hospital mortality was 9.2% and non-recovery discharge rate was 24.0%; for type B dissection, these rates were 1.7% and 10.8%, respectively.

HQMS data show that in 2022, 2,244 hospitals (39.8% of hospitals providing CVD care) managed aortic aneurysm, treating 31,000 inpatients with a mean age of (67.5$±$12.2) years and women comprising 20.6%. Comorbidities included hypertension (59.6%) and stroke (19.5%). Endovascular surgery was performed in 42.5% of patients, open surgery in 13.5%, and 44.0% received no surgery. In-hospital mortality was 0.8% and non-recovery discharge rate was 7.5%.

A multicenter registry study of 1,058 acute type A aortic dissection patients (2018-2021) [59] found a median time from onset to presentation of 10.65 hours and from presentation to surgery of 13 hours. Total arch replacement was performed in 88.7% of cases and frozen elephant trunk stenting in 75.6%, with an in-hospital mortality of 7.6%.

2.7.2 Peripheral Vascular Disease HQMS data show that in 2022, 3,262 hospitals (57.8% of hospitals providing CVD care) managed carotid atherosclerotic stenosis/occlusion disease, treating 171,000 inpatients with a mean age of (58.2$±$13.8) years and women comprising 24.7%. Surgical treatment was performed in 47,000 cases (27.66%), carotid intervention in 38,000 (22.2%), and open carotid surgery in 9,647 (5.6%). Postoperative in-hospital mortality was 0.7% and non-recovery discharge rate was 2.2%.

HQMS data show that in 2022, 4,098 hospitals (72.6% of hospitals providing CVD care) managed varicose veins, treating 174,000 inpatients with a mean age of (58.8$±$11.2) years and women comprising 43.4%. Surgical treatment was performed in 150,000 patients (86.4%), including 131,000 (75.1%) undergoing conventional stripping, 17,000 (10.0%) radiofrequency ablation, and 38,000 (21.7%) laser surgery.

2.8 Pulmonary Hypertension and Venous Thromboembolism

2.8.1 Pulmonary Hypertension HQMS data show that in 2022, 4,875 hospitals (86.3% of hospitals treating CVD inpatients) managed pulmonary hypertension, treating 1.131 million adult inpatients (1.9% of CVD inpatients) with a mean age of (66.9$±$19.1) years and women comprising 48.2%. In-hospital mortality was 1.6% and non-recovery discharge rate was 9.9%.

The distribution of pulmonary hypertension categories was: pulmonary arterial hypertension (7.6%), pulmonary hypertension due to left heart disease (33.0%), pulmonary hypertension due to lung disease and/or hypoxia (23.1%), pulmonary hypertension due to pulmonary artery obstruction (2.0%), and pulmonary hypertension with unclear and/or multifactorial mechanisms (4.8%), with 29.5% unclassifiable.

Right heart catheterization was performed in 1.0% of all pulmonary hypertension patients, ranging from 0.2% to 7.2% across categories.

An observational cohort study explored percutaneous transluminal pulmonary angioplasty (PTPA) for Takayasu arteritis-pulmonary hypertension (TA-PH). Between January 2016 and December 2019, 50 TA-PH patients underwent PTPA and 21 declined. During mean follow-up of (37$±$14) months, 3 (6.0%) PTPA patients died versus 6 (28.6%) non-PTPA patients, with 1 complication in the PTPA group. Cox regression showed PTPA was associated with significantly reduced all-cause mortality (RR=0.18; 95%CI: 0.05-0.73; P=0.017) [60].

2.8.2 Venous Thromboembolism HQMS data show that in 2022, 4,516 hospitals (80.0% of hospitals treating CVD inpatients) managed pulmonary embolism (PE), treating 260,000 adult inpatients (0.4% of CVD inpatients). Deep venous thrombosis (DVT) was managed in 5,092 hospitals (90.2%), treating 1.321 million adult inpatients (2.2% of CVD inpatients). In-hospital mortality was 6.0% for PE and 2.0% for DVT; non-recovery discharge rates were 15.9% and 9.7%, respectively. Surgical history was present in 56.1% of PE and 64.1% of DVT patients; 35.3% of PE patients had DVT and 6.9% of DVT patients had PE; malignancy was present in 25.0% of PE and 26.8% of DVT patients. Catheter-directed thrombolysis was performed in 2.8% of PE and 1.7% of DVT patients; venous filters were placed in 7.0% of DVT patients.

2.9 Cardiomyopathy

HQMS data show that in 2022, 4,928 hospitals (86.3% of hospitals treating CVD inpatients) managed cardiomyopathy, treating 562,000 inpatients (26.6% with cardiomyopathy as primary diagnosis). Dilated cardiomyopathy (DCM) was most common (69.9%), followed by hypertrophic cardiomyopathy (HCM) (18.6%). Women comprised 34.4% of cardiomyopathy inpatients.

Secondary DCM accounted for 103,000 inpatients, with anemic heart disease (45.1%) and uremic cardiomyopathy (21.5%) being most common. Secondary HCM accounted for 6,261 inpatients, with Fabry disease (37.7%) and cardiac amyloidosis (22.1%) being most common.

In-hospital mortality for cardiomyopathy patients was 1.3% and non-recovery discharge rate was 8.0%. Myocardial biopsy was performed in 835 cases (0.56% of cardiomyopathy inpatients) at 107 hospitals (2.2% of hospitals treating cardiomyopathy). ICD therapy was performed in 0.5% and CRT/CRT-D in 0.6% of cardiomyopathy patients.

Chinese researchers pioneered transapical beating-heart septal myectomy (TA-BSM) for obstructive HCM. The first-in-human study enrolled 47 patients with drug-refractory symptomatic obstructive HCM, achieving procedural success in 42 cases (89.4%) at 3 months [61].

2.10 Cardiac Rehabilitation

HQMS data show that in 2022, HF patients received 1.094 million rehabilitation sessions, followed by post-coronary intervention patients (339,000), post-valvular surgery patients (45,000), and post-CABG patients (34,000).

In 2022, post-CABG rehabilitation patients had an average hospital stay of 11.2 days versus 17.8 days for non-rehabilitation patients. Post-valvular surgery rehabilitation patients averaged 11.3 days versus 17.4 days for non-rehabilitation patients.

2.11 Obstructive Sleep Apnea

HQMS data show that in 2022, 4,051 hospitals (71.7% of hospitals providing CVD care) offered OSA services, with 1,017 (25.1%) providing overnight sleep breathing monitoring and 1,695 (41.8%) offering non-invasive positive pressure ventilation. CVD inpatients with OSA (aged $ 18*years*)*totaled*276, 000(0.5±$15.1) years and women comprising 27.5%.

The top four comorbidities among OSA inpatients were hypertension (77.9%), CHD (34.8%), HF (21.3%), and arrhythmia (21.1%). Non-invasive positive pressure ventilation was administered to 18,000 (6.5%) of 276,000 CVD-OSA patients during hospitalization. In-hospital mortality was 0.39% and non-recovery discharge rate was 3.5%.

HQMS data reveal that fewer than 30% of hospitals providing CVD care offer overnight sleep breathing monitoring, and only about 0.5% of CVD inpatients are diagnosed with OSA.

A cohort study of 2,031 hypertensive patients with OSA found that during median follow-up of 6.8 years, 317 (15.61%) experienced cardiovascular events, including 198 (9.75%) CHD and 119 (5.86%) stroke cases. Each standard deviation increase in the metabolic score for insulin resistance (METS-IR) was associated with 30% higher risk of new cardiovascular events, 32% higher CHD risk, and 27% higher stroke risk [62].

2.12 Kidney Disease

HQMS data show that in 2022, among hospitals treating cardiac patients, 5,375 (95.2%) could diagnose CKD, 4,687 (83.0%) could diagnose acute kidney injury (AKI), 3,260 (57.7%) could perform hemodialysis, 1,551 (27.5%) peritoneal dialysis, and 2,663 (47.2%) continuous renal replacement therapy.

In 2022, 6.211 million CVD inpatients had CKD, 341,000 had AKI, 815,000 received hemodialysis, 176,000 received peritoneal dialysis, and 160,000 received continuous renal replacement therapy. CKD prevalence was 21.0% in HF, 17.6% in atrial fibrillation, 17.0% in valvular heart disease, and 15.6% in AMI patients. Among CKD patients, 69.3% were diagnosed with chronic renal insufficiency or failure, with comorbid hypertension (78.8%), diabetes (32.6%), and renal artery stenosis (0.5%).

CVD inpatients with CKD had higher in-hospital mortality (2.5% vs 0.9%), non-recovery discharge rate (10.6% vs 6.3%), AKI incidence (1.1% vs 0.6%), and longer hospital stays (8 vs 7 days) than those without CKD.

A nationwide multicenter prospective cohort study (2011-2016) enrolled 12,523 untreated CKD patients, following them for 439,970 person-years. CKD patients with blood pressure $ $130/90 mmHg had significantly increased risks of cardiovascular events (myocardial infarction, stroke, HF hospitalization/treatment, cardiovascular death) and renal events (eGFR decline $ $20%, end-stage renal disease, renal death), with risks increasing at higher blood pressure levels. Compared with systolic blood pressure 90-119 mmHg, systolic pressure 130-139 mmHg increased cardiovascular and renal event risks by 60% (HR=1.60; 95%CI: 1.06-2.43) and 35% (HR=1.35; 95%CI: 1.05-1.74), respectively. Compared with diastolic pressure 50-69 mmHg, diastolic pressure 90-99 mmHg increased cardiovascular and renal event risks by 51% (HR=1.51; 95%CI: 1.10-2.06) and 40% (HR=1.40; 95%CI: 1.11-1.76), respectively [63].

2.13 Stroke

HQMS data show that in 2022, 5,501 hospitals (2,133 tertiary and 3,368 secondary) treated 12.762 million stroke inpatients (including cerebral infarction, intracerebral hemorrhage, and subarachnoid hemorrhage), with cerebral infarction accounting for 92.7%. Stroke was the primary diagnosis in 49.7% of cases. The mean age was (68.5$±$12.0) years, with in-hospital mortality of 1.3% and non-recovery discharge rate of 8.6%.

Hypertension, CHD, and diabetes were the most common comorbidities (66.6%, 29.1%, and 25.6%, respectively).

A randomized controlled trial across 44 Chinese hospitals enrolled 810 acute large-vessel occlusive ischemic stroke patients with complete revascularization and systolic blood pressure $ $140 mmHg persisting for $ $10 minutes within 3 hours. Patients were randomized to intensive (target <120 mmHg) or standard (140-180 mmHg) blood pressure control. Intensive control increased the risk of poor 90-day outcomes (OR=1.37; 95%CI: 1.07-1.76), early neurological deterioration (OR=1.53; 95%CI: 1.18-1.97), and higher 90-day disability (OR=2.07; 95%CI: 1.47-2.93), with no difference in symptomatic hemorrhagic transformation. These results demonstrate that post-revascularization systolic blood pressure <120 mmHg is not reasonable for acute ischemic stroke patients [64].

A prospective, open-label, randomized controlled trial across 46 Chinese medical centers enrolled 456 patients with anterior circulation large-vessel acute occlusion and Alberta Stroke Program Early CT Score of 3-5 or infarct core volume of 70-100 ml, randomized 1:1 to endovascular treatment (EVT) plus medical therapy (231 patients) or medical therapy alone (225 patients). At 90 days, EVT produced better modified Rankin Scale score distribution than medical therapy alone (OR=1.37; 95%CI: 1.11-1.69; P=0.004). Symptomatic intracranial hemorrhage occurred in 14 (6.1%) EVT patients versus 6 (2.7%) medical therapy patients, with intracranial hemorrhage in 113 (49.1%) versus 39 (17.3%). EVT within 24 hours improved outcomes for acute ischemic stroke with large infarct, though with more intracranial hemorrhage [65].

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3. CVD Research

3.1 Basic CVD Research

High-quality basic CVD research from mainland China began emerging after 2005, with influential publications in *Circulation*, *Circulation Research*, *Signal Transduction and Targeted Therapy*, *Cell Discovery*, and *Nature Communications*. Analysis of recent publications in *Nature*, *Circulation*, *European Heart Journal*, *Circulation Research*, *Nature Communications*, and *Cardiovascular Research* reveals rapid development of domestic high-level cardiovascular basic research.

Between 2022 and 2023, 97 basic research articles with corresponding and first authors from mainland China explored cardiac and vascular anatomy, development, function, and pathogenesis, covering myocardial infarction, HF, ischemia-reperfusion injury, cardiomyopathy, cardiac remodeling, aortic dissection, atherosclerosis, and vascular remodeling. Hot topics included cardiac protection, regeneration, and gene therapy.

3.2 Clinical CVD Research

CVD research in China has flourished in both quantity and quality. China ranks second globally in CVD publications, behind only the United States, with growth rates exceeding the US since 2018. The most active subspecialties are CHD, hypertension, arrhythmia, and HF, with CHD and hypertension publication numbers surpassing those from the US.

In 2022, 14 clinical research articles were published in the six highest-impact general medical journals and four cardiovascular specialty journals, predominantly randomized controlled trials and large prospective cohort studies. This reflects a shift in focus from disease characterization to scientific evaluation of interventions and preventive measures tailored to China' s context.

From August 2022 to July 2023, the National Medical Products Administration approved 68 innovative medical devices, including 42 cardiovascular products (61.5%), with 67 (98.5%) being domestically developed original products. Among 156 approved domestic cardiovascular Class III devices, 125 were interventional, 4 imaging, 6 hemodynamic measurement systems, 4 open surgery, 3 active surgical devices, 6 AI software, and 8 diagnostic products.

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4. CVD Health Economics

4.1 Economic Burden of CVD

In 2021, cardiovascular and cerebrovascular disease discharges totaled 27.6498 million (15.36% of all-cause discharges), including 14.8723 million CVD discharges (8.26%) and 12.7775 million cerebrovascular disease discharges (7.10%) [Figure 17: see original paper]. The leading causes were ischemic heart disease (9.449 million, including 4.168 million angina and 1.148 million AMI) and cerebral infarction (8.624 million), accounting for 34.17% and 31.19% of discharges, respectively [Figure 18: see original paper].

In 2022, unstable angina accounted for the highest proportion of total CHD hospitalization costs (38.6%; ¥35.93 billion), followed by unclassified CHD (18.8%; ¥17.54 billion), STEMI (15.2%; ¥14.19 billion), NSTEMI (11.5%; ¥10.67 billion), stable angina (10.8%; ¥10.08 billion), AMI (3.1%; ¥2.89 billion), and acute coronary syndrome (2.0%; ¥1.88 billion) [Figure 19: see original paper].

The average per-hospitalization cost for CVD patients in 2022 was ¥17,312.8. Valvular heart disease had the highest cost (¥64,375.7), followed by arrhythmia (¥28,421.4), CHD (¥15,212.3), HF (¥10,156.7), and hypertension (¥7,135.1). Material costs accounted for higher proportions of total costs in CHD and valvular heart disease, while diagnostic fees were more prominent in HF, arrhythmia, and hypertension. Surgical treatment and material fees were higher than non-surgical costs in CHD, arrhythmia, and valvular disease, but not in hypertension and HF [Figure 20: see original paper].

4.2 Cardiovascular Health Economics Evaluation

A health economics evaluation based on the CORE Diabetes Model showed that compared with biphasic insulin aspart 30 (BIAsp30), insulin degludec/insulin aspart (IDegAsp) treatment for Chinese type 2 diabetes patients yielded 0.280 additional quality-adjusted life years (QALYs) over 30 years at an incremental cost of ¥3,888, with an incremental cost-effectiveness ratio (ICER) of ¥13,886/QALY. At a willingness-to-pay threshold of ¥80,976/QALY, IDegAsp was a cost-effective option for Chinese type 2 diabetes patients with inadequate basal insulin control [66].

EVT within 24 hours has proven cost-effective for acute ischemic stroke with large infarct. A health economics evaluation showed that compared with medical therapy alone, EVT yielded lifetime benefits of 1.33 QALYs at an additional cost of ¥73,900 (US$11,400), with an ICER of ¥55,500 (US8, 530).*Atawillingness−to−paythresholdof*¥243, 000/*QALY*(3×$ China's 2021 per capita GDP), EVT was cost-effective in 99.5% of probabilistic sensitivity analysis simulations [67].

A health economics evaluation based on the COMPASS trial found that in Chinese patients with stable CVD, low-dose rivaroxaban plus aspirin had an ICER of US$7,937.30/QALY compared with aspirin alone, while rivaroxaban alone had an ICER of US$15,045.78/QALY. At a willingness-to-pay threshold of US$11,000, low-dose rivaroxaban plus aspirin was likely cost-effective for secondary prevention in stable CVD patients [68].

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Note: Figure translations are in progress. See original paper for figures.