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Report on Cardiovascular Diseases in China 2012

About *Chinese Medical Journal*

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Report on Cardiovascular Diseases in China 2012

Outline of report on cardiovascular diseases in China

Writing Committee of Annual Report on Cardiorasoular Diseases in China

The prevalence of cardiovascular diseases (CVDs) is associated with the socioeconomic prosperity, lifestyle changes, accelerated process of ageing and urbanization. The prevalence of CVDs is continuously increasing in China and will remain an upward trend in the next 10 years. CVDs are the leading cause of death for Chinese in both urban and rural area. Nowadays, 41.09% of deaths in rural area and 41.52% of deaths in urban area are caused by CVDs in China. The burden of CVDs remains heavy and has become an important public health problem. Effective strategies should be enforced urgently for the prevention of CVDs under the supervision of the government. In 2012, the Ministry of Health of China and 14 governmental departments jointly issued *the Work Plan for Chronic Disease Prevention and Control in China (2012−2015),* a guideline for the prevention of chronic diseases, especially CVDs in China.

Authorized by the Bureau of Disease Prevention and National Health and Family Planning Commission of China, National Center for Cardiovascular Diseases (NCCD) of China organizes the experts of cardiology, neurology, nephrology, diabetes, epidemiology, community health, health economics and biostatistics and other related fields to compile the annual report on CVDs in China. Seven reports have been published since 2005, which are authoritative documents for the CVDs prevention and control in China and frequently used by relevant leaders, experts and researchers.

This paper summarizes the main contents of *the Report on Cardiovascular Diseases in China, 2012*:

Prevalence of cardiovascular diseases

In general, the prevalence of CVDs (including heart disease and cerebrovascular disease) is continuously increasing in China. It is estimated that the number of patients with CVDs is 290 million, in which 266 million have hypertension, more than 7 million are attacked by stroke, 2.5 million have myocardial infarction (MI), 4.5 million have cardiac failure, 5 million have pulmonary heart disease, 2.5 million have rheumatic heart disease, and 2 million have congenital heart disease. One of 5 adults is afflicted by CVDs.

Mortality of CVDs

It is estimated that 3.5 million patients die of CVDs every year, which accounts for 41% of all deaths. Averagely 9 590 Chinese die of CVDs each day, i.e. 400 deaths per hour and 1 death every 10 seconds.

Continuous increase of cardiovascular risk factors

Hypertension

Hypertension is the primary risk factor for stroke and coronary heart disease. More than half of CVDs are associated with hypertension in China.

Hypertension prevalence

The prevalence of hypertension in adults aged >18 year was 18.8% according to a National Survey in 2002, and increased to approximately 25% in recent years according to the reports from various provinces or municipalities. In some areas in northern China, the prevalence was as high as 30%. It is estimated that 266 million Chinese are hypertensive, indicating that 2−3 of 10 adults are afflicted with hypertension. The prevalence of hypertension in both males and females increased from 1979 to 2002. The difference in hypertension prevalence between rural residents and urban residents is not obvious. It was 19.3% in urban residents and 18.6% in rural residents in 2002.

Hypertension incidence

An eight-year follow-up study among 10 525 people aged >40 years indicated that the estimated annual incidence of hypertension was 3% in China.

High-normal blood pressure

According to a survey in 2002, the prevalence of high normal blood pressure in adults aged >18 years was 34% in China. There were 300 million people with high-normal blood pressure. Compared with normotensives, the risk of hypertension and CVDs in people with high normal blood pressure increased by 3.2 and 1.74, respectively. Half of people with high-normal blood pressure will develop hypertension in 10 years.

Rate of awareness, treatment and control of hypertension

According to a National Survey in 2002, the awareness, treatment and control rates of hypertension in China were 30.6%, 24.7% and 6.1% respectively. The rate of blood pressure control reached 25% by treatment for hypertensive patients. The rates of awareness, treatment and control of hypertension were lower in rural area than those in urban area, and the differences among different areas were statistical significant. At the out-patient departments of cardiology, nephrology and endocrinology in tertiary

hospitals, the rate of blood pressure control was only 30.6% in hypertensive patients aged >18 years.

The major risk factors of hypertension are high-salt diet, overweight/obesity, excessive consumption of alcohol, physical inactivity and chronic stress, etc.

Prevalence of hypertension in adolescents
According to a survey conducted among Chinese children and adolescents aged 6−17 years in seven provinces, municipalities and autonomous regions, the prevalence of hypertension increased significantly from 7.1% in 1991 to 14.6% in 2004 with an annual increase of 0.58%.

Compared with children with normal body weight, the relative risk of hypertension among those who were overweight, obese or abdominal obese was 2.9, 6.0 and 4.6, respectively.

Cigarette smoking
Prevalence of smoking
Despite non-smoking rate increased slightly in people aged >15 years in recent years, China still faces significant challenges in smoking control. According to the report of the Global Adult Tobacco Survey (GATS) 2010, there are 350 million active smokers and 540 million passive smokers in China. The smoking rate has reached a plateau in males, but is slightly increasing in young females. During 2002−2010, the smoking rate among people aged 40−59 years showed an upward trend.

Trend in smoking cessation
The proportion of people trying smoking cessation increased from 9.42% in 1996 to 11.5% in 2002, and up to 16.9% in 2010. The people who stopped smoking increased by 15 million. The rate of passive smoking did not change in recent 10 years.

Generally, smoking rate was significantly higher in rural residents than in urban residents (29.8% vs. 26.1%). It was higher in rural males than in urban males (56.1% vs. 49.2%), but it was significantly higher in urban females than that in rural females (2.6% vs. 2.2%).

The direct economic loss due to smoking was calculated to be RMB 166.56 billion Yuan, the indirect economic loss was RMB 86.111−120.501 billion Yuan, and the total economic loss was about RMB 300 billion Yuan in 2005, accounting for 1.5% of Gross Domestic Product (GDP).

Dyslipidemia
The prevalence of dyslipidemia in Chinese shows an upward trend, and the increase in juveniles is of particularly concern. According to the National Health and Nutrition Survey in 2002, the prevalence of dyslipidemia was 18.6% in adults. Among the dyslipidemia cases, 2.9% was hypercholesterolemia (total cholesterol (TC ≥ 5.72 mmol/L)), 11.9% was hypertriglyceridemia (TG ≥ 1.70 mmol/L), 7.4% was low high-density–lipoprotein-cholesterol (HDL-C <1.04 mmol/L). It is estimated that dyslipidemia affects at least 250 million people in China.

According to a survey conducted in 31 provinces and municipalities in 2002, the awareness rate of dyslipidemia (TC ≥5.72 mmol/L, and/or TG≥1.70 mmol/L, and/or HDL-C <0.91 mmol/L) in adults was only 3.2% (3.4% in males and 2.7% in females). The lipid examination rate was 6.4%. Two rates increased markedly with age and were higher in urban area than in rural area.

According to the National Health and Nutrition Survey in 2002, the prevalence of hypercholesterolemia (TC ≥ 220 mg/dl (5.72 mmol/L)) was 0.8% in children and adolescents (3−18 years), 1.4% in urban area and 0.6% in rural area. The prevalence of hypertriglyceridemia (TG≥150 mg/dl (1.70 mmol/L)) was 2.8%, 2.5% in urban area and 2.9% in rural area.

According to a study of diabetes and abnormal metabolism in 14 provinces, municipalities and autonomous regions in China during 2007−2008, the prevalence of high level of LDL-C (4.14−4.91 mmol/L) and very high level of LDL-C (≥ 4.91 mmol/L) in adults was 3.5% and 3.0%, respectively.

Diabetes
According to a survey conducted among 46 239 adults aged >20 years in 14 provinces and municipalities by Diabetes Division of Chinese Medical Association during 2007−2008, the age-standardized prevalence of diabetes was 9.7%, 10.6% in males and 8.8% in females. The prevalence of diabetes increased with age and body weight. It was 3.2%, 11.5% and 20.4% in people aged 20−39, 40−59 and >60 years, respectively. The prevalence of impaired glucose tolerance was higher than that of impaired fasting glucose (11.0% vs. 3.2% in males and 10.9% vs. 2.2% in females).

20-year follow-up study in Daqing city
It has been confirmed that lifestyle interventions have a long-term effect on prevention of diabetes. The cumulative incidence of diabetes was 80% in intervention group and 93% in control group. For preventing 1 diabetes case, intervention should be given to 6 people. After adjusted by multiple factors, the incidence of diabetes in intervention group decreased by 43% compared with the control group. The disease course of the subjects in the intervention group was averagely 3.6 years shorter than that in the control group. In addition, the incidence of severe retinopathy (blindness or complication which need laser treatment) decreased by 47% due to lifestyle improvement.

Multicenter intervention study over 3 years with combination of lifestyle improvement and drug treatment showed that the annual natural incidence of diabetes in people with impaired glucose tolerance was 11.6%, 8.2% in lifestyle improvement group, 4.1% in metformin plus lifestyle improvement group and 2.0% in acarbose plus lifestyle improvement group; these two drugs reduced the

risk of diabetes by 76.8% and 87.8%, respectively.

Overweight/obesity
According to the National Health and Nutrition Survey in 2002, the prevalence of overweight (BMI 24.0−27.9 kg/m^2) was 17.6% and the prevalence of obesity (BMI ≥ 28 kg/m^2) was 5.6%. It is estimated that the number of overweight and obese people aged >18 years might be as high as 240 million and 70 million, respectively according to the population in 2006. The prevalence of overweight and obesity increased significantly.

The National Health and Nutrition Survey made a long term observation on Chinese diet and health status in 9 provinces and municipalities. The results indicated that in the past 20 years the prevalence of overweight/obesity in China was in an upward trend. The prevalence of overweight, obesity and central obesity (waist circumference ≥ 85 cm in males and ≥ 80 cm in females) was 30.0%, 8.7% and 45.3%, respectively in 2009.

Physical inactivity
The National Health and Nutrition Survey showed that the physical activities in residents aged 18−55 years were mainly conducted in workplace and at home. Leisure activities increased, while other forms of activities decreased. Compared with 1997, the total physical activities decreased by 27.8% in males and by 36.9% in females in 2006.

According to the data from the Third National Sports Exercises Survey, 28.2% of Chinese aged >16 years, including school students, took regular exercises (≥ 3 times per week, each time ≥ 30 minutes). Whereas, the rate of taking regular exercises in age group 20−49 years was significantly lower than those of other age groups.

Diet and nutrition
In general, the Chinese dietary pattern has been markedly improved, but some diet habits are still problematic. The intake of grain decreased significantly, whereas the intake of fat increased dramatically. The daily intake of salt (>12 g/d) was much higher than the level recommended by dietary guidelines (< 6 g/d). The consumption of vegetables and fruits was also not enough.

Long-term observation made by the National Health and Nutrition Survey in 9 provinces and municipalities in China showed that the total energy intake significantly declined, but the percentage of total energy from fat was much higher than the level recommended by the dietary guidelines (30%). While the percentage of total energy from carbohydrates decreased according to the dietary guidelines (55%−65%). The dietary cholesterol intake increased obviously. Although the dietary calcium intake increased slightly, it was only half of the recommended level (800 mg/d).

Chronic kidney disease (CKD)
The first national study on CKD in China recruited 47 204 subjects from 13 provinces and municipalities. CKD was defined as eGFR less than 60 ml/min per 1.73 m^2 or the presence of albuminuria. The result indicated that the overall prevalence of CKD was 10.8%, the adjusted prevalence of eGFR less than 60 ml/min per 1.73 m^2 was 1.7% and of albuminuria was 9.4%. The number of patients with CKD in China is estimated to be about 120 million. Among CKD patients, only 12.5% are aware of their disease status. Factors independently associated with CKD were age, sex, hypertension, diabetes, history of cardiovascular disease, hyperuricaemia, living area and economic status.

Mortality and status of CVDs

In 2011, CVDs ranked first among all causes of death, higher than tumor and other diseases.

Coronary heart disease
The mortality of coronary heart disease was 86.34 per 100 000 in urban area and 69.24 per 100 000 in rural area in 2010. The mortality was higher in males than that in females.

The mortality of acute myocardial infarction increased dramatically in rural residents in recent years, which is close to the level of urban residents.

The age-standardized incidence of acute coronary heart disease was 166.4 per 100 000 in local residents in Beijing from 2007 to 2009 (218.5 per 100 000 in males and 115.2 per 100 000 in females). It was 144.3, 154.7, and 195.8 per 100 000 in urban, suburban and exurban areas, respectively. The age-standardized incidence increased by 8.1% in 2009 compared with 2007, the increase in males (11.1%) was greater than in females (2.5%). The incidence increased by 30.3% in 2009 compared with 2007. The highest increase was in males aged 35−44 years.

Based on the data from the fourth family health survey in 2008, the overall prevalence of ischemic heart disease was 7.7‰, 15.9‰ in urban area and 4.8‰ in rural area, indicating 7.70 million Chinese had ischemic heart disease. Compared with the data of the third survey in 2003 (4.6‰, 12.4‰ for urban residents and 2.0‰ for rural residents), the prevalence of ischemic heart disease increased considerably.

The 2007−2008 China National Diabetes and Metabolic Disorders Survey randomly recruited 46 239 adults aged >20 years, the prevalence of coronary heart disease was 0.74% in males and 0.51% in females.

Stroke
The mortality of cerebrovascular disease in 2010 was 125.15 per 100 000 for urban residents and 145.71/100 000 for rural residents. It was estimated that 833 000 urban residents and 982 000 rural residents died of cerebrovascular disease in 2010. In general, the death rate

was higher in rural area than in urban area, and in males than in females.

The crude death rate of cerebrovascular disease in 2009 increased by 1.41 times in urban area, and by 1.44 times in rural area compared with 2006, but the rate declined in 2010 in both urban residents and rural residents compared with 2009.

The incidence of stroke is high in China. The number of patients who had stroke is 4−5 times of the number of patients who had myocardial infarction.

The prevalence of cerebrovascular disease in China was 9.7 ‰ in 2008, indicating more than 9.7 million Chinese were afflicted with cerebrovascular disease.

From September 2007 to August 2008, 14 702 patients who had ischemic stroke were recruited in Chinese National Stroke Registry (CNSR) Study. Among 11 675 patients with known time of stroke onset, 2 514 (21.5%) arrived at emergency departments within 3 hours, 1 469 (12.6%) were eligible for thrombolytic treatment, and 284 (2.4%) were finally treated, 181 (1.6%) received intravenous rtPA. The median onset-to-needle time was 180 minutes (interquartile range, 150 to 228 minutes); the median door-to-needle time was 116 minutes (interquartile range, 70 to 150 minutes); the median imaging-to-needle time was 90 minutes (interquartile range, 60 to 129 minutes). Patients with younger age arrived at emergency departments more quickly. The patients with higher National Institutes of Health Stroke Scale scores, having higher income and higher education had a better chance of receiving intravenous rtPA. Approximately 1 of 5 stroke patients who arrived at emergency departments within 3 hours received thrombolytic therapy. The onset-to-needle time, door-to-needle time and imaging-to-needle time were significantly longer than those in developed countries.

Atrial fibrillation

The prevalence of atrial fibrillation is 0.65% in Chinese aged >30 years, indicating that about 4.20 million Chinese have atrial fibrillation. Among all atrial fibrillation patients, the prevalence of valvular atrial fibrillation, nonvalvular atrial fibrillation and isolated atrial fibrillation is 12.9%, 65.2% and 21.9%, respectively. The incidence of stroke in patients with atrial fibrillation is significantly higher than that of patients without atrial fibrillation (12.1% vs. 2.3%). A retrospective study among hospitalized patients of cardiology departments in 22 provincial hospitals showed that the prevalence of arrhythmia was 26.8%. Among all arrhythmia patients, the rate of patients with atrial fibrillation was highest (35.0%), followed by paroxysmal supraventricular tachycardia (28.0%), sick sinus syndrome (11.9%) and ventricular premature beat (11.6%).

Sudden cardiac death

The annual incidence of sudden cardiac death (SCD) in China is 41.8 per 100 000, and it is higher in males than in females (44.6 /100 000 vs. 39.0/100 000). Significantly higher SCD incidence is observed in people aged >25 years (61.7/100 000 for males and 53.3/100 000 for females). It is estimated that 544 000 sudden cardiac deaths occur annually in China.

Lower extremity arteriosclerosis disease

The prevalence of lower extremity arteriosclerosis disease (LEAD) is 3.04% in China, but the awareness rate of LEAD was only 1.38%. The prevalence is about 25% among patients aged >50 years with coronary heart disease and diabetes. In Beijing, one fifth of people aged >60 years suffer from LEAD.

Heart failure

The prevalence of heart failure is 0.9% in China (0.7% in males and 1.0% in females). The prevalence increases obviously with age (P <0.01). It is higher in northern China than in southern China (1.4% vs. 0.5%, P<0.01) and higher in urban area than in rural area (1.1% vs. 0.8%). In recent 30 or 20 years, the main cause of heart failure changed from rheumatic valvular heart disease to coronary heart disease.

Prevalence of congenital heart disease

A survey conducted in several regions in China reported that the prevalence of congenital heart disease in perinatal fetus ranged from 6.8‰ to 14.39‰. If 8‰ was used for the estimation, there would be about 160 000 newborn babies with congenital heart disease each year in the mainland of China.

The monitoring report of birth defects in China indicates that the incidence of congenital heart disease is between 0.7‰ and 7.32‰ and increases over time.

Based on a cross-sectional study in some areas in China, the prevalence of congenital heart disease ranges from1.30‰ to 17.0‰, usually 2‰−8‰.

Treatment for cardiovascular disease

Cardiac surgery

Number of cardiac surgeries in China

The number of cardiac surgeries was 187 983 in 2011, an increase of 10.3% compared with 2010. Of these surgeries, 150 787 were performed on-pump. One hundred and fifty−six heart transplant surgeries were conducted in 2011, an increase of 13.2% compared with 2010. The total number of oxygenator used in 2010 was 13 670, an increase of 88% compared with 2004.

A total of 2 541 patients who underwent coronary artery bypass grafting (CABG) in Beijing were followed up for 5 years, and the results showed that in comparison with non-smoking, persistent smoking after CABG was associated with higher rates of all-cause mortality, cardiovascular mortality, major adverse cardiovascular events and angina.

A retrospective study conducted in Beijing analyzed the

post-operation data of 2 277 patients with rheumatic heart disease, the result indicated that age, mitral valve orifice area, left atrium diameter and atrial fibrillation were the major risk factors for left atrial thrombosis.

The validation study for Sino System for Coronary Operative Risk Evaluation (SinoSCORE) suggested that SinoSCORE seems to be more suitable than EuroSCORE in predicting postoperative mortality for off-pump coronary artery bypass patients in China.

Arrhythmia

Pacemaker implantation

The total numbers of pacemaker implantation continued to increase, 42 986 pacemakers were implanted in 2011, an increase of 10.9% compared with 2010, in which 50.6% were for sick sinus syndrome, 39.0% were for atrioventricular block .

Implantable cardiaoversion-defibrillator (ICD) implementation

Totally 1 288 cases received ICD implantation in 2011, an increase of 19.6% compared with 2010, 14.7% of them (179 cases) were dual chamber ICD implantation.

Cardiac resynchronization therapy (CRT) implantation

Totally 1 822 cases received CRT implantation in 2011, an increase of 19.3% compared with 2010.

Radiofrequency ablation (RF ablation)

Totally 63 355 cases received RF ablation in 2011, an increase of 16.1% compared with 2010, in which 56% were for supraventricular tachycardia, 26.5% were for atrial flutter and 13.9% were for atrial fibrillation.

Community-based prevention and treatment of CVDs

Prevention and treatment of CVDs in community

The prevention and treatment of CVDs in Capital Iron and Steel Company conducted by Fuwai Hospital in Beijing in 1969 was the first model of community-based healthcare program in China. The incidence of stroke was reduced by 50% via adequate BP control. The prevention and treatment of CVDs in China experienced a series of changes over past 4 decades and has gradually become a government-sponsored and multi-sectoral coordinated program.

Standardized management for hypertension in community in Hebei province

In April, 2007, physicians from communities in Hebei province were invited to participate the Program of *National Community-based Standardized Management for Hypertension*. More than 1100 doctors from 206 communities in 67 counties of 8 cities received the training. They were responsible for the management of 41 800 hypertension patients. The blood pressure of the patients decreased by 14.8/8.2 mmHg and the control rate increased from 8.9% to 77.3% after intervention.

Costs of CVDs

Number of patients with CVDs discharged from hospital

A total of 12.896 million patients with CVDs were discharged from hospitals in 2011, which accounted for 12.0% of the total discharges. Of these, 6.709 million were heart disease patients and 6.187 million were cerebrovascular disease patients. Most CVDs patients discharged from hospitals in 2011 had ischemic heart disease (4.463 million, including 297 000 AMI) and cerebral infarction (3.726 million), accounting for 34.6% and 28.9% of total CVDs patients, respectively. The other discharged patients had hypertension (2.016 million), diabetes mellitus (2.127 million), cerebral hemorrhage (1.199 million) and rheumatic heart disease (0.23 million). The average annual increase in the number of CVDs patients discharged (9.4%) during 1980−2011 was higher than that of all diseases (6.0%). The average annual increase in discharge rates was highest for diabetes mellitus (14.1%), followed by cerebral infarction (12.3%), ischemic heart disease (11.6%), cerebral hemorrhage (10.5%), AMI (8.9%), hypertension (8.1%), hypertensive heart disease and renal disease (5.2%).

Costs of hospitalization for CVDs

The cost of hospitalization in 2011 was RMB 4.99 billion Yuan for AMI, RMB 14.16 billion Yuan for cerebral hemorrhage, and RMB 22.3 billion Yuan for cerebral infarction. The expenditure for each hospitalization was RMB 16 793 Yuan for AMI, RMB 11 802 Yuan for cerebral hemorrhage, and RMB 7 325 Yuan for cerebral infarction. The annual increase in expenditure for each hospitalization due to the above diseases since 2004 was 7.0%, 5.4% and 1.6%, respectively.

Cost of medicines for CVDs

The total cost of medicines in hospitals with >100 beds was RMB 366 billion Yuan in 2011, in which 46 billion Yuan was spent on medicines to treat CVDs. The first five classes of medicine were those to improve cerebral circulation, myocardial nutrition and coronary circulation, i.e. calcium antagonists, lipid modifiers and angiotensin II receptor blockers.

Members of the writing committee:
Hu Shengshou, Kong Lingzhi, Gao Runlin, Liu Lisheng, Zhu Manlu, Chen Weiwei, Wang Wen, Wang Yongjun, Wu Zhaosu, Chen Chunming, Chen Yude, Du Wanliang, Gu Dongfeng, He Jianguo, Hu Dayi, Jia Weiping, Li Guangwei, Li Wei, Li Xiaoying, Li Xiaomei, Li Ying, Liu Kejun, Liu Jing, Liu Mingbo, Luo Xinjin, Luo Ren, Mi Jie, Rao Keqin, Tang Xinhua, Wang Chunning, Wang Haiyan, Wang Jinwen, Wang Mei, Wang Wei, Wang Wenzhi, Wang Yilong, Wang Yu, Wang Zengwu, Wu Di, Wu Liangyou, Wu Xigui , Xu Zhangrong, Yang Gonghuan, Yang Jingang, Yang Xiaohui, Yao Chonghua, Zeng Zhechun, Zeng Zhengpei, Zhang Jian, Zhang Shu, Zhang Yuhui, Zhao Dong, Zhao Liancheng, Zhou Xin, Zhu Jun, Zuo Huijuan

Report on Cardiovascular Diseases in China 2012

Cardiovascular diseases

Liu Mingbo, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China

It is estimated that the number of existing patients with cardiorascular discases (CVDs) (including coronary artery disease, stroke, heart failure and hypertension, etc) is about 290 millions in China. It is estimated that at least 266 millions are patients with hypertension, 7 millions patients with stroke, 2.5 millions with myocardial infarction, 4.5 millions with heart failure, 5 millions with Pulmonary heart disease, 2.5 millions with rheumatic heart disease, and 2 millions with congenital heart diseases in China. The mortality of CVD is still at lofty level in recent years in China. The mortality of CVD ranked first and was still higher than that of tumor and other diseases in 2011.

The number of existing patients with CVDs

It is estimated that the number of existing patients with CVDs (including coronary artery disease, stroke, heart failure and hypertension, etc) is about 290 millions in China, which means one CVD patient in every 10 adults .

According to the four national hypertensive prevalence surveys in China from 1959 to 2002, the average value of three hypertensive prevalence growth rate is 3.1% and using the geometric progression method, the hypertensive prevalence rate of the national population over 15 years old is 24%. It is estimated that at least 266 millions are patients with hypertension, 7 millions patients with stroke, 2.5 millions with myocardial infarction, 4.5 millions with heart failure, 5 millions with pulmonary heart disease, 2.5 millions with rheumatic heart disease, and 2 millions with congenital heart diseases in China.

Death of CVD

① It is estimated that about 3.5 millions patients die of CVDs every year.
② Two in every five deaths are attributed to CVDs.
③ There are 9 590 patients that die of CVDs every day. It is estimated that there are 400 deaths of CVDs in every hour and 1 death of CVDs in every 10 seconds.

Mortality and all-causes of death of CVD

① The mortality of CVD is still at lofty level in recent years in China. The mortality of CVD ranked first and was still higher than that of tumor and other diseases in 2011 (Figure 1-4).

② In all-cause death of major diseases in Chinese residents, CVD is the leading cause (Figure 5-6).

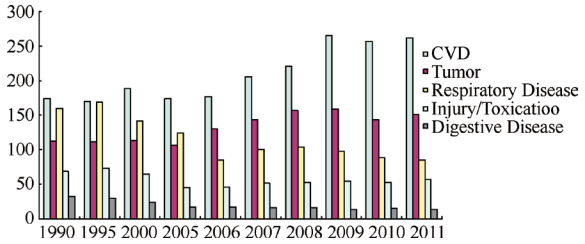

Figure 1. Mortality of major diseases in Chinese rural (1990-2011).

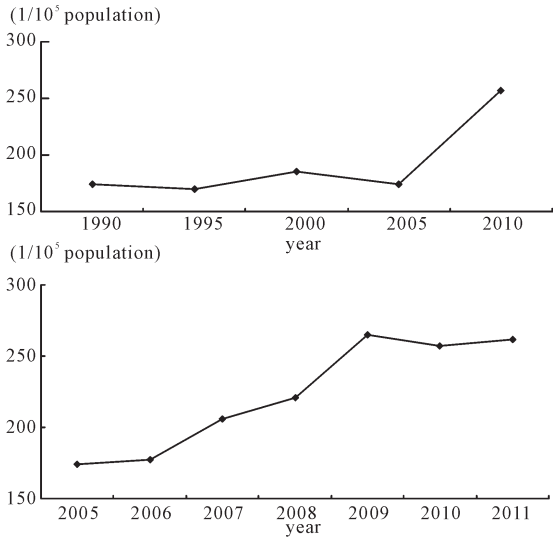

Figure 2. Mortality of CVDs in Chinese rural (1990-2011).

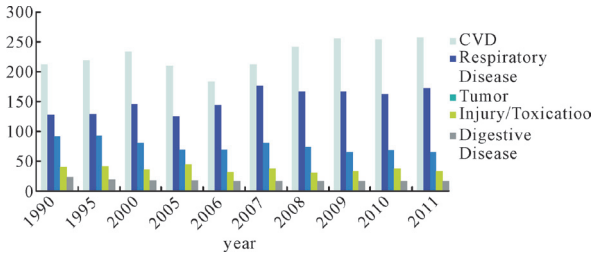

Figure 3. Mortality of major diseases in Chinese urban.

National Center for Cardiovascular Diseases, Fuwai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100037, China (Liu MB)

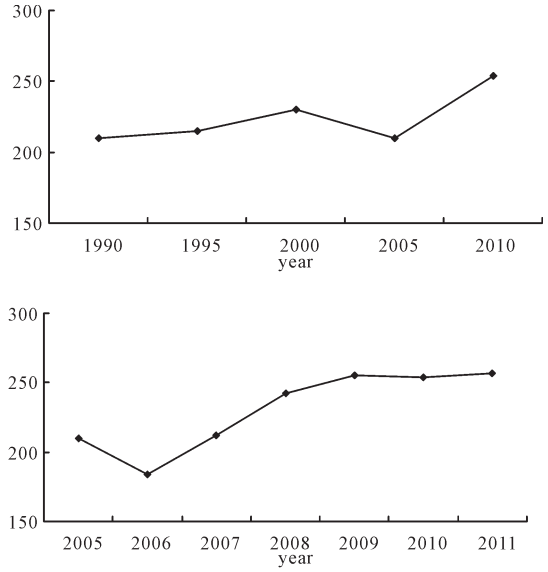

Figure 4. Mortality of CVDs in Chinese rural (1990-2011).

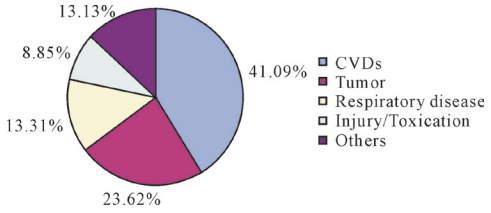

Figure 5. Death constituents of major diseases in Chinese rural.

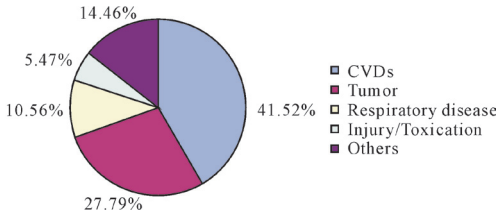

Figure 6. Death constituents of major diseases in Chinese urban.

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Report on Cardiovascular Diseases in China 2012

Hypertension

Wang Zengwu, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China.

Hypertension is one of the most important risk factors for cardiovascular and cerebrovascular diseases. Blood pressure beginning with 110/75mmHg, the risk of cardiovascular diseases increase with blood pressure rising. 70% of stroke and 50% of myocardial infarction (MI) are attributed to the increase of blood pressure, and hypertension also accounts for 6% in the reasons of disability. Increase of blood pressure leads to 2 millions premature deaths, and at least 36.6 billion direct medical costs all over the country every year. So recognizing prevalence of hypertension timely and accurately is significant to the prevention of cardiovascular diseases.

Primary hypertension

Prevalence of hypertension

There were four national large-scale epidemiological sampling surveys on prevalence of hypertension since 1959, and the outcomes showed that prevalence of hypertension trended to increase significantly (Figure 1). Based on the geometric progression, prevalence of hypertension is 24% among population aged 15 and above in China and the number of patients with hypertension has reached 266 millions approximately in 2012.

The data from the Chinese National Nutrition and Health Survey in 2002[1] showed that prevalence of hypertension in adults was 18.8%, and prevalence of hypertension increased with age significantly in both males and females. Prevalence of hypertension increased more in males than in females before 45 years old, but the prevalence was higher in females than in males over 45 years old (Figure 2).[2]

According to the trend between 1979 and 2002, prevalence of hypertension presented an upward trend. The prevalence rose faster and the differences among various periods increased over 40 years old in both males and females (Figure 3).[2]

The data of surveys on prevalence of hypertension in different periods demonstrated that the differences were significant between urban and rural areas and among

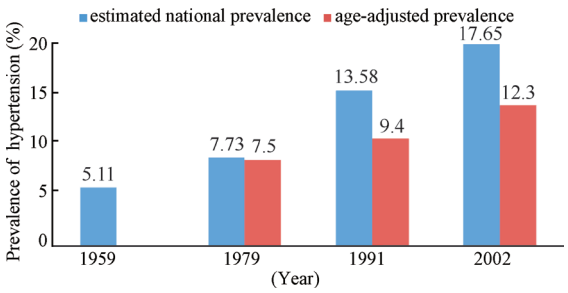

Figure 1. Prevalence of hypertension among population aged 15 and above in four National Epidemiological Sampling surveys in China

Note: The diagnostic criteria of hypertension were somewhat different among various surveys: In 1959, it was DBP >90 mmHg and/or SBP >140 mmHg under the age of 39, and SBP would be 10 mmHg more every 10 years over 40 years old; In 1979 - 1980, it was SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg without consideration of any anti-hypertensive drugs taken within 2 weeks. In 1991, it was SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg, or taking anti-hypertensive drugs within recent 2 weeks. In 2002, it was the same as the criteria in 1991.

The diagnostic criterion of hypertension used the criterion in 1979-1980 uniformly. The national population aged 15 and above in 1964 was used as the standardized population. BP unit was mmHg in all four surveys.

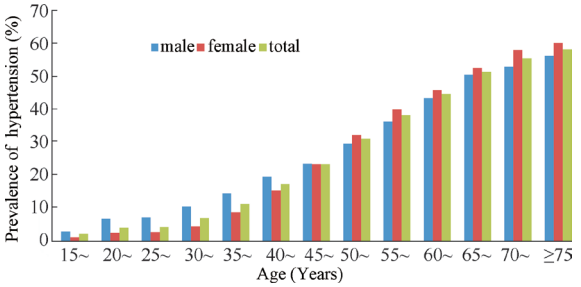

Figure 2. Prevalence of hypertension in different age groups of Chinese population

Note: The diagnostic criterion of hypertension was SBP ≥140 mmHg and/or DBP ≥90 mmHg, or taking anti-hypertensive drugs within recent 2 weeks.

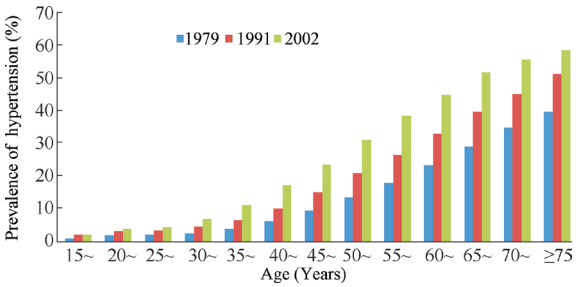

Figure 3. Trend of prevalence of hypertension among different age groups in 1979, 1991 and 2002.

Note: the diagnostic criteria of hypertension: In 1979, it was SBP >140 mmHg and/or DBP >90 mmHg. In 1991 and 2002: it was SBP ≥140 mmHg and/or DBP ≥90 mmHg, or taking anti-hypertensive drugs within recent 2 weeks.

National Center for Cardiovascular Diseases, Fuwai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100037, China (Wang ZW)

different regions. The standardized prevalence in urban areas reached 19.3%, and it was 18.6% in rural areas in 2002. But based on the trend, the gap of the prevalence between urban and rural areas was narrowing (Figure 4).
The data[3] of hypertension about different ethnic groups from 152 683 subjects aged over 15 which can be analyzed showed that Tibetan had the highest prevalence (24.7%) and the prevalence was the lowest in Hmong; compared with it in 1991, prevalence of hypertension in 2002 increased most in Manchu and declined in Mongolian (Table 1).

There was no national survey after 2002, but some regional surveys showed that prevalence of hypertension remained high (Table 2).

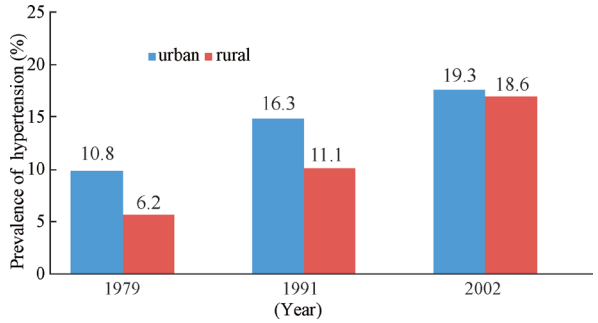

Figure 4. the Trend of prevalence of hypertension in different periods[2]
Note: the diagnostic criteria of hypertension: In 1979, it was SBP >140 mmHg and/or DBP >90 mmHg. In 1991 and 2002: it was SBP ≥140 mmHg and/or DBP ≥90 mmHg, or taking anti-hypertensive drugs within recent 2 weeks. The prevalence was not a standardizedrate except in 2002.

Table 1. The standardized prevalence of hypertension about different ethnic groups in 1991 and 2002

Ethnic	Male (%)		Female (%)		Total (%)	
	1991	2002	1991	2002	1991	2002
Han	11.6	17.7	10.3	15.3	11.3	16.2
Mongolia	21.1	18.8	15.6	17.2	18.2	17.6
Hui	10.4	16.2	9.3	16.2	9.8	16.0
Tibetan	19.5	25.6	16.4	24.0	17.8	24.7
Hmong	8.3	9.2	7.0	6.1	7.7	7.7
Zhuang	9.4	16.1	7.5	8.3	8.8	11.8
Bouyei	11.6	13.9	7.8	10.7	9.5	12.4
Manchu	13.4	23.1	11.1	18.7	12.3	20.5

Another research[19] found that prevalence of hypertension were respectively 20.4%, 24.5%, and 30.6% among rural residents aged between 35 and 74 in Shandong Province in 1991, 2002 and 2007; and the prevalence trended to increase.

Incidence of Hypertension

A study[20] including 10 525 non-hypertensive adults aged over 40, after average 8.2 years' follow-up, found that 28.9% of men and 26.9% of women developed into hypertension (Figure 5). It was estimated that annual incidence of hypertension was about 3%.

Another research[21] containing 24 052 non-hypertensive adults aged over 35, after average 28 months' follow-up, showed that 26.5% of participants developed into hypertension (Figure 6). Participants who were at the higher baseline of BP or older tended to develop into hypertension.

Detection rate of high-normal BP

In a survey[2] on Nutrition and Health of Chinese people in 2002, the data of total 147 472 participants aged 18 and above were classified by BP levels based on the definition of Hypertension Guidelines for Prevention and Control in China in 2005, and the participants with high-normal BP accounted for 34% and it was estimated that the number of people with high-normal BP was 300 millions.

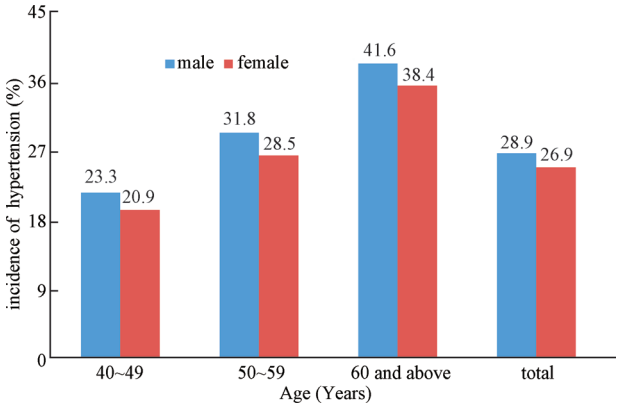

Figure 5. 8-year cumulative incidence of hypertension in adults in different genders and age groups.

Table 2. Prevalence of hypertension in different regions of China

Time (year)	Region	Age (years)	Sample Size (million)	Prevalence (%)	Standardized Prevalence (%)
2004	Tianjin City[4]	≥15	2.39	31.57	—
2005~2007	Liaoning Province[5]	≥35	45 925	37.8	—
2007	Countryside in Shandong Province[6]	≥25	16 364	43.8	—
2007	Urban-rural fringe in Shanghai City[7]	≥60	11 220	49.73	—
2007	Eight counties in Yunnan Province[8]	15~69	5 000	24.8	21.7
2007	Heilongjiang Province[9]	≥15	10620	30.48	—
2007~2008	Xin'an County in Henan Province[10]	≥18	20194	30.77	20.71
2008	Xuzhou City[11]	20~75	17500	20.87	16.39
2008	Chengdu City[12]	≥18	3 524	—	21.87
2007~2009	Hangzhou City[13]	≥20	42998	27.49	—
2008~2009	Wuzhong City[14]	≥18	5442	23.7	19.7
2009	Tibet[15]	≥40	701	55.9	57.1
2008~2010	Fangshan District in Peking City[16]	≥40	58 308	47.2	46.1
2009~2010	Cities in Liaoning Province[17]	18~74	25 196	28.7	—
2011	Hulunbuir City in Inner Mongolia[18]	≥20	1996	31.71	33.62

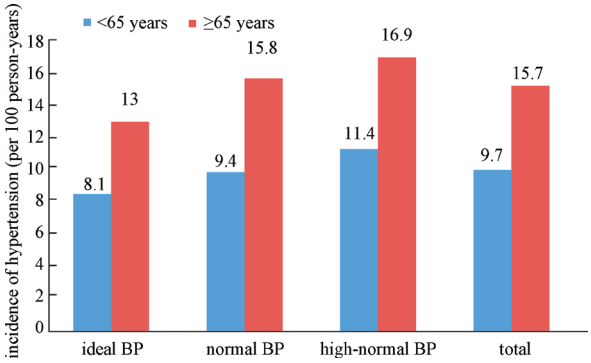

Figure 6. Incidence of Hypertension in different baselines of blood pressure and age groups (per 100 person-years)
Note: ideal BP: SBP <120 mmHg and/or DBP<80 mmHg; normal BP: SBP 120-129 mmHg and/or DBP ≥ 80-84 mmHg; high-normal BP: SBP 130-139 mmHg and/or DBP 85-89 mmHg.

The proportion of males with normal BP was lower than females; by contrast, the proportion of high-normal BP was opposite (Figure 7).

Another survey[19] analyzed the trend of high-normal blood pressure among rural population aged from 35 to 74 years old in Shandong Province. The results showed that the prevalence of high-normal blood pressure were respectively 20.4%, 24.5% and 30.6% in 1991, 2002 and 2007; and presented an upward trend,.

It was reported[22] that high-normal blood pressure could increase the risk of stroke, coronary heart diseases (CHD) and overall CVD by 56%, 44% and 52% respectively. The attributable risk (AR) of high-normal blood pressure was respectively 12.4%, 15.2% and 14.4% in the events of CHD, stroke and overall CVD. The result of a study[16] about risk factors of cardiovascular diseases among 58 308 rural residents aged over 40 in Fangshan district in Peking city between 2008 and 2010 showed that prevalence of prehypertension was 37.8%. Another epidemiological investigation[17] on high-normal blood pressure conducted among 25196 urban residents aged from 18 to 74 in Liaoning province between 2009 to 2010 showed that the proportion of prehypertension in males was higher than

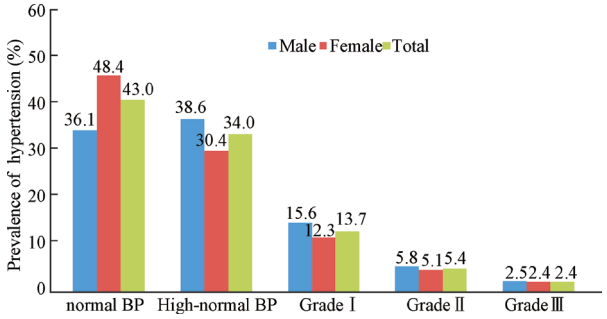

Figure 7. The constituent ratio of BP levels in Chinese adults in 2002
Note: classification of BP levels was based on the definition of hypertension guidelines for prevention and control in China in 2005.

in females, which was the same as hypertension, and the proportion of prehypertension decreased gradually as age increasing, which was opposite to hypertension (Table 3).

Isolated Systolic Hypertension

According to the data of the survey[23] in 2002, the standardized prevalence of isolated systolic hypertension (ISH) was 6.0% in Chinese adults; it was 5.4% and 6.9% in males and females. It was estimated that there were 50 millions patients with ISH in Chinese population. Generally, the prevalence of ISH presented an upward trend with the increase of age, and the trend was obvious especially in the people aged over 40. Before 40 years old, the prevalence was higher in males than in females; by contrast, over 40 years old, it was higher in females (Figure 8).

In different age groups, the prevalence of ISH in female adults was higher than in male adults and the characteristic was not consistent with prevalence of hypertension completely in Chinese adults (Figure 9).

The Blood Pressure level in Chinese Population

According to the results of the Chinese National Nutrition and Health Survey in 2002,[24] the mean blood pressure

Table 3. Prevalence of prehypertension and hypertension in urban population in Liaoning province (%)

Age (Years)	Sample Size (*n*)	Prehypertension (%)	Hypertension (%)
Male			
18~34	5028	55.1	19.8
35~44	2560	48.6	30.8
45~54	2469	43.9	41.2
55~64	1426	36.9	52.7
65~74	930	31.9	56.5
Total	12412	47.7	32.9
Female			
18~34	4792	31.7	4.7
35~44	2693	38.8	16.9
45~54	2689	36.7	36.4
55~64	1670	29.3	55.9
65~74	939	26.6	60.4
Total	12783	33.6	24.7
All			
18~34	9820	43.7	12.4
35~44	5253	43.6	23.7
45~54	5158	40.2	38.7
55~64	3096	32.8	54.5
65~74	1869	29.3	58.4
Total	25196	40.5	28.7

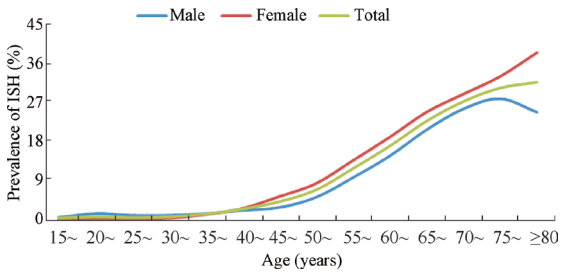

Figure 8. The Standardized prevalence of ISH in different age groups in China[23]
Note: Prevalence in different age groups was adjusted by composition of regions.

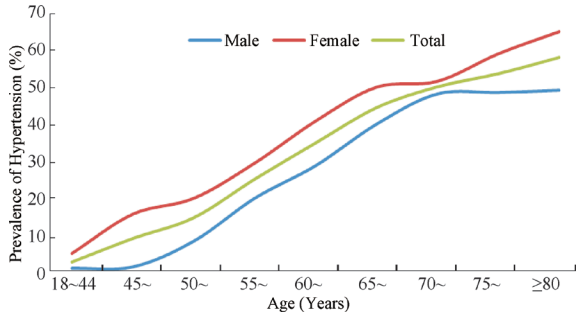

Figure 9. The standardized prevalence of ISH in different age groups in Chinese adults[23]
Note: Prevalence in different age groups was adjusted by composition of regions.

level in Chinese population rose with age increasing. Under 45 years old, the level of systolic blood pressure (SBP) was higher in males than in females; while over 45 years old, the level of SBP was lower in females. Although the level of diastolic blood pressure (DBP) was lower in females among all age groups, the gap reduced gradually after 45 years old (Table 4).

The data[3] about different ethnic groups in the Chinese National Nutrition and Health Survey in 2002 showed based on the available information of 152 683 participants aged over 15 years old, the mean level of SBP was the highest in Manchu, and it was 126.2 mmHg and 125.7 mmHg in males and females respectively; however, the mean level of DBP was the highest in Tibetan, and it was 85.7 mmHg and 81.6 mmHg in males and females respectively (Table 5).

The blood pressure level of herdsmen aged 40 years old and above in Tibet in 2009 was showed in Table 6.[15]

Awareness, treatment and control of hypertension
According to a survey in 2002,[25] awareness, treatment and control of hypertension among Chinese population were 30.6%, 24.7% and 6.1% respectively, and the control rate reached 25% among patients with hypertension receiving anti-hypertensive treatment. Awareness, treatment and control of hypertension elevated as age increased, and they were higher in urban areas than in rural areas (Table 7).

Awareness, treatment and control rate of hypertension were 32.7%, 27.5% and 11.6% among the Chinese population aged between 15 and 69 in 2007.[26]

A study[27] investigated the control of 26 655 out-patients with hypertension, and the control rate of hypertension was 50.2% and 56.7% after taking anti-hypertensive drugs for 4 weeks and 12 weeks respectively. The control rates under treatment of various types of hypertension were different, and the rates were also different among hypertensive patients with different risk stratification. What's more, the control rate decreased as the risk stratification advanced, and the rate in patients with diabetes or nephropathy was significantly lower than the mean level (Table 8).

Some regional surveys showed that awareness, treatment and control of hypertension were lower in rural areas than in urban areas, and different areas varied greatly (Table 9).

Table 4. The mean level of blood pressure in Chinese population aged 15-74 years old

Age (Years)	SBP (mmHg)		DBP (mmHg)	
	Male	Female	Male	Female
15~24	112.4	107.6	71.9	69.8
25~34	115.7	109.4	75.6	71.5
35~44	118.4	114.8	78.1	74.9
45~54	122.9	123.1	80.0	78.3
55~64	129.3	130.4	80.7	79.1
65~74	135.2	136.8	79.8	78.7

Table 5. The mean level of blood pressure in different ethnic groups among Chinese population aged 15 years old and above

Ethnic	SBP (mmHg)		DBP (mmHg)	
	Male	Female	Male	Female
Han	123.3	120.3	78.6	75.9
Mongolia	123.3	123.3	78.2	77.1
Hui	120.4	118.3	78.2	75.3
Tibetan	124.8	117.0	85.7	81.6
Miao	116.2	111.0	73.0	69.7
Zhuang	123.8	116.7	77.4	72.7
Bouyei	119.7	117.3	77.1	73.5
Manchu	126.2	125.7	79.4	77.7
Tujia	122.6	121.0	74.4	73.1
Others	118.2	114.3	76.9	74.6
Total	123.1	120.0	78.5	75.7

Table 7. Awareness, treatment, and control among the hypertensive population in China

	Age (Years)	Urban (%)	Rural (%)	Total (%)
Awareness	18~	17.8	11.6	13.6
	45~	40.8	25.1	31.0
	60~	48.5	26.8	37.6
	total	41.1	22.5	30.6
Treatment	18~	11.8	7.9	9.1
	45~	34.1	19.4	25.0
	60~	43.1	21.3	32.2
	total	35.1	17.4	24.7
Control	18~	4.2	2.1	2.7
	45~	10.0	3.8	6.2
	60~	11.3	3.9	7.6
	total	9.7	3.5	6.1
Control under treatment	18~	36.3	26.8	30.7
	45~	29.7	20.2	25.2
	60~	26.6	19.1	24.1
	total	28.2	20.4	25.0

Table 6. The blood pressure level of Herdsmen aged 40 years old and above in Tibet (height 4 300 m) in 2009

Age (Years)	Male			Female			Total		
	N (*n*)	SBP (mmHg)	DBP (mmHg)	N (*n*)	SBP (mmHg)	DBP (mmHg)	N (*n*)	SBP (mmHg)	DBP (mmHg)
40~49	127	135.6±23.2	89.6±14.4	159	126.1±18.8	82.4±10.3	286	130.3±21.4	85.6±12.8
50~59	72	155.7±29.1	101.2±15.3	85	137.3±24.1	87.7±12.9	157	145.7±28.0	93.9±15.6
60~69	67	161.1±33.8	98.8±17.7	90	157.0±29.8	95.0±17.3	157	158.8±31.5	96.6±17.5
≥70	35	182.8±31.1	102.6±10.9	66	170.8±30.1	98.7±14.5	101	175.0±30.9	100.0±13.4
Total	301	151.6±32.2	95.9±16.0	400	142.8±30.1	89.0±14.8	701	146.6±31.3	92.0±15.7

Table 8. the control rate of hypertension among patients with different characteristics in different periods

Duration of Treatment (week)	ISH (%)	IDH (%)	SDH (%)	Low risk (%)	Moderate risk (%)	High risk (%)	Very high risk (%)	Diabetes (%)	Nephropathy (%)	Total (%)
4	56.0	69.1	48.1	84.6	69.6	43.7	40.9	18.9	27.7	50.2
12	57.9	72.6	55.6	93.9	79.5	54.1	49.9	30.3	45.5	56.7

Note: ISH: Isolated systolic hypertension; IDH: Isolated diastolic hypertension; SDH: Systolic and diastolic hypertension.

Table 9. Awareness, treatment and control of hypertension in different regions of China

	Guangdong[29]	Liaoning[28]	Shandong[6]	Xuzhou[11]	Tibet[15]	Liaoning[17]
Year	2002	2005~2007	2007	2008	2009	2009~2010
Sample Size (*n*)	13 889	45 925	16 364	17 500	701	25 196
Participants	Permanent residents	Rural residents	Rural residents	Permanent residents	Herdsmen	Permanent residents
Age (Years)	≥20	≥35	≥25	20~75	40~89	18~74
Awareness (%)	31.3	29.5	26.2	42.19	19.9	42.9
Treatment (%)	26.1	20.2	22.1	34.12	2.6	28.2
Control (%)	9.3	0.9	3.9	9.27	0.3	3.7
Control under Treatment (%)	34.9	4.5	—	—	—	12.9

A epidemiological survey[30] among 5 086 out-patients with hypertension aged 18 years old and above, who were treated in the Departments of Cardiology, Nephrology and Endocrinology in 92 Grade A hospitals in 2009, showed that the control rate of hypertension was 30.6%. The control rate of hypertension was 45.9% in pure hypertensive patients, and they were 31.1%, 14.9% and 13.2% in hypertensive patients with coronary heart diseases, diabetes and renal dysfunction respectively. The control rate of out-patients with hypertension increased, but it still remained low.

A study[31] analyzed awareness, treatment and control of hypertension in 12 comparable groups of Chinese population. Awareness, treatment and control of hypertension were 48.4%, 38.5% and 9.5% in 2004-2005 respectively. Among hypertensive patients receiving treatment, the rate of control was 12.2%, 19.2% and 24.0% in 1992-1994, 1998 and 2004 respectively (Figure 10).

Factors influencing prevalence of hypertension

Age is an unchangeable risk factor of hypertension in both males and females, and the risk of hypertension rise by times as age increases. Compared with males aged 15-24, the risk in males aged 65-74 increased by 21 times; comparing the same age groups of females, the risk increased by 56 times.[25] In the context of the relative risk between genders in different age groups, the risk was higher in males than in females under 45 years old, and the risk was lower in males over 45 years old.[25]

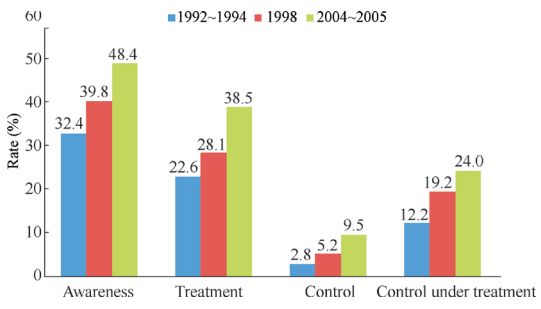

Figure 10. Awareness, treatment and control of hypertension in 12 groups of middle-aged Chinese population in 1992-1994, 1998 and 2004-2005

The risk of hypertension in persons with family history of hypertension was 2 times higher than those without the family history. And the more the alcohol intake was, the higher the risk of hypertension was. Compared with people with normal weight, the risk of hypertension among people with overweight or obesity increased. No matter which of triglyceride, cholesterol and high dense lipoprotein cholesterol (HDL-C) was abnormal, the risk of hypertension would be higher.[25]

A survey[32] about prevalence and influencing factors of hypertension in the offspring of hypertensive patients, showed that prevalence of hypertension in the population with family history of hypertension was higher than those without the family history, and for people with the family history, overweight, obesity, smoking, drinking and high-salt diet could increase the risk of hypertension (Table 10).

A survey[33] among 26 681 patients aged 30~70 years old in 20 community hospitals of Shengli oilfield in Shandong Province in 2003~2004, showed that body mass idex (BMI) and drinking could influence ISH and especially in overweight and obesity patients (Table 11, 12).

A study[34] based on 19 519 community people aged 35~91 years old in Changning district in Shanghai in 2008, showed that age, male, a high BMI, high salt intake, high income, family history of hypertension and the history of hyperlipidemia were main risk factors of hypertension (Table 13).

A survey[35] among 5 523 She people aged 20~80 years

Table 10. Analysis of risk factors of hypertension

Risk Factor	Detection Rate (%)		*OR* (95% *CI*)
	control	offspring	
overweight and abdominal obesity	17.14	30.87	3.11 (2.23, 3.91)
drinking	13.21	29.23	2.28 (1.14, 3.76)
smoking	10.71	23.65	2.11 (1.15, 3.77)
high-salt diet	31.43	33.33	3.83 (2.17, 4.21)

Table 11. The risk of all kinds of hypertension in different alcohol consumption based on classification of BMI

OR (95% *CI*)	ISH	IDH	SDH
BMI<25			
Moderate Drinking	1.05 (0.90, 1.22)	1.38 (1.21, 1.59)	1.20 (1.07, 1.34)
Excessive Drinking	1.56 (1.28, 1.89)	2.17 (1.83, 2.58)	2.49 (2.19, 2.84)
25≤BMI<30			
Moderate Drinking	0.79 (0.66, 0.94)	1.39 (1.20, 1.60)	0.98 (0.87, 1.10)
Excessive Drinking	0.92 (0.75, 1.14)	1.93 (1.63, 2.27)	1.57 (1.38, 1.79)
BMI≥30			
Moderate Drinking	0.70 (0.41, 1.19)	1.22 (0.82, 1.84)	0.77 (0.57, 1.04)
Excessive Drinking	1.66 (0.96, 2.87)	2.54 (1.63, 3.98)	1.64 (1.16, 2.34)

Note: ISH: Isolated systolic hypertension; IDH: Isolated diastolic hypertension; SDH: Systolic and diastolic hypertension; the group of normal blood pressure and no drinking was used as the control group.

Table 12. The risk of all kinds of hypertension in different BMI based on classification of drinking

OR (95% *CI*)	ISH	IDH	SDH
No Drinking			
25≤BMI<30	2.27 (1.99, 2.59)	2.40 (2.11, 2.73)	2.98 (2.71, 3.29)
BMI≥30	2.74 (1.99, 3.76)	3.68 (2.77, 4.89)	6.71 (5.51, 8.17)
Moderate Drinking			
25≤BMI<30	1.69 (1.40, 2.04)	2.42 (2.07, 2.82)	2.43 (2.14, 2.27)
BMI≥30	1.82 (1.16, 2.84)	3.23 (2.34, 4.46)	4.32 (3.34, 5.58)
Excessive Drinking			
25≤BMI<30	1.33 (1.03, 1.71)	2.13 (1.74, 2.61)	1.87 (1.60, 2.19)
BMI≥30	2.94 (1.81, 4.78)	4.34 (2.95, 6.39)	4.49 (3.26, 6.18)

Note: ISH: Isolated systolic hypertension; IDH: Isolated diastolic hypertension; SDH: Systolic and diastolic hypertension; the group of normal blood pressure and BMI<25 was used as the control group.

Table 13. The risk of hypertension in residents with different risk factors in Shanghai

Risk Factor	Levels of Risk Factor	Prevalence (%)	*OR* (95% *CI*)
Gender	Male	39.12	1.0
	Female	40.49	1.064 (1.060, 1.068)
Annual household income	<50 000	41.58	1.0
	50 000~100 000	32.39	2.349 (1.559, 3.540)
	>100 000	16.15	2.462 (1.620, 3.742)
Salt intake	<6 g/d	36.24	0.888 (0.832, 0.947)
	6~12 g/d	44.11	1.0
	>12 g/d	54.54	1.117 (1.016, 1.220)
Family history of hypertension	No	33.92	1.0
	Yes	51.30	1.831 (1.722, 1.947)
Hyperlipidemia	No	39.00	1.0
	Yes	72.67	1.507 (1.329, 1.708)

old in Fujian Province in 2009 showed that overweight or obesity, drinking, diabetes mellitus and dyslipidemia were the main risk factors of prehypertension and hypertension, and the risk of hypertension among people with 3 risk factors or above was nearly 10 times higher than those without risk factors (Table 14).

Table 14. The risk of hypertension in She with different Numbers of risk factors

Number of Risk Factors (*n*)	Prehypertension Adjusted *OR* (95% *CI*)	Hypertension Adjusted *OR* (95% *CI*)
0	1.0	1.0
1	1.65 (1.35, 2.20)	1.96 (1.52, 2.53)
2	2.21 (1.77, 2.76)	3.72 (2.85, 4.86)
≥3	3.74 (2.75, 5.07)	9.73 (6.94, 13.64)

Note: OR was adjusted based on age, gender, education, smoking, family history of hypertension and so on.

2.1.2 Secondary hypertension

At present, there is still few data of large-sample epidemiological survey for secondary hypertension. It was estimated that secondary hypertension account for 5%~10%. A study[36] among 2 274 hospitalized hypertensive patients aged from 14 to 92 years old within four years, found 14% of patients were diagnosed with secondary hypertension (details is showed in Figure 11). For the diagnosed hypertensive patients, especially young patients, history of the disease, medical examination and targeted laboratory tests must be done to explore the cause of high blood pressure. The patients with resistance to drug treatment are more likely to suffer from secondary hypertension. Treatment of secondary hypertension differs from primary hypertension, and some secondary hypertension could be cured radically after removing the cause or surgical treatment. So it is very important to distinguish secondary hypertension from primary hypertension and treat timely and properly in the clinical work.

Another study reported that etiology composition of 245 hospitalized patients (except obstructive sleep apnea syndrome (OSAS)) with secondary hypertension within 10 years (Figure 12).

Li NF etc analyzed etiology composition of 7 809 hospitalized hypertensive patients in 1999~2008, and found that secondary hypertension accounted for 24.9% and OSAS and primary aldosteronism took up the highest proportion. The proportion of secondary hypertension was 39.3% and 9.5% in 2008 and 1999 respectively, and the

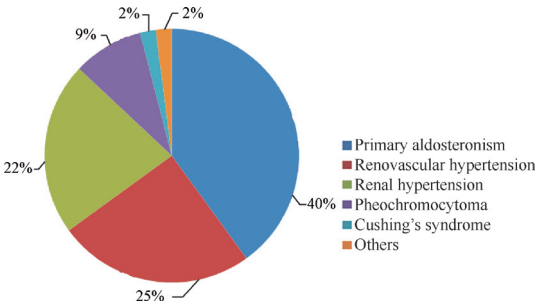

Figure 11. Subtypes distribution of secondary hypertension in hospitalized Patients (%)

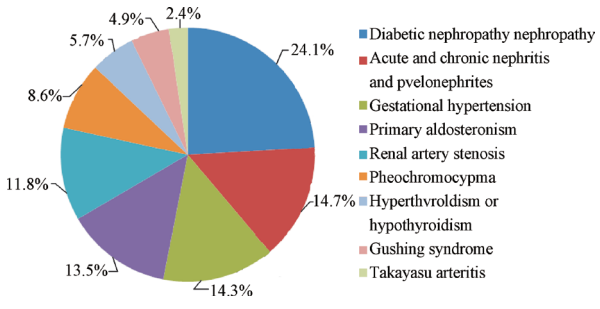

Figure 12. Subtypes distribution of secondary hypertension in 245 hospitalized patients (%)

proportion of secondary hypertension increased year by year within 10 years.

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Report on Cardiovascular Diseases in China 2012

Hypertension in children and adolescents

Mi Jie, Dong Hongbo, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China

Blood pressure reference standards for Chinese children and adolescents

In 2010, the blood pressure reference standards for Chinese children and adolescents was developed using the international least mean square (LMS) method. Blood pressure (BP) of 110 000 children aged 3–18 years from eleven provinces in mainland China was measured with auscultatory method.[1] As the Table 1 and 2 show, this standards is in line with the international hypertension classification, which defined P_{90}, P_{95}, P_{99} as the "high-normal BP", "hypertension" and "severe hypertension" cut-offs respectively.

Prevalence of hypertension in children

Owing to different screen strategies, prevalence of hypertension in children reported in different researches varied. As most epidemiology surveys reported BP readings based on one occasion (namely repeated BP measurements obtained on a single visit), prevalence of hypertension in their surveys were pretty high. In 2004, The American National High Blood Pressure Education Program (NHBPEP) working group recommended that the diagnosis of hypertension could be confirmed only if average SBP and/or DBP was greater than or equal to the 95th percentile for sex, age, and height on 3 or more occasions,in the fourth report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents.[1] Recently, domestic reports on prevalence of hypertension in children have increasingly adopted screening strategy on multiple occasions. Therefore, the screening strategy should be given so as to compare different data, when report on prevalence of hypertension in children.

Trends in prevalence of hypertension in Chinese children

China Health and Nutrition Survey (CHNS) had investigated the blood pressure of children and adolescents aging 6 to 17 in 7 provinces in mainland China from 1991 to 2004. Blood pressure reference standards for Chinese children and adolescents[1] and one occasion screening strategy were adopted, the result showed a continuous upward trend for prevalence of hypertension with 0.58% of average annual increase, from 7.1% in 1991 to 14.6% in 2004 (Figure 1).[3]

Prevalence of hypertension in different geographic areas

Recently, epidemiological investigations on hypertension in children were conducted consecutively in Beijing, Changsha, the Yangzi delta area and Hong Kong, their results and methods were illustrated in Table 3. The diagnosis of hypertension was based on the "blood pressure reference standards for Chinese children and adolescents"[1] for all mainland investigations listed above, but the study conducted in Hong Kong applied the standards developed by Sung's group, on the basis of BP data of 14 842 children aged 6–18 years measured by oscilliometric devices.[4]

Prevalence of hypertension in children measured by different screening strategies

In 2006, Leung et al[8] screened the hypertension on three separate occasions among 6 193 (3 074boys, 49.6%) Han children aged 6–18years in Hong Kong, China. Prevalence of elevated BP on the first screen was 6.6 times of the thrid one, and the first, second and third screen was 9.54%, 2.77% and 1.44%, respectively.

Meng surveyed prevalence of hypertension on three occasions among 6 692 (3 327boys, 49.7%) school-aged children in Being from 2009 to 2010.[5] BP was measured using a mercury sphygmomanometer, with K4 sound used as systolic DBP, and evaluated by "blood pressure reference standards for Chinese children and adolescents".[1] Prevalence of hypertension was 18.2%, 5.1% and 3.1% on the first, second and third screen, respectively. As the Figure 2 illustrated, the prevalence of hypertension on the first screen was 5.9 times of the third one.

The results revealed that multiple screening visits can dramatically reduce false diagnosis of hypertension in children in epidemiological investigations, though neither BP measurement methods nor prevalence was identical in those areas, following the rule that the hypertension positive rate declines as the visit grows. Compared with the detection rate on the first occasion, the second one dropped over 70% and the third one decreased about 80%. Hence, at least measurements on two occasions are required in screening for hypertension in children.

Risk factors of hypertension in children

Overweight and obesity

Obesity associates with hypertension in children closely. Shandong students' constitution and health survey in 2005 on blood pressure and weight status of 8 555 (4 325 boys, 50.6%) school-aged children displayed that BP among overweight and obese children of each age category was

Capital Institute of Pediatrics, Beijing 100020, China (Mi J and Dong HB).
Correspondence to: Prof. Mi Jie, Department of Epidemiology, Capital Institute of Pediatrics, No.2 YaBao Road, Beijing 100020, China (Email: jiemi@vip.163.com)

Table 1. Recommended blood pressure reference cut-offs for Chinese boys (mmHg)

Age	SBP			DBP-K4			DBP-K5		
(years)	P_{90}	P_{95}	P_{99}	P_{90}	P_{95}	P_{99}	P_{90}	P_{95}	P_{99}
3	102	105	112	66	69	73	66	69	73
4	103	107	114	67	70	74	67	70	74
5	106	110	117	69	72	77	68	71	77
6	108	112	120	71	74	80	69	73	78
7	111	115	123	73	77	83	71	74	80
8	113	117	125	75	78	85	72	76	82
9	114	119	127	76	79	86	74	77	83
10	115	120	129	76	80	87	74	78	84
11	117	122	131	77	81	88	75	78	84
12	119	124	133	78	81	88	75	78	84
13	120	125	135	78	82	89	75	79	84
14	122	127	138	79	83	90	76	79	84
15	124	129	140	80	84	90	76	79	85
16	125	130	141	81	85	91	76	79	85
17	127	132	142	82	85	91	77	80	86

SBP: systolic blood pressure; DBP: diastolic blood pressure; SBP and (or) DBP ≥P_{90}–P_{95} or SBP and (or) DBP ≥120/80 mmHg for children above 12 years old was defined as high-normalBP; SBP and (or) DBP ≥P_{95}–P_{99} was defined as hypertension; SBP and (or) DBP ≥P_{99} was defined as severe hypertension.

Table 2. Recommended blood pressure reference cut-offs for Chinese girls (mmHg)

Age	SBP			DBP-K4			DBP-K5		
(years)	P_{90}	P_{95}	P_{99}	P_{90}	P_{95}	P_{99}	P_{90}	P_{95}	P_{99}
3	101	104	110	66	68	72	66	68	72
4	102	105	112	67	69	73	67	69	73
5	104	107	114	68	71	76	68	71	76
6	106	110	117	70	73	78	69	72	78
7	108	112	120	72	75	81	70	73	79
8	111	115	123	74	77	83	71	74	81
9	112	117	125	75	78	85	72	76	82
10	114	118	127	76	80	86	73	77	83
11	116	121	130	77	80	87	74	77	83
12	117	122	132	78	81	88	75	78	84
13	118	123	132	78	81	88	75	78	84
14	118	123	132	78	82	88	75	78	84
15	118	123	132	78	82	88	75	78	84
16	119	123	132	78	82	88	75	78	84
17	119	124	133	79	82	88	76	78	84

SBP: systolic blood pressure; DBP: diastolic blood pressure; SBP and (or) DBP≥P_{90}–P_{95}, or SBP and (or) DBP ≥120/80 mmHg for child above 12 years old was defined as high-normal BP; SBP and (or) DBP ≥P_{95}–P_{99} was defined as hypertension; SBP and (or) DBP ≥P_{99} was defined as severe hypertension.

statistically higher than that of normal weight children (Figure 3).[10]

The multiple center research on children blood pressure conducted in 6 mainland cities, including Beijing, Jinan, Shanghai, Chongqing, Guangzhou. BP, height, waist circumferences and other physical indicators were measured among 8 898 (4 580 boys, 51.5%) children aged from 3 to 17.[7] Hypertension was diagnosed on the basis of "blood

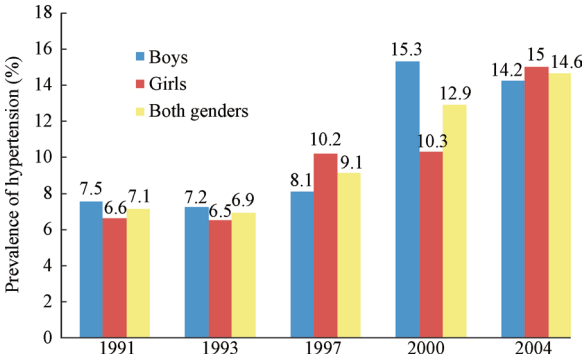

Figure 1. Trends on prevalence of hypertension in Chinese children aged 6–17 years from 1991 to 2004.

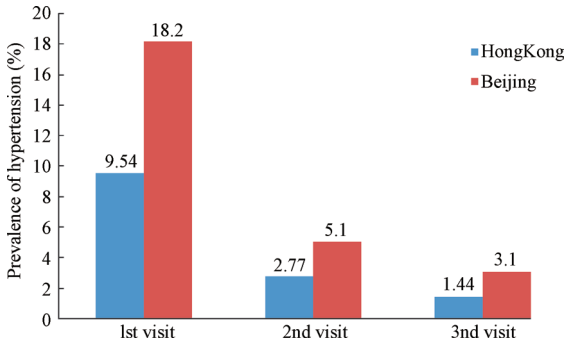

Figure 2. Prevalence of hypertension in children on three occasions in Hong Kong and Beijing.

pressure standards reference for Chinese children".[1] Figure 4 showed the results of this study, that the prevalence of hypertension among obese children, overweight children and normal-weight children was 29.1%, 17.4% and 7.8%, respectively. Prevalence of hypertension among children with abdominal obesity was 27.9%, which was 8.4% among their counterparts. Adjusting age, sex, income level, parents' education level and puberty, the odds ratio (*OR*) was 2.9 (95% *CI*: 2.3–3.6) and 6.0 (95% *CI*: 4.9–7.4) for overweight and obese children, respectively. Abdominal obese children had 4.6 (*OR*=4.6, 95% *CI*: 3.9–5.5) folds of risk of hypertension compared with their counterparts.

Leung et al[8] analyzed factors influencing hypertension in children among 6 193 ((15.2±1.9) years old) adolescents. They found that waist circumference ≥85th centile increased the risk of hypertension by 2.4-fold (adjusted *OR*=2.4, 95% *CI*: 1.13–4.99) after adjustment of sex, BMI and sleeping duration.

Ma et al studied the data of 231 227 school-aged children from Chinese National Survey on Students' Constitution

Table 3. Results and methods of epidemiological investigations on hypertension in children

Investigation region	Investigation period	Age (years)	DBP	Sample size	Measurement method	Prevalence
Beijing[1]	2009–2010	3–18	K4	6692	auscultation	18.2
Changsha[2]	2009	12–17	K4	88947	auscultation	3.1
Six eastern cities[3]	----	7–13	K5	8898	auscultation	11.1
Hong Kong[4]	2006	15.2±1.9	----	6193	oscillometry	9.54
The Yangtze Delta[5]	2008–2009	6–18	----	4935	auscultation	17.9

DBP: diastolic blood pressure.

and Health (CNSSCH)[1]. They noticed that the BP level of children was associated with weight, BMI and height. After adjustment of age, SBP increased 3.70 mmHg (95% *CI*: 3.64–3.76) and DBP-K5 increased 2.02 mmHg (95% *CI*: 1.97–2.07) in boys, meanwhile those respectively increased 2.63 mmHg (95% *CI*: 2.57–2.69) and 1.61 mmHg (95% *CI*: 1.56–1.66) in girls, corresponding to 1 standard deviation (*SD*) increase in BMI. After controlling age and height, Systolic BP increased 3.96 mmHg (95% *CI*: 3.88–4.04) and DBP-K5 increased 2.00 mmHg (95% *CI*: 1.93–2.07) for boys, at the same time those respectively increased 2.92 mmHg (95% *CI*: 2.84–2.99) and 1.73 mmHg (95% *CI*: 1.66–1.80) for girls, corresponding to 1 *SD* increase in weight, 1 *SD* increase in height, Systolic BP and DBP-K5, adjusted by age and weight, correspondingly increased 0.27 mmHg (95% *CI*: 0.19–0.35) and 0.55 mmHg (95% *CI*: 0.48–0.62) in boys, and those respectively increased 0.10 mmHg (95% *CI*: 0.03–0.17) and 0.31 mmHg (95% *CI*: 0.24–0.37) in girls. Accordingly, height had little impact on BP in Chinese children, compared with weight and BMI (Figure 5).

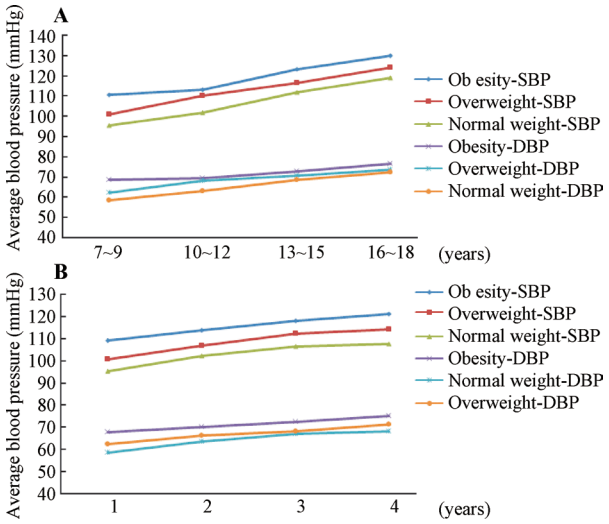

Figure 3. Blood pressure level among children with different weight status in each age categories(boys) (**A**). Blood pressure level among children with different weight status in each age categories (girls) (**B**).
SBP: systolic blood pressure; DBP: diastolic blood pressure.

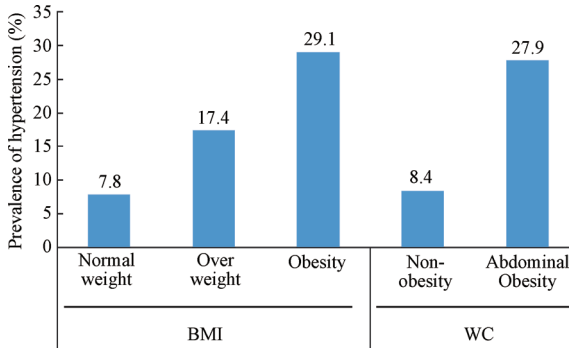

Figure 4. Prevalence of hypertensionin children in different weight status. BMI: body mass index; WC: waist circumference.

Glucose and metabolic abnormities
The results of multicenter blood pressure survey, conducted in Harbin, Beijing, Jinan, Shanghai, Chongqing and Guangzhou, revealed that children with higher levels of TG, glucose, and HOMA-IR were at a higher risk of having hypertension, after adjustment of age, sex, BMI, income level and education level of their parents.[7]

Family history of hypertension
Beijing Children and Adolescents Metabolic Syndrome (BCAMS) working group studied the blood pressure level of 19 088 (9 319 boys, 48.8%) children aged 6–17 on one screen occasion in 2004.[1] The association between hypertension in children and family history of hypertension was analyzed. The results showed that prevalence of hypertension in children was respectively 8.72%, 13.83% and 11.50%, in the group of "parents without hypertension", "father hypertension", and "mother hypertension" (Table 4)

Meng et al[5] conducted a cross-sectional survey on BP of children aged from 3 to 18 in Beijing in 2010, found that children with a paternal history of hypertension had increased the risk of hypertension by 1.8 fold (*OR*=1.80, 95% *CI*: 1.15–2.81).

Additionally, other factors could impact on hypertension of children, like unhealthy diet (high-fat or high-salt diet), physical activity deficiency and psychological stress.

Prognosis of children blood pressure level in adult hypertension and target-organ abnormities

Association between blood pressure in childhoodand hypertension in adulthood
In 2004, "Beijing children and adolescents blood pressure (BP) study" (BBS) cohort working group followed up 412 adults, who participated in the baseline BP investigation in 1987. As the Figure 6 displayed, 42.9% children diagnosed with hypertension (SBP/DBP ≥P95) at the baseline survey became hypertensive in adulthood. After controlling the factors such as age, gender, height and BMI in adulthood, hypertensive children diagnosed at the baseline had 4.63 fold of risk (*OR*=4.63, 95% *CI*: 2.09–10.25) of developing into hypertension than their counterparts.[13]

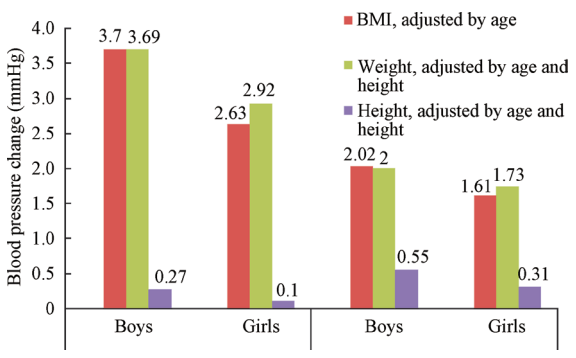

Figure 5. Blood pressure changescorrespondingto 1 standard deviation (*SD*) increase in height and weight and BMI respectively. SBP: systolic blood pressure; DBP: diastolic blood pressure; BMI: body mass index.

18-year follow-up of Shaanxi "Hanzhong cohort survey on hypertension in children"[1] found that 28% participants with hypertension in childhood had hypertension in their later life, which was statistically higher (*RR*=6.88, *P* <0.01) than normotensive children (4.1% became hypertension).

Association between pubertal hypertension and adult hypertension

Beijing BBS working group followed children blood pressure for18 years and figured that puberty was the effect modifying factor between BP level of children and adult hypertension.[2] After adjustment of sex, age, family history of hypertension, obesity in childhood and adulthood, pre-pubertal (testis development in boys and breast development in girls are in the Tanner I) hypertension (BPs ≥P95) predicted a higher risk of adult hypertension than normotensives (BPs <P90), with *OR* (95% *CI*) of 2.71 (95% *CI*: 0.83–8.85), while the pubertal hypertension had tenfold risk (95% *CI*: 3.03–33.07) of adult hypertension.

Association between hypertensionin childhood and abnormalities of cardiac and renal functions in adulthood

Several tests including ultrasonic cardiogram (UCG), renal function, micro albuminuria (MAU) were ran among the BBS follow-ups, and the results showed that the risk of having abnormalities in cardiac and renal function tripled(*OR*=4.07, 95% *CI*: 1.47–11.24) among continuous hypertension group than sustained normotensive one.[3]

After Evaluation of the flow-mediated dilation (FMD) and artery elasticity of the follow-ups in Shaanxi cohort study, the working group found that FMD in adulthood ((0.103±0.044) mm) of the hypertensive children group was statistically (<0.05) lower than the FMD ((0.117±0.005) mm) of normotensive group. The value of artery elasticity index C2 of the former group ((12.93±3.31) ml/mmHg*10) was statistically (*P* <0.01) lower than that of latter one ((15.21±4.11) ml/mmHg*10) as well.

Table 4. Association between hypertension in children and parental hypertension

Parents with HTN	Prevalence of HTN	*OR* (95% *CI*)
None	8.7	1
Father	13.8	1.68 (1.39–2.06)
Mother	12.6	1.56 (1.16–2.09)
Both	11.5	1.27 (0.67–2.41)

HTN: hypertension; *OR*: odds ratio.

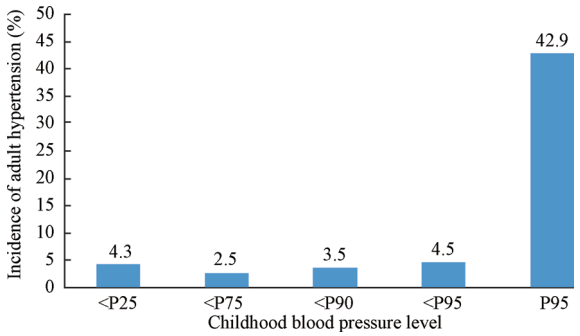

Figure 6. Blood pressure status at baseline (1987) and incidence of hypertension in adulthood (2004).

Cohort studies above indicated that the prevention of hypertension should begin from childhood.

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Report on Cardiovascular Diseases in China 2012

Tobacco use and its association with cardiovascular disease in China

Yang Xiaohui, Ma Changsheng, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China

During the period 2002 to 2010, tobacco use prevalence in males has been staying at a high level in China. Findings from the Global Adult Tobacco Survey-China (GATS-China) provide clear picture of epidemiology data of tobacco use in China. It estimated that 52.9% of males and 2.4% of females currently smoke in China. Furthermore, 52.7% of the smokers aged 18−34 start smoking before the age of 20. More than 70% of the Chinese population, or 738 million people, are regularly exposed to secondhand smoke in 2010. The economic burden attributable to tobacco use was big. According to estimation, the total health care cost was almost RMB 300 billion Yuan in 2005, which accounted for 1.5% of GDP of the year. Chinese smokers need more support for cessation. The overall quit rate in China remains low, the quitting rate 16.9% in 2010. Meanwhile, the relapse rate has been rising from 10.5% in 1996 to 33.1% in 2010. Health consequences of cigarette smoking and secondhand smoke exposure on incidence and prognosis of vascular diseases were re-examined in Chinese population according to some important studies, including persistent smoking is associated with higher rates of mortality and morbidity after CABG, and smoking cessation had a general trend of lowering the risk of metabolic syndrome, etc.

Introduction

China is the largest tobacco producer and consumer in the world. China has more than 300 million smokers. As it known to all that tobacco use is one of the most important independent risk factors associated with many smoking related disease, including CVD, which make it the leading cause of death in China. It is noted that approximately 10% of CVD is caused by smoking, and it is estimated that the death toll attributable to tobacco use was more than 1 million in China. Smoking poses a major public health burden in China. More and more high-quality researches in the field of epidemiology of tobacco use and smoking hazards have been conducted in Chinese population during the past decades. To review the study information timely is of great need for providing powerful evidence for efficient tobacco control in China. This report summarizes the findings from a few nationwide projects on epidemiology from 1984 to 2010 and refined studies about smoking association with cardiovascular disease in China, especially those published in 2012.

Epidemiology of tobacco use in China

Prevalence of cigarette smoking in China

Since 1984, China has been listed as one of the most prevalent countries of tobacco use in the world. During the period 1996 to 2002, the smoking rate had dropped by 3.1% in men, but from 2002 to 2010, the decline of tobacco use prevalence in males was quite modest, tobacco use prevalence in males has been staying at a high level in China.

In 2010, the Global Adult Tobacco Survey-China (GATS-China) was conducted among persons 15 years of age or older ("adults") in 28 provinces in China. Results of the survey shows: the total smoking rate was 62.8% in males and 3.1% in females, with an estimated 340 million men and 16.39 million women were cigarette smokers. Compared with 1996 and 2002, there was a modest reduction in total smoking rate in men in 2010, but non-significant change occurred in the standardized prevalence rate. In 2010, an estimated approximately 310 million of adults (28.1%) in China (290 million men (52.9%) and 10.46million women (2.4%)) were current smokers. From 1996 to 2002, smoking rates were dropped at different degrees in most age-groups except the young age-group. During the period 2002 to 2010, current smoking rate was found increased in men aged 40−59 years. Although the smoking rate maintained at a relative low level in the total female population, the rate among young females was increasing. Among men, the prevalence of smoking significantly higher among rural residents (56.1%), as compared with inhabitants of urban areas (49.2%). And as for women, the prevalence was significantly higher among urban residents (2.6%), as compared with inhabitants of rural areas (2.2%) (Table 1, 2) [1-4].

Smoking rate among male physicians and teachers in China

The smoking rate among male physicians and teachers were more than 50% during the period 1996 to 2002. GATS-China 2010 shows that the current smoking rate among population ages 15−59 was 40% in males, and 36.5% in females respectively, indicates a significant decline from 2002. Still, Chinese male physicians have been regarded as one of the most prevalent subgroups of tobacco use in the world.[1,3-5]

Smoking prevalence of Chinese juvenile

Results from a survey conducted in 2005 showed that, among the college and middle school students aged 11−23 years old, the attempting rate for smoking was 50.9% in

Beijing Municipal Office for CVD prevention & Control, Beijing Anzhen Hospital, Capital University of Medical Science, Beijing 100029, China (Yang XH and Ma CS)

Table 1. Comparison of smoking prevalence among Chinese aged 15 and older in 1996, 2002 and 2010

Survey year	Sample size (*n*)	Age (years)	Males (%)	Females (%)	Total (%)
1984	519 600	15−	61.0	7.0	33.9
1996	22 700	15−69	63	3.8	35.3
2002	16 056	15−69	57.4	2.6	31.4
2010	13 354	15−69	52.9	2.4	28.1

There was difference at the definition of Cigarette smoking identified by 3 surveys：1984 National Sample Survey of Smoking Prevalence, "smoker" was defined as a person who at the time of survey has smoked at least 1 cigarette per day for 1 year or longer. 1996 National Prevalence Survey of Smoking Pattern, "smoker" was defined as a person who at the time of survey has smoked daily for at least 6 months. 2002 National Behavioral Risk Factors Surveillance, "smoker" was defined as a person who at the time of survey has smoked at least 100 cigarettes. 2010, Global Adult Tobacco Survey-China (GATS-China), smoking prevalence rate refers to current smoking rate.

Table 2. Estimated prevalence of current smoking among adults 15 years of age or older, according to sex and selected demographic characteristics-GATS, China, 2010 (%)

Demographic characteristics	All adults	Men	Women
Overall	28.1	52.9	2.4
Age (years)			
15−24	17.9	33.6	0.7
25−44	31.0	59.3	1.6
45−64	33.6	63.0	3.2
≥65	22.7	40.2	6.7
Residence			
Urban	26.1	49.2	2.6
Rural	29.8	56.1	2.2

schoolboys and 23.0% in schoolgirls, current smoking rate was 22.4% in schoolboys and 3.9% in schoolgirls.

The current smoking rate was increasing with age rapidly among schoolboys. Meanwhile, the age of start smoking was becoming earlier in China. Among the students ever smoked, the proportion of completely smoked one cigarette under the age of 13 years was 55.9% of schoolboys and 57.0% of schoolgirls, respectively. According to 2010 GATS survey, 52.7% of the smokers aged 18−34 start smoking before the age of 20.[1,2,6]

Passive smoking

Data of epidemiological surveys indicated that in recent decades, rate of exposure to "secondhand smoke" changed little. The prevalence of passive smoking in non-smokers was 51.9% in 2002, estimated 540 million Chinese people exposure to tobacco smoke.[3] More than 70% of the Chinese population, or 738 million people, are regularly exposed to secondhand smoke in 2010.[2,3,4,6] (Figure 1)

Figure 1. Rate of exposure to second-hand smoke in China.

The definitions of secondhand smoke exposure were different in the 1996 and 2002 survey compared with that in GATS-China, 2010. In the 1996 and 2002 survey, it was defined as " in the past 30 days, one has been exposure to tobacco smoke for more than 15 minutes per day, for at least 1 day per week." GATS-China, 2010: it was defined as "exposure to tobacco smoke for more than 1 day per week."

Smoking cessation

The smoking cessation rate was increasing year by year, rose from 9.42% in 1996 to 11.5% in 2002. And according to the results of GATS in 2010, the quitting rate was 16.9%. Furthermore, 16.1% of the current smokers attempt to stop smoking within 12 months.[3] Since 2002, the proportion of current smokers without intention of attempting to quit was unchanged ((44% in 2002 compared with 44.9% in 2010)). The ratio of abstainers to total smokers was increased from 9.42% in 1996 to 16.9% in 2010,, the number of abstainers increased by 15 million. Meanwhile, the relapse rate has been rising from 10.5% in 1996 to 32.5% in 2002, rising to 33.1% in 2010.[1-4]

Health consequences of cigarette smoking and secondhand smoke exposure

Conclusive evidence proves heart diseases, malignant neoplasms, and cerebrovascular disease account for approximately two thirds of the total deaths in the Chinese population 40 years of age and older. Cigarette smoking is one of the major preventable causes of death among men and women in China, the relative risk (*RR*) and population attributable risk (*PAR*) of death associated with smoking in China was 1.23 (95%*CI* 1.18−1.27) and 7.9%, *RR*1.18 (1.13−1.23), *PAR* 10.0% for males, and *RR* 1.27(1.19−1.34), *PAR* 3.5% foe females. An estimated 673 thousand death in Chinese adults ages 40 and over were attributable to tobacco use.[8] (Figure 2)

Health consequences of cigarette smoking on incidence and prognosis of vascular diseases

Cigarette smoking was an independent risk factor for CVD

10-year follow-up study on 30 000 Chinese ages 35−64

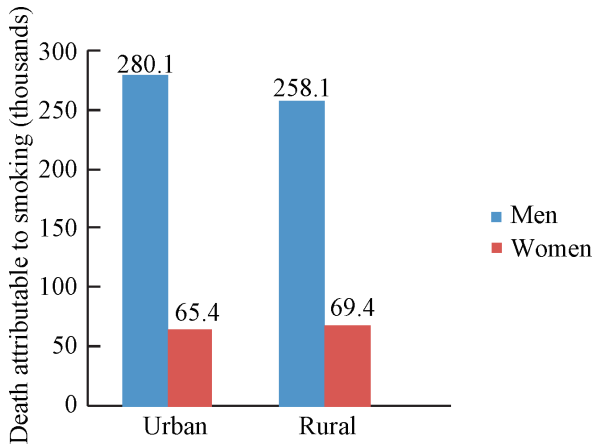

Figure 2. Death attributable to Tobacco Use in China, 2005.

(Chinese Multi-Provincial Cohort Study, CMCS) showed that cigarette smoking was one of the independent risk factors for CVD and stroke events, 19.9% acute coronary events and 11.0% acute ischemic stroke events among the cohort population could be attributed to smoking. Multivariate analysis found that cigarette smoking results in a 1.75 times risk for coronary events, 1.37 times risk for ischemic stroke events, and 1.21 times risk for haemorrhage stroke events.[9] The findings were confirmed by another large Chinese cohort study, which followed 10 000 people for up to 15 years, that 31.9% of the total ischaemic CVD events (CHD and ischemic stroke) among the cohort population aged 35−59 could be attributed to cigarette smoking. Compared with nonsmokers, male smokers are 2 times more likely to develop ischaemic CVD (*RR*: 2.04, 95%*CI*(1.43−2.92)), and female smokers are 1.59 times more likely to develop it (*RR*: 1.59, 95%*CI*(1.10−2.30)).[10]

Cigarette smoking was a risk factor for stroke[11]

Results from a prospective cohort study which included national representative 169 871 Chinese men and women aged 40 years and older show that the relative risk of incidence and mortality of stroke for current male smokers were 1.28 (95% *CI*: 1.19−1.37) and 1.13 (95% *CI*: 1.03−1.25), and 1.25 (95% *CI*: 1.13−1.37) and 1.19 (95% *CI*: 1.04−1.36) for current female smokers, respectively.

Impact of smoking and smoking cessation on long-term outcome of patients after coronary artery bypass grafting[12]

In order to determine the impact of smoking behaviors on long-term outcomes of coronary artery bypass grafting (CABG), a survey was conducted in 2 541 consecutive patients who underwent CABG in Fuwai hospital from January 1, 2004 to December 30, 2005. The patients were followed up for 4.27 to 6. 41 years (average 5.09 years), and their preoperative and postoperative smoking habits, were obtained. Death, major adverse cardiovascular or cerebrovascular events (MACCE) and angina pectoris were observed. The patients were divided into never smokers and ever smokers. The ever smokers were further divided into the current smokers who smoked before and after CABG and former smokers who stopped smoking before CABG, quitters who stopped smoking after CABG. Results showed that after CABG, the percentage of persistent smoking patients was 22.1%. The relative risk of adverse events was analyzed by univariate and multivariate Cox analysis. After adjusting baseline characteristics, relative risk for tumor related death (*RR*:2.38, 95%*CI*:1.06−5.36), MACCE (*RR*:1.26, 95%*CI*:1.01−1.57) and angina pectoris (*RR*:1.29, 95%*CI*:1.04−1.59) were significantly higher in ever smokers than in never smokers. Similarly, relative risk of death from all causes (*RR*:2.60, 95%*CI*: 1.53−4. 46), cardiac death (*RR*: 2.51, 95%*CI*: 1.32−4.78), tumor cause death (*RR*: 5.12, 95%*CI*: 2.08−12.59), major adverse cardiovascular or cerebrovascular events (*RR*:1.83, 95%*CI*: 1.42−2.34) and angina pectoris (*RR*: 1.69, 95%*CI*: 1.33−2.16) were also significantly higher in current smokers than in never smokers. Outcome was similar between patients who stopped smoking and never smokers (all *P*>0.05). Results indicated that smoking prevalence is high in patients after CABG in China. Persistent smoking is

Table 3. Major adverse events in patients with different smoking status (*n* (%))

Items	Nonsmokers ((*n*=1016))	Smokers (*n*=1441)			
		Pre-PCI Quitters (*n*=403)	Post-PCI Quitters (*n*=496)	Persistent smokers (*n*=542)	Total (*n*=1441)
Death from all causes	41 (4.1)	16 (4.0)	15 (3.0)	47(8.7)*	78(5.4)*
Cardiac death	23 (2.3)	8 (2.0)	9 (1.8)	26 (4.8)*	43 (2.9)*a
Death from tumor	11 (1.1)	4 (1.0)	4 (0.8)	16 (3.0)*	24 (1.7)*
Stent post-PCI	19 (1.9)	10 (2.5)	10 (2.0)	24 (4.4)*	44 (3.1)*
Repeated CABG	5 (0.5)	4 (0.2)	5 (0.4)	2 (0.4)	5 (0.3)
revascularization	24 (2.4)	14 (3.5)	15 (3.0)	25 (4.6)	54 (3.3)
MI	13 (1.3)	6 (1.5)	7 (1.4)	15 (2.8)	28 (1.1)
Stroke	95 (9.4)	37 (9.2)	46 (9.2)	61 (11.3)	144 (10.0)
MACCE	155 (15.3)	65 (16.1)	77 (15.5)	126 (23.2)*	268 (18.6)*
AP	376 (37.0)	154 (38.2)	179 (36.1)	240 (44.3)*	573 (39.8)*

CABG: coronary bypass surgery; MACCE: major cardiovascular or cerebrovascular events; PCI: percutaneous coronary intervention; MI: myocardial infarction; AP: angina pectoris. *P <0.05 (compared with nonsmokers).

Table 4. Metabolic syndrome and metabolic risk factors between different smoking status (*OR*, 95%*CI*)

Groups	MS	FPG (≥5.6mmol/L,or diagnosed DM)	TG (≥1.7 mmol/L)	HDL-C (men <0.9 mmol/L; women <1.1 mmol/L)	WC (men ≥90 cm women ≥85 cm)	BP (≥130/85 mmHg or diagnosed HTN)
Male						
Never smokers	1.0	1.0	1.0	1.0	1.0	1.0
Ever smokers	1.10 (0.76−1.43)	1.20 (0.83−1.70)	1.19 (0.92−1.47)	1.08 (0.79−1.32)	0.94 (0.76−1.32)	1.24 (0.90−1.61)
Current smokers	1.49 (1.06−1.89)	1.09 (0.76−1.52)	1.36 (1.02−1.69)	1.59 (1.13−1.89)	0.89 (0.72−1.19)	0.96 (0.71−1.18)
P value	0.002	0.645	0.004	<0.001	0.047	0.749
Female						
Never smokers	1.0	1.0	1.0	1.0	1.0	1.0
Ever smokers	0.94 (0.69−1.41)	1.32 (1.01−1.68)	1.22 (0.89−1.85)	1.01 (0.68−1.47)	1.24 (0.89−1.71)	0.98 (0.72−1.24)
Current smokers	1.09 (0.76−1.98)	1.03 (0.74−1.34)	1.77 (0.96−1.54)	1.28 (0.99−1.54)	1.12 (0.82−1.51)	1.15 (0.92−1.43)

Adjusted by age, alcohol consumption, physical exercise. MS: metabolic symptom; HDL-C: high density lipid protein; FPG: fasting serum glucose; TG: triglyceride; WC: waist circumference; BP: blood pressure; HTN: hypertension.

associated with higher rates of mortality and morbidity after CABG while smoking cession is associated with reduction of morbidity and mortality in patients after CABG (Table 3).

Gender difference in association between smoking and metabolic risks among community adults[13]

Cigarette smoking is a risk factor for the development of insulin resistance. However, whether a smoker has a lesser waist circumference (WC) and whether the potential changes in WC reduce the benefits of smoking cessation remains in dispute. The relationships between smoking and metabolic syndrome (MS, defined according to the International Diabetes Federation (IDF) criteria) were re-examined by using a cross-sectional data sampled from community adults in Beijing in 2007. A total of 3 710 men and 6 344 women aged 18−92 years old were analyzed. Results showed that compared with females, males tended to have a higher level of mean BP (systolic and diastolic), triglycerides (TG) and a lower level of high-density lipoprotein cholesterol (HDL-C). The mean waist circumference (WC) was higher in males than that in females whereas the mean body mass index (BMI) was higher in females. The prevalence of MS in male smokers was higher than that in male nonsmokers (23.0% vs. 21.2%, $P<0.05$). With adjustment for age, alcohol intake, and regular physical activity, the odds ratios(*OR* (95% *CI*)) of never smokers, ex-smokers, and current smokers were 1.00, 1.19(0.92−1.47) and 1.36 (1.02−1.69) ($P<0.05$) for hypertriglyceridemia, was 1.00, 1.08 (0.79−1.32) and 1.59 (1.13−1.89) ($P<0.05$) for low HDL-C. The odds ratios of MS were 1.00 (reference), 1.10 (0.76−1.43), and 1.49 (1.06−1.89) for never smokers, ex-smokers and current smokers respectively ($P<0.05$). In females, only a low HDL-C was associated with chronic tobacco use, but the prevalence of MS and obesity was similar between smokers and nonsmokers. This study concluded that smoking was an independent risk factor of metabolic syndrome in male subjects. Although smokers tend to have a lower WC than nonsmokers, smoking cessation had a general trend of lowering the risk of metabolic syndrome in a year. But there is no significant relationship between smoking and MS in females (Table 4).

Hazards from second hand smoke (SHS) exposure on morbidity and mortality of vascular diseases[14]

Second hand smoke (SHS) exposure ("passive smoking") was defined as exposure to another person's tobacco smoke at home or in the workplace. SHS exposure is also associated with increase of CVD incidence and death. Results of a meta-analysis reviewed 18 epidemiology studies showed that the risk of CVD increase by 25% (*RR*:1.25, 95%*CI* 1.17−1.32) among SHS exposed persons..

Disease burden of tobacco use in China

Heavy burden was caused by tobacco use in China, especially the smoking-related non-communicable diseases, including CVD.

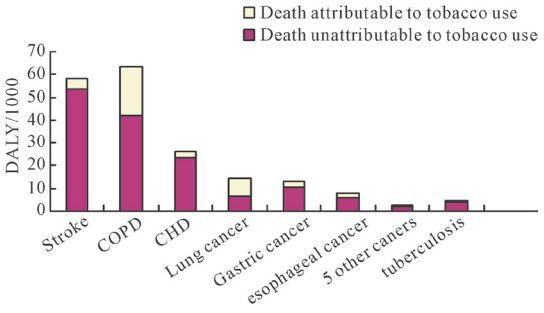

Figure 3. Disease burden attributable to tobacco use.

Table 5. Direct health cost of smoking related diseases in China, 2005

Year	Cost (10 billion RMB, Yuan)	GDP (%)
2000	998.97	1.116 56
2005	1665.60	0.913 55

Direct cost from smoking: total health care cost owing to diseases caused by smoking.

Disease burden attributable to tobacco use[15]

Disability-adjusted Life Years (DALY) Lost of Chinese people due to smoking-related diseases (stroke, chronic obstructive pulmonary disease (COPD), coronary heart disease (CHD), lung cancer, gastric cancer, esophageal cancer, 5 cancers in other sites), and tuberculosis was 158.2 years/1000 in people aged 40 and over, 118.1 years/1000 in people aged 40−69, and 445.4/1000 in people above 70 years old, respectively. And Years Lived with Disability (YLD) contributed 32.3% of total DALY. The younger of the age, the larger of the years of life lost (YLL). In men, especially those aged 70 years and older, the DALY Lost is the highest. COPD and lung cancer were the major contributors of total DALYs (Figure 3).

Economic burden attributable to tobacco use[16]

An estimation was explored based on epidemiologic and statistic data and the existing literature of smoking related diseases by using data of more than 1 400 thousand death caused by tobacco use in 2005, which calculated that the direct cost of smoking were RMB166.56 billion Yuan, indirect costs were RMB 86.111−120.501 billion Yuan, total cost was almost RMB300 billionYuan, accounted for 1.5% of GDP of the year of 2005.

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Report on Cardiovascular Diseases in China 2012

Dyslipidemia

Li Ying, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China

Lipid levels and prevalence of dyslipidemia in Chinese adults

Serum total cholesterol, low density lipoprotein cholesterol (LDL-C) levels were lower in Chinese populations compared to that in Western countries, while high density lipoprotein cholesterol (HDL-C) was higher in Chinese men, according to the epidemiological studies during the 80's to 90's of the 20th Century.[1,2] The levels of lipids and dyslipidemia were also varied among different geographically and economically classified populations. In the two national multicenter collaborative studies, the mean level of serum total cholesterol in middle aged populations by area was (137.7±5.9) mg/dl ((3.57±0.15) mmol/L) to (203.1±0.9) mg/dl ((5.26±0.02) mmol/L), the age standardized prevalence of hypercholesterolemia (total cholesterol (TC) ≥200 mg/dl, 5.18 mmol/L) was 4.8% to 46.5%.[3,4] The prevalence of dyslipidemia increased markedly in the past 30 years. According to China Multicenter Collaborative Study on Cardiovascular Epidemiology, the age standardized prevalence of hypercholesterolemia (≥200 mg/dl, 5.18 mmol/L) from 9 groups of people was 17.6% and 33.1% in men, and 19.2% and 31.7% in women respectively in 1982–1984 and in 1998 (Figure 1).[5]

In 2000–2001, INTERASIA study, with 15 540 participants aged 35–74 years old, from 10 provinces, the mean of serum TC, HDL-C, LDL-C and triglyceride (TG), was 181.6 mg/dl, 51.7 mg/dl, 109.5, mg/dl 128.1 mg/dl; the prevalence of TC borderline high (200–239 mg/dl, 5.18–6.19 mmol/L) and high (≥240 mg/dl, 6.22 mmol/L) was 23.8% and 9.0%; the prevalence of LDL-C borderline high (130–159 mg/dl, 3.37–4.13 mmol/L), high (160–189 mg/dl, 4.14–4.91 mmol/L) and very high (≥190 mg/dl, ≥4.92 mmol/L) was 17.0%, 5.1%, 2.7%; the prevalence of low HDL-C (<40 mg/dl, 1.04 mmol/L) was 19.2%.[6]

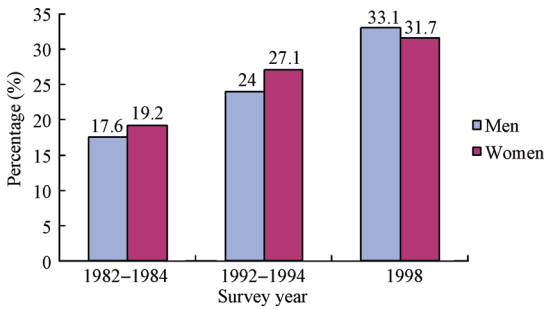

Figure 1. Age standardized prevalence of hypercholesterolemia (≥200 mg/dl, 5.18 mmol/L) in middle aged populations (35–59 years, from 9 groups of people) in 1982–1984, 1992–1994, 1998.

The China National Nutrition and Heath Survey 2002 (the China NNHS 2002) reported that the prevalence of dyslipidemia (at least one was exist among TC ≥5.72 mmol/L, TG ≥1.70 mmol/L, HDL-C <0.91 mmol/L) was 18.6% in adults (≥18 years of age), and the estimated number of patients with dyslipidemia was 200 million according to the China census 2006. The prevalence of borderline high TC (TC 5.20–5.71 mmol/L), high TC (≥5.72 mmol/L), high TG (≥1.70 mmol/L), low HDL-C (<1.04 mmol/L) was 3.9%, 2.9%, 11.9% and 7.4%, respectively. The prevalence for borderline high and high TC was markedly higher in urban and in middle aged and elderly people (Figure 2).[7]

In China Diabetes and Metabolic Abnormalities Study 2007–2008, in adults (20 years and older) from 14 provinces and autonomous regions, the age-adjusted mean of serum TC, TG, LDL-C was higher, and HDL-C was lower in urban than in rural (Table 1); age standardized prevalence for elevated TC, LDL-C categoried to the ATP III on detection, evaluation, and treatment of high blood cholesterol was also higher in urban than in rural (Figure 3). The prevalence of TC borderline high (5.18–6.21 mmol/L) plus high (≥6.22 mmol/L) was 31.5%, estimated number of cases is about 308 million.

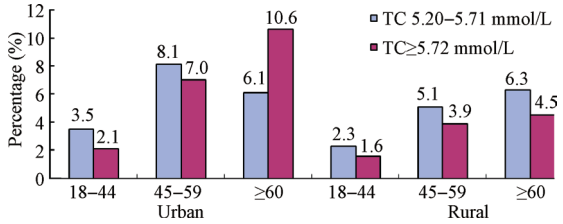

Figure 2. The prevalence of TC borderline high (5.20–5.72 mmol/L), and high (≥5.72 mmol/L) in Chinese adults by age, and urban-rural (adjusted and weighed by age and region).

Table 1. Age adjusted mean of serum TC, HDL-C, LDL-C and TG in Chinese adults in China Diabetes and Metabolic Abnormalities Study, 2007–2008

Variables	Men			Women		
	Total	Urban	Rural	Total	Urban	Rural
TC (mmo/L)	4.70	4.79	4.63	4.73	4.79	4.69
HDL-C (mmol/L)	1.25	1.23	1.27	1.35	1.37	1.34
LDL-C (mmol/L)	2.68	2.81	2.56	2.69	2.81	2.59
TG (mmol/L)	1.71	1.82	1.62	1.42	1.40	1.43

National Center for Cardiovascular Diseases, Fuwai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100037, China

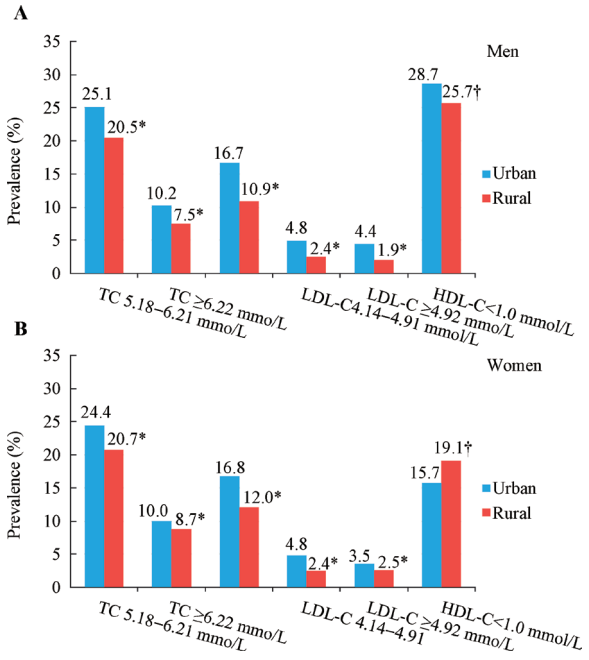

Figure 3. Age-standardized prevalence of major dyslipidemia categories in Chinese male **(A)** and female **(B)** adults (≥20 years old), in China Diabetes and Metabolic Abnormalities Study, 2007–2008. $^{*}P$ <0.001, $^{\dagger}P$=0.01, prevalence variation between urban and rural.

Effect of dyslipidemia on cardiovascular disease

In most of prospective cohort studies in middle age and older populations in China it was confirmed that elevated serum TC, LDL-C increase the risk of cardiovascular disease.[14-19] It was also confirmed in some studies that reduced HDL-C, elevated non high density lipoprotein cholesterol (non-HDL-C) which include all apoB containing lipoproteins, elevated very low density lipoprotein cholesterol (VLDL-C), the lipoprotein rich in TG was also predictive for cardiovascular disease in Chinese populations.

In the combined report of two multicenter cohort studies in middle aged populations, borderline high and high level of serum TC (5.18–6.19 mmol/L, ≥6.22 mmol/L), LDL-C (3.37–4.10 mmol/L, ≥4.13 mmol/L), the relative risk of ischemic cardiovascular disease is about 1.6 to 1.7; LDL-C 4.14–4.90 mmol/L, LDL-C ≥4.90 mmol/L, relative risk was 1.4 and 2.0 respectively.[14] In China MUCA study, based on the data followed up from1992–1994 to 2000, relative risk of ischemic cardiovascular disease was 2.0 (95% *CI* 1.3–3.0), the population attributable risk was 11.4% in serum TC ≥5.7 mmol/L compared with that TC <5.7 mmol/L.[16] In Capital Steel and Iron Company cohort study (more than 5 000 men, followed up for 20 years), compared with the group of serum TC <4.7 mmol/L, the relative risk of myocardial infarction (MI) increased linearly, was 1.70 (95% *CI* 1.03–2.82), 1.95 (95% *CI* 1.14–3.32) and 2.76 (95% *CI* 1.54–4.95) and 3.69 (95% *CI* 2.18–6.24) in the group of TC 4.7–5.1 mmol//L, 5.2–5.6 mmol/L, 5.7–6.1 mmol/L, and ≥6.2 mmol/L.[17] In a hypertensive cohort, relative risk of myocardial infarction increased gradually with increased TC levels.[18] In elderly cohort study (1 211 people, follow up 11.2 years), LDL-C is still significantly increases the risk of coronary heart disease, *OR* 1.54 (95% *CI* 1.32–1.81).[19]

Compared with the group of HDL-C ≥1.0 mmol/L, the relative risk of acute coronary heart disease events and ischemic stroke onset was 1.39 (95% *CI* 1.00–1.92) and 1.45 (95% *CI* 1.15–1.83 respectively) respectively in the group of HDL-C <1.0 mmol/L.[20] In elderly population, increased HDL-C significantly reduced the risk of coronary heart disease, *OR* 0.688 (95% *CI* 0.574–0.824).[19]

Some studies reported that increased non-HDL-C,[15,21] TG[22] and VLDL-C,[23] independently associated with the risk of ischemic cardiovascular disease, or CHD and ischemic stroke separately.

Table 2. The prevalence (%) of dyslipidemia in children and adolescents in some previous studies

Area	Year	Age (years)	Sample size	High TC	High TG
Beijing[10]	1987	7–19	1201	1.3	4.2
Guang Dong[*11]	2005	3–14	6188	2.1	2.2
Beijing[*12]	2007	6–18	Urban 9978	1.6	9.5
			Rural 9523	0.8	8.1

High TC: TC ≥200 mg/dl (5.17 mmol/L); High TG: TG ≥150 mg/dl (1.70 mmol/L).
[*]Fasting capillary blood was used.

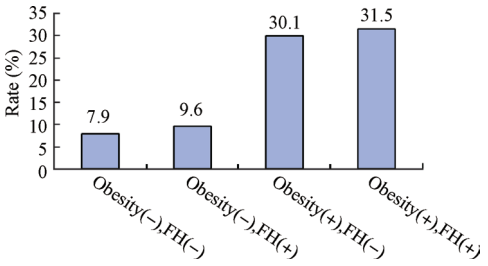

Figure 4. The rate of dyslipidemia in children and adolescents (6–18 years old) with or without family history (CVD, diabetes, dyslipidemia or obesity) and obesity in Beijing (in 2007, 19 037 participants)

Prevention and control of dyslipidemia

Status of control in community

2000–2001, INTERASIA study in people 35–74 years of age, from 10 provinces, urban and rural, reported the rate of awareness was 8.8% in men and 7.5% in women with serum TC level ≥200 mg/dl (5.17 mmol/L); and was 21.3% in men and 18.1% in women with serum TC level ≥240 mg/dl (6.22 mmol/L).[6]

China NNHS 2002 reported that the rate of awareness in adults (18 years old and older) with dyslipidemia (at least one disorder of TC ≥5.72 mmol/L, TG ≥1.70 mmol/L, HDL-C <0.91 mmol/L) was 3.2% in total, and was 3.4% in men, 2.7% in women, 7.0% in urban, 1.5% in rural respectively (Figure 5). The rate of ever taking lipid

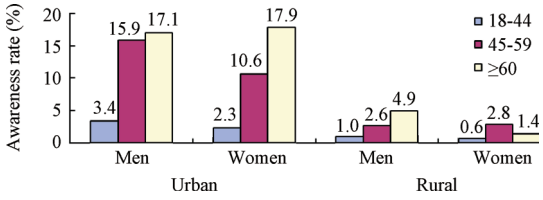

Figure 5. Awareness rate of dyslipidemia in Chinese adults (≥18 years old), the China NNHS 2002.

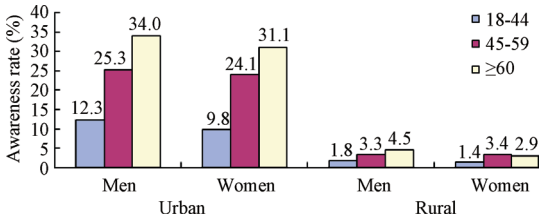

Figure 6. Blood lipid examination rate in Chinese adults (≥18 years old), the China NNHS 2002.

examination before the survey in the surveyed population was 6.4% in total, 16.5% in urban and 2.2% in rural, and the rate was getting higher with age (Figure 6).[9]

In 2007–2008 China Diabetes and Metabolic Abnormalities Survey in adults aged 20 years and older, the rate of awareness, treatment and control of serum cholesterol is still low in participants with cholesterol levels at borderline high and over (≥5.17 mmol/L) and high (≥6.22 mmol/L). In those under treatment, the percentage for TC achieving the corresponding target level was 52.1% and 88.1% in men,

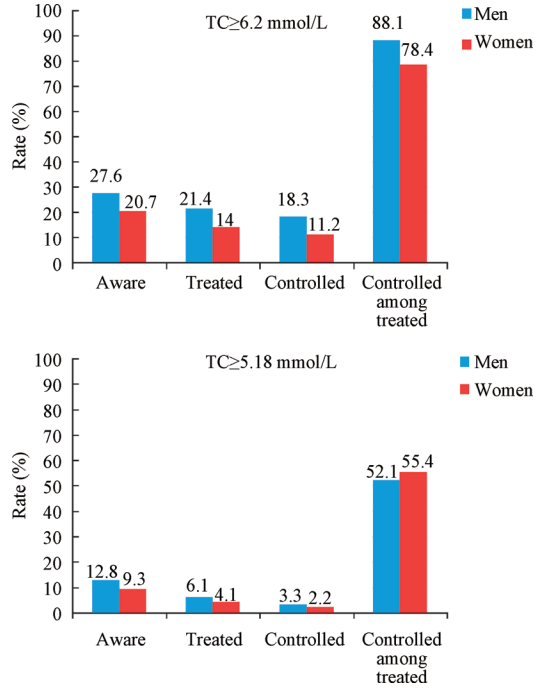

Figure 7. The rate of aware, treatment and control in men and women, and the control rate in those accepted lipid lowering therapy. China Diabetes and Metabolic Abnormalities Study, 2007–2008.

55.4% and 78.4% in women respectively (Figure 7). The rates were much higher in urban than that in rural.[8]

Status of control in Clinic

The National Investigations on Control of Dyslipidemia in Clinic conducted separately in 2000 and in 2006, more than 20 provincial hospitals from 12 metropolitans and several county hospitals, 2 136 and 2 237 participants included in each survey respectively. The participants were hypercholesterolemia patients, accepted lipid-lowering drug therapy and maintained the treatment for more than 2 months. In 2000, the overall rate for goal achievement (The Recommendations on Prevention and Control of Dyslipidemia for Chinese Adults, 1997") was 26.5%. In 2006 the overall LDL-C goal achievement rate was 34% according to NCEP ATP III 2004, and was 50% according to "The Guidelines on Prevention and Control of Dyslipidemia for Chinese Adults (2007).[24,25] In 539 patients who were diagnosed and managed according to the same criteria with that in 2000, the goal achievement rate was 39.9%, markedly higher than the rate in the year 2000.[26]

In 2008, the China Cholesterol Education Program (CCEP) investigated 4 778 outpatients with coronary heart disease in 52 centers located in 6 provinces of China. It was reported that 82.8% of the patients received TLC (Therapeutic Lifestyle Change), 82.2% of them received statin therapy. Among the patients received statin teatment, 36.2% of high-risk patients achieved the target LDL-C level (<2.59 mmo/L), and 10.9% of the very high risk patients achieved the optimal LDL-C level (<1.82 mmo/L) and 42.2% of them achieved the target LDL-C level (<2.59 mmo/L).[27]

In 2009, a study on 51 hospitals across the country indicated, the rate of receiving statin therapy in 2 901 patients with acute coronary syndrome was 80.4%, 65.8% and 59.4% at discharge of hospital, and follow up 6 months and 12 months respectively.[28]

During April 2010 to March 2011, 2 436 cases of coronary heart disease (CHD) patients, who had received lipid-lowering therapy for at least 6 weeks or longer, were recruited from six large cardiovascular centers in the country via cardiovascular outpatient clinic and hospitalization. Of 2 436 patients, 96.7% of patients received stain therapy. 67% of patients achieved a LDL-C goal of <100 mg/dl, while only 38% attained a goal of <70 mg/dl. Among patients whose LDL-C was ≤100 mg/dl, 38% were treated with atorvastatin (average dose 24 mg per day), 22% were treated with simvastatin (average dose 30 mg per day), while in patients whose LDL-C was ≤70 mg/dl, 22% were treated with atorvastatin (average dose 28 mg per day), and 10% were treated with simvastatin (average dose 35 mg per day). Less than 1% and 0.2% of patients whose LDL-C was respectively ≤100 mg/dl and ≤70 mg/dl using a combinational strategy of lipid-lowering drugs. Most of them received a combination of statin with ezetimibe. With regard to non-HDL-C, 66% of patients

achieved a non-HDL-C goal of <130 mg/dl, while only 40% attained the lower non-HDL-C goal of <100 mg/dl. Regarding status of HDL-C levels among patients, 94% of men and 75% of women achieved normal levels of HDL-C.[29]

In the nearly 30 years, prevalence of dyslipidemia increased rapidly in Chinese populations. Dyslipidemia is more common in economy developed areas and in middle aged and elderly populations. The prospective studies in Chinese populations have confirmed that dyslipidemia, especially hypercholesterolemia, is the important risk factors of cardiovascular disease. Although lipid control is improved markedly in clinical patients, especially in CHD patients, it is still much insufficient in community, the percentage of awareness, treatment and control of dyslipidemia is very low. It is important to take measures to improve prevention and control of dyslipidemia and reducing the risk of cardiovascular disease.

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Report on Cardiovascular Diseases in China 2012

Diabetes mellitus in China's adult

Lu Zuqian, Xu Zhangrong, Li Guangwei, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China.

Prevalence of diabetes mellitus increased dramatically in Chinese adult population. Diabetes is a risk factor of cardiovascular diseases (CVD), which are leading causes of death in China. The major risk factors for diabetes include age (≥40 years old), overweight or obesity, reduced physical activities or sedentary lifestyle, dyslipidemia, hypertension. Of which overweight or obesity, reduced physical activities or sedentary lifestyle, dyslipidemia, and hypertension are modifiable. The Daqing study demonstrated the group based lifestyle interventions can effectively reduce not only the incidence of diabetes but also decreased the risk of chronic diabetic micro-complications and CVD mortality.

Epidemic trends of diabetes mellitus in the Chinese adult

Cardiovascular diseases have become the leading causes of death in Chinese adult population followed by the rapid economic growth, an increase in life expectancy, and modernized changes in lifestyle in the last 30 years.[1] Diabetes mellitus is a major risk factor for CVD.[2] In the last decades, prevalence of diabetes mellitus increased dramatically in Chinese adult population, and had a trend to youth. Now it becomes an epidemic disease and the public health problem in China.

The first China's national survey,[3] conducted in 1980 and enrolled 300 000 Chinese residents from 14 provinces and municipalities, showed that the prevalence of diabetes mellitus was 0.67%. In 1994, a population-based cross-sectional study finished by the National Diabetes Prevention and Control Cooperative Group (NDPCCG) [4] reported that the prevalence of diabetes mellitus was 2.5% in 224 251 residents aged 25–64 years in 19 provinces and areas in China. In the national representative sample survey in 2000 to 2001 enrolled 15 540 Chinese adult population aged 35 to 74 years the prevalence of diabetes mellitus was 5.5%.

Recent years, the most influential China's diabetes epidemic data was published by Chinese Medical Association Diabetes Society (CDS), which was conducted from June 2007 to May 2008.[5] The survey samples were taken from 14 provinces and cities, and 46 239 adults aged ≥20 years were recruited. All participants received oral glucose tolerance test (OGTT), and fasting and two hours plasma glucose after OGTT were conducted. The history of diabetes is confirmed according to the patient's self-reported information. The data showed that the prevalence of diabetes and pre-diabetes were 9.7% (10.6% among men and 8.8% among women) and 15.5% (16.1% among men and 14.9% among women), respectively. In 2008, it is estimated that there were about 92 400 000 Chinese adults with diabetes (50 200 000 men and 42 200 000 women) and 148 200 000 Chinese adults with pre-diabetes (76 100 000 men and 72 100 000 women). The prevalence of diabetes increased with aging (3.2%, 11.5%, and 20.4% among persons who were 20 to 39, 40 to 59, and ≥60 years of age, respectively) and with body weight gain (4.5%, 7.6%, 12.8%, and 18.5% among persons with a body-mass index (the weight in kilograms divided by the square of the height in meters) of <18.5, 18.5 to 24.9, 25.0 to 29.9, and ≥30.0, respectively (Figure 1). The prevalence of diabetes was higher among urban residents than among rural residents (11.4% vs. 8.2%, Figure 2). The prevalence of isolated impaired glucose tolerance (IGT) was higher than that of isolated impaired fasting glucose (IFG) (11.0% vs. 3.2% among men and 10.9% vs. 2.2% among women).

The latest Chinese diabetes epidemic data[6] were published by the 2010 China Noncommunicable Disease Surveillance Group (NDSG), which conducted a cross-sectional survey in a nationally representative sample of 98 658 Chinese adults in 2010. The prevalence of diabetes and pre-diabetes were estimated to be 11.6% and 50.1%, respectively. It was 12.1% (95% *CI*, 11.7%–12.5%) among men and 11.0% (95% *CI*, 10.7%–11.4%) among women. The prevalence of diabetes was higher in older age groups, in urban residents, and in persons living in economically developed regions (Figure 3). But the criteria of diabetes and prediabetes adpted in the two diabetes epidemic study is different.[5,6] Actually the prevalence of diabetes is similar if the diabetes was identified by same criteria based on fasting and two hours glucose level of OGTT. The paper published in 2013 predicted that 113.9 and 493.4 million Chinese adults' population with diabetes and prediabetes respectively in the year 2010.

These findings indicate that the diabetes has become the most important noncommunicable disease and one of

Diabetes Center, 306th Hospital of PLA, Beijing 100101, China (Lu ZQ and Xu ZR).
National Center for Cardiovascular Diseases, Fuwai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100037, China (Li GW)
Correspondence to: Li Guangwei, National Center for Cardiovascular Diseases, Fuwai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100037, China (Email: guangwei_li@medmail.com.cn)

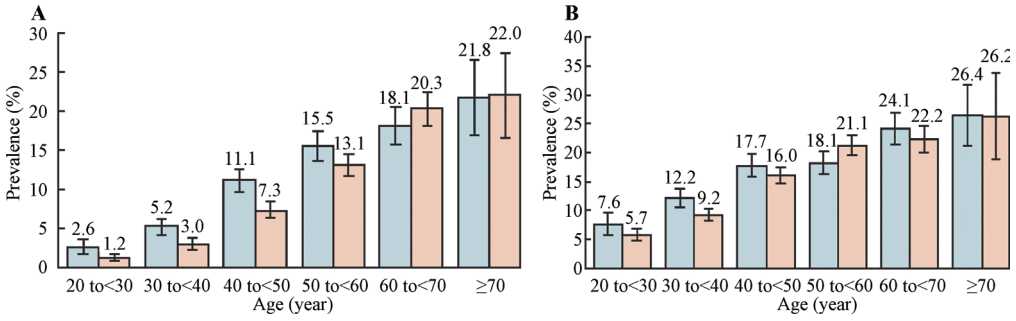

Figure 1. Age-specific prevalences of diabetes and prediabetes among Chinese adults 20 years of age or older. It is indicated the prevalences of total diabetes (**A**) and prediabetes (**B**) among men and women aged 20 years and older, respectively, according to different ages. Prediabetes was defined as IFG or IGT.

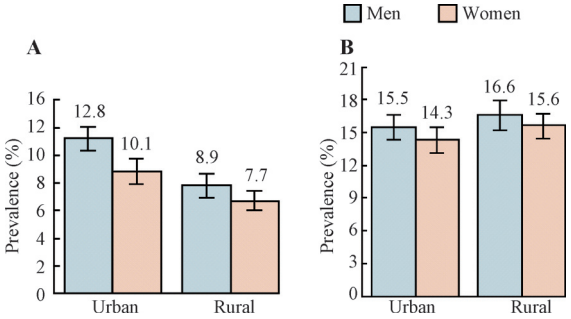

Figure 2. Prevalences of diabetes and prediabetes among Chinese adults aged ≥20 years, according to urban or rural residence. It is indicated the prevalence of total diabetes (**A**) and prediabetes (**B**) among men and women aged 20 years and older, respectively, according to rural or urban residence in China. Prediabetes was defined as IFG or IGT.

public health problem threating adults Chinese health. Furthermore, diabetes will continue increasing and ever more serious, and the prevalence of pre-diabetes is much higher than diabetes in the future because of the huge population with prediabetes. The risk factors for rapid increase of diabetes, such as overweight and obesity, hypertension, high triglycerides, and other factors, have not been effectively controlled. The longer life expectancy reflects the progress of mankind. with aging of the population, noncommunicable chronic diseases such as diabetes, hypertension, and coronary heart disease will be bound to further increase.

The national surveys[5,6] in year 2008 and 2010 reported the highest prevalence of diabetes than in previous surveys, and the prevalence of diabetes was significantly higher than the 2002 national survey obtained (2.69%).[7] The plausible reasons for the increase are as following. First, diagnosis of diabetes is based on a standard OGTT which is a sensitive method for diagnoses of diabetes. In type 2 diabetes patients, a considerable proportion of patients has normal fasting glucose concentration but two-hour postprandial glucose concentration after taking glucose has reach the standard of diabetes, especially in new-onset diabetics. If the diagnosis of diabetes is based on fasting glucose, it may cause over 1/3 of diabetic patients missed. Second, survey samples were mainly from the centers cities and its surrounding rural areas, thus it is not an overall random sample of the population. There are quite different between areas among health care, the economy, culture, and habits because of China's vast area. China's first national diabetic epidemiological survey found that different ethnic differences exist up to seven times among the prevalence

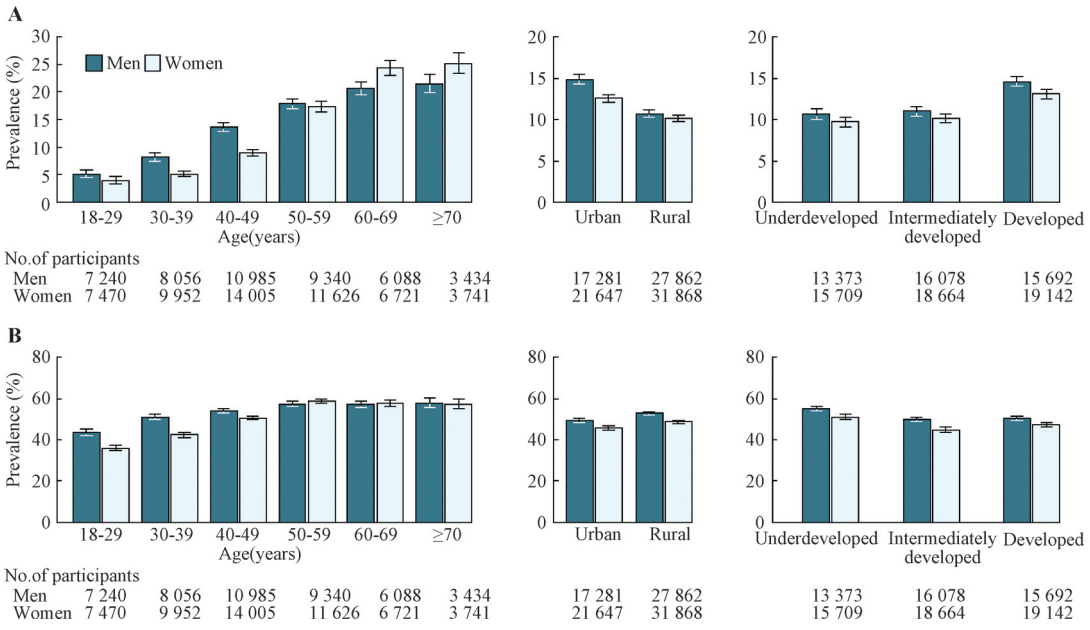

Figure 3. Age-specific and age-standardized prevalence of diabetes (**A**) and prediabetes (**B**) in Chinese adults aged 18 years or older in 2010.

of diabetes.[3] Regional differences in prevalence of diabetes may be 2–3 times in survey in 1996.[8] Zhejiang province, fourth of the richest region according to national GDP, the age standardized prevalence of diabetes was only 5.94%. This survey enrolled 17 437 subjects from 18 districts and counties in 2010.[9] It was far below the national survey reported 9.7%, and its urban and rural standardized prevalence rate of diabetes was 7.52% and 5.19%.[5,9] Third, it is the aging of the population. The average life of Beijing and Shanghai cities has reached 80 years of age. Sixty years or older in 2000 was 10%, and increased to 13% in 2006. Increase in the elderly population will inevitably produce more diabetics. Finally, the process of urbanization, lifestyle changes, and decreased physical activities increase obesity and overweight population. These factors have contributed to nearly two-digit prevalence of diabetes epidemiology. Those diabetic epidemiological results indicate a significant increase in the reality of China recent years.

Major risk factors and their impact on diabetes mellitus in the Chinese adult

The major risk factors for diabetes mellitus include age (≥40 years old), previous pre-diabetes, overweight or obesity, reduced physical activities or sedentary lifestyle, dyslipidemia profile, hypertension, family history, gestational diabetes or macrosomia delivery, PCOS, severe depression or receiving anti-depression drugs, and so on. In those major risk factors, some are not modifiable, such as age, family history or genetics, gestation diabetes, etc.; while overweight or obesity, reduced physical activities or sedentary lifestyle, dyslipidemia profile are modifiable risk factors.

Ageing

In Chinese population, the age is the major risk factors for diabetes. The prevalence of diabetes significantly increased with increasing age in Chinese adult population. In 1994, the national survey data[2] showed that the prevalence of diabetes among the adult population who were 25–34, 35–44, 45–54, and 55–64 years of age was 0.30%, 1.41%, 3.71%, and 7.11%, respectively. In 2007 to 2008, CDS data[5] indicated that the prevalence of diabetes among persons who were 20 to 39, 40 to 59, and ≥60 years of age was 3.2%, 11.5%, and 20.4%, respectively. The latest Chinese diabetes epidemic data[6] conducted by the 2010 China's NDSG suggest that the prevalence of diabetes among residents who were 18 to 29, 30 to 39, 40 to 49, 50 to 59, 60 to 69, and ≥70 years of age was estimated to be 4.5% (4.1%–5.0%), 6.6% (6.1%–7.1%), 11.3% (10.8%–11.8%), 17.6% (17.0%–18.3%), 22.5% (21.6%–23.4%), and 23.5% (22.3%–24.7%), respectively. The above data indicate that the prevalence of diabetes was higher in older age groups, and the age is a major risk factor for diabetes in Chinese adult population.

The urbanization

Data from CDS in 2007 to 2008[5] and China's NDSG in 2010[6] showed that the prevalence of diabetes in urban and rural residents was 11.4% vs. 8.2% and 14.3% (13.9%–14.8%) vs. 10.3% (10.0%–10.6%), respectively. The national surveys conducted by NDPCCG[2] in 1994 and China's NDSG in 2010[6] indicated that the prevalence of diabetes was higher among the persons who had higher annual income and lived in economically developed regions. Those suggest the urbanization, a risk factor for diabetes, take an important role in the pathogenesis of diabetes in Chinese adult population.

Overweight or obesity

Overweight or obesity is major risk factor for diabetes mellitus, and it can be modified. Reduced physical activities or sedentary lifestyle may lead to overweight or obesity, so increase the risk factor for suffering diabetes. A trend in overweight or obese increase is in parallel with diabetes.

The national survey[10] in 1996 found that the prevalence of diabetes in subjects with body mass index (BMI) <25, 25–27, and >27 kg/m^2 populations was 2.47%, 5.83% and 8.48%, respectively. China Obesity Task Forc[11] in 2003 studied relationship between BMI and diabetes among 40 000 subjects all over the country, and the results showed that the prevalence of diabetes in BMI >28 kg/m^2 population was three times than in BMI ≤24 kg/m^2 population; waist circumference in men ≥85 cm and female >80 cm were 2–2.5 times than the normal waist circumference. The national survey[5] from Chinese Medical Association Diabetes Society in 2008 found that the populations in BMI ≤18.5, 18.5–24.9, 25.0–29.9 and ≥30 kg/m^2 accounted for 4.5%, 7.6%, 12.8% and 18.5%. Obesity is a modified risk factor for diabetes, and to control obesity is a key factor in the prevention of diabetes.

Data from Li and its colleagues[12] indicated that prevalence rate of overweight among Chinese adults was 30.6% (31.5% for males and 29.75% for females). It was 33.9% and 29.1% in urban and rural areas, respectively. The prevalence rate of obesity among Chinese adults was 12.0% (11.9% for males and 12.1% for females). It was 13.5%, 11.9%, and 9.9% in eastern, central and western regions, respectively. The total prevalence rate of overweight and obesity among Chinese adults was 42.6%. It suggested that the total prevalence rate of overweight and obesity among urban populations (48.1%) were higher than rural populations (40.1%), P <0.01.

Many cross-sectional studies[13-18] indicated that overweight and obesity is a major risk factor for suffering diabetes among Chinese adult population. Deng's study[13] showed that the prevalence of diabetes and IGT among obesity and overweight population (11.68%, 19.71%, 8.18%, and 17.785, respectively) were higher than among non-obesity and non-overweight (4.74% and 9.79%). Zhao's data[15] indicated body mass index (BMI) and waist hip ratio (WHR) gradually increased during transition from normal glucose tolerance (NGT) to diabetes, and they were risk factor for disturbance of carbohydrate metabolism. The risks of occurrence of glucose metabolism increased 7.3% and 24.7%, respectively, when BMI was increased by 1

and WHR by 0.05. Wu's study[16] suggested that the obesity had approximately 1.6 times diabetes more than the non-obesity.

Dyslipidemia

In the Chinese population, patients had dyslipidemia, fatty liver and obesity for many years until they were diagnosed with type 2 diabetes. Diabetes is often associated with dyslipidemia, such as increased serum level of triglycerides (TG), low-density lipoprotein cholesterol (LDL-C), and decreased serum level of high-density lipoprotein cholesterol (LDL-C). Zhou and the colleague[19] showed that the fatty liver patients had higher prevalence of fasting and two-hour-postprandial hyperglycemia than the non fatty liver patients. Wang's data[20] suggested that dyslipidemia, was detected in 3 160/3 593 (87.9) diabetics with overweight or obesity, and the prevalence of hypertriglyceridemia low blood HDL-C, hypercholesterolemia, and high blood LDL-C was 52.5% (1 888/3 593), 54.1% (1 945/3 593), 33.1% (1 188/3 593) and 27.4% (985/3 593) respectively. Yang's data[21] indicated that among 3 316 subjects, 75.6% had dyslipidemia, the prevalence was 72.5% in men and 77.6% in women, and diabetics with dyslipidemia had higher BMI, waist circumference, blood pressure, plasma glucose and hemoglobin A_{1c} (A1C).

Zhang and the colleague[22] confirmed that BMI WHR, serum total cholesterol (TC), and TG in diabetic patients were significantly higher than the non-diabetic patients, and those data suggested that hypercholesterolemia, overweight and obesity were major risk factors for type 2 diabetes. Wang's data[23] showed that there exists a definite ratio of undiscovered impaired glucose metabolism in dyslipidemia patients who have not suffered from cardiovascular disease, especially in hypertriglyceridemic and combined dyslipidemic patients. Ye and the colleague[24] studied the prevalence of hyperglycemia in dyslipidemia patients in Shanghai's communities. The data showed that the frequencies of impaired glucose regulation (IGR) and diabetes were significantly higher in subjects with dyslipidemia than those with normal lipid profile (P <0.05 and P <0.01). Isolated postprandial hyperglycemia was the most common type of hyperglycemia in individuals with dyslipidemia combined with hyperglycemia, and the frequencies were 73.9% in IGR and 48. 9% in diabetic subjects. The dyslipidemia subjects with combined high TC/LDL-C with high TG and low HDL-C had the highest incidences of IGR (14.6%) and diabetes (13.5%).

Those data suggested that the Chinese population with dyslipidemia, especially high TG and LDL-C and low HDL-C have higher prevalence of diabetes or prediabetes than normal lipid profile, and the dyslipidemia and fatty liver is major risk factors for future progressed to diabetes.

Hypertension

Hypertension and diabetes are not only constituent components of the metabolic syndrome. Hypertension is the most common complication of diabetes, which may be one of the important causes of diabetic macrovascular and microvascular disease; Diabetic patients with hypertension are very common, whereas hypertension patients with diabetes are also very common. Hypertension often in combination with impaired glucose metabolism may accelerate the occurrence and progress of atherosclerosis.

Diabetes and hypertension are closely related. Compared to no-diabetic patients, the diabetic patients have more prevalence of hypertension, whereas the hypertensive patients have more diabetes than the non-hypertensive patients. Lu and the colleagues[25] showed that the prevalence of diabetes and impaired glucose regulation among the hypertensive patients were 19.01% and 18.22%, respectively; whereas among the non-hypertensive patients were 6.54% and 7.87%, respectively. The prevalence rate of hyperglycemia in the hypertension group is three folds than without hypertension group, in addition, more patients with hypertension showed higher postprandial hyperglycemia. Qiu and the colleagues[26] studied the status of newly-onset type 2 diabetes complicated with hypertension in middle-aged or elderly, and showed that the prevalence of hypertension in newly diagnosed diabetes was 48.4%. Sun's data[27] suggested that prehypertension is the independent correlated risk factors for newly-onset hypertension in diabetic patients and the incidence of hypertension increases with age. Zhang et al[28] suggested that 76.4% of the individuals with impaired glucose tolerance and 78.2% of individuals with newly diagnosed diabetes would have remained undetected if OGTT had not been performed.

Pre-diabetes

Pre-diabetes include IFG and/or IGT. IFG is defined as fasting plasma glucose (FPG) levels 5.6 mmol/L to 6.9 mmol/L; IGT defined as two-hour values in the OGTT of 7.8 mmol/L to 11.0 mmol/L.[29] IFG and IGT should be viewed as risk factors for diabetes as well as cardiovascular disease. Prediabetes is an intermediate state between normal blood glucose and diabetes, and it may eventually progress to type 2 diabetes at different speeds.

The data from China Daqing diabetes prevention in 1992[30] indicated that the incidence of diabetes in obese IGT subjects (BMI ≥27.5 kg/m^2) was 17.2% per year, and in non obese IGT subjects was 13.3% per year. In the USA, however, the prevalence of diabetes was 11.1% per year in significant obese IGT subjects. These results suggested that Chinese population with IGT converted to type 2 diabetes faster than Caucasians.

IGT is an independent risk factor for coronary heart disease (CHD). In the Daqing survey[30] of 100 000 subjects in 1985, the incidence of CHD as diagnosed by ECG was 9.5 times in IGT compared with normal subjects. Dyslipidemia in IGT subjects was higher than in normal subjects. Hypertension, obesity and urinary albumin excretion rate was twice normal compared with same age and sex normal subjects. In a 20-year follow-up, 211 patients developed

Table 1. Incidence of IGT in China Daqing diabetes prevention study in 1986

Age (years)	Men total surveyed	Women total surveyed	Man IGT (*n*)	Man IGT per 1 000	Woman IGT (*n*)	Woman IGT per 1 000
25–29	8 908	8 534	11	1.2	3	0.4
30–34	11 189	13 064	26	2.3	28	2.1
35–49	12 273	13 883	55	4.5	53	3.8
40–44	8 144	7 923	45	5.5	62	7.8
45–49	5 475	8 286	33	6.0	63	7.6
50–54	5 966	2 219	73	12.2	32	14.4
55–59	2 286	875	47	20.6	12	13.7
60–64	535	469	9	16.8	10	21.3
≥65	615	416	12	19.5	3	7.2
Total	55 391	55 669	311	5.6	266	4.8

Source: Daqing six-year prospective study (Pan et al. Diabetes Care 1997; 16: 150-156)

first CVD event (145 with stroke and 66 with AMI), 142 patients with death, and 68 patients with CVD.[31]

In China, IGT patients had a rapid growth during 1985 and 1996,[30] the details are shown in Table 1.

Prevention of diabetes mellitus in the Chinese population

The major risk factors for diabetes mellitus in the Chinese population may include overweight or obesity, reduced physical activities or sedentary lifestyle, dyslipidemia, hypertension, and so on. More attention should be paid to modifiable risk factors, especially overweight or obesity, dyslipidemia profile and hypertension because modifying those risk factors may greatly reduce the prevalence of diabetes, so as to reduce the cardiovascular event.

Prevention status for high risk population of diabetes mellitus

IGT is not only a transitional stage from pre-diabetes to diabetes, but also a last pass to prevent type 2 diabetes. It is crucial to identify the IGT population and give it therapeutic intervention. The prevention and treatment for IGT include lifestyle intervention and drug therapy.

In the past 10 years, many domestic clinical trials[31-33] confirm that intensive lifestyle intervention or drug therapy can be successful in reducing the incidence of diabetes, the details are shown in Table 2.

Life style intervention may decrease diabetic prevalence for high risk population by 30%–50%

Daqing six-year prospective intervention study of diabetes, finished the year 1986–1992, is the first large-scale international randomized clinical study to lifestyle intervention.[34] After six years of follow-up, diabetes developed in 67.7% in control group, 43.8% in diet alone, 41.1% in single-exercise group, and 46.6% in diet plus exercise group.[34] After adjusting BMI and fasting blood glucose, the above three intervention groups had reduced the risk of diabetes by 31%, 46% and 41%, respectively.[34]

Table 2. Intervention of IGT may prevent the incidence of diabetes in China population

Trial	Years of follow-up	Samples (*n*)	Interventions	Reduced incidence of diabetes (%)
Daqing study[31]	6 (1986–1992)	530	Life style	51
Multicenter study[32]	3 (1996–1999)	304	Life style	29.5
			drugs	82.8
Shougang study[33]	1 (1992–1993)	70	Drugs	85.4

Twenty-year follow-up study in China Daqing diabetes prevention

The 20-year follow-up study of China Daqing diabetes prevention has proved the long-term impact of lifestyle intervention on preventing diabetes. In the active intervention period (1986–1992), the cumulative incidence of diabetes was 43% in the intervention group, while it is 66% in the control group.[31] Compared to the control group, the risk of diabetes was decreased by 51% in the intervention group (*HR*=0.49; 95% *CI* 0.33–0.73), and the number need to treat was five people to prevent a case of diabetes.[31] In the 20 years of follow-up, the cumulative incidence of diabetes was 80% in the intervention group, while it was 93% in the control group; and the number need to treat was eight people to prevent a case of diabetes. After multivariate analysis for adjusting random factors of age and group influence, the incidence of diabetes was decreased by 43% (*HR*=0.57; 95% *CI* 0.41–0.81) in the intervention group compared with the control group, and participants in the intervention group had an average of 3.6 fewer years with diabetes than the control group.[31]

Anti-diabetic drugs can reduce the incidence of diabetes in high-risk populations by 70%–80%

China-Japan Friendship Hospital finished a three-year multi-center clinical trial with lifestyle intervention in combination with drugs.[32] The findings showed that 11.6%

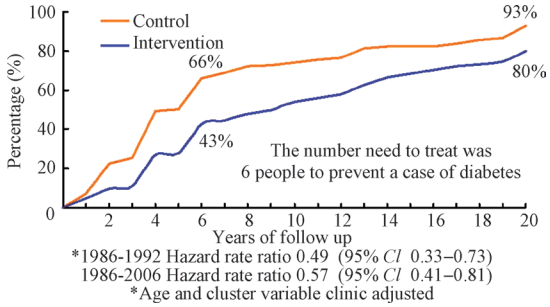

Figure 4. The source: Lancet 2008; 371: 1783-1789.

of IGT naturally progressed to diabetes every year; lifestyle intervention group was 8.2%; small dose of metformin or acarbose in combination with lifestyle intervention groups were 4.1%, 2.0%, respectively; while the combination of two drugs decreased the risk of diabetes 76.8% and 87.8%.[32].

Diabetes prevention and cardiovascular disease and death

In a 20-year follow-up of China Daqing diabetes prevention studyj,[31] cumulative CVD mortality in the intervention group is a 28% lower (12% vs. 17%) than in the control group, but no significant difference exists between the two groups. There was no significant difference in all-cause mortality between the two groups (25% vs. 29%). During 14 years follow-up after the end of the active intervention, the risk of first CVD events in the intervention group was a 8% lower than in the control group (39% vs. 42%); CVD mortality low 33% (12% vs. 17%); and all-cause mortality low 18% (22% vs. 27%). However, the difference was statistically not significant. Adjusted for age, sex, degree of obesity, blood pressure and smoking factors in baseline in the IGT group, 5.0 mmol/L increment of two-hour postprandial glucose may increase stroke and CVD events by 20%, increase all-cause mortality by 33.5%. Additionally, lifestyle intervention may reduce the risk factor of severe retinopathy (laser therapy and blindness) by 47% (*HR*=0.53, 95% *CI* 0.29–0.99, *P*=0.048).[35] These results suggest that lifestyle interventions may reduce the micro-vascular and macro-vascular diabetic complications. However, because the sample size diabetic is small, the results still need to be confirmed by long-term larger scale clinical study.

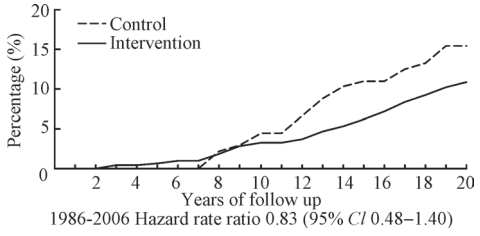

Figure 5. The cumulative mortality of cardiovascular and cerebrovascular diseases in a 20-year follow-up of China Daqing diabetes prevention study.

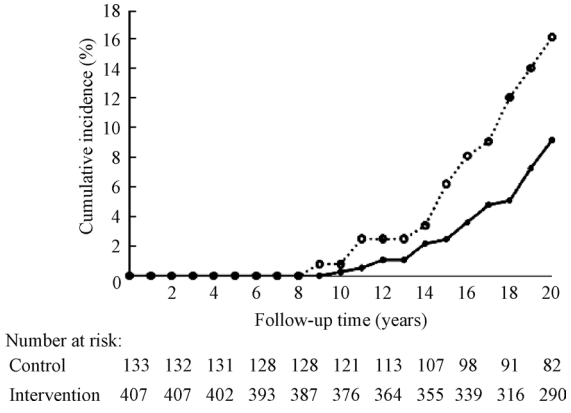

Figure 6. Cumulative incidence of severe retinopathy during the 20-year follow-up of the China Daqing Diabetes Prevention Outcome Study in the control group (dotted line, white circles) and intervention group (solid line, black circles). The hazard ratio (*HR*) between the intervention and control group was 0.53 (95% *CI* 0.29–0.99).

Exploring diabetes community management

Recently, diabetic patients with multiple cardiovascular risk factors have received more and more attentions. Diabetes community management can effectively reduce the incidence and development of chronic diabetic complications.

Beijing community survey[36] showed that diabetic patients accounted for only 4.7% with diabetes alone, 32.6% with one metabolic abnormality, 42.1% with two metabolic abnormalities and 20.6% with three metabolic abnormalities, and diabetes associated with the metabolic syndrome was 62.7%.

Shanghai Zhenru town community medical service center[37] studied the incidence of chronic comorbidities and complications of diabetes in 1 533 subjects. The findings showed that the incidence of peripheral vascular disease (PAD) was 67.0%, hypertension 63.2%, dyslipidemia 45.1%, familial diabetes 34.8%, hyperuricemia 29.0%, retinopathy 28.0%, fatty liver 27.1%, diabetic nephropathy 21.1%. These data remind whole society that comprehensive prevention and treatment of diabetes should be urgently strengthened.

Shanghai Sixth People's Hospital jointed center for disease control in Putuo district in Shanghai, Putuo district central hospital, Liqun hospital as well as Caoyang, Zhenru, and Taopu town communities health center and other units to explore the integration of community and hospital diabetes management mode.[38] They started from the training of community professionals and archiving, and standardize the diagnosis and treatment processes, and implement disease classification management according to patients' conditions with two-way referral of patients with diabetes. During the period from December 2007 to September 2008, the screening rates of chronic diabetic complications increased from 9.88% to 46.62%; the target rates of triglyceride, cholesterol, blood pressure and urinary albumin were 48.99%, 39.97%, 79.82%, and 36.05%, respectively; the target A1C rate (<6.5%) increased from 8.91% in 2002 to 31.74% in 2008.[38]

The data[39] from Beijing institute of technology showed that intensive glycaemic control can significantly reduce cumulative incidences of eye disease, renal disease, foot ulcer and cardiovascular disease (all P <0.05) compared with conventional glycaemic control. Compared with conventional glycaemic control, intensive glycaemic control showed the reduced cumulative incidences of eye disease, renal disease, foot ulcer and cardiovascular disease (all P <0.05). Background retinopathy, end-stage renal disease,

foot ulcer, congestive heart failure, myocardial infarction events were reduced by 4.30%, 0.81%, 2.36%, 2.59% and 4.00%, respectively.[39] Therapy of intensive glycaemic control improved life expectancy significantly (0.476±0.251 years) and associated with improvements by 0.418±0.173 quality-adjusted life years (QALYs), but increased direct medical costs by Chinese Yuan (CNY) 5 940 per patient as compared to conventional glycaemic control.[39] However, the incremental cost-effectiveness ratio was calculated as CNY 14 217 per QALY gained. So the intensive glyeaemic control reduces the cumulative incidences of diabetes complications and improves long term health outcomes for patients with T2DM; and is associated with improvements in life expectancy and QALYs.

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Report on Cardiovascular Diseases in China 2012

Overweight and obesity, deficiency of physical activities, and diet and nutrition

Zhao Liancheng, PengYaguang, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China.

During recent three decades, with the rapid development of economy, the life style of Chinese people has changed dramatically. The prevalence of overweight and obesity has increased significantly. It is estimated that among Chinese adults 240 million are overweight and 70 million are obesity. Meanwhile, physical activity levels have declined, especially in occupational activity levels. The nutritional status of Chinese people has improved, but some of unfavorable dietary factors, such as higher intake of salt, lower intake of vegetables and fruits, are still remained. In addition, the amount of dietary fat and cholesterol has increased considerably, and the mean percentage of total energy from fat increased, from carbohydrate decreased, which had been exceeded the range recommended by *Chinese Dietary Guidelines*. Great effects should be made to improve healthy eating, control overweight and obesity, and increase the amount of physical activity for cardiovascular disease prevention.

Overweight and obesity

During recent three decades, with the development of economy and the change of the life style, the prevalence of overweight and obesity in China has been increasing dramatically. It has been one of the most important challenges to public health in China.

According to the outcomes of National Nutrition and Health Survey 2002, it was estimated that there were about 200 million people with overweight (BMI: 24.0−27.9 kg/m^2) and about 60 million with obesity (BMI≥ 28 kg/m^2) in China. The number of people with overweight and obesity reached 240 million and 70 million, respectively, based on the statistics of 2006 census. The prevalence of overweight and obesity in China has increased significantly (Figure 1).[1]

The China Health and Nutrition Surveys (CHNS) were the continuing cross-sectional survey in 9 provinces and cities of China in the past 20 years, which were conducted to monitor long-term status of diet and health for Chinese population. The results showed that the prevalence of overweight and obesity still continued up-rising.[2] The prevalence of overweight and obesity (male and female combined) reached 30.0% and 8.7%, respectively (Figure 2), and the prevalence of central obesity (waist circumference ≥ 85 cm for male and 80 cm for female) was up to 45.3% in 2009 (Figure 3).

To prevent and control the epidemic of obesity and other CVD risk factors, with increasing fiscal budget, National Health and Family Planning Commission (Ministry of Health previously) has made a series of strategy plans, including the "Health of China 2020", "China Chronic Disease Prevention and Control Planning 2011−2015", "National Fitness Program 2011−2015", to support the prevention and control of chronic diseases. Some national intervention projects for obesity were held successfully, such as "National Health Lifestyle Action", "Community-based Population Physical Exercise Promotion Project".

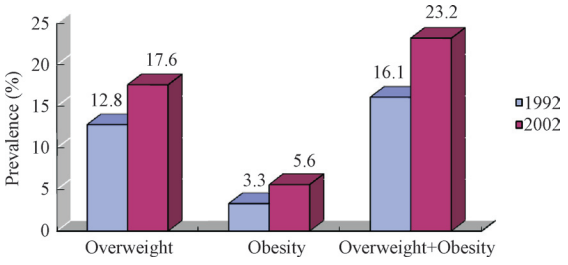

Figure 1. Prevalence of Overweight and Obesity in China in 1992 and 2002.

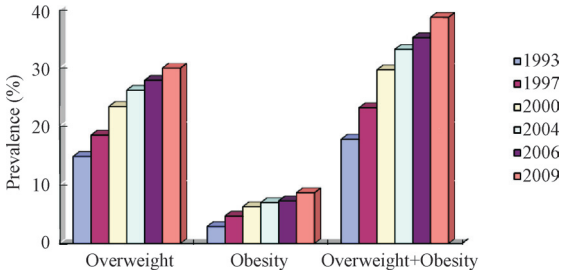

Figure 2. Prevalence of overweight and obesityin 9 provinces and cities in China from 1993 to 2009.

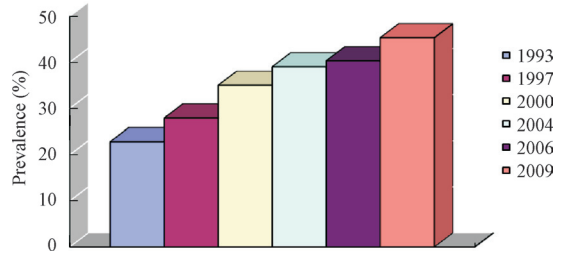

Figure 3. A trend in prevalence of central obesity in 9 provinces and cities in China from 1993 to 2009.

National Center for Cardiovascular Diseases, Fuwai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100037, China (Zhao LC and Peng YG)

We should more widely mobilize the forces of the society to advocate the healthy lifestyle and strengthen prevention and control of the obesity, thus the rising prevalence trend of obesity can be stagnated and reversed.

Deficiency of physical activities

Deficiency of physical activities (physical inactivity) was one of the CVD risk factors and could also cause obesity, hypertension, dyslipidemia and hyperglycemia which increased the hazard to incidence of CVD.

With the socio-economic development, the physical activity levels of Chinese residents decreased significantly. The findings[3] of CHNS showed the occupational physical activities contributed the most part of total physical activities, followed by household physical activities among residents aged 18−55 years. The amount of physical activities in leisure time and consumed in daily travel was less. Compared with the data of 1997, the amount of total physical activities decreased by 27.8% in men and by 36.9% in women in 2006 (Table 1).

Taking exercise actively is an important approach to increase physical activity. According to the data from the Third National Sports Exercises Investigation (2007),[4] 28.2% of Chinese residents aged 16 and above, including school students, participated regular exercise (exercise≥3 times per week, each time≥30 minutes). Whereas, the rate of doing regular exercise in residents aged 20−49 was lower than those of other age groups (Figure 4).

The data from three national large-scale sampling surveys in 1997, 2001 and 2007 showed that there was a little increasing trend in the regular exercise rate for residents aged 16 (not including school student)[4] (Figure 5).

In the Third National Sports Exercises Investigation (2007),[4] it showed that the main purposes of the residents participating physical exercise in China were increasing the amount of total physical activity (34.8%), entertainment (26.8%), prevention and cure diseases (18.9%)(Figure 6). The purpose of doing exercise in young people was mainly for entertainment, while in elderly, it was mainly for prevention and cure.

The reasons for not taking exercise were mainly "No time" (33.8%), followed by "No interests" (20.4%), "Lack of facility" (12.9%) and "No necessary" (12.6%)[4] (Figure 7).

The rate of taking exercise increased a little in recent years in Chinese residents, but not enough, especially in young people. To increase the amount of physical activities, we should still continue to promote and advocate for residents to take physical exercise actively, and improve the hardware establishment including the sports field and exercise facilities. In 2011, the Ministry of Health had issued the *China Adults Physical Exercise Guideline*[5] and *National Fitness Program 2011−2015*. Practicing the Guideline and the Program will help to promote the prevention of chronic diseases including CVD.

Diet and nutrition

Compared with the previous National Nutrition Survey, the results of the National Nutrition and Health Survey

Table 1. Change in physical activity levels among Chinese men and women (MET-hours/week)

Items	Men			Women		
	1991	1997	2006	1991	1997	2006
Occupational	370.6	334.4	241.5	399.7	340.1	217.1
Household	19.1	11.7	5.6	61.3	46.8	25.3
Leisure time		1.4	3.6		0.6	2.3
Daily travel		2.6	1.9		2.5	1.3
Total		350.0	252.7		390.0	246.1

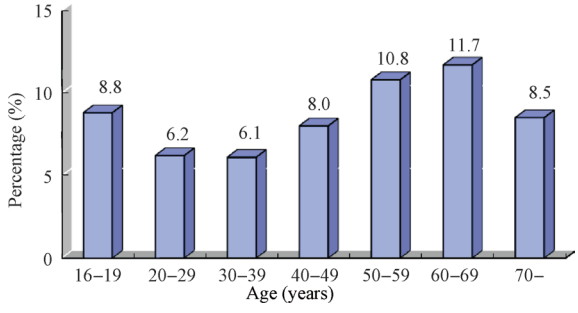

Figure 4. Rate of exercise participate in each age group population.

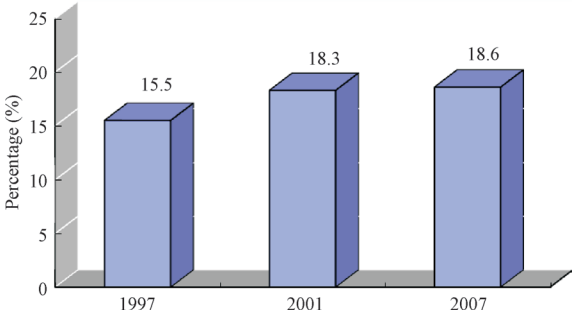

Figure 5. Regular exercise rate in 1997, 2001 and 2007.

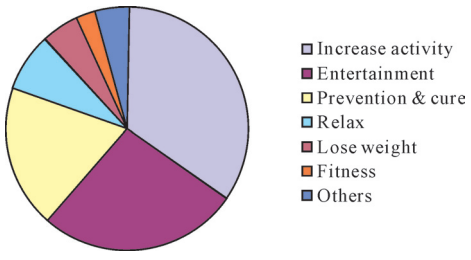

Figure 6. The purposes of doing exercise (%).

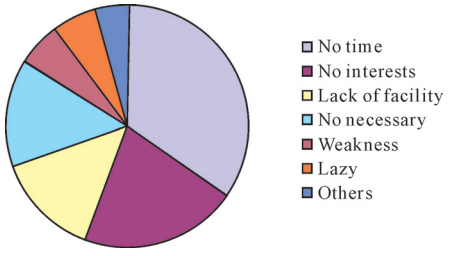

Figure 7. Reasons for not taking exercise (%).

2002 showed that there was a great change in Chinese dietary pattern. Some of unfavorable changes, which might increase the CVD risk, included: cereals intake decreased greatly, while the amount of fat intake increased considerably; and the percentage of total energy from carbohydrate decreased, but that from fat increased, which had exceeded the range recommended by *Chinese Dietary Guidelines*.[6] Furthermore, the amount of vegetables and fruits intake in Chinese residents were still low but the amount of salt intake extremely exceeded the recommended standard, which was <6 g/d. In 2002, salt intake that was estimated from the dietary sodium intake was 15.9 g per captia.

The CHNS[7] was a long-term observational project held in 9 provinces and cities in China. From 1989 to 2009, there were totally 8 cross-sectional surveys conducted in order to explore the changes of dietary and nutrition and health status in Chinese residents. The results showed that the total energy intake was significantly declined (Figure 8), but the percentage of total energy from fat increased and proportion of that percentage over 30% was increased (standard recommended by the guideline was ≤ 30%)[8] (Figure 9). While the percentage of total energy from carbohydrates decreased and proportion of that percentage under 55% was increased (standard recommended by the guideline was 55%–65%)[8] (Figure 10). The dietary cholesterol intake was increased obviously[9] (Figure 11). The dietary calcium intake was increased slightly[10] (Figure 12). The average level of calcium intake was still about half of the recommended level (recommended level was 800 mg/d).

The above results indicated there were some changes happened in features of dietary pattern in 9 provinces and cities. Some unfavorable dietary factors, which do harm for prevention and control of the CVD, might have aggravated,

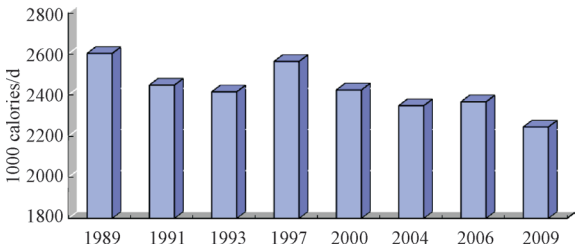

Figure 8. The change of energy intake in population (18–49 years) from 9 provinces and cities from 1989 to 2009.

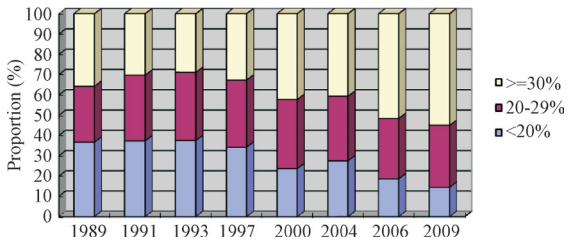

Figure 9. The change of the proportion of fat for energy content in population (18–49 years) from 9 provinces and cities from 1989 to 2009.

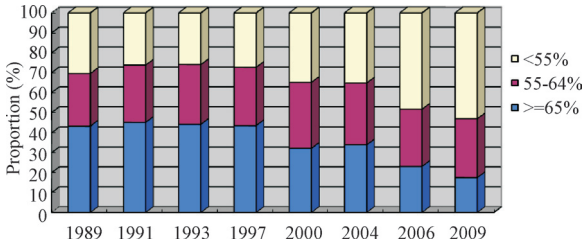

Figure 10. The change of the proportion of carbohydrate for energy content in population (18–49 years) from 9 provinces and cities from 1989 to 2009.

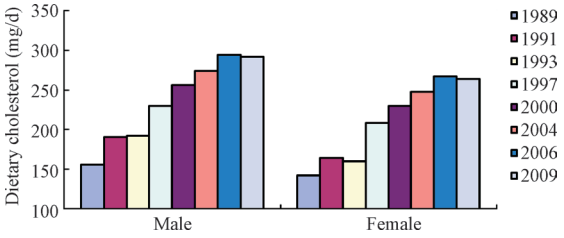

Figure 11. The change of dietary cholesterol intake level inpopulation (19–49 years) from 9 provinces and cities from 1989 to 2009.

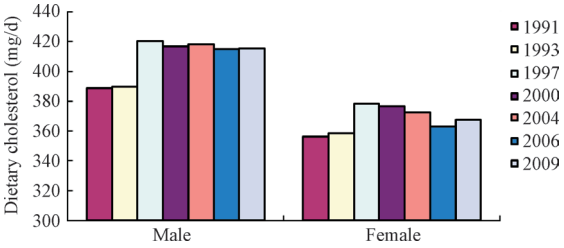

Figure 12. The change of dietary calcium intake level in population (18-49 years) from 9 provinces and cities from 1989 to 2009.

such as the imbalance structure of the energy resources, the increasing amount of dietary fat and cholesterol intake, and no radical changes in low calcium intake. Our government, health management organizations, disease control institutions and the public should be aware of these changes. We should continue to advocate and promote *Chinese Dietary Guidelines*, to improve our diet for CVD prevention.

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Report on Cardiovascular Diseases in China 2012

Prevalence rate of metabolic syndrome

Zuo Huijuan, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China.

Metabolic syndrome (MS) is a clustering of multiple risk factors in one person. The result of National Nutrition and health Survey in 2002 showed, crude prevalence rate of MS was 6.6% according to the diagnostic criteria of MS based on Chinese Association of Diabetes (CDS) criteria. Some studies indicated that life style was significantly associated with MS. Now some studies were conducted continuously to repot the prevalence trends in different region. In the present article, we reviewed recent epidemiological data of MS in China, and collected the prevalence of MS in different city and its' risk factors.

Prevalence rate of MS

Population aged over 18 in National Nutrition and Health Survey, crude prevalence rate of MS was 6.6% according to the diagnostic criteria of MS based on Chinese Association of Diabetes (CDS) criteria 2004, based on the ATPIII criteria of adult hypercholesterolemia of NCEP in USA, the crude rate was 13.8%.

According to the diagnostic criteria of MS based on International Diabetes federation (IDF), the crude rate of MS was 7.3% in subjects over 20 years old in Guamgdong, and 30.7% in subjects over 35 years old in Xinjiang. According to the diagnostic criteria of MS based on Chinese Association of Diabetes (CDS) 2004, the crude rate of MS was 18.7% in subjects over 20 years old in Jiangsu, and 7.62% in subjects over 15 years old (including 15 years old) in Shenzhen.

Risk factors

The following factors have been reported as being associated with incident of metabolic syndrome: smoking, alcohol consumption, and occupational stress factors.

A total of 693 men with no MetS at baseline were followed up 2.9–5.5 years in Shanghai. [5] Subjects were divided into nonsmokers, ex-smokers, and current smokers according to baseline smoking status. After adjusting for age, education level, alcohol intake, fasting plasma insulin, HOMA-IR index, and BMI at baseline and weight change, current smokers were dose-dependently associated with increased risk for developing new MetS compared with nonsmokers. The odds ratio (*OR*) was 2.131 (95% *CI*, 1.264–3.592; *P* <0.01) for the NCEPIII definition or 3.083 (95% *CI*, 1.807–5.295; *P* <0.01) for the JCDCG definition of MetS. Ex-smokers who had quit for ≥13 years significantly decreased the risk for developing new MetS defined by the JCDCG definition.

Table 1. Prevalence of MS in different region

Region	Age (years)	Sampling (*n*)	Investigation method	Prevalence rate (%)	
				IDF	CDS
Jiangsu[1]	>20	3 436	Multi-steps cluster sampling		18.7
Guangzhou[2]	>20	6 468	Multi-steps cluster sampling	7.3	
Xinjiang[3]	>35	10 242	Multi-steps cluster sampling	30.7	
Shenzhen[4]	≥15	8 782	Multi-steps cluster sampling		7.62

A community-based cross-sectional study[6] was performed in 19 215 participants aged 40 years or over in Shanghai of China from June 2008 to April 2009. In male wine-only consumers, after adjusted for age, sex, BMI, education levels, exercise and smoking habit, severe alcohol consumption (≥ 50.0 g/d), compared with non-alcohol consumption, conferred 53% increased risk of having MetS. In women, alcohol consumption did not have relation to the prevalence of Mets.

In a cross-sectional survey[7] in 1 480 policemen, police with medium category and highest of occupational stress were more likely to become metabolic syndrome than that with the lowest category, odds ration was 3.33 (95% *CI*: 1.62–6.79) and 4.82 (95% *CI*: 1.50–15.41) respectively. Multivariate Logistic regression analysis showed, role overload, role insufficiency and responsibility were the main occupational stress factors, odds ration was 1.06 (95% *CI*: 1.02–1.10), 1.04 (95% *CI*: 1.02–1.07), 1.03 (95% *CI*: 1.01–1.06).

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Beijing Institute of Heart, Lung & Blood Vessel Diseases, Beijing Anzhen Hospital, Capital Medical University, Beijing 100029, China (Zuo HJ)

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Report on Cardiovascular Diseases in China 2012

Epidemiological studies of coronary heart disease

Zeng Zhechun, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China

Mortality and epidemic trends of coronary heart disease (CHD) in Chinese population[1]

Crude Death Rate of CHD in 2010

According to the data from Health Statistic Yearbook of Ministry of Health of China in 2010, the crude death rate of CHD was 86.34/100 000 among urban residents and 69.24/100 000 among rural residents. Both had a slightly decrease compared to the year 2009 (94.96/100 000, 71.27/100 000). In general, the crude death rate of CHD was higher in urban areas than in rural areas, and higher for men than for women (Figure 1, Table 1).

Trends of crude death rate form CHD and AMI from 2002 to 2010

Although, the crude mortality rate of CHD was still higher in urban areas, the rate in rural areas was continually exceeded the rate in small and middle cities for three years. Both areas had a slightly decrease compared to the previous year (Figure 2).

It is worth noting that the crude mortality of AMI in rural areas increased dramatically from the year 2005, it exceeded urban areas in the year 2009 and exceeded big cities (metropolises) became the highest AMI mortality areas in China (Figure 3).

Trends of age-specific death rates of AMI in Chinese population from 2002 to 2010 (1/100 000)

The age-specific death rates of AMI rose with the increasing of age, and significantly increase by the age of 40. It presented an exponential curve. Similar curves were found not only for urban and rural but also for men and women (Figures 4–7).

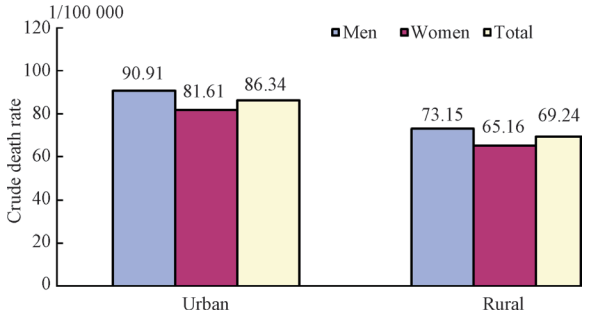

Figure 1. Comparison of CHD crude death rate between different genders in Chinese urban and rural areas in 2010.

Prevalence rate of ischemic heart disease in Chinese population[2]

According to the report of 2008 National Health Services Survey in China, the prevalence rate of ischemic heart disease in urban areas was 15.9‰, 4.8‰ in rural areas and totally 7.7‰. It has a significantly increase compared to the year 2003 (urban 12.4‰, rural 2.0‰, total 4.6‰).

Hospitalization rates for coronary heart disease from 2007 to 2009 in Beijing[3]

In order to examine the distribution and trends of hospitalization rates for CHD in Beijing, researchers synthesized hospitalization data for CHD from Beijing Hospital Discharge Information System from 2007 to 2009 and population census data in Beijing from Beijing Municipal Bureau of Statistics.

CHD includes acute myocardial infarction, unstable angina and other forms of CHD. Age-standardized hospitalization rates for CHD per 100 000 population aged 25 years or more were calculated.

Results: During 2007–2009, a total of 248 049 patients aged 25 years or more hospitalized in Beijing with the primary discharge diagnosis of CHD were enrolled, of whom 73.7% were permanent registered Beijing citizens. The average hospitalization rate for CHD in 2007–2009 was 651.2/100 000 for the permanent residences in Beijing (741.2/100 000 in men, 560.9/100 000 in women). The highest average hospitalization rate (671.9/100 000) was seen in exurban area compared to other areas in Beijing. The average hospitalization rate for acute myocardial infarction, unstable angina, and other CHD was 126.4/100 000, 226.4/100 000 and 298.4/100 000, respectively. The hospitalization rate for CHD increased 18.1% from 2007 to 2009 (from 598.1/100 000 to 706.5/100 000). The same trend was seen in women (20.2%) and men (16.6%). The hospitalization rates of CHD in the urban, suburban, and exurban areas of Beijing all increased in the three years, and the greatest increase (36.6%) was found in exurban area. Hospitalization rates of acute myocardial infarction and unstable angina increased 24.5% and 55.3%, respectively, in the three years, while hospitalization rates of other CHD decreased 5.7%.

Beijing Institute of Heart, Lung & Blood Vessel Diseases, Beijing Anzhen Hospital, Capital Medical University, Beijing 100029, China (Zeng ZC)

Table 1. Crude death rate of CHD in 2010 (1/100 000)

CHD	Total of urban area			Large city			Middle or small city			Rural area		
	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women
AMI	42.27	42.39	33.63	42.27	47.04	37.35	23.73	26.56	20.76	43.19	47.06	39.15
Others	53.65	48.52	47.98	53.65	53.79	53.51	29.75	30.61	28.85	26.05	26.09	26.01
Total	95.92	90.91	81.61	95.92	100.83	90.86	53.48	57.17	49.61	69.24	73.15	65.16

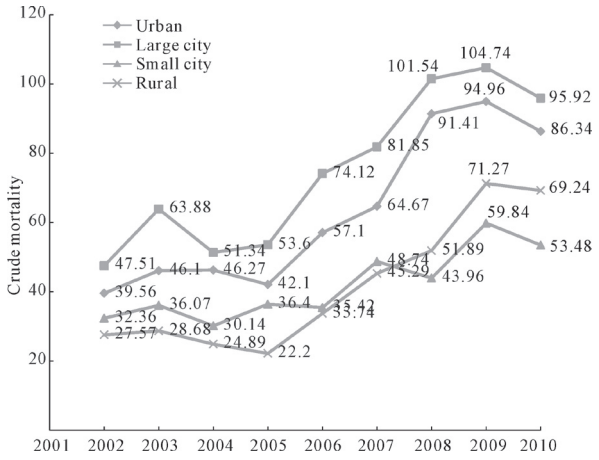

Figure 2. Trends of CHD crude mortality of China, from 2002 to 2010 (1/100 000).

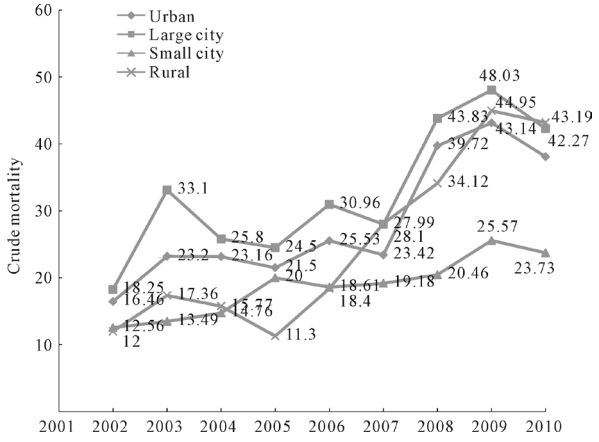

Figure 3. Trends of AMI crude mortality of China, from 2002 to 2010 (1/100 000).

Surveillance on the incidence of acute coronary events in the permanent residents of Beijing from 2007 to 2009[4]

In order to survey the incidence of acute coronary events and its trend across Beijing residents, researchers synthesized the routinely collected data of people aged 25 years and more from 2007 to 2009 from the Hospital Discharge Information System and Cause of Death Register System in Beijing. Estimated incidence of acute coronary events, distribution of the incidence across gender, age groups and regions were calculated. Acute coronary event was defined as non-fatal myocardial infarction and death from coronary heart disease. Numbers of residents by age, gender and area were obtained from the Beijing Statistics Bureau.

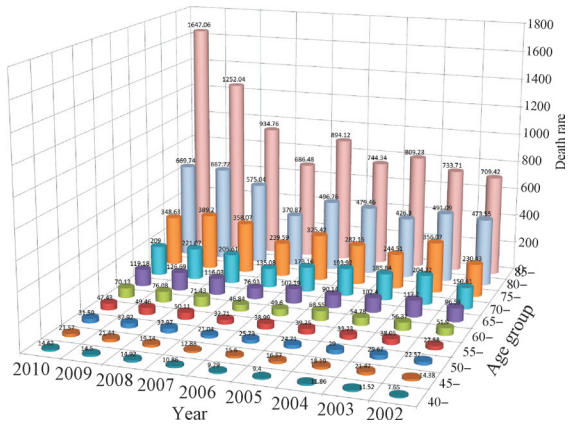

Figure 4. Trends of age-specific death rates of AMI for men in urban areas, from 2002 to 2010.

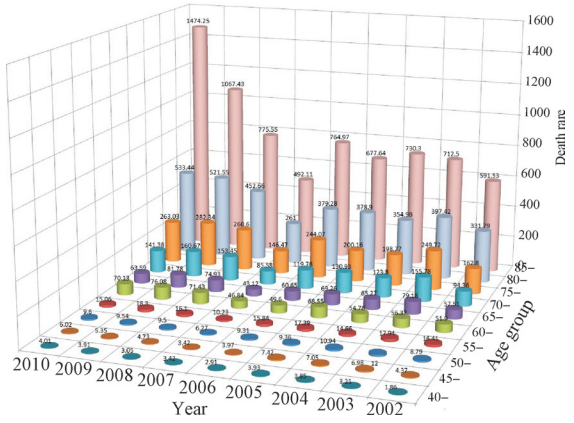

Figure 5. Trends of age-specific death rates of AMI for women in urban areas, from 2002 to 2010.

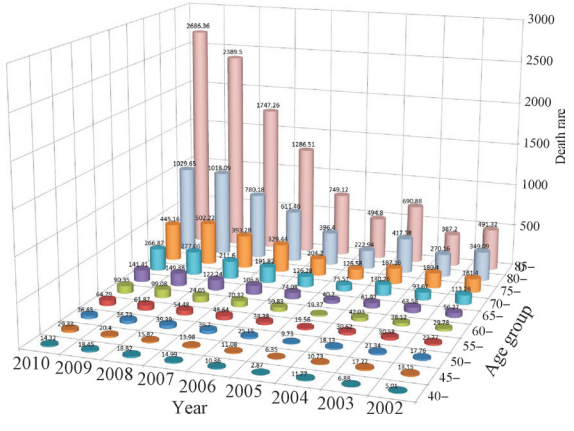

Figure 6. Trends of age-specific death rates of AMI for men in rural areas, from 2002 to 2010.

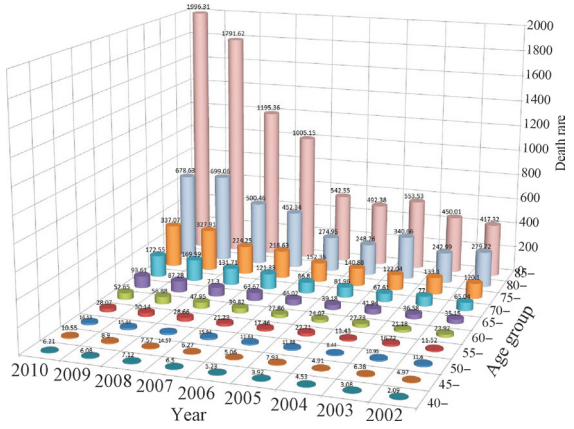

Figure 7. Trends of age-specific death rates of AMI for women in rural areas, from 2002 to 2010.

Results: A total of 68 390 acute coronary events were identified among permanent residents of Beijing aged 25 years and more from 2007 to 2009. The age-standardized incidence was 166.4 per 100 000 people in overall population, with 218.5 in males and 115.2 in females. The age-standardized incidence was 144.3, 154.7,and 195.8 per 100 000 people in urban, suburban, and exurban area, respectively. The incidence was the highest in Huairou district (263.8 per 100 000), while was the lowest in Haidian district (121.5 per 100 000). The age-standardized incidence was 158.4, 169.4, and 171.2 per 100 000 in 2007, 2008, and 2009, respectively. The age-standardized incidence increased by 8.1% in 2009 compared to 2007, increase in men (11.1%) was greater than in women (2.5%). The incidence increased significantly with age in each year. The incidence raised by 30.3% in 2009 compared to 2007 for men aged 35–44 years. In 2009, the incidence was 146.7, 155.9, and 207.4 per 100 000 people in urban, suburban, and exurban area, respectively. The rates increased by 3.2% in both urban and suburban areas, and 16.4% in exurban areas in 2009 compared to 2007.

Studies on CHD risk factors

Prevalence of cardiovascular disease risk factor in the Chinese population[5]

This study using the data from gathered from the 2007–2008 China National Diabetes and Metabolic Disorders Study. A nationally representative sample of 46 239 adults, 20 years of age or older, was randomly recruited using a multistage stratified design method. Lifestyle factors, diagnosis of CVD, stroke, diabetes, and family history of each subject were collected, and an oral glucose tolerance test or a standard meal test was performed. Various non-fatal CVDs were reported by the subjects.

The prevalence of coronary heart disease, stroke, and CVDs was 0.74%, 1.07%, and 1.78% in males; and 0.51%, 0.60%, and 1.10% in females, respectively. The presence of CVDs increased with age in both males and females. The prevalence of being overweight or obese, hypertension, dyslipidaemia, or hyperglycaemia was 36.67%, 30.09%, 67.43%, and 26.69% in males; and 29.77%, 24.79%, 63.98%, and 23.62% in females, respectively. In the total sample of 46 239 patients, the prevalence of one subject having 1, 2, 3, or ≥4 of the 5 defined risk factors (i.e. smoking, overweight or obese, hypertension, dyslipidaemia, or hyperglycaemia) was 31.17%, 27.38%, 17.76%, and 10.19%, respectively. Following adjustment for gender and age, the odds ratio of CVDs for those who had 1, 2, 3, or ≥4 risk factors was 2.36, 4.24, 4.88, and 7.22, respectively, when compared with patients with no risk factors.

Association of psychological risk factors and acute myocardial infarction in China[6]

The aim of this study was to explore possible associations between psychological risk factors and AMI among the Chinese population with a large-scale case-control study.

This study was part of the INTER-HEART China study, itself part of the large international INTER-HEART study of cardiovascular risk factors. In this case-control study, 2 909 cases and 2 947 controls were recruited from 17 cities. Psychological stress, negative life events, depression and controllability of life circumstances were assessed.

Cases reported more psychological stress at home or work and odds ratios (*OR*s) were 3.2 (95% *CI* 2.1– 4.9) for permanent stress and 2.1 (95% *CI* 1.5–2.8) for several periods of stress respectively. More cases experienced depression compared with controls (19.6% vs. 9.3%) and *OR*s were 2.2 (95% *CI* 1.9–2.6). Subjects with 1, 2 and 3 or more depressive symptoms had increased risk of AMI by 2.1, 2.2 and 2.6 fold, respectively, i.e., more depressive symptoms were associated with higher risks of AMI (P <0.000 1). Women had a greater risk of AMI from depression (*OR* 3.0, 95% *CI* 2.2–4.0) compared to men (*OR* 2.0, 95% *CI* 1.6–2.4), P=0.0364. Negative life events in subjects were associated with increased risk of AMI, *OR* 1.7 (95% *CI* 1.4–2.0) for one event and 1.8 (95% *CI* 1.3–2.4) for two or more events. High levels of controllability of life circumstances reduced the risk for AMI (*OR* 0.8, 95% *CI* 0.7–1.0).

Marital status, education, and risk of acute myocardial infarction in the mainland of China[7]

This study was also a part of the INTER-HEART China case-control study. The main outcome measure was first AMI. Incident cases of AMI and control patients with no past history of heart disease were recruited. Controls were matching by age (±5 years) and sex. Marital status was combined into 2 categories: single and not single. Education level was classified into 2 categories: 8 years or less and more than 8 years.

From 1999 to 2002, we recruited 2909 cases and 2947 controls from 17 cities. After adjustment for age, sex, BMI, psychosocial factors, lifestyle, other factors, and

mutually for other risk factors, the *OR* for AMI associated with being single was 1.51 (95% *CI*: 1.18–1.93) overall, 1.19 (0.84–1.68; *P*=0.072) in men and 2.00 (1.39–2.86; *P* <0.000 1) in women. The interaction of sex and marital status was statistically significant (*P*=0.045). Compared with a high education level, a low education level increased the risk of AMI (1.45, 1.26–1.67); the *OR* in men and women were 1.29 (1.09–1.52) and 1.55 (1.16–2.08), respectively. Single women with a low education level had a high risk of AMI (2.95, 1.99–4.37).

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Report on Cardiovascular Diseases in China 2012

Clinical study on coronary heart disease

Wang Chunning, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China.

The mortality of coronary heart disease was 86.34 per 100 000 in urban areas and 69.24 per 100 000 in rural areas in 2010. The mortality is higher in male than that in female.

The mortality of acute myocardial infarction has been increasing dramatically in rural residents in recent years, and is approaching to the level of urban residents.The age-standardized incidence of acute coronary heart disease from 2007 to 2009 was 166.4 per 100 000 in Beijing permanent residents, 218.5 in male and 115.2 in female. It was 144.3, 154.7, and 195.8 per 100 000 in urban, suburban and exurban areas, respectively. The age-standardized incidence increased by 8.1% in 2009 compared to 2007, increase in men (11.1%) was greater than in women (2.5%). The incidence raised by 30.3% in 2009 compared to 2007. The highest increase occurred in men aged 35-44 years. Based on the data from the fourth family health survey in 2008, the overall prevalence of ischemic heart disease was 7.7‰, 15.9‰ in urban areas and 4.8‰ in rural areas. This presents 7.70 million Chinese with ischemic heart disease. Compared with the data of the third survey in 2003 (4.6‰, 12.4‰ for urban residents and 2.0‰ for rural residents), the prevalence of ischemic heart disease increased considerably. The 2007–2008 China National Diabetes and Metabolic Disorders randomly recruited 46239 adults aged over 20 years old, the prevalence of coronary heart disease was 0.74% in males and 0.51% in females.

Coronary artery intervention

Clinical safety and efficacy of a biodegradable-polymer coated sirolimus-eluting stent in "real-world" practice: three-year outcomes of the CREATE (Multi-Center Registry of EXCEL Biodegradable Polymer Drug Eluting Stents) study

A total of 2 077 patients were enrolled in the post-marketing surveillance multicenter registry study at 59 centers from 4 countries[1]. The mean age was (61±11) years, 74% were men, and 90% were admitted with acute coronary syndromes. All lesions were exclusively treated with biodegradable polymer based sirolimus-eluting (EXCEL) stent. A total of 3,080 target lesions were treated and 3 748 EXCEL stents were implanted. Antiplatelet regimen was clopidogrel and aspirin for 6 months followed by chronic aspirin therapy. Patients had clinical evaluations at 30 days and at 6, 12, 18, 24, and 36 months. The primary outcome was the rate of major adverse cardiac events (MACE) and the secondary outcomes were cumulative TLR and thrombotic event rates. Clinical safety and efficacy of a biodegradable-polymer coated sirolimus-eluting stents were evaluated. The results showed that clinical follow-up was completed in 2,025 (97.5%) patients at 3 years, 80.5% patients discontinued clopidogrel at six months. Clinical outcomes at 3 years were shown in table 1 and stent thrombotic events at 3 years were shown in table 2. Prolonged clopidogrel therapy (>6 months) was not beneficial in reducing cumulative hazards of MACE or stent thrombosis.

This study demonstrates sustained 3-year clinical safety and efficacy of biodegradable polymer-based sirolimus-eluting stents when used with 6 months of dual antiplatelet therapy in a "real-world" setting.

Safety and efficacy of polymer-free paclitaxel-eluting microporous stent in real-world practice: 1-year follow-up of the SERY-I registry:[2]

A total of 1045 patients were enrolled in the multicenter, prospective registry study at 27 centers in China from June 2008 to September 2009. The mean age was 64±11 years, 74% were men, and 74% had non-ST segment elevation acute coronary syndrome. All patients received YinYi sent implantation, and dual antiplatelet therapy for at least one year. The primary endpoint was defined as rate of composite major adverse cardiac event (MACE) during 1-year follow-up. The secondary endpoint was the

Table 1. Clinical outcomes at three years

Three-year outcomes (n = 2,025)	n (%)
Death	80 (4.0)
Cardiac	40 (2.0)
Noncardiac	40 (2.0)
Nonfatal MI	14 (0.7)
TLR	49 (2.4)
MACE	92 (4.5)

Data are depicted as n (%). MI: myocardial infarction; TLR: targetlesion revascularization; MACE: major adverse cardiac events.

Table 2. Stent thrombotic events at three years

Thrombotic events	ARC definite	ARC probable	ARC possible	Total
Acute (≤24 hours)	1	1	0	2 (0.10)
Subacute(24 hr–30 days)	4	4	0	8 (0.39)
Late (30 days–1 year)	1	0	6	7 (0.34)
Very late (> 1 year)	4	6	4	14 (0.69)
Total	10 (0.49)	11 (0.54)	10 (0.49)	31 (1.53)

Data are depicted as n or n (%). ARC: Academic Research Consortium.

National Center for Cardiovascular Diseases, Fuwai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100037, China

incidence of stent thrombosis. A total of 1 376 target lesions were treated and 1 713 stents were implanted. Follow-up data available for 1045 patients at 30 days (100.0%), for 1035 patients at 6 months (99.0%), and for 1032 patients at 1 year (98.8%), respectively. The primary outcomes and occurrence of stent thrombosis are shown in Tables 3 and 4.

This study proves that the polymer-free paclitaxel-eluting microporous Yinyi stent is safe and efficient for patients with coronary heart diseases in "real-world" practice.

Comparison of a five-year clinical outcome between Chinese women and men with de novo coronary disease treated with implantation of a drug-eluting stent: a three-center, prospective, registry study[3].

This is a prospective registry study. A total of 996 patients (women 298 and men 698) with newly diagnosed de novo coronary lesions were enrolled in 3 centers from Jan. 2005 to Dec. 2005. Patients were treated with implantation of a drug-eluting stent (DES). The primary endpoint was the occurrence of major adverse cardiac events (MACEs) over a 5-year follow-up. The baseline characteristics and 5-year cumulative cardiac outcomes are shown in Tables 5 and 6.

The study demonstrates that Chinese men have equivalent outcomes to women after DES after adjustment by PSM over a 5-year follow-up.

Study on independent no-reflow predictors in female patients with ST-elevation acute myocardial infarction (STEMI) treated with primary percutaneous coronary intervention PCI[4]:

This study is a prospective observational study conducted at two medical centers in Beijing. Between January 2007 and January 2010, 320 consecutive female patients who were admitted within 12 hours after the onset of STEMI were enrolled. Patients were treated with PCI. All clinical, angiographic, and procedural data were collected. The no-reflow was found in 81 (25.3%) of 320 female patients. Multiple logistic regression analysis was used to identify baseline characteristics for no-reflow and normal reflow groups and to explore the independent no-reflow predictors. Baseline characteristics is shown in Table 7, Univariate and multivariate stepwise logistic regression analysis results on no-reflow predictors are shown in Table 8.

The no-reflow incidence significantly increased as the numbers of independent predictors increased (Figure 1).

The study demonstrates that the no-reflow predicting variables in female patients with STEMI treated with PCI were admission SBP <100 mmHg, target lesion length >20 mm, collateral circulation 0-1, pre-PCI thrombus score ≥ 4, and IABP use before PCI.

Table 3. Results of primary outcomes

Outcomes	*n* (%)
30 days (*n*=1 045)	
Non-cardiac death	0 (0)
Cardiac death	2 (0.19)
Non-fatal MI	2 (0.19)
TVR	0 (0)
All MACE	4 (0.38)
6 months (*n*=1 035)	
Non-cardiac death	1 (0.08)
Cardiac death	6 (0.58)
Non-fatal MI	5 (0.48)
TVR	25 (2.42)
All MACE	36 (3.48)
1 year (*n*=1 032)	
Non-cardiac death	1 (0.08)
Cardiac death	8 (0.78)
Non-fatal MI	6 (0.58)
TVR	46 (4.45)
All MACE	61 (5.91)

MACE: major adverse cardiac events; MI: myocardial infarction; TVR: target vessel revascularization.

Table 4. Occurrence of stent thrombosis at 1-year follow-up

Stent thrombosis	ARC definite	ARC probable	ARC possible	Total
Acute (≤24 hours)	0	0	0	0 (0)
Subacute(24 hours–30 days)	0	2	0	2 (0.19)
Late (30 days–1 year)	6	0	2	8 (0.78)
Total	6	2	2	10 (0.97)

ARC: Academic Research Consortium.

Table 5. Baseline characteristics by gender

Variables	Women (*n*=298)	Men (*n*=698)	*P* values
Age (years)	64±9	63±11	0.660
Height (cm)	160±4	165±6	<0.001
Weight (kg)	60±8	65±11	<0.001
Fasting TC (mmol/L)	5.17±1.12	4.57±1.10	<0.001
STEMI (*n* (%))	26 (8.7)	134 (19.2)	<0.001
LVEF (%)	61±11	57±13	0.003

TC: total cholesterol; STEMI: ST elevation myocardial infarction; LVEF: left ventricular ejection fraction

Table 6. Cumulative MACE over a 5-year follow-up

Variables	Women (*n*=298)	Men (*n*=698)	*P* values
MACE	53 (17.8)	176 (25.2)	0.011
MACE after propensity score matching (*n* (%))	33 (15.5)	47 (22.1)	0.106

MACE: major adverse cardiac events

Table 7. Baseline characteristics

variables	No-reflow (*n*=81)	Normal reflow (*n*=239)	*P* values
Age (years)	70±9	68±10	0.060
SBP (mmHg)	101.1±26.7	114.2±24.4	<0.0001
DBP (mmHg)	66.0±17.4	71.5±14.1	0.005
Killip classes (*n* (%))			<0.0001
1	37 (45.7)	160 (66.9)	
2	29 (35.8)	61 (25.5)	
3	3 (3.7)	12 (5.0)	
4	12 (14.8)	6 (2.5)	
Peak CK-MB values (U/L)	239±205	160±166	0.003

SBP: systolic blood pressure; DBP: diastolic blood pressure.

Acute Coronary Syndrome

Association of psychological risk factors and acute myocardial infarction in China: the INTER-HEART China study[5]:

This study was part of the INTER-HEART China study,

Table 8. Univariate and multivariate logistic regression for the no-reflow predictors

Variables	Univariate analysis		Multivariate analysis	
	P values	*OR* (95% *CI*)	*P* values	*OR* (95% *CI*)
SBP on admission <100 mmHg	<0.0001	1.022 (1.011–1.033)	0.004	1.019 (1.006–1.032)
Target lesion length >20 mm	0.002	1.951 (1.921–1.982)	0.016	1.948 (1.908–1.990)
Collateral circulation 0–1	0.009	1.726 (1.148–2.595)	0.019	1.952 (1.914–1.992)
Pre-PCI thrombus score ≥4	<0.0001	3.669 (3.548–3.815)	0.007	4.184 (1.482–11.813)
IABP use before PCI	0.003	1.894 (1.898–2.996)	0.011	1.949 (1.168–3.253)

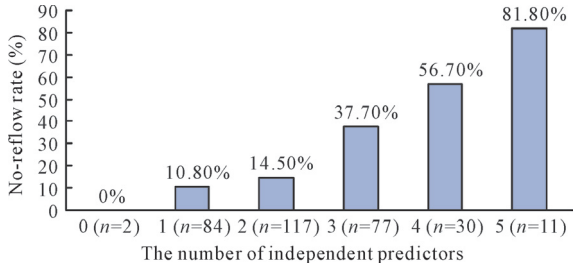

Figure 1. Relationship between no-reflow rate and the number of independent predictors

itself part of the large international INTER-HEART study of cardiovascular risk factors. In this case-control study, 2 909 cases and 2 947 controls were recruited from 17 cities. Psychological stress, negative life events, depression and controllability of life circumstances were assessed.

As shown in Table 9, cases reported more psychological stress at home or work and odds ratios (ORs) were 3.2 (95% *CI* 2.1–4.9) for permanent stress and 2.1 (95% *CI* 1.5–2.8) for several periods of stress respectively. More cases experienced depression compared with controls (19.6% vs. 9.3%) and *ORs* were 2.2 (95% *CI* 1.9–2.6). Subjects with 1, 2 and 3 or more depressive symptoms had increased risk of AMI by 2.1, 2.2 and 2.6 fold, respectively, i.e., more depressive symptoms were associated with higher risks of AMI (P for trend <0.01). Women had a greater risk of AMI from depression (OR 3.0, 95% CI 2.2–4.0) compared to men (*OR* 2.0, 95% *CI* 1.6–2.4), P for interaction =0.0364. Negative life events in subjects were associated with increased risk of AMI, *OR* 1.7 (95% *CI* 1.4–2.0) for one event and 1.8 (95% *CI* 1.3–2.4) for two or more events. High levels of controllability of life circumstances reduced the risk for AMI (*OR* 0.8, 95% *CI* 0.7–1.0).

In conclusion, several psychological factors were closely associated with increased AMI risk among Chinese population. Psychological stress had a greater AMI risk in men but depression was more significant among women.

Impact of admission heart rate on short-term outcome of ST-elevation myocardial infarction patients[6]:

A total of 7485 Chinese STEMI patients from a global randomized controlled trial (CREATE) database were divided into six groups by admission HR: < 60 (*n*=991), 60–69 (*n*=1 491), 70–79 (*n*=1 743), 80–89 (*n*=1 495), 90–99 (*n*=794) and ≥ 100 bpm (*n*=971). The primary outcome was 30-day all-cause death; the secondary outcomes were the composite of 30-day all-cause death, reinfarction, cardiogenic shock or deadly arrhythmia.

Admission glucose level, proportion of female gender, incidence of anterior myocardial infarction, previous diabetes mellitus, hypertension and Killip level were significantly higher in patients with admission HR ≥ 90 bpm compared to 60–69 bpm group (*P* <0.05). The 30-day mortality was shown in Figure 2 and the incidence of MACE was shown in Figure 3.

The 30-day mortality was lowest (6.3%) in the 60-69 bpm group and was 9.6% in HR <60 bpm group (*P* <0.05 vs. 60–69 bpm group). In patients with admission HR >60 bpm, the 30–day mortality increased in proportion to higher admission HR: 8.1% in 70–79 bpm, 9.2% in 80–89 bpm, 12.6% in 90–99 bpm and 24.6% in ≥100 bpm groups (all P<0.05 vs.60–69bpm group). The incidence of MACE was similar as that of 30-day mortality: 27.0% in <60 bpm,12.5% in 60–69 bpm,13.7% in 70–79 bpm, 14.3% in 80–89bpm, 17.5% in 90–99 bpm and 31.1% in ≥100 bpm

Table 9. Psychological risk factors between cases and controls

Risk factors	Cases (*n* (%))	Controls (*n* (%))	*OR* (95% *CI*)
General stress (*n*=5 816)			
Permanent	87 (3.0)	34 (1.2)	3.2 (2.1–4.9)
Several periods	312 (10.8)	178 (6.1)	2.1 (1.5–2.8)
Some periods	1 511 (52.5)	1 671 (56.8)	1.1 (1.0–1.2)
Never experienced	966 (33.6)	1 057 (36.0)	1.0 (1.0–1.0)
Stress at work (*n*=2 468)			
Permanent	44 (3.7)	26 (2.0)	2.2 (1.3–3.7)
Several periods	135 (11.5)	90 (6.9)	1.8 (1.4–2.6)
Some periods	552 (47.1)	696 (53.7)	1.0 (0.8–1.2)
Never experienced	441 (37.6)	484 (37.3)	1.0 (1.0–1.0)
Stress at home (*n*=5 814)			
Permanent	48 (1.7)	9 (0.3)	5.2 (2.5–10.9)
Several periods	224 (7.8)	113 (3.8)	2.4 (1.9–3.1)
Some periods	1 400 (48.7)	147 (50.2)	1.1 (1.0–1.3)
Never experienced	1 203 (41.8)	1 342 (45.7)	1.0 (1.0–1.0)
Financial stress (*n*=5 839)			
High/Severe	334 (11.5)	332 (11.3)	1.3 (1.0–1.5)
Moderate	1 393 (48.1)	1 279 (43.4)	1.3 (1.2–1.5)
Little/none	1 167 (40.3)	1 334 (45.3)	1.0 (1.0–1.0)
Negative life events (*n*=5 844)			
2 or more	156 (5.4)	81 (2.7)	1.8 (1.3–2.4)
1	452 (15.6)	264 (9.0)	1.7 (1.4–2.0)
none	2 289 (79.0)	2 602 (88.3)	1.0 (1.0–1.0)
Controllability (*n*=5 856)			
High	412 (14.2)	441 (15.0)	0.8 (0.7–1.0)
Moderate	1 906 (65.5)	2 025 (68.7)	0.9 (0.8–1.0)
Low	591 (20.3)	481 (16.3)	1.0 (1.0–1.0)
Depression (*n*=5 776)			
Felt depressed	559 (19.6)	273 (9.3)	2.2 (1.9–2.6)
None	2 295 (80.4)	2 649 (90.7)	1.0 (1.0–1.0)

groups. Multivariate analysis showed that the incidence of 30-day mortality positively correlated with the admission HR (P <0.05) except in the patients with admission HR<60 bpm (OR=0.832, P=0.299), the risk of joint endpoint events was higher in the patients with HR <60 bpm (OR=1.532,95% CI: 1.201–1.954, P <0.05), 90–99bpm (OR=1.436, 95% CI: 1.091–1.889, P <0.05) or ≥100bpm (OR=1.893, 95% CI: 1.471–2.436, P <0.01). Conclusion Admission HR is an independent risk factor for short-term outcome in Chinese STEMI patients.

The results of multivariate analysis were showed in Table 10 and Table 11.

In conclusion, admission HR is an independent risk factor for short-term outcome in Chinese STEMI patients.

Comparison on therapeutic approach and short-term outcomes between male and female patients with ST-segment elevation myocardial infarction[7]:

Data of Chinese STEMI patients were retrospectively analyzed from a global multicenter clinical trial of reviparin and metabolic modulation in acute myocardial infarction treatment evaluation (CREATE). The patients were divided into two groups according to gender and difference on demographic, baseline clinical characteristics at admission, reperfusion and drug therapy and 30-day all-cause mortality, re-infarction, stroke, hemorrhage, heart failure and combined end poin ts were compared.

As in Table 12, of the 7 431 patients, 29.1% were female. This study showed that on admission, heart rate, diastolic blood pressure and Killip class were higher and the delay between onset of chest pain and arrival at hospital was longer in female patients than in male patients. Multivariate logistic regression analysis showed that female gender was a predictor for less PCI therapy. Thirty-day all cause mortality (OR=1.425, 95% CI: 1.163–1.747, P <0.01) and combined end points (OR=1.193, 95% CI: 1.010–1.410, P=0.04) were significantly higher in female patients than in male patients. Treatment during the hospitalization and 30 days outcomes was shown in Table 13 and 14.

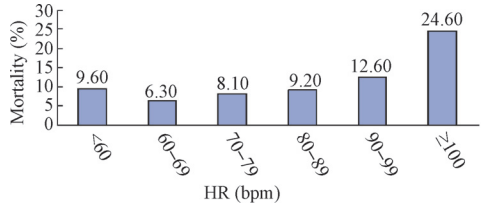

Figure 2. Relationship between different HR group and mortality at 30 days.

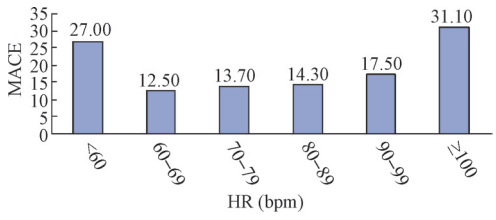

Figure 3. Relationship between different HR group and MACE at 30 days

There are gender-related differences on therapeutic approach and short-term outcome in Chinese STEMI patients. The unfavorable demographic and baseline clinical profile could partially explain the less reperfusion therapy rate and worse prognosis in female patients.

Prospective multi-center study of female patients with ST-elevation myocardial infarction in Liaoning province, China:[8]

This was a prospective, multicenter, observational study in which patient data were collected by questionnaire at the time of diagnosis and at approximately 30 days and 1 year later by telephone inquiries. Patients were diagnosed with STEMI between June 1, 2009 and June 1, 2010 at any of the 20 hospitals that gave treatment representative of current STEMI treatment in Liaoning Province. Unified

Table 10. Multivariate analysis showed that the incidence of 30-day mortality positively correlated with the admission HR except in the patients with admission HR <60 bpm

HR (bpm)	*OR*	95% *CI*	*P* values
< 60	0.832	0.589–1.177	0.299
60–69	1.000		
70–79	1.391	1.028–1.883	0.032
80–89	1.447	1.066–1.966	0.018
90–99	1.834	1.303–2.582	0.001
≥100	2.579	1.893–3.515	<0.001

Table 11. Multivariate analysis showed that the risk of joint endpoint events was higher in the patients with HR <60 bpm, 90–99 bpm or ≥100 bpm

HR (bpm)	*OR*	95% *CI*	*P* values
<60	1.532	1.201–1.954	0.001
60–69	1.000		
70–79	1.173	0.930–1.480	0.177
80–89	1.254	0.989–1.889	0.061
90–99	1.436	1.091–1.889	0.010
≥100	1.893	1.471–2.436	<0.001

Table 12. Baseline characteristics

	Male (n=5 275)	female (n=2 156)	*P* values
Age (years)	60±12	68±9	<0.01
Heart rate (bpm)	77±18	79±20	<0.01
Systolic blood pressure (mmHg)	125±25	127±29	0.09
Diastolic blood pressure (mmHg)	79±17	77±18	<0.01
Killip ≥III (n (%))	281 (5.3)	194 (9.0)	<0.01
Time from symptom onset to hospital arrival (minutes)	342±196	363±193	<0.01
Infarction site (n (%))			
Anterior	2 857 (54.2)	1 081 (50.1)	<0.01
Inferior	2 333 (44.2)	1 011 (46.9)	<0.01
laterior	85 (1.6)	64 (3.0)	<0.01
History (n (%))			
Myocardial infarction	455 (8.6)	137 (6.4)	<0.01
hypertension	1 992 (37.8)	1 015 (47.1)	<0.01
Heart failure	113 (2.1)	81 (3.8)	<0.01
Diabetes	478 (9.1)	358 (16.6)	<0.01
Stroke	477 (9.0)	222 (10.3)	0.05
Laboratoty test			
Blood sugar (mmol/L)	8.18±3.99	9.41±4.93	<0.01

Table 13. Treatment during the hospitalization (*n* (%))

Treatment	Male (*n*=5 275)	Female (*n*=2 156)	*P* values
Thrombosis	2 910 (55.2)	1 001 (46.4)	<0.01
PCI	693 (13.1)	169 (7.8)	<0.01
Drugs			
Aspirin	5 076 (96.2)	2 039 (94.6)	<0.01
Clopedegral	1 544 (29.3)	528 (24.5)	<0.01
β- blocker	3 320 (62.9)	1 250 (58.0)	<0.01
ACEI	3 814 (72.3)	1 486 (69.5)	0.01
Lipid Lowering therapy	3 800 (72.0)	1 503 (68.9)	0.00
CCB	651 (12.3)	291 (13.5)	0.09

Table 14. 30 days outcomes (*n* (%))

Endpoints	Male (*n*=5 275)	Female (*n*=2 156)	*P* values
Death	435 (8.2)	372 (17.3)	<0.01
Re-infartion	93 (1.8)	47 (2.2)	0.14
Stroke	33 (0.6)	23 (1.1)	0.04
Major bleeding	20 (0.4)	13 (0.6)	0.13
Heart Failure	912 (17.3)	558 (25.9)	<0.01
Composite endpoint	1 156 (21.9)	724 (33.6)	<0.01

Table 15. Baseline characteristics

	Female (*n*=388)	Male (*n*=1 041)	*P* values
Age (year)	70±10	60±12	<0.001
Family history (*n* (%))	54 (13.9)	234 (22.5)	<0.001
Smoking (*n* (%))	49 (12.6)	598 (57.4)	<0.001
Renal dysfunction (*n* (%))	10 (2.6)	16 (1.5)	0.191
Hypertension (*n* (%))	238 (61.3)	415 (39.9)	<0.001
Diabetes (*n* (%))	144 (37.1)	179 (17.2)	<0.001
Hyperlipidemia (*n* (%))	136 (37.1)	281 (27.0)	0.03
Symptom onset to hospital arrival			
Median (25th–75th), (minutes)	180 (111–395)	120 (60–250)	<0.001
≤60 minutes (*n* (%))	55 (14.2)	293 (28.1)	<0.001
≤120 minutes (*n* (%))	130 (33.5)	531 (51.0)	<0.001
MI location (*n* (%))			0.535
Anterior	201 (51.8)	559 (53.9)	
Inferior	166 (42.8)	439 (42.2)	
Other (laterior, posterior)	21 (5.4)	43 (4.1)	

follow-up questionnaire was used to visit the STEMI patients.

A total of 1429 consecutive patients with STEMI were analyzed in Liaoning province. Female patients accounted for 27.2% of these patients (*n*=388). Female patients were older (70.0 vs. 60.3, *P* <0.001) and were less likely to receive emergency reperfusion therapy than male ones (39.2% vs. 58.0%, *P* <0.001). Female gender was associated with higher unadjusted 30-day mortality rates (HR=2.118, 95% CI: 1.572–2.854, *P* <0.001) and higher unadjusted 1-year mortality rates (HR=2.174, 95%CI: 1.659–2.848, *P* <0.001). Multivariate Cox regression analysis showed that female gender was not an independent predictor of 30-day mortality rates (HR=1.273, 95% *CI*: 0.929–1.745, *P*=0.133) nor of 1-year mortality rates (HR=1.112, 95% *CI*: 0.831–1.487, *P*=0.475). Baseline characteristics and the results were listed in Table 15–19.

In conlusion, women with STEMI appear to be at increased risk of 30-day and 1-year mortality compared with male STEMI patients, but this difference may be explained by older age and less frequent receipt of reperfusion therapy among the women.

Primary and secondary prevention of coronary artery disease[9]

This was a 12-week, multicenter, open-label, without parallel-group comparison, phase clinical trial. There were 427 subjects in the safety set. The adverse events mainly included vomiting, myalgia and the elevations of aspartate transaminasc (AST), alanine transaminase (ALT) and creatine kinase (CK), etc.

The incidence of drug-related adverse events was 4.22%. There were no significant differences between pre-exposure and post-exposure average levels of renal function indicators and blood routine examination item (all P <0.05). None of them had a high AST/ALT value, i.e.3 times upper limits of normal (ULN), or had a high CK value, i.e. 10 times ULN. There were 397 subjects in the per

Table 16. Hospital care and clinical outcomes

Description	Male	Female	*P* values
Emergency reperfusion	152 (39.2)	604 (58.0)	<0.001
Primary PCI	79 (20.4)	322 (30.9)	<0.001
Door-to-balloon time			
Medium (25–75th, minutes)	130 (103-218)	150 (110-200)	0.660
≤90 minutes	13 (17.6)	44 (14.3)	0.477
Thrombolytic therapy	72 (18.6)	277 (26.6)	0.002
Door-to-needle time			
Medium (25th-75th, minutes)	60 (33-133)	50 (30-95)	0.043
≤30 minutes	18 (25.0)	99 (35.7)	0.085
Killip class on admission			<0.001
I	270 (69.6)	880 (84.5)	
II	57 (14.7)	89 (8.5)	
III	28 (7.2)	32 (3.1)	
IV	33 (8.5)	40 (3.8)	
Medical therapy			
Aspirin	370 (95.4)	1 010 (97.0)	0.125
Clopidogrel	303 (78.1)	867 (83.3)	0.023
β-blockers	253 (65.2)	690 (66.3)	0.703
ACEI/ARBs	246 (63.4)	705 (67.7)	0.124
Statins	337 (86.9)	950 (91.3)	0.013
LMWH	340 (87.6)	939 (90.2)	0.158
GPIIb/IIIa	24 (6.2)	107 (10.3)	0.017
TCM	111 (28.6)	241 (23.2)	0.033

Table 17. Primary and secondary outcomes

Description	Female (*n* (%))	Male (*n* (%))	*P* values	HR (95% *CI*)
Death from any cause				
30 days	76 (19.6)	100 (9.7)	<0.001	2.118 (1.572–2.854)
1 year	93 (25.3)	121 (11.8)	<0.001	2.174 (1.659–2.848)
Cardiac death				
1 year	91 (24.4)	118 (11.5)	<0.001	2.178 (1.657–2.863)
Fatal and nonfatal reinfarction				
30 days	11 (3.3)	12 (1.3)	0.014	2.678 (1.182–6.069)
1 year	22 (7.3)	40 (5.4)	0.062	1.634 (0.971–2.749)
Nonfatal reinfarction				
30 days	1 (0.3)	9 (1.0)	0.266	0.328 (0.042–2.591)
1 year	8 (3.2)	31 (4.4)	0.513	0.772 (0.355–1.680)

Table 18. Independent predictors of 30-day mortality (Cox regression)

Description	β	*P* values	HR	95% *CI*
Age	0.043	<0.001	1.044	1.030–1.059
Renal insufficiency	0.921	0.004	2.512	1.350–4.675
Anterior wall MI	0.320	0.038	1.377	1.018–1.863
Emergency reperfusion	–0.937	<0.001	0.392	0.276–0.557

Table 19. Independent predictors of one-year mortality (Cox regression)

Description	β	*P* values	HR	95% *CI*
Age	0.054	<0.001	1.056	1.041–1.070
Renal insufficiency	1.048	<0.001	2.851	1.642–4.951
Smoking	0.404	0.016	1.497	1.079–2.077
Family history	0.373	0.034	1.452	1.029–2.048
Anterior wall MI	0.337	0.016	1.401	1.064–1.844
Emergency reperfusion	–0.858	<0.001	0.424	0.308–0.584

Table 20. LDL-C at 4 weeks and 12 weeks

Items	value	Percentage change	95% *CI*
Baseline	4.10±0.77	–	–
4 weeks	2.97±0.90	–26.0±23.8	–28.4~–23.7
12 weeks	2.78±0.84	–30.3±26.2	–32.8~–27.7

Table 21. Percentage of patients reaching LDL-C target at 12 weeks in patients with different risk

Risk profile	*n*	Patient with reaching LDL-C target	%	95% *CI*
Low risk (<4.14 mmol/L)	207	191	92.3	88.7–95.9
Moderate risk (<3.37 mmol/L)	46	35	76.1	61.0–87.0
High risk (<2.59 mmol/L)	134	64	47.8	39.3–56.3
Very high risk (<2.07mmol/L)	10	4	40.0	12.0–74.0

protocol set. At week 12 post-treatment, the blood levels of total cholesterol and low density lipoprotein cholesterol (LDL-C) in subjects without previous treatment decreased 24.6% and 31.0% respectively, that of high density lipoprotein cholesterol (HDL-C) in subjects with HDL-C <1.04 mmol/L increased 60.1% while that of triglyceride (TG) in subjects with TG 1.70 mmol/L decreased 22.5% (P<0.05). And 207 (92.3%) subjects were at a low risk, 46 (76.1%) subjects at an intermediate risk,134 (47.8%) subjects at a high risk and 10 (40.0%) of subjects at a very high risk had achieved a LDL-C target value; the LDL-C goal achievement rate after switching from previous medication to pitavastatin was significant higher than that of pre-switching (Table 20 and 21).

In conclusion, pitavastatin demonstrates positive safety and efficacy. It may be used for the treatment of patients with hypercholesterolemia in China.

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Report on Cardiovascular Diseases in China 2012

Stroke in China: prevalence, mortality, and trends

Wang Jinwen, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China

Trends in stoke prevalence: 1993-2008[1]

Prevalence of stroke was according to the data from National Health Services Survey. The surveys encompassed all 31 provinces, autonomous regions and municipalities in the mainland of China. A multi-stage stratified random cluster sampling methods has been adopted in the Household Health Survey (HHS). The 1993 survey included 92 counties, 55 000 households and 215 163 people. The 1998 survey sampled 95 counties, 57 000 households and 216 101 people. The 2003 survey included 95 counties, almost 57 000 households and 193 698 people. The 2008 survey included 94 counties, almost 56 400 households and 177 501 people. The prevalence of stroke rose from 4‰ in 1993, to 5.8‰ in 1998, to 6.6‰ in 2003, to 9.7‰ in 2008 (Figure 1).

Prevalence of stroke 2007–2008[2]

In 2007–2008, a nationally representative sample of 46 239 adults, 20 years of age or older, was randomly recruited using a multistage stratified design method. Lifestyle factors, diagnosis of CVD, stroke, diabetes, and family history of each subject were collected. The prevalence of stroke in the entire population (including both males and females) was 8.3‰. Women have lower stroke incidence than men (women 6.0‰ vs. men 10.7‰).

Mortality rate 2010[3]

According to data from the China Public Health Statistical Yearbook (2011 volume), the mortality rate due to cerebrovascular disease was 125.15 per 100 000 population in urban areas and 145.71 per 100 000 population in rural areas. Cerebrovascular disease caused ≈833,000 deaths in urban areas and caused ≈982,000 deaths in rural areas in China in 2010. Among gender groups, male population faces the more severe burden of stroke than female population in the nation (Figure 2 and Table 1).

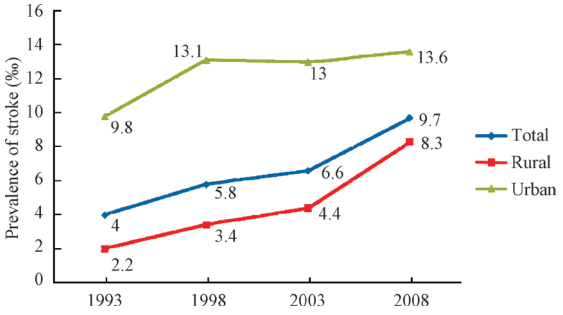

Figure 1. Trend in the prevalence of stroke, China, 1993–2008.

Age-adjusted stroke mortality in urban areas[3]

According to data from the China Public Health Statistical Yearbook (2011 volume), Men have higher age-adjusted stroke mortality than women in urban areas. Mortality rate varied by age in men: 2.01 per 100 000 male population in patients 20 to 24 years of age, 83.15 in those 50 to 54 years of age, and 4855.81 in those ≥85 years of age. These trends were seen in men and women (Table 2 and Figure 3).

Age-adjusted stroke mortality in rural areas[3]

According to data from the China Public Health Statistical Yearbook (2011 volume), men have higher age-adjusted stroke mortality than women in rural areas. Mortality rate varied by age in men: 1.17 per 100 000 male population in patients 20 to 24 years of age, 96.63 in those 50 to 54 years of age, and 8636.89 in those ≥85 years of age. These trends were seen in men and women (Table 3 and Figure 4).

Temporal trends in stroke mortality[3]

An analysis of data (China Public Health Statistical Yearbook) from 2003 to 2010 showed that an overall stroke death rate was higher among rural population than that of urban population. From 2003 to 2006, the rude death rates from stroke remained stable. The data from 2006 to 2009 showed that the rude death rates increased by 41% in urban areas, and increased by 44% in rural areas. Comparing 2009 to 2010, the rude death rates in urban areas decreased 2.2 percent, from 127.96 per 100 000 population in 2009 to 125.15 per 100 000 population in 2010, whereas the rude death rates in rural areas decreased 4.2 percent, from 152.09 per 100 000 population in 2009 to 145.71 per 100 000 population in 2010 (Figure 5).

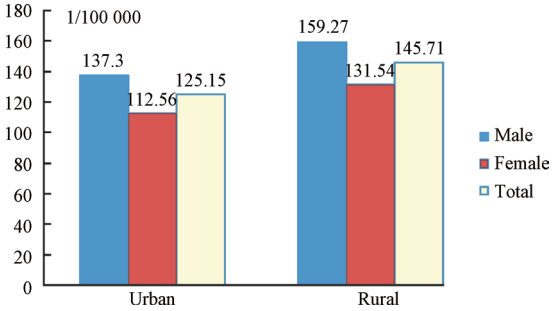

Figure 2. Mortality (per 100 000 population) of cerebrovascular disease for urban or rural males and females in China (2010).

Beijing Institute of Heart, Lung & Blood Vessel Diseases, Beijing Anzhen Hospital, Capital Medical University, Beijing 100029, China (Wang JW)

Table 1. Crude mortality rate (per 100 000 population) of cerebrovascular diseases in China (2010)

	Urban total			Metropolis			Small and mid-sized cities			Rural		
	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female
Cerebrovascular diseases	125.15	137.3	112.56	132.09	144.60	119.18	101.36	112.51	89.67	145.71	159.27	131.54

Table 2. Age, sex-specific mortality rate (per 100 000 population) in urban area in China (2010)

Gender	20~	25~	30~	35~	40~	45~	50~	55~	60~	65~	70~	75~	80~	85~
Male	2.01	2.39	6.36	13.79	28.27	53.98	83.15	128.89	226.81	404.24	750.72	1390.35	2427.74	4855.81
Female	0.97	1.31	2.17	4.55	11.21	19.95	35.25	62.79	128.29	225.46	486.98	963.97	1866.46	4139.36

Table 3. Age, sex-specific mortality rate (per 100 000 population) in rural area in China (2009)

Gender	20~	25~	30~	35~	40~	45~	50~	55~	60~	65~	70~	75~	80~	85~
Male	1.17	3.01	5.36	10.85	28.64	53.09	96.63	172.6	321.17	551.55	1071.27	1908.68	3593.87	8636.89
Female	0.98	2.07	2.59	4.63	11.88	30.38	54.09	101.17	179.95	322.79	669.53	1198.85	2336.19	6082.08

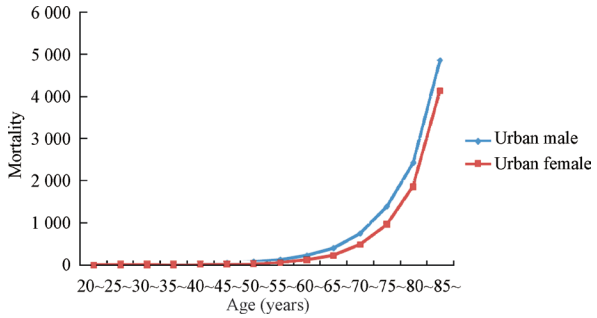

Figure 3. Age, sex-specific mortality in urban area (per 100 000 population).

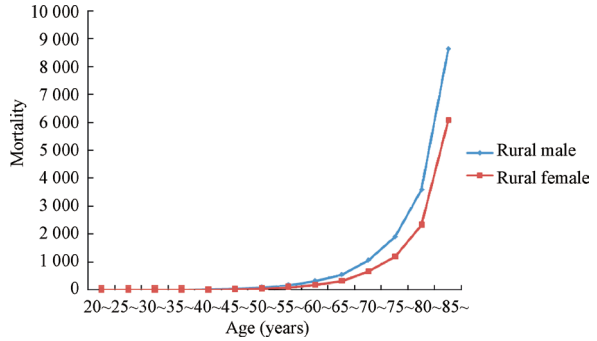

Figure 4. Age, sex-specific mortality in rural area (per 100 000 population).

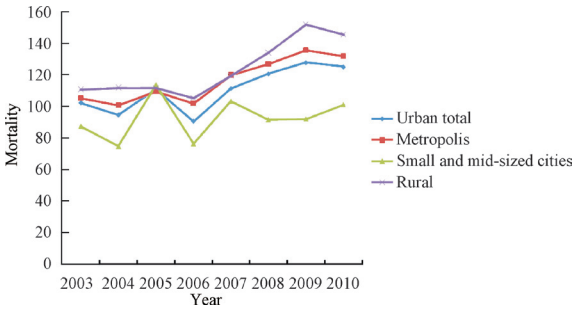

Figure 5. Temporal trends in stroke mortality (per 100 000 population) for urban and rural areas in China (2003–2010).

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Report on Cardiovascular Diseases in China 2012

Clinical study on stroke

Du Wanliang, Wang Jinwen, Wang Yongjun, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China

In 2008, stroke prevalence was 9.7 ‰ in China. In 2010, the crude death rate of stroke was 125.15/100 000 in China. The prevalence and mortality in rural areas is higher than urban areas. This report also describes the trends and other characteristics of stroke in different regions; the use of rtPA thrombolysis for acute ischemic stroke; the impact of age, atrial fibrillation, dietary on the incidence and outcomes of stroke; the public's knowledge of stroke.

Prevalence of stroke in different regions

Characteristics of stroke in Tibet autonomous region

A hospital-based study[1] on acute first-ever stroke in the People's Hospital of Tibet Autonomous Region (PHOTAR) indicated, that the peak age group in PHOTAR was one decade younger than in West China Hospital (WCH). Intracerebral hemorrhage (ICH) was the main stroke subtype in PHOTAR (74.1%). The prevalence of hypertension and heavy alcohol consumption prior to stroke were the most important vascular risk factors. In-hospital mortality was higher for each subtype (Tables 1 and 2).

Spatio-temporal variations in stroke incidence and case-fatality in Hong Kong

Residence-based hospital discharge data from the Hospital Authority (HA) in Hong Kong[2] were geo-referenced and used to examine incidence rates and case-fatality rates by stroke subtype among the population aged 35 years and above in 1999–2007. Multilevel models were used to examine the spatio-temporal variations. Ischemic stroke incidence was found to decrease among those aged above 55 years, while hemorrhagic stroke incidence increased. Ischemic stroke case-fatality was found to decrease but hemorrhagic stroke case-fatality remained stable. For both subtypes, there were significant variations in stroke incidence and case-fatality across the districts of residence, but insignificant variations across HA service clusters. Only variations in ischemic stroke incidence and hemorrhagic stroke case-fatality at the district level could be partly explained by district-level SES (Table 3).

Early management of stroke

Using recombinant tissue plasminogen activator to treat acute ischemic stroke (Chinese National Stroke Registry, CNSR)

Funded by Chinese government, CNSR is the only nationwide stroke registry that includes 132 urban hospitals.[3] All patients eligible for intravenous recombinant tissue plasminogen activator (rtPA) were included for analysis. From September 2007 to August 2008, 14 702 patients with ischemic stroke were entered into CNSR. Among 11 675 patients with known time of stroke onset, 2 514 (21.5%) presented to the emergency department within 3 hours, 1 469 (12.6%) were eligible for thrombolytic treatment, and 284 (2.4%) were finally treated, 181 (1.6%) of them with intravenous rtPA. The median onset-to-needle time was 180 (interquartile range, 150 to 228) minutes; the median door-to-needle time was 116 (interquartile range, 70 to 150) minutes; the median imaging-to-needle time was 90 (interquartile range, 60 to 129) minutes. Patients who were younger, presented to the emergency department quicker, with higher National Institutes of Health Stroke Scale scores, having higher income, and better education had a better chance of receiving intravenous rtPA. Approximately 1 in 5 patients with stroke presenting within 3 hours received thrombolytic therapy. The onset-to-needle time, door-to-needle time, and especially imaging-to-needle time were significantly longer than those in developed countries (Table 4, Figures 1 and 2).

Risk factors of stroke

Age (Chengdu Stroke Registry)[4]

Consecutive patients with acute ischemic stroke were prospectively enrolled from March, 2002 to October, 2008 into the analysis. Of the 2 619 cases included, 302 (11.5%) patients were 80 years or older. Compared with patients

Table 1. Demographic characteristics in stroke patients in WCH and PHOTAR

Characteristics	PHOTAR (*n*=301)	WCH (*n*=3334)	*P* value	*OR* with 95% *CI*
Demographics				
Age (years)	54.63±13.96	60.01±10.95	<0.0011	–
Age group (*n* (%))				
<45 years	78 (25.9)	580 (17.4)	<0.001	1.66 (1.26–2.18)
45–54 years	70 (23.3)	557 (16.7)	0.004	1.51 (1.14–2.00)
55–64 years	80 (26.6)	689 (20.6)	0.016	1.39 (1.06–1.82)
65–74 years	57 (18.9)	804 (24.1)	0.043	0.74 (0.55–0.99)
75–85 years	10 (3.3)	586 (17.6)	0.000	0.16 (0.09–0.31)
>85 years	6 (2.0)	118 (3.5)	0.157	0.55 (0.24–1.27)
Male	180 (59.8)	1 962 (58.8)	0.748	1.04 (0.82–1.32)
Stroke subtypes (*n* (%))				
IS	43 (14.3)	2 060 (61.8)	<0.001	0.10 (0.07–0.14)
ICH	223 (74.1)	656 (19.7)	<0.001	11.67 (8.89–15.31)
SAH	35 (11.6)	618 (18.5)	0.003	0.58 (0.40–0.83)

Beijing Tiantan Hospital, Beijing 100050, China (Du WL, Wang JW and Wang YJ)

Table 2. Comparison of admission time, risk factors, and early outcome between WCH and PHOTAR in IS

Items	PHOTAR (*n*=43)	WCH (*n*=2 060)	*P* value	*OR* with 95% *CI*
Admission time (years)				
Range	1–720 (719*)	2–720 (718*)	–	–
Median	24	48	–	–
Admission time (*n* (%))				
<3 hours	6 (14.0)	496 (24.1)	0.123	0.51 (0.22–1.22)
3–6 hours	9 (20.9)	619 (30.1)	0.196	0.612 (0.29–1.29)
6–24 hours	11 (25.6)	388 (18.8)	0.264	1.48 (0.74–2.97)
1–10 days	14 (32.5)	418 (20.3)	0.049	1.90 (0.99–3.62)
11–28 days	3 (7.0)	139 (6.7)	0.765†	1.04 (0.32–3.39)
Risk factors (*n* (%))				
Hypertension	30 (69.8)	1 013 (49.2)	0.008	2.39 (1.24–4.60)
Heavy alcohol consumption	13 (30.2)	426 (20.7)	0.127	1.66 (0.86–3.21)
Hyperlipidemia	3 (7.0)	117 (5.7)	0.734†	1.25 (0.38–4.09)
Diabetes mellitus	1 (2.3)	323 (15.7)	0.010†	0.13 (0.02–0.93)
Atrial fibrillation	3 (7.0)	173 (8.4)	1.000†	0.82 (0.25–2.67)
HAP	2 (4.7)	16 (0.8)	0.051†	6.23 (1.39–27.99)
Early outcomes (*n* (%))				
Survived with independence	12 (27.9)	836 (40.6)	0.094	
Survived with disability	26 (60.5)	1 163 (56.4)	0.600	
In-hospital mortality	5 (11.6)	61 (3.0)	0.001	

* Range width. †Student's *t* test.

Table 3. Regression results of district variations in stroke incidence and case-fatality in Hong Kong, China

District council	Estimate of Incidence		Estimate of Case-fatality	
(DC) district	Hemorrhage	Ischemic	Hemorrhage	Ischemic
Hong Kong Island				
Central & Western	–0.1067 (0.0344)*	–0.0750 (0.0417)	–0.0004 (0.0764)	–0.0875 (0.0656)
Wan Chai	–0.0792 (0.0359)*	–0.0893 (0.0424)*	–0.0737 (0.0772)	–0.0055 (0.0738)
Eastern	–0.0815 (0.0268)*	–0.0118 (0.0404)	–0.0497 (0.0679)	–0.1435 (0.0534)*
Southern	–0.0667 (0.0327)*	–0.1029 (0.0411)*	–0.0220 (0.0742)	–0.1071 (0.0597)
Kowloon				
Yau Tsim Mong	–0.0828 (0.0309)*	–0.0218 (0.0275)	–0.1219 (0.0599)*	–0.1562 (0.0576)*
Sham Shui Po	–0.0783 (0.0280)*	–0.0026 (0.0266)	–0.0740 (0.0546)	–0.1916 (0.0521)*
Kowloon City	–0.0447 (0.0289)	–0.0916 (0.0270)*	–0.0768 (0.0562)	–0.1317 (0.0547)*
Wong Tai Sin	–0.0118 (0.0273)	–0.0186 (0.0263)	–0.0671 (0.0534)	–0.1066 (0.0533)*
Kwun Tong	–0.0424 (0.0263)	–0.0295 (0.0260)	–0.2372(0.0531)*	–0.3462 (0.0536)*
New Territories				
Kwai Tsing	0.0279 (0.0273)	–0.0194 (0.0263)	–0.0389 (0.0539)	–0.0663 (0.0541)
Tsuen Wan	–0.0218 (0.0332)	–0.1020 (0.0286)*	–0.0442 (0.0646)	–0.0080 (0.0655)
Tuen Mun	–0.0617 (0.0305)*	–0.0471 (0.0271)	–0.1093 (0.0600)	–0.0915 (0.0572)
Yuen Long	–0.0571 (0.0299)	–0.1526 (0.0269)*	–0.0380 (0.0587)	–0.1203 (0.0551)*
North	–0.0391 (0.0337)	–0.0868 (0.0281)*	–0.0148 (0.0656)	–0.0791 (0.0621)
Tai Po	–0.0681 (0.0332)*	–0.0698 (0.0282)*	–0.0587 (0.0652)	–0.0128 (0.0631)
Sha Tin	–0.0269 (0.0274)	–0.0180 (0.0264)	–0.1601 (0.0551)*	–0.1010 (0.0537)
Sai Kung	–0.0231 (0.0335)	–0.0731 (0.0415)	–0.0465 (0.0757)	–0.2647 (0.0703)*
Islands	–0.1557 (0.0470)*	–0.1712 (0.0349)*	–0.1289 (0.0889)	–0.0482 (0.0901)

* P <0.05.

Table 4. Reasons documented for not giving IV rtPA to 1 045 patients within 3 hours of symptom onset

Reasons (*n*=1 045)	No. (%)
Age >80 years	139 (13.30)
Stroke too severe (NIHSS <25)	56 (5.36)
Stroke symptoms had significantly improved before rtPA therapy	437 (41.82)
Major early infarct signs involving greater than one third of the middle cerebral artery territory on the CT scan	54 (5.17)
Seizure at onset	23 (2.20)
Prior stroke or head trauma within the last 3 months	13 (1.24)
Uncontrolled hypertension	17 (1.63)
Known history of ICH, brain aneurysm, or hemorrhagic diathesis within the last 6 months	18 (1.72)
Blood glucose >50 or >400 mg/dl	2 (0.19)
Platelet count <100 000/mm^3	3 (0.29)
PT (INR) >1.4, PT >15, or APTT >40 seconds	6 (0.57)
Time window became >3 h because of delay in hospital	712 (68.13)
Consent was not available	171 (16.36)
Others	37 (3.54)

<80 years, patients over 80 years old had higher rates of hypertension (66.2% vs. 56.1%, *P*=0.001), atrial fibrillation (23.5% vs. 14.5%, *P*=0.000), and coronary heart disease (13.6% vs. 5.7%, *P*=0.000). In addition, they were less likely to have received transthoracic echocardiography (45.4% vs. 55.4%, *P*=0.001), color Doppler of extracranial vessels (54.0% versus 61.2%, *P*=0.015), antiplatelet agents (80.8% vs. 86.8%, *P* =0.004), or anticoagulants (4.0% vs. 9.0%, *P*=0.003). After adjusting for sex and stroke severity on admission, the very elderly patients had higher case-fatality and disability rates at one year (33.8% vs. 13.2%, *P*=0.000; 37.8% vs. 20.9%, *P*=0.000; respectively).

Atrial fibrillation (Chengdu Stroke Registry)[5]

First-ever ischemic stroke patients who were admitted

within 1 month of stroke onset during the period of March 2002 through December 2008 were included. Of the 2 683 patients, 366 (13.6%) had atrial fibrillation (AF). In this group, valvular AF was observed in 153 (41.8%) patients. Compared to patients without AF, patients with AF were older (66.1 vs. 63.6, P= 0.001) and had a higher NIHSS score on admission (median 10 vs. 4, $P < 0.001$) and more frequently suffered from hemorrhagic transformation (7.3% vs. 2.8%, $P < 0.001$), pulmonary infection (27% vs. 10.6%, $P < 0.001$), urinary tract infection (8.5% vs. 3.0%, $P < 0.001$), acute gastrointestinal tract hemorrhage (4.1% vs. 1.9%, $P = 0.008$), electrolyte disturbance (5.2% vs. 1.8%, $P < 0.001$), acute renal failure (1.1% vs. 0.5%, $P = 0.005$) and urinary incontinence (3.8% vs. 0.6%, $P < 0.001$) during hospitalization. The percentages of patients with AF who received oral anticoagulants were 3.3% before stroke onset and 14.2% at discharge. Moreover, patients with AF had a higher proportion of disability (determined as modified Rankin Scale score 3-5) in 3-month, 6-month and 1-year follow-ups (46.6%, 41.9% and 37.6% vs. 29.1%, 24.0% and 19.3%, respectively, $P < 0.001$) and higher case fatality in hospitalization, 3-month, 6-month and 1-year follow-ups (10.1, 25.5, 29.1 and 34.0 vs. 2.0, 7.4, 8.8 and 11.6%, respectively, $P < 0.001$).

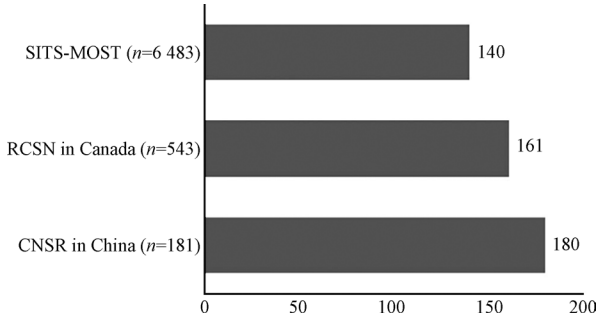

Figure 1. Comparison of onset-to-needle times for patients receiving intravenous recombinant tissue plasminogen activator (IV rtPA) among different registries. Data are shown in median time (minutes); Safe Implementation of Thrombolysis in Stroke-Monitoring Study (SITS-MOST): 285 centers in 14 countries; Registry of the Canadian Stroke Network (RCSN): 31 hospitals in 8 provinces; China National Stroke Registry (CNSR) in China: 132 hospitals in 32 provinces.

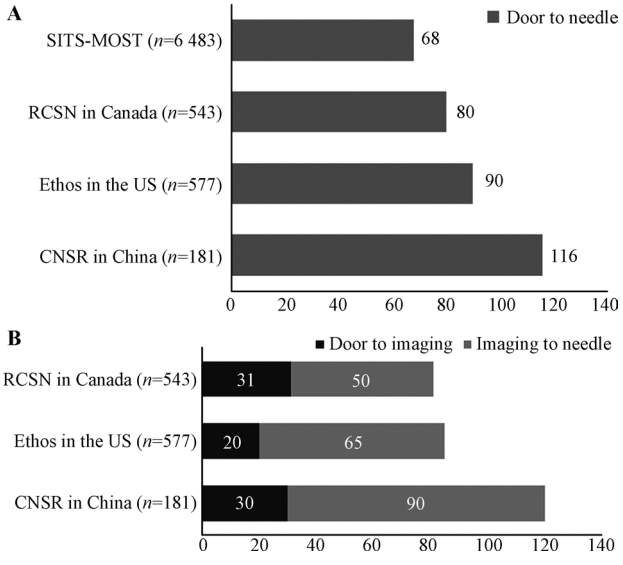

Figure 2. A, Comparison of door-to-needle times for patients receiving intravenous recombinant tissue plasminogen activator (IV rtPA) among different registries. **B,** Comparison of door-to-imaging times and imaging-to-needle times for patients receiving rtPA among different registries. Data were shown in median time (minutes); Safe Implementation of Thrombolysis in Stroke-Monitoring Study (SITS-MOST); Registry of the Canadian Stroke Network (RCSN); Ethos in the United States.

Dietary (China National Nutrition and Health Survey)[6]
The association of Chinese dietary patterns and risk of stroke were examined among 26 276 Chinese adults aged ≥45 years by using data from the 2002 China National Nutrition and Health Survey. The traditional southern Chinese dietary pattern, characterized by high intakes of rice and vegetables and moderate intakes in animal foods, was related to the lowest prevalence of stroke. Compared to the traditional southern dietary pattern, the traditional northern Chinese dietary pattern, characterized by high intakes of refined cereal products, potatoes, and salted vegetables, was associated with an elevated risk of stroke (*OR*=1.96 (95% *CI*=1.48−2.60); P <0.0001). Adjustment for conventional cardiovascular risk factors did not appreciably change the association (multivariate adjusted *OR*=1.59 (95%*CI*=1.16−2.17); P=0.004). The Western dietary pattern characterized by high consumption of beef, fruit, eggs, poultry, and seafood is also associated with an elevated risk of stroke (*OR*=2.36 (95%*CI*=1.82−3.06); $P <$ 0.0001), but the associations became non-significant after adjustment for obesity, hypertension, hyperglycemia, and dyslipidemia.

Prevention of stroke

Urban community residents sampled from Beijing, Shanghai, Changsha and Chengdu filled in the self-designed questionnaire.[7] Total integral questionnaires numbered 2519. The investigation showed that (1) the awareness percentage of the stroke risk factors were 44.2%−87.7%; the awareness percentage of the early symptoms of stroke were 58.2%−80.2%; (2) community residents would prefer to acquire stroke knowledge through health education lectures by doctors (63.2%) , television (74.4%) ,newspapers (61.8%) , internet (21.4%) and magazines (41.6%) ; (3) the stroke knowledge score and education level were positively correlated ($r(s)$ = 0.088, P<0.001), and age was negatively correlated ($r(s)$ = −0.142, P<0.001); (4) the knowledge level of women was higher than men. At present, the urban community residents in China are lacking in knowledge about stroke. Going forward, we should strengthen health education through health education lectures by doctors and mass media. Targeted educational populations should be directed at those who are elderly or male and those people with lower education or high stroke risk.

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Report on Cardiovascular Diseases in China 2012

Chronic kidney disease in China

Wang Yu, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China

Introduction

Chronic kidney disease (CKD) has become a worldwide public health problem. It may not only progress to end-stage renal disease (ESRD) and demand for expensive renal replacement therapy, but also greatly affect the morbidity and mortality of cardiovascular disease (CVD). Large increases of CKD risk factors such as diabetes, hypertension, obesity etc. have occurred in recent years in China and resulted in a great socioeconomic burden of CKD in China. In the present article, we review epidemiological data on CKD and its related CVD in China.

Epidemiology of CKD in China

Incidence of CKD in China

According to the China National Survey of Chronic Kidney Disease, which was conducted among 47 204 participants (age ≥18 years) in 13 provinces over the period 2009 to 2010, the overall prevalence of CKD was 10.8% (10.2–11.3) in mainland China. It was estimated that about 119.5 million (112.9–125.0 million) people were present with CKD. The prevalence of CKD varied greatly between geographical regions, with high incidence in North (16.9% (15.1–18.7)) and Southwest (18.3% (16.4–20.4)).[1]

The cohort study from Taiwan reported an overall prevalence of CKD as 11.93% (11.66–12.28).[2] It was noted that the prevalence was substantially higher in the group with low socioeconomic status than in the high status group (19.87% (19.84–19.91) vs. 7.33% (7.31–7.35)).

Incidence of ESRD in China

According to the report from Chinese Society of Blood Purification (CSBP), there were totally 65074 ESRD patients on dialysis treatment at the end of 2007. This number increased to 102 863 at the end of 2008. The estimated annual incidence of ESRD was 36.1 per million population in 2008. The leading cause for ESRD was chronic glomerulonephritis (45%), followed by diabetes nephropathy (19%) and hypertensive glomerulosclerosis (13%). CVD was the major cause of death in ESRD patients, accounted for 31.0% of total death. Stroke, infection and other reasons contributed 20.3%, 19.9% and 28.8% of total death, respectively.[3]

Risk factors for CKD in China

Age, sex, hypertension, diabetes, metabolic disturbance, overweight/obesity, history of CVD, infection, area of residence and economic status were all risk factors for CKD.

Hypertension

Hypertension is an independent risk factor for the development of CKD and ESRD and a major risk factor for cardiovascular disease (CVD) morbidity and mortality related to CKD. In a cross-sectional study of 13 925 adults in Beijing, hypertension (with duration > 10 years) was an independent risk factor for the development of CKD with odds ratio (95% *CI*) as 1.85 (1.19 to 2.88).[4] Another study examined the relationship between BP level and incidence of ESRD in a prospective cohort study of 158365 Chinese (age ≥40 years). During 1 236 422 person-years of follow-up, 380 participants initiated renal replacement therapy or died from renal failure (30.7 cases per 100 000 person-years). Compared with those with normal BP, the multivariate adjusted hazard ratios (95% *CI*) of ESRD for stage 1 and stage 2 hypertension were 1.47 (1.06 to 2.06) and 2.60 (1.89 to 3.57), respectively. Also, the results indicated that systolic BP was a stronger predictor of ESRD than diastolic BP or pulse pressure.[5]

Two nationwide surveys were conducted in mainland China in 1999–2000 and 2004–2005, respectively, to evaluate the awareness, treatment and control of blood pressure among non-dialysis hypertensive CKD patients. Compared with the data from 1999–2000, the data from 2004–2005 showed increased awareness (87.2 vs. 75.7%, P <0.001), treatment (85.9 vs. 80.4%, P <0.001) and control (30.0 vs. 21.1%, P <0.001, by the general threshold of BP <140/90mmHg). However, the control rate by an optimal threshold of BP <130/80 mmHg was still as low as 7.7% in 2004–2005. Based on these data, it is evident that great effort is needed to improve the total condition of hypertension in CKD patients in the future.[6]

Metabolic disturbances

Diabetes mellitus, abnormal lipid metabolism and obesity are all known risk factors for CKD. A cross-sectional survey was conducted in a nationally representative sample of 15 160 Chinese adults aged 35–74 years to examine the relationship between the metabolic syndrome and risk of CKD. The multivariate-adjusted odds ratios (95% *CI*) of

Renal Division, Department of Medicine, Peking University First Hospital; Institute of Nephrology, Peking University; Key Laboratory of Renal Disease, Ministry of Health of China; Key Laboratory of Chronic Kidney Disease Prevention and Treatment, Ministry of Education, Beijing 100034, China (Wang Y)

CKD in participants with metabolic syndrome was 1.64 (1.16 to 2.32). Compared to those without any components of the metabolic syndrome, the multivariate-adjusted odds ratios of CKD for those with 2, 3, and 4 or 5 components increased steadily.[7] Similar results were reported by a study conducted in Beijing. Among 2 310 participants (aged ≥40 years), those with metabolic syndrome had a higher prevalence of CKD (15.4% vs. 8.3%, P <0.001) than those without the syndrome. As the number of metabolic syndrome traits increased, so did the prevalence of CKD.[8] When metabolic syndrome was complicated by the presence of coronary heart disease (CHD) as reported in China Heart Survey, those with metabolic syndrome were more prone to develop CKD than those without metabolic syndrome with the odds ratio (95% *CI*) as 1.27 (1.07–1.51).[9]

In a prospective cohort study including 143 802 men and women (aged ≥40 years), 350 participants initiated renal replacement therapy or died of renal failure during a total 1 112 667 person-years of follow-up. Compared with those with normal body weight (BMI, 18.5 to 24.9 kg/m^2), multivariate-adjusted relative risks (95% *CI*) for all-cause ESRD for overweight (BMI, 25.0 to 29.9 kg/m^2) and obese subjects (BMI ≥30 kg/m^2) were 1.21 (0.92 to 1.59) and 2.14 (1.39 to 3.29), respectively.[10] In another community-based cross-sectional study, 4 611 participants were enrolled to evaluate the association between different indexes of obesity and CKD. Multivariate Logistic regression showed waist-to-height ratio was a risk factor for CKD, independent of hypertension and diabetes.[11]

History of CVD

CKD shares many risk factors with chronic heart failure (CHF). A report from China Heart Survey showed that the incidence of CKD was 34.2% among 1009 CHF patients. There was a stepwise increase of CKD prevalence with New York Heart Association classes.[12]

The incidence of stroke is high in China. In one study, the total incidence of CKD was as high as 47.7% among 1 014 in-patients with CT or MRI verified cerebrovascular disease.[13]

Morbidity and mortality of CVD in CKD in China

It has been widely accepted that CKD is an independent risk factor for CVD. And CKD contributes greatly to CVD mortality.

Morbidity of CVD in CKD

In a community-based study, the prevalence and the spectrum of CVD in individuals with early-stage CKD were studied. Compared with individuals with normal eGFR, the prevalence of myocardial infarction, stroke, and total CVD of individuals increased stepwise with decreased eGFR. It was noted that stroke was more prevalent than myocardial infarction for each eGFR category.[14]

Increased carotid artery intima-media thickness (IMT) predicts future vascular events in the general population. A cross-sectional study of 1046 residents (aged ≥40 years) showed that compared with subjects with normal eGFR, subjects with decreased eGFR had higher mean IMT.[15] A cohort study evaluated the prediction power of carotid ultrasonography for cardiovascular event in stages 3 to 4 CKD patients. The result suggested that higher quartile of IMT conferred excess hazard for developing cardiovascular event.[16]

Several studies have been conducted to evaluate the role of CKD as a risk factor for coronary artery disease (CAD) in Chinese with type 2 diabetes. In a study including 2 434 type 2 diabetes patients, serum creatinine >1.5 mg/dl, eGFR <60 ml/min, and urinary ACR >30 mg/g were found to be independent risk factors for CAD in diabetic men, and that serum creatinine >1.4 mg/dl and eGFR <60 ml/min were independently associated with CAD in women.[17] Another study from Hong Kong enrolled a prospective cohort of 7 067 Chinese type 2 diabetic patients without history of CHD to examine how albuminuria and CKD may influence the effects of other risk factors on CHD. The results indicated that albuminuria played a linking role between conventional risk factors and CHD. The onset of CKD changed risk associations between lipids and CHD.[18] Stroke is the leading cause of long-term adult disability and is the second leading cause of death in China. In a prospective study, 176 first-ever strokes occurred among 3 711 hypertensive patients (aged ≥35 years) during a median follow-up of 4.9 years. Analysis suggested that the risk of total and ischemic stroke strongly increased with decreasing eGFR.[19]

CKD and cardiovascular mortality

CKD contributes greatly to CVD mortality not only in general population but also in high risk population.

The results from the cohort study of Taiwan showed that CKD patients had 100% higher mortality for CVD.[2]

A study from Hong Kong investigated the effects of stages of renal function on all-cause mortality and cardiovascular end points in a prospective cohort including 4 421 type 2 diabetic patients. After a median follow-up period of 39.4 months, all-cause mortality rate increased significantly as renal function deteriorated from CKD stage 1 to stage 4. The respective rate of new cardiovascular end points also increased significantly from 2.6% to 25.3%. The results indicated that Chinese type 2 diabetic patients with reduced eGFR were at high risk of developing cardiovascular end points and all-cause mortality.[20]

Similar results were found in the studies conducted in patients with established CVD. One study investigated the role of CKD in 1-year all cause mortality and cardiovascular mortality among Chinese patients (aged ≥50 years) who had a history of CAD, stroke, or peripheral vascular disease (PAD), or with two or more cardiovascular

risks. The result showed an eGFR of <45 $ml \cdot min^{-1} \cdot 1.73m^{-2}$ was an independent predictor of all causes of death and of cardiovascular death.[21] The Chinese Ankle Brachial Index Cohort study investigated the combined effect of CKD and PAD on all-cause and CVD mortality. The Cohort consisted of 3 732 adults aged 35 years or older. It was found that the survival rate for the CKD and PAD group was significantly lower than that for any single disease, for both all-cause and CVD mortality.[22]

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Report on Cardiovascular Diseases in China 2012

Cardiovascular Surgery

Luo Xinjin, Hu Shengshou, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China

The sum amount of cardiac operations and cardiopulmonary bypass (CPB) in mainland China reached 187 983 and 150 787 respectively in 2011. The cardiac surgical volume has been keeping the improving trends in the recent nine years. In the report, we summarized the investigation result of Chinese Scoiety of Extro-Corporeal Circulation about the development trends of domestic CPB during 2003 to 2010, and the validation result about SinoSCORE system in risk evaluation in Chinese patients. The research result on the impact of smoking behaviors on long-term outcomes of coronary artery bypass grafting (CABG) and risk factors for left atrial thrombosis in patients with rheumatic mitral stenosis was also included.

Cardiac Surgical Volume in China

In 2011, the cardiac surgical volume reached 187 983 cases in mainland of China, including 150 787 cases performed under CPB support (Table 1 and Figure 1).

The cardiac surgical volume has been increasing in the recent nine years in mainland of China.

Analysis of domestic cardiopulmonary bypass status: eight-year development trends[1,2]

In order to investigate the development trends of cardiopulmonary bypass (CPB) in mainland of China, a questionnaire survey was conducted annually from 2003 to 2010 by Chinese Society of Extra-Corporeal Circulation (CHSECC).

The domestic hospitals that carry out cardiovascular surgeries were inquired with questionnaire annually upon the number of on-pump and off-pump cardiac operations, oxygenators of different types and extracorporeal membrane oxygenations (Table 2).

Cardiac operation with CPB support

In 2010, the sum amount of cardiac operations and cardiac operations with CPB support reached 170 547 and 136 753 respectively. During 2003 to 2007, the ratio of cardiac operations with CPB support (on-pump) in total cardiac operations was inclined to rise. However, the ratio decreased year by year from 2008 to 2010 in mainland of China (Figure 2).

Oxygenators used in cardiac operation

In mainland of China, from 2004 to 2010, the sum amount of oxygenators used in cardiac operations increased from 73 134 to 137 670. The composition of imported membrane oxygenator climbed up from 43.22% to 59.75%, while the composition of bubble oxygenator decreased from 43.78%

Table 1. Cardiac surgical volume in mainland of China[1]

Area	Province	2010			2011		
		Total	CPB	HTx	Total	CPB	HTx
North	Beijing	22 818	15 145	81	24 553	16 995	67
	Tianjin	3 563	2 541	3	3 623	2 187	3
	Hebei	5 189	4 046		5 562	4 354	1
	Shanxi	2 077	1 474		2 218	1 534	
	Inner Mongolia	1 257	906		1 379	916	
North-east	Helongjiang	3 047	2 129		3 242	2 204	
	Jilin	1 929	1 549		1 850	1 619	
	Liaonin	3 918	2 799	2	4 177	2 974	4
East	Shanghai	14 879	12 588	22	15 381	12 958	28
	Shandong	10 998	8 177		11 782	8 017	
	Jiangsu	7 935	6 550		8 391	7 022	
	Zhejiang	4 800	4 157		5 386	4 529	2
Middle	Hubei	9 767	9 009	11	10 963	9 915	29
	Hunan	6 740	5 843		7 168	5 756	1
	Jiangxi	2 753	2 527		4 486	4 069	
	Henan	13 263	11 431		17 616	14 659	
	Anhui	3 828	3 738		4 245	3 817	
South	Guangdong	13 101	11 288	1	14 325	12 350	1
	Guangxi	3 407	3 054		3 703	3 243	5
	Fujian	5 364	3 875	9	5 004	3 916	11
	Hainan	680	625		850	745	
North-west	Shanxi	7 674	5 343	9	7 079	5 630	4
	Gansu	2 436	1 846		2 358	2 024	
	Qinghai	627	443		324	267	
	Ninxia	739	434		911	478	
	Xinjiang	3 361	2 341		5 157	3 946	
South-west	Chongqing	4 388	4 103		4 820	4 384	
	Sichuan	5 839	5 048		6 294	5 271	
	Yunnan	2 860	2 482		3 149	3 140	
	Guizhou	1254	1 206		1 900	1 806	
	Tibet				87	62	
Total		170 491	136 697	138	187 983	150 787	156

HTx: heart transplantation; CPB: cardiopulmonary bypass support.

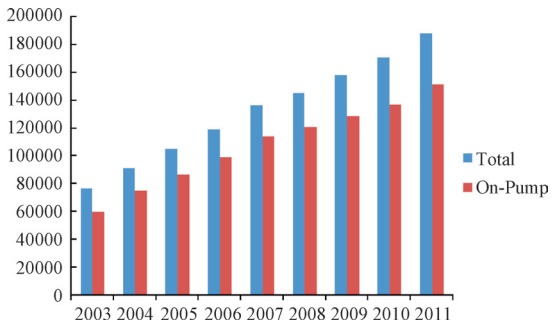

Figure 1. Cardiac surgical volume in mainland of China from 2003 to 2011.

National Center for Cardiovascular Diseases, Fuwai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100037, China (Luo XJ and Hu SS)

Table 2. Information about questionnaires

Year	Mailed questionnaires	Response questionnaires	Reply ratio (%)	Investigation contents		
				Surgical volume	Oxygenators	ECMO
2003	499	499	100	√	—	—
2004	500	482	96	√	√	√
2005	602	576	96	√	√	√
2006	728	646	89	√	√	√
2007	750	676	90	√	√	√
2008	774	690	89	√	√	√
2009	773	694	90	√	√	√
2010	772	714	92	√	√	√

ECMO: extracorporeal membrane oxygenations.

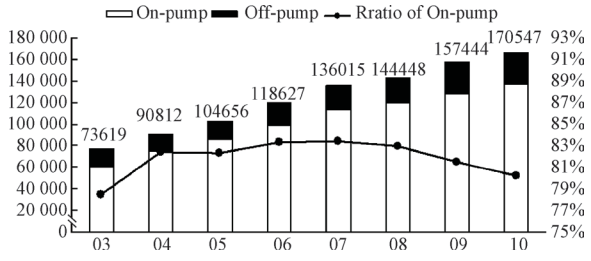

Figure 2. Number of on-pump and off-pump cardiac operations.

to 14.59% (Figure 3).

Domestic hospitals which carry out cardiac surgeries

In 2003, there were only 11 hospitals whose annual cardiac surgical volume was over 1 000 cases. The sum of cardiac surgical volume of these 11 hospitals occupied 28% of the total cardiac surgical volume of mainland china. At that time, the annual cardiac surgical volume in most hospital was 50–100 cases (104 hospitals) or less than 50 cases (172 hospitals).

In 2010, the number of hospital with annual cardiac surgical volume over 1 000 cases increased to 32, and they occupied 43% of the total volume. The number of hospital with annual cardiac surgical volume less than 50 cases increased to 255. But the sum of cardiac surgical volume of these hospitals only occupied 3% of the total cardiac surgical volume of mainland china.

Classify all the hospitals according to the cardiac surgery amount, and analyze the market share of each grade hospital (Figure 4 and 5).

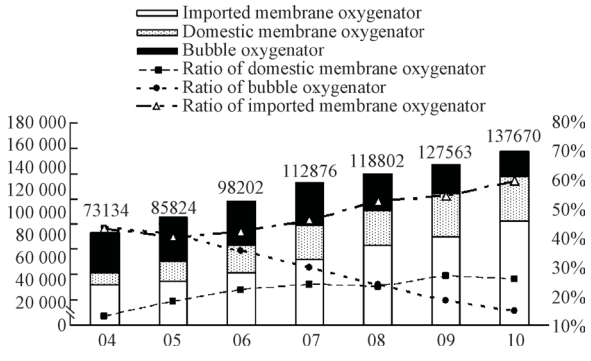

Figure 3. Number and different types of oxygenator used in 2004–2010.

Since 2004, the generalization and application of ECMO (extracorporeal membrane oxygenations) technique is progressing rapidly in mainland of China. Compared to that of 2004, the annual cases of ECMO have risen 3.5 fold in 2010 (Figure 6).

Top five cardiac surgical center in mainland of China

In recent eight years, Fu Wai Hospital (Beijing) was always ranking the No.1 position of surgical volume of cardiac operations and cardiac operations with CPB support. The top 5 cardiac surgical center according to the surgical volume in mainland china were showed in Table 3 and 4.

Chinese system for cardiac operative risk evaluation-SinoSCORE

"Chinese Cardiovascular Surgery Registry" has constructed a new risk stratification system, the Sino System for Coronary Operative Risk Evaluation (SinoSCORE), for the predicting mortality after cardiac surgery in Chinese patients.[3]

The risk evaluation by SinoSCORE included two steps. First, the risk factors weights which a patient would suffer were calculated according to the Table 5.

Then, the thresholds according to the total weights of the risk factors were defined in Table 6 for different risk groups for the prediction of in-hospital mortality in Chinese

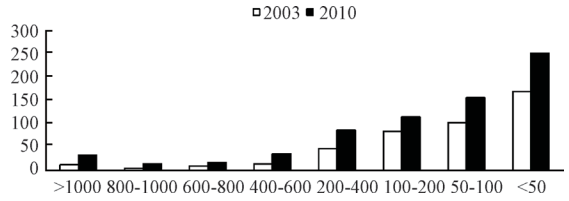

Figure 4. Number of hospital in each grade in 2003 and 2010.

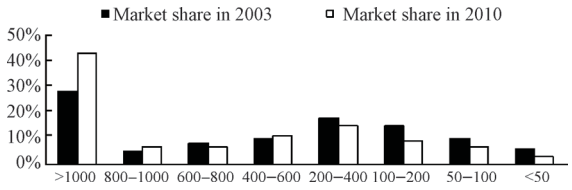

Figure 5. Market share of each grade hospital in 2003 and 2010. The market share of each grade hospital = the sum of cardiac surgical volume of each grade hospital / the total cardiac surgical volume of mainland of China.

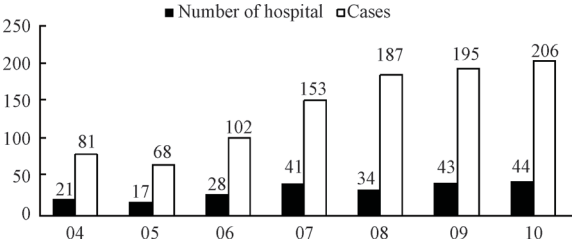

Figure 6. ECMO technique in mainland of China in 2004–2010.

Table 3. Top five cardiac surgical center according total volume of cardiac operations

Rank	Hospitals (annual cardiac surgical volume)		
	2003	2007	2010
1	Fu Wai Hospital (4 915)	Fu Wai Hospital (7 007)	Fu Wai Hospital (9 384)
2	An Zhen Hospital (2 476)	An Zhen Hospital (4 557)	An Zhen Hospital (7 293)
3	Guangdong Cardiovascular Institute (2 100)	Wuhan Asia Heart Hospital (3 595)	Xi Jing Hospital (4 105)
4	Wuhan Asia Heart Hospital (2 000)	Xi Jing Hospital (3 206)	Wuhan Asia Heart Hospital (4 022)
5	Shanghai Children's Medical Center (1 500)	Guangdong Cardiovascular Institute (3 014)	Guangdong Cardiovascular Institute (3 728)

Table 4. Top five center according to volume of cardiac operations with CPB support

Rank	Hospitals (annual cardiac operations with CPB support)		
	2003	2007	2010
1	Fu Wai Hospital (3 931)	Fu Wai Hospital (5 900)	Fu Wai Hospital (7 394)
2	Guangdong Cardiovascular Institute (1 900)	Wuhan Asia Heart Hospital (3 366)	Wuhan Asia Heart Hospital (3 856)
3	Wuhan Asia Heart Hospital (1 760)	Guangdong Cardiovascular Institute (2 700)	An Zhen Hospital (3 663)
4	An Zhen Hospital (1 592)	An Zhen Hospital (2 641)	Guangdong Cardiovascular Institute (3 385)
5	The second Xiangya Hospital (1 375)	The second Xiangya Hospital (2 470)	Xi Jing Hospital (2 635)

Table 5. Eleven risk factors in Chinese patients

Risk factors	Definition	Weights
65–69 years		3
70–74years		5
≥75years		6
BMI ≥24 kg/m^2		–2
BMI <18 kg/m^2		5
Chronic renal failure	History of renal failure, or history of Scr >176 umol/L	6
Extracardiac arteriopathy	Angina cruris, or carotid artery occlusion or stenosis >50%, or operative history on artery of extremity, abdominal aorta, or carotid artery	5
Chronic obstructive pulmonary disease	Long-term use of bronchodilators or cortical hormone because of pneumonopathy, forced expiratory volume in one second / forced vital capacity < 0.7	4
NHYA III	NHYA Stage	3
NHYA IV	NHYA Stage	7
Preoperative AF/Af	Within 2 weeks	2
LVEF <50%	Depending on echocardiography	4
Critical preoperative state	Preoperative cardiogenic shock, or ventricular fibrillation / flutter, or preoperative IABP support	4
Non-selective operation		5
Combined valve procedure	CABG combined valve procedure	4

patients. The mortality risk of CABG procedure for a Chinese patient can be estimated.

In 2011, the SinoSCORE system was validated by several cardiac centers in mainland china.[4-7] Data from patients undergoing heart surgery in these centers were retrospectively collected. The SinoSCORE was calculated for each patient. Mortality was defined as any in-hospital death. Area under the receiver operating characteristics curve (AUC) was used to study the discriminatory abilities of the models. The Hosmer-Lemeshow (H-L) goodness-of-fit test was used to study the calibration of the predictive models.

The results indicated that SinoSCORE was a good and well-validated risk stratification model applicable to Chinese patients with off-pump coronary bypass or heart valve surgery, and it was also suitable for senior age patients or Cantonese patients who received heart surgery.

Table 6. Prediction of in-hospital mortality in Chinese patients

	Weights	Prediction of in-hospital mortality (95% *CI*)
Low risk	≤ 1	0.52–0.89
Moderate risk	2–5	1.29–1.94
High risk	≥6	6.36–6.63

Surgical treatment of coronary artery disease

Impact of smoking and smoking cession on long-term outcome of patients after coronary artery bypass grafting

In order to determine the impact of smoking behaviors on long-term outcomes of coronary artery bypass grafting (CABG). The researcher conducted a survey in 2 541 consecutive patients who underwent CABG in Fu Wai Hospital from January 1, 2004 to December 30, 2005.[8]

The preoperative and postoperative smoking habits were obtained. The patients were divided into never smokers and ever smokers. The ever smokers were further divided into the current smokers who smoked before and after CABG and former smokers who stopped smoking before CABG, quitters who stopped smoking after CABG. Death, MACCE (major adverse cardiovascular or cerebrovascular events) and angina pectoris were observed. The relative risk of adverse events in different sub group were analyzed (Figure 7 and 8).

The patients were followed up for 4.27 to 6.41 years (average 5.09 years). After CABG, the percentage of persistent smoking patients was 22.1%. Smoking prevalence was still high in these CABG patients. After adjusting baseline characteristics, relative risk of death

Table 7. Validation research for SinoSCORE in 2011

Objective	Period	Cases	AUC	Hosmer-Lemeshow
OPCAB patients[4]	2004–2005	4 920	0.794	*P*=0.636
Cantonese heart surgery patients[5]	2004–2008	2 462	0.84	*P*=0.34
Heart valve surgery patients[6]	2007–2008	13 353	0.74	*P*=0.47
Heart surgery patients older than 65[7]	2004–2008	9 445	0.73	*P*=0.45

OPCAB: off-pump coronary bypass

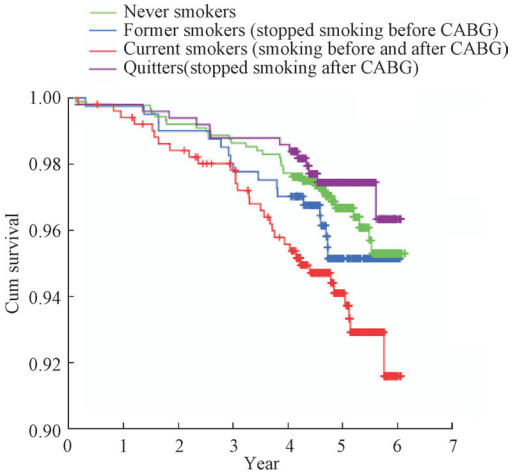

Figure 7. Kaplan-Meier survival line of death for all causes in different sub groups (*P* <0.001).

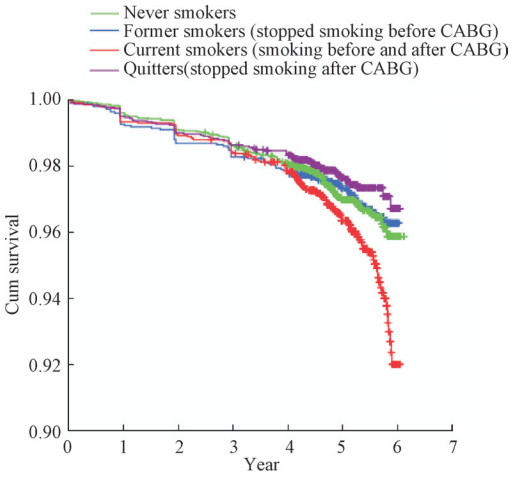

Figure 8. Kaplan-Meier survival line of MACCE in different sub groups (*P*=0.001).

for all causes, cardiac death, tumor cause death, MACCE and angina pectoris were all significantly higher in current smokers than in never smokers. However, the outcomes were similar between who stopped smoking and never smokers. This indicated that persistent smoking was associated with higher rates of mortality and morbidity after CABG while smoking cession was helpful for improving the outcomes of CABG.

Surgical treatment of heart valve disease

Analysis of risk factors for left atrial thrombosis in patients with rheumatic mitral stenosis

Rheumatic heart disease was still common in mainland china, and mitral stenosis could be found in 71% of them. Almost 15%–30% of patients with rheumatic mitral stenosis would suffer left atrial thrombosis and be confronted with the risk of developing systemic embolism. The incidence of thromboembolism for them was 1.5%–7% each year.[9]

In order to analysis the risk factors for the left atrial thrombosis in patient with rheumatic mitral stenosis. The researcher retrospectively collected data from 2 277 patients with rheumatic mitral stenosis who underwent operation in An Zhen Hospital from January, 2001 to December, 2008. The patients were divided into left atrial thrombosis group (n=554) and no thrombosis group (n=1 723) according to the findings during the operation.

Analysis indicated that 12 variables had statistic difference between two groups. With multivariate Logistic regression for these 12 factors, age, mitral valve orifice area, left atrial diameter and atrial fibrillation were found to be the risk factors for left atrial thrombosis. Mitral regurgitation was found to be a protective factor.

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Report on Cardiovascular Diseases in China 2012

Peripheral arterial disease

Li Xiaoying, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China.

Peripheral arterial disease (PAD) is a common manifestation of systemic atherosclerosis excluding the coronary and intracalvarium arteries. This report is only involved in lower extremity arteriosclerosis disease (LEAD) and carotid artery arteriosclerosis (CAD).

Lower extremity arteriosclerosis disease (LEAD)

LEAD morbidity

LEAD is a common clinical syndrome in middle-older people. Many epidemiology studies were conducted on LEAD morbidity by non-invasive methods including Rose Claudication Questionnaire, ankle-brachial index (ABI) and the speed of pulse wave velocity (PWV), etc. The studies demonstrated that LEAD morbidity was dependent on age, risk factors and baseline diseases. The Chinese epidemiology studies on LEAD morbidity were shown in Table 1, and diagnosis of LEAD was based on ankle brachial index (ABI) less than 0.90.

These literatures showed that there was a significant difference in LEAD morbidity among the populations, but in those with risk factors there were similarly high morbidities. In addition, the LEAD morbidity increased with aging, and morbidity of females were higher than that of males in most studies.

Risk factors for LEAD

Epidemiological study showed that prevalence of LEAD increased with aging and the risk factors related to atherosclerosis. Main cause to lead to LEAD is atherosclerosis, and all atherogenic risk factors such as smoking, diabetes, lipid disorders, hypertension and hyperhomocysteinaemia can increase the morbidity of LEAD. Epidemiological studies in Beijing City showed that prevalence and severity of LEAD were positively related to age, smoking, duration of diabetes, blood glucose level, higher systolic pressure, hypercholesterolemia and higher LDL-C level.[4,8] LEAD was detected in 30% patients with cerebrovascular disorder and in 25% patients with ischemic heart disease respectively.[3,4] Therefore, LEAD is an important window reflecting the systemic arteriosclerotic disease, and the early detection and treatment for LEAD are very important for dealing with systemic arteriosclerotic diseases.

Impact of LEAD on mortality

Mortality of patients with LEAD is significantly higher than those without LEAD at the same age, and the mortality of patients with LEAD gradually increases with the ABI reduction. A study revealed that according to ABI grades, 3210 cases with high risk for atherosclerosis were divided into 4 groups and the follow-up study for 3 years showed the different mortality among the groups (Table 2). In the group of ABI ≤ 0.4, all cause mortality was three times higher than those in the other 3 groups (95% *CI*: 1.936–4.979), and the cardiovascular mortality was five times higher than those in the other 3 groups (95% *CI*: 2.740–8.388).

Carotid atherosclerotic disease (CAD)

Morbidity and risk factors for carotid atherosclerotic disease

CAD is a common clinical syndrome in elderly patients. Previous epidemiological studies on CAD morbidity were performed by detecting carotid atherosclerotic plaque and carotid intima-media thickness (IMT) with vascular ultrasound examination. The studies showed that the different morbidity of CAD was based on age, risk factors and baseline condition. A Sino-US cooperation cohort study for population in Shijingshan district and Peking University community showed that the rate of carotid artery plaque was 60.3% in 2681 subjects aged 43 to 81 years, and those rates in males and females were 66.7% and 56.2% respectively. Carotid plaque mainly occurred at the enlargement part of carotid artery (55.4%, Table 3). In addition, multivariate analysis showed that IMT of carotid artery became thick with increases of blood pressure, blood glucose, and low density lipoprotein cholesterol (LDL-C) levels. As compared with subjects without risk factors, the carotid plaque detection rates obviously increased in subjects with hypertension, diabetes, smoking, and high blood LDL-C levels. The study suggested that CAD was prevalently present in Chinese middle-elderly people and was associated with multiple cardiovascular risk factors. [11]

From 2007 to 2010, the study on 13,896 residents with Uygur, Kazak and Han nationalities, aged 35 and above in Xinjiang Uygur Autonomous Region showed that the total rate of carotid artery plaque was 10.2%, and that of the Uygur, Kazak and Han groups was 12.5%, 7.2%, and 10.4% respectively. Further analysis suggested that age, smoking, total cholesterol, blood glucose and systolic blood pressure are independent risk factors for the formation of carotid plaque, while sex of female and high density lipoprotein cholesterol were the protective factors. The

Department of Geriatric Cardiology, Chinese PLA General Hospital, Beijing 100039, China

Table 1. Chinese epidemiology studies on LEAD morbidity

Population	Year	Cases	Age (years)	Morbidity (%)		
				Male	Female	All
Fisher in Zhoushan area of Zhejiang province[1]	2005	2668	35~	3.0	1.2	2.1
Group of MUCA[2]	2007	18140	35~	5.4	9.3	6.0
The elderly in Wanshoulu area, Beijing[3, 4]	2003	2124	60-95	12.7	18.1	16.4
Diabetes[5]	2007	1347	50~	18.3	20.4	19.4
Patients with metabolic syndrome[6]	2006	2115	32-91	21.7	23.4	22.5
Hypertensive patients[7]	2006	3047	>50	–	–	27.5
Natural population in community[8]	2009	21152	18~	1.8	4.3	3.04
Elderly diabetes patients in Wuhan City[9]	2010	2010	60~	–	–	24.1

MUCA: multiple units cooperation of Chinese epidemiology cardiovascular diseases.

Table 2. Mortality of patients with different ABI during 3-year follow-up study

Mortility	ABI ≤ 0.4	0.41–0.9	0.91–0.99	1.0–1.4	All ABI	*P*
All cause mortality (%)	37.7	24.4	13.2	12.1	15.7	< 0.001
Cardiovascular mortality (%)	27.5	14.5	8.1	6.3	8.9	< 0.001

Table 3. Detection rate of carotid plaque in middle-aged and elderly people in Beijing City

Parameters	*n* (%)	Detection rate of carotid plaque (%)			
		Common carotid artery	carotid bifuracation	Internal carotid artery	Carotid artery
Males					
< 55 (years)	237 (9.2)	7.1	46.9	15.5	53.1
55–59 (years)	121 (4.7)	12.0	56.0	13.6	64.2
60–64 (years)	170 (6.6)	24.0	58.7	23.5	63.1
65–69 (years)	168 (6.6)	21.8	62.6	26.3	68.7
70–74 (years)	204 (8.0)	32.1	72.0	33.9	78.9
≥ 75 (years)	102 (4.0)	32.4	78.8	38.9	79.6
In total	1002 (39.1)	20.9	61.2	24.7	66.7
χ^2 value		54.773	40.235	38.704	42.820
Females					
55 (years)	360 (14.0)	3.0	28.6	5.7	32.4
55–59 (years)	177 (6.9)	6.1	38.7	7.7	45.3
60–64 (years)	410(16.0)	10.9	50.0	11.8	53.9
65–69 (years)	295 (11.5)	20.7	64.3	14.8	69.2
70–74 (years)	217 (8.5)	23.4	73.0	18.9	77.9
≥75 (years)	103 (4.0)	36.2	29.0	22.9	83.8
In total	1562 (60.9)	13.8	51.6	12.2	56.2
χ^2 value		115.822	180.461	40.053	187.935
In total	2564 (100)	16.6	55.4	17.2	60.3

relatively low carotid artery plaque detection rate in the study was probably related to low cardiovascular risk factors among these groups.[12]

A study in 2012 in Hangzhou City showed that all 6142 subjects aged ≥ 20 years who underwent health examination received vascular ultrasound scan, and detection rates of carotid atherosclerotic plaque were 12.6% in males and 7.2% in females. The study also revealed that the factors of male, age, blood pressure, blood glucose, and LDL-C levels were independent risk factors, and of high density lipoprotein cholesterol (HDL-C) level was a protective factor for carotid atherosclerosis and plaque formation. In addition, there was a high detection rate of carotid atherosclerosis in patients with metabolic syndrome, the rates were 16.6% and 11.8% in the males and females respectively.[13]

CAD and the risk for ischemic heart disease

A 5-year follow-up study disclosed that the baseline IMT of carotid was independent predictor for ischemic cardiovascular disease in patients without carotid lesion (*HR* = 1.59, 95% *CI*: 1.04–2.45), and the risk of ischemic cardiovascular disease significantly increased with the increase in total area of plaque (*HR* = 1.29, 95% *CI*: 1.08–1.55)and the number of plaque (HR=1.14, 95% *CI*: 1.02–1.27).[14, 15]

CAD can be detected conveniently and feasibly by vascular ultrasound scan in the early stage of lesion, and carotid atherosclerotic progression can be retarded through quitting smoking, controlling hypertension, diabetes, and lipid disorders.

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Report on Cardiovascular Diseases in China 2012

Cardiac arrhythmia in China

Zhang Shu, Fan Xiaohan, Ning Xiaohui, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China

The interventional therapies for cardiac arrhythmia have developed rapidly in China within past few decades. There is a rapidly growing trend in electrophysiological procedures and implantation of cardiac implantable electronic devices (CIEDs) in most of hospitals. The present article reviews the development and current status of cardiac electrophysiology and arrhythmia treatment in China.

Permanent pacemaker

The first case of permanent pacemaker implantation in mainland was performed in 1962 in Shanghai.[1] Since then, implantation cases have increased gradually, and the proportion of physiological pacemaker has also elevated. The documents indicated that in 2005, there were 460 hospitals capable of permanent pacemaker implantation, and the total implantation cases reached 18 090. The male patients was accounted for 55.5%, and 23.6% of the patients was below 60 years old (Figure 1).[2-4] In 2006, the implantation number grew to 20 000.[5] Studies in 2009[6]demonstrated that the capable hospitals were 783, and cases reached to 47 915, 52% of the cases were male, patients aged above 60 years accounted for 79%, and aged above 80 years accounted for 17%.

The database of online registration system established by Ministry of Health proved that total PM implantation cases reached to 49 502 in 2012 (except for military hospitals), indicated a 15.2% increase compared with that in 2011. According to the Six General Census, implantation cases of PM in China were 29/1 million in 2010, 36/1 million in 2011, and 35/1 million in 2012, far below the numbers in Europe (951/1 million in 2010). In 2011, there were 7 252 cases of PM replacement (16.87%), 15 588 cases with rate response function (36.26%), and 1 756 cases with remote monitoring (4.09%). The average age of patients was 69.25 years old, male patients were 22 108 (51.43%). Among the indications, there were 21 762 sick sinus syndrome (SSS) patients (50.6%), 16 765 auriculo-ventricular block (AVB) patients (39%), and 4 459 other patients (14.4%).[7] In 2012, dual chamber PM accounted for 60%, numbers in Zhejiang province and Shanghai exceeded 4 000, and numbers in Guangdong, Shandong, Hubei, and Anhui province exceeded 2 000. There was only one hospital (Fuwai hospital) with annual implantation number above 1 000, accounted for 2.7% of the national implantation amount. There were 53 hospitals (5.6%) with annual implantation number above 200, accounted for 32.8% of the national implantation amount.

Statistic data indicated that the ratio of dual chamber pacemaker was 51.5% in 2005, and it reached 52.9% if AAI/R physiological pacemaker was included. Data of 2012 demonstrated that among the indications, 50% was SSS (23 995 cases), 38.7% AVB (18 387 cases), and 10.8% others (7 120 cases) (Figure 2).

Implantable cardiovertor defibrillator (ICD)

The first ICD implantation in mainland was implemented in 1996. The total case numbers had reached 285 by 2001. In 2005, the implantation cases were 186, and the number increased annually (Figure 3). Studies about the cases of ICD implantations between Jan. 2005 to Dec. 2006 showed that 121 cases (85.2%) was implanted according to the I class recommendation (secondary prevention), and only 15 cases (10.6%) according to the IIa recommendation (primary prevention).[8] Among the 497 patients that meet with the class I recommendation, only 22.5% (112 cases) of the patients completed the ICD implantation and 77.5% of them refuse ICD implantation because of various reasons. Followed up for (11±3) months, this study proved that the mortality in ICD implantation patients was 1.8%, whileas in non ICD implantation patients, the mortality was 9.4%, with an 6.7% incidence of sudden cardiac death.[9]

By 2009, the total cases had grow to 1 316, 116 of which was for replacement, and there were 45 single chamber ICD, 19 dual chamber ICD, and 36 CRT-D among them.[6]

In 2011, there were 1 228 cases of ICD implantation, with an increase of 19.6% compared with 1 027 cases in 2010, and dual chamber ICD accounted for 14.7% (179 cases). According to the Six General Census, implantation cases of ICD in China were only 1/1 million in 2010 and 2011, far below the numbers in Europe (158/1 million in 2010). The average age of patients was 59.33 years old, there were 889 male patients (72.4%). About 58.8% of the ICD cases (722 cases) were used as secondary prevention, and 41.2% used as primary prevention, 100 cases were used for replacement, and 126 cases had remote monitoring function (10.26%).[7] The database of online registration system established by Ministry of Health (except for military hospital) proved that there were 1 553 cases of ICD implantation in 2012, which indicated an increase of 23.5% compared with that in 2011 (1 228 cases), and dual chamber ICD accounted for 33%. Added up with the number of CRT−D implantations,

National Center for Cardiovascular Diseases, Fuwai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100037, China

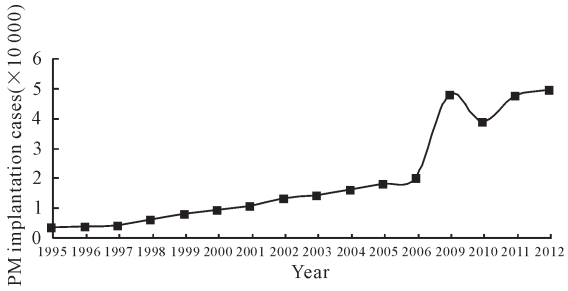

Figure 1. Annual PM implantation cases in China (1995–2012).

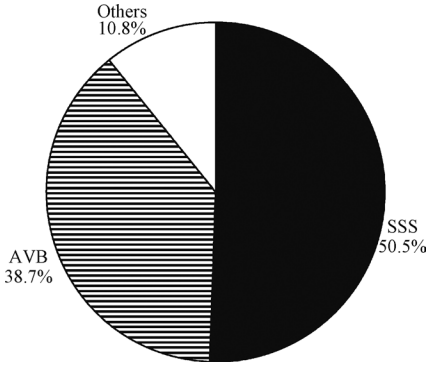

Figure 2. Distribution of PM implantation indications in 2012.

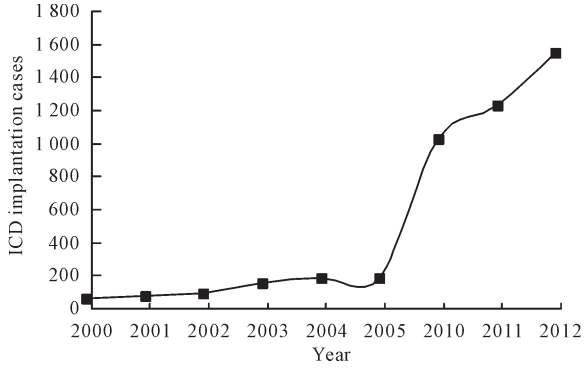

Figure 3. Annual ICD implantation cases in China (2000–2012).

the total implantation numbers reached to 2 726, which means 2 cases in every 100 million people, and there was still a huge gap to be narrowed between China and Europe. In 2012, ICD implantation numbers in Zhejiang and Guangdong province were above 200.

Cardiac resynchronization therapy (CRT)

In 1999, CRT in mainland was started, between 2002–2007, the annual growth rate of implantation was more than 30% on average. Data from 193 hospitals indicated that there were 541 CRT implantation cases in 2007, including 59 CRT-D. There were 401 male cases (74.12%), and age distribution was 20–90 (60±12) (Figure 4).[10] The implantations numbers increased to 1 300 in 2009.

In 2011, there were 1 822 implantations of CRT in China, and there was an increase of 19.3% compared with that in 2010 (1 573 cases), 987 cases were CRTP (54%), 835

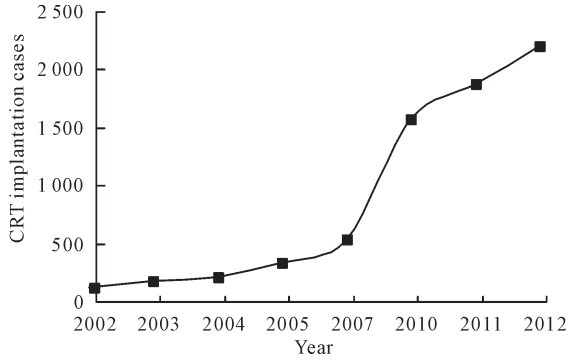

Figure 4. Annual CRT implantation cases in China (2002–2012).

cases were CRTD (46%). According to the Six General Census, implantation cases of CRT in China were under 1/1 million (0.68/1million in 2010 and 0.74/1 million in 2011), far below the numbers in Europe (38/1 million in 2010). The average age of patients was 62.37 years old, 1 335 male patients (71.16%). Among them, 160 cases were used for replacement (0.11%), and 124 cases had remote monitoring function (8.17%).[7] According to the database of online registration system established by Ministry of Health (except for military hospital), there were 2 210 cases of CRT implantation in 2012, which indicated an increase of 17.8% compared with that in 2011, and CRTD accounted for 53%, still under 1 case in every 1 million people. In 2012, CRT implantation numbers exceeded 300 in Zhejiang province, and exceeded 200 in Jiangsu province. There were 50 hospitals in mainland that had the annual implantation number above 50 cases.

Catheter ablation

The first clinic application of radiofrequency ablation was reported in 1991 in the mainland of China,[11] RF ablation cases have increased rapidly since 1990s, 10 811 cases were reported in 2000, and there were 136 capable hospitals (Figure 5).[12] In 2006, the number increased to 20 000.[5]

In 2000, 56.3% of the ablations cases were for AVNRT, 31.7% of the cases for AVRT, others for ventricular or atrial arrhythmia. While as in 2011, there were 20 876 cases of AVNRT ablations (29.5%), 18 805 cases of AVRT ablations (26.5%), 18 805 cases of AFL ablations (26.5%), 9 856 cases of AF ablations (13.9%), 4 271 cases of VPC ablations (6%) , 2 330 cases of VT ablations (3.3%), 227 cases of APC ablations, 1 982 cases of AT ablations (Figure 6).

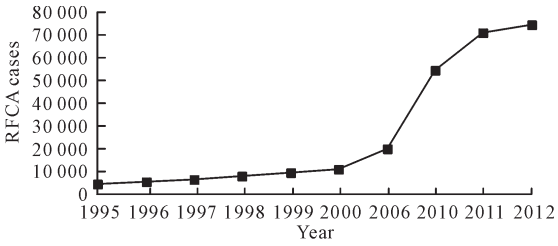

Figure 5. Annual RFCA cases in China (1995–2012).

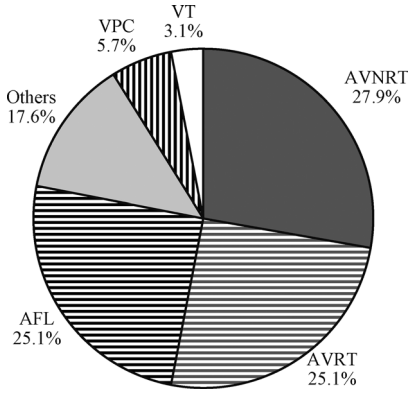

Figure 6. Distribution of RFCA indications in 2011. APC: atrial premature contraction; AT: atrial tachycardia; AFL: atrial flutter; VPC: ventricular premature contraction; VT: ventricular tachycardia.

As an ever-growing mature treatment therapy of pre-excitation syndrome and supraventricular tachycardia, catheter ablation has been widely employed in over 600 hospitals in China. The statistic data of online registration system established by Ministry of Health (except for military hospital) demonstrated 63 355 catheter ablation cases in 2011, rose by 16.1% than that in 2010 (54 559 cases) . According to the Six General Census, catheter ablation cases were 41 in every one million people in 2010, the number rose to 47/1 million in 2011. The average age of patients was 47.7 years old, 32 274 were male patients (50.94%).[7] According to the database of 2012, there were 74 410 catheter ablation cases, compared with data of 2011, there was a 17.5% increase, and catheter ablation of atrial fibrillation accounted for 16.6% of the total ablation numbers. Radiofrequency of catheter ablation numbers exceeded 5 000 in Beijing, and exceeded 5 000 in Zhejiang, Jiangsu, Guangdong and Shanghai. There was only one hospital that had annual catheter ablation cases above 3 000 (Fuwai hospital), accounted for 5.2% of the total cases. Thirty hospitals reported more than 500 cases of catheter ablation (4.1%), accounted for 38.8% of the total ablation cases.

Analyses of nationwide registration information indicated that, from 1998 to 2007, the AF ablation cases elevated progressively, from 11 cases in 1998 to 2 620 cases in 2007 (Figure 7). The major operative modes of AF were

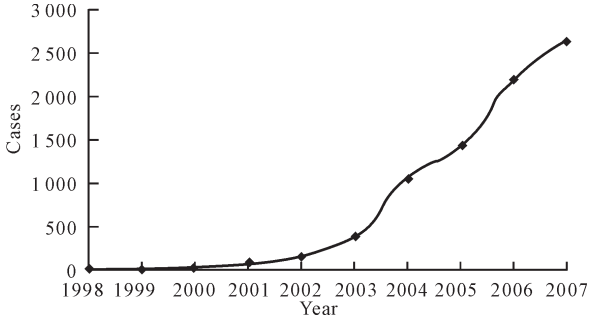

Figure 7. Registration numbers of RFCA of AF in China (1998–2007).

circumferential pulmonary vein ablation or segmental pulmonary vein ablation. The total success rate was 77.1%, recurrent rate was 22.9%, and incidence of complication was 5.3%.[13] The register study of catheter ablation of AF in China which started from 2008 indicated that,[14] by Oct. 5, 2010, there had been 2 808 cases from 54 hospitals, and 1 946 out of which were male, age (57.4±11.4) years old. Among all the cases, 71.5% of them were paroxysmal AF, 22.8% persistent AF, 5.7% permanent AF. During the 1–18 (9.6±3.8) months of follow up, total success rate was 82.1%, and the complication rate was 1.7%, the incidence of severe complications such as cardiac tamponade and pulmonary vein stenosis was 0.74%, no atrial-esophageal fistula was reported.

Atrial fibrillation

The prevalence of AF in the population above 30 years old in China was 0.77%, according to the 1990 population age structure of China, the age-adjusted incidence was 0.61%, and the prevalence was higher in male gender than female gender (0.9% vs. 0.7%). The proportion of valvular AF, NON-valvular AF and lone AF was 12.9%, 65.2% and 21.9%. The common type of stroke secondary to AF was ischemic stroke, and the incidence of stroke in patients with AF was significantly higher than that without AF (12.1% vs. 2.3%).[15] Another study indicated that,[16] among the population of age below 35 years old, the prevalence of AF in male was 0.74%, while in female was 0.72%, and among all the AF patients, first-diagnosed was 30.9%, paroxysmal AF was 33.0%, persistent AF was 7.2%, permanent AF was 28.9%. Research in 2004 in 10 different regions[17] (4 urban areas and 6 rural areas) indicated that the morbidity of atrial fibrillation in people aged between 35–59 was 0.42%, and in people aged above 60 was 1.83%,after adjustment of age and sex, the morbidity was 0.77%, 0.78% in male and 0.76% in female. 19% of male patients and 30.9% of female patients had cardiac valvular disorders. After adjustment of age and sex, the history of myocardial infarction, left ventricular hypertrophy, obesity and drink were the risk factors of atrial fibrillation.

The anti-coagulation study of non-valvular AF in China enrolled 988 cases that had risk of thromboembolism, patients were randomly divided into 3 groups: standard warfrin anticoagulation intensity group (INR 2.1–2.5), low warfrin anticoagulation intensity group (INR 1.6–2.0), asprin group (200 mg/d). During the follow up of 15 months, the annually incidence of thromboembolism in the three groups were 2.3%, 2.6%, 6.4% separately, and its incidence of embolism events was significantly lower in standard and low warfrin anticoagulation intensity groups than in asprin group (P=0.018, P=0.044). There was no statistic difference between standard and low warfrin anticoagulation intensity groups. The incidence of severe hemorrhage was 2.9%, 2.8% and 1.0% in 3 groups (P=0.101). Low warfrin anticoagulation (INR 1.6–2.0) was as effective as standard warfrin anticoagulation intensity group (INR 2.1–2.5).[16]

The Geriatric Medicine Specialized Committee of Chinese Medical Association draw up the first "Chinese professional proposal of diagnosis and treatment of geriatric atrial fibrillation", characterized the old patients' stroke risk evaluation, drug treatment of rate and rhythm control, and anti-coagulation treatment.[18]

The stroke prevention is crucial for atrial fibrillation patients, and the research of new anti-coagulation drugs indicated an important clinical development in the prevention of stroke in AF. New anticoagulation drugs include direct thrombin inhibitor dabigatran, and direct factor Xa inhibitor rivaroxaban and apixban. These new anticoagulation drugs facilitated long term therapy because they need no survey of the coagulation function.

RE-LY study indicated that oral intake of small dose of dabigatran (110 mg bid) had the same thromboembolism event prevention efficiency as warfarin, but the incidence of massive hemorrhage decreased; and large dose of dabigatran (150 mg bid) can further decrease the stroke and systematic thrombembolism events compared with warfarin ,while had the same incidence of massive hemorrhage. This study enrolled 569 patients in 11 Chinese medical centers, which help to develop clinical application of dabigatran in China.[19]

ROCKET-AF study demonstrated that direct factor Xa inhibitor rivaroxaban (20 mg qd) was no inferior to or even better than warfarin in thromboembolism event prevention in non valvular AF patients, and it claimed superior drug-safety. ROCKET-AF study included 496 patients in 37 medical centers in China.[20] ARISTOLE study enrolled 18 201 AF patients with high stroke risk, the double-blinded, double simulated, randomized controlled trail demonstrated that compared with dose-adjusted warfarin, apixban was even more effective in decreasing stroke and circulatory embolism events, and in decreasing hemorrhage events and all-cause mortality.[21] The new anti-coagulation drugs proved effective and safe choices for the prevention of thrombembolism complications in AF patients.

Sudden cardiac death (SCD)

During a follow up of 678 718 patients from July 2005 to June 2006, there were 2 983 cases of death, 284 of which was SCD (9.5%), the incidence was higher in men than in women (44.6/100 000 and 39.0/100 000). It has a relatively higher incidence of SCD in the population of age above 25 years old, 61.7/100 000 in men and 53.3/100 000 in women. It is estimated that there are 544 000 cases of SCD in China annually.[22-24]

The follow-up study in 497 patients from 31 hospitals with class I recommendation of ICD implantation between Jan. 2005 and Dec. 2006 indicated that the incidence of sudden cardiac death was 5%, 7%, and 8% at 3, 6, and 12 months of follow-up.[25] The study of sudden cardiac death included 470 000 people in Haidian district and Xicheng district in Beijing between Oct. 2008 and Sep. 2009 (male 244 000, and female 236 000), there were 184 cases of sudden cardiac death monitored (male 86, female 98). The incidence of sudden cardiac death was 35.2/100 000 (95% *CI* (27.8–42.7)/100 000) in male and 41.6/100 000 (95% *CI* (33.4–49.8)/100 000) in female in this study. The ratio of sudden cardiac death in total mortality was 13.4% in male and 15.2% in female. Sudden cardiac death cases were observed in 171 people with age older than 55 years, accounted for 91%. This study indicated that in Beijing people above the age of 55, the incidence of sudden cardiac death increased significantly with age.

Other arrhythmia

A retrospective investigation which enrolled the hospitalized patients in cardiological department in 22 provincial hospitals demonstrated that 26.8% of all the patients had cardiac arrhythmia. Among all of the patients, AF is the most common arrhythmia (35.0%), followed by paroxysmal superventricular tachycardia (28.0%), sick sinus syndrome (11.9%) and ventricular premature contraction (11.6%).[26] The investigation that enrolled 16 681 patients with chronic systolic heart failure in Hubei area indicated that the incidence of atrial premature contraction, atrial tachycardia and AF was 35.39%, 23.57%, 40.81%, respectively. The incidence of atrial tachycardia and AF increased with age and the decrease of LVEF.[27]

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Report on Cardiovascular Diseases in China 2012

Pulmonary hypertension

Li Wen, Yang Tao, Jing Xiaoli, He Jianguo, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China

Pulmonary hypertension (PH) is a clinically pathophysiological syndrome, which is characterized by elevated pulmonary arterial pressure, caused by pulmonary vascular functional change and (or) structure remolding, and will ultimately result in right heart failure and even death.[1,2]

Screening study of pulmonary hypertension in patients with congenital heart disease

Between May 2007 and December 2008, a total of 692 CHD patients admitted into Fuwai Hospital were prospectively enrolled. Doppler echocardiography was employed to measure the level of pulmonary artery systolic pressure (PASP). PAH occurred when there was an increase in PASP >40 mmHg (1 mmHg=0.133 kPa) at rest. Results[3] showed that 187 (27.0%) patients suffered from atrial septal defect, 456 (65.9%) patients suffered from ventricular septal defect and 49 (7.1%) patients had patent ductus arteriosus (Table 1). The numbers of patients with PAH-CHD and Eisenmenger syndrome were 329 (47.5%) and 105 (15.2%) respectively. Among the PAH-CHD patients, 31.9% of them had Eisenmenger syndrome. The patients with large shunts were at an elevated risk of PAH. Logistic regression analysis showed that advanced age was an independent risk factor of PAH (*OR*=1.04, *P* <0.001). Compared with atrial septal defect, ventricular septal defect and patent ductus arteriosus increased the risks of PAH (*OR*=2.78, *P* <0.001 and *OR*=2.50, *P* <0.001 respectively, Table 2).

Clinical features of PAH

We collected the demographic, clinical and hemodynamic features of 551 WHO-I and WHO-Ⅳ PH patients (Figuer 1; Table 3),[4,5] who enrolled in the Research for Improving diagnostic level of PAH from 31 level-three hospitals all over China between May 2007 and October 2008, which was supported by China's 11th five-year plan of science and technology.

Table 1. Characteristics of CHD patients

Items	Total (*n*=692)	Without PAH (*n*=363)	With PAH (*n*=329)	*P* values*
Age† (years)	5 (1–18)	6 (3–19)	2 (1–17.5)	0.027
Male/female	319/373	168/195	151/178	0.939
BMI (kg/m^2)	17±4	18±4	16±4	<0.001
SBP (mmHg)	100±15	102±13	97±16	<0.001
DBP (mmHg)	61±13	63±12	60±14	<0.001
Inner diameter of defect (mm)				
ASD	22.0±8.4	20.7±7.2	24.9±9.9	0.005
VSD	9.3±4.8	6.2±2.3	11.9±4.8	<0.001
PDA	6.2±3.2	4.5±1.4	8.2±3.5	<0.001
Pulmonary arterial systolic pressure (mmHg)	44±24	26±9	64±18	<0.001

*Represent the comparison between patients without and with PAH; †Median age (Quartile); 1 mmHg=0.133 kPa.

Prognosis of idiopathic pulmonary arterial hypertension (IPAH)

The study enrolled 90 newly diagnosed adult (age ≥18 years) IPAH patients, who were followed up at Fuwai Hospital Pulmonary Vascular Disease Center between March 2006 and November 2009, with an average follow-up of 16 months. Results showed that the one-year, two-year and three-year survival rates for IPAH patients with sildenafil therapy were 84.1%, 73.7% and 70.6% respectively. While the one-year, two-year and three-year survival rates for IPAH patients, who received conventional therapy, were 67.7%, 55.9% and 47.0%. In conclusion, sildenafil therapy was found to be associated with improved survival in patients with IPAH.[6] Results of different studies were shown in Table 4, and factors, which influence the prognosis of IPAH, could be found in Table 5.

The prognosis of CHD patients with Eisenmenger syndrome.

The study included 121 CHD patients, who were diagnosed with Eisenmenger syndrome for the first time between

Table 2. Independent factor of CHD patients with PAH

Items	*OR*	95% *CI*	*P* values
Age (per year increase)	1.04	1.02–1.06	<0.001
BMI (per 1 kg/m^2 increase)	0.90	0.85–0.96	0.001
SBP (per 1 mmHg increase)	0.97	0.96–0.99	<0.001
DBP (per 1 mmHg increase)	1.00	0.99–1.02	0.773
Shunt type			
VSD/ASD	2.78	1.77–4.38	<0.001
PDA/ASD	2.50	1.26–4.95	<0.001

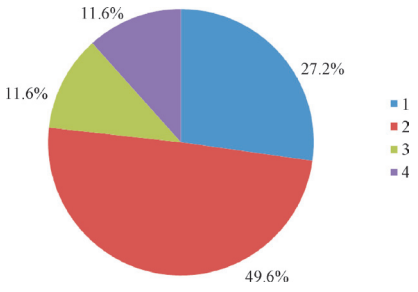

Figure 1. The proportion of different types of PAH. 1: IPAH; 2: PAH-CHD; 3: PAH associated with connective tissue disease; 4: CTEPH.

National Center for Cardiovascular Diseases, Fuwai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100037, China

Table 3. Demographic, clinical and hemodynamic features of 551 PH patients according to different PH types

Characteristics	ALL	IPAH	CHD-PAH	CTD-PAH	CTEPH
Cases (*n*)	551	150	273	64	64
Age (years)	35±12	36±13	30±10	42±11	50±11
Gender (*n*)					
Female	386	100	194	61	31
Male	165	50	79	3	33
BMI (kg/m^2)	20.8±3.5	21.3±3.5	19.6±3.1	21.4±3.2	24.0±3.2
BMI ≥30 (%)	1.63	2.03	1.10	1.59	3.13
6MWD (m)	352±91	337±101	374±73	313±104	333±97
Borg dyspnea score	3.0 (2.0, 4.0)	3.0 (2.0, 4.0)	2.0 (2.0, 3.0)	3.0 (2.0, 5.0)	3.0 (2.0, 5.0)
WHO-FC (*n* (%))					
I/II	327 (59)	70 (47)	191 (70)	34 (53)	32 (50)
III/IV	224 (41)	79 (53)	82 (30)	30 (47)	32 (50)
Haemodynamic indicators					
RAP (mmHg)	9±6	10±6	9±6	11±6.	10±7
mPAP (mmHg)	67±20	61±16	77±19	52±12	53±13
CI (L·min^{-1}·m^{-2})	2.7±1.2	2.3±0.8	3.0±1.3	2.2±0.8	2.3±0.9
PVR dyn·sec·cm^{-5}	1496±783	1484±699	1594±869	1322±585	1243±644
SvO_2 (%)	65.9±9.1	64.8±9.2	67.7±8.2	63.2±12.4	63.0±8.1

ALL: 551 patients with pulmonary hypertension; IPAH: idiopathic pulmonary arterial hypertension; CHD-PAH: pulmonary arterial hypertension associated with congenital heart disease; CTD-PAH: pulmonary arterial hypertension associated with connective tissue disease; CTEPH: chronic thromboembolic pulmonary hypertension; BMI: body mass index; 6MWD: 6-minute walk distance; WHO-FC: WHO pulmonary hypertension function classification; Borg score: Borg dyspnea index; mRAP: mean right atrial pressure; mPAP: mean pulmonary arterial pressure; CI: cardiac index; PVR: pulmonary vascular resistance; SvO_2: mixed venous oxygen saturation.

Table 4. Prognosis of IPAH in different studies (%)

Follow up (years)	Fuwai Hospital after 2006 (90 patients)	Fuwai Hospital before 2006[7] (72 patients)	NIH 1980s[8] (162 patients)	5 centers (Shanghai etc.) after 2006[9] (173 patients)	French 2006[10] (264 patients)
1	84.1	68	68	92.1	85.7
2	73.7	56.9	–	–	69.6
3	70.6	38.9	48	75	54.9

Table 5. Predictor for prognosis of IPAH patients

Variables	*HR*	95% *CI*	*P* values
Age (per 10-year increase)	0.51	0.28–0.95	0.033
Weight (per 5-kg increase)	0.75	0.58–0.99	0.039
Pericardial effusion	4.20	1.53–11.52	0.005
Without PAH targeted drug therapy	7.82	2.75–22.26	<0.001

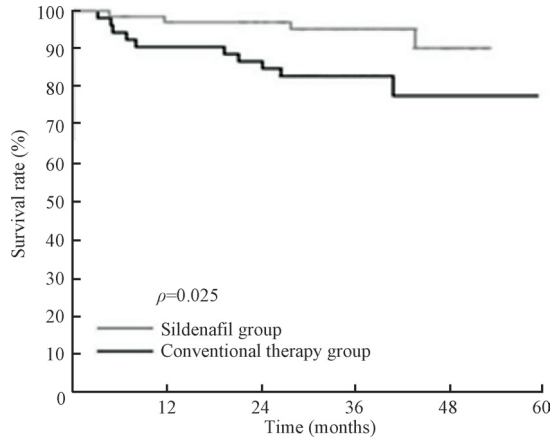

Figure 2. Survival rates of two CHD-Eisenmenger patients groups.

January 2005 and December 2009. The patients enrolled were divided into Sildenafil group and conventional therapy group. Their survival rates were shown in Figure 2 and prognostic predictors were presented in Table 6.

Long-term survival rates for CTEPH patients

A retrospective cohort study was conducted in 504 patients with CTEPH, who were treated surgically (*n*=360), or non-surgically (*n*=144) in Anzhen Hospital from February 1989 to August 2007 were collected. The patients in surgical group received a standard pulmonary thromboendarterectomy (PTE), while those in non-surgical group were given thrombolytic therapy. The in-hospital mortality for the surgical group and non-surgical group are 4.44% and 3.50%, respectively. The PTE procedure has statistically superiority over thrombolytic therapy for the proximal type of CTEPH in terms of actuarial survival (*P*=0.0004); however, for the distal type of CTEPH, the PTE procedure provides no benefits with regard to actuarial survival (P=0.874)[11]. The actuarial survival rates of CTEPH patients could be found in Table 7, and the actuarial survival rates of CTEPH patients after a standard pulmonary thromboendarterectomy in China and overseas were shown in Table 8.

Table 6. Prognostic predictors of CHD-Eisenmenger patients

Parameters	HR (95% *CI*)	*P* values
Mean pulmonary arterial pressure	1.35 (1.13, 1.61)	0.001
WHO-FC ≥III	5.20 (1.46, 18.55)	0.001
Receive Sildenafil therapy	0.55 (0.34, 0.87)	0.001

Long-term survival rates for PAH patients after lung transplantation

A total of 244 lung transplantations were performed at 20 institutes in China between January 1978 and December 2010. One hundred of 244 lung transplantations were performed at the Wuxi People's Hospital, consisting of single-lung transplantations (*n*=72) and bilateral

Table 7. The actuarial survival rates of CTEPH patients (%)

Groups	Proximal type		Distal type		*P* values
	10 years survival	15 years survival	10 years survival	15 years survival	
Surgical group	94.60±2.38	90.96±4.24	71.78±4.66	29.57±15.10	<0.0001
Non-surgical group	81.40±7.14	56.43±14.70	69.84±7.78	32.59±13.70	0.5

Table 8. The actuarial survival rates of CTEPH patients after a standard pulmonary thromboendarterectomy in China and overseas

Items	Country	Center	Period	Cases	Mortality in hospital (%)	Long-term survival rates(Proximal type)
Beijing Anzhen Hospital	China	Beijing Anzhen Hospital	1989–2007	360	4.40	94.60% (10 years), 90.96 % (15 years)
Thistlethwai et al[12]	America	UCSD Medical Center	1997–2007	988	4	96% (1 years), 88% (5 years)
Condliffe et al[13]	UK	Papworth Hospital	2001–2006	236	16	98%–99% (1 year), 93%–94% (3 years)
Keiichi et al[14]	Japan	Chiba University	1990–2010	77	9	84% (5 years), 82% (10 years)

Table 9. Survival rates for patients after lung transplantation in China and overseas

Period	Institute	Cases	1 year survival (%)	3 years survival (%)	5 years survival (%)
1978.1–2012.12	20 institutes in China	244	50	30	20
2002.6–2012.12	Wuxi center	100	73.30	53.50	40.70
2000.1–2009.6	ISHLT[16] (158 institutes)	19 524	79	63	52

lung transplantations (*n*=28). Patients who received transplantation included IPAH, CHD-PAH and PAH associated with chronic lung disease. Survival rates for patients were showed in Table 9.[15]

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Report on Cardiovascular Diseases in China 2012

Heart failure

Zhang Jian, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China.

Incidence

One survey[1] was performed in 20 urban and rural areas in 10 provinces and cities. The provinces and cities included: Jiangsu, Hubei, Fujian, Guangxi, Sichuan in the south, and Beijing, Jilin, Shanxi, Qinghai, Shandong in the north. The survey involved 15 518 people, and the proportion of male and female, urban and rural population were similar. The survey showed there were 4 million heart failure patients in the 35–74 year-old in China, the incidence of chronic heart failure was 0.9%, and the incidence was 0.7% and 1.0% in male and female respectively (Tables 1 and 2).

Basic information of heart failure patients

Chinese scholars analyzed the basic situation of elderly patients with chronic heart failure in the last 30 year. Another study made a retrospective investigation of hospitalized patients with heart failure in 42 hospitals around China in 1980, 1990 and 2000. 10 714 heart failure patients were involved, and found that the duration of hospitalization reduced year by year, the cardiac function in most patients was New York Heart Association classification (NYHA) III when they were on admission. The results were shown in Table 3.

The etiology and treatment of heart failure

In recent years, Chinese scholars have done a lot of researches on the analysis of the cause, treatment and the trend change of heart failure. There are representative meanings in the following four large-scale epidemiological investigations. It is shown in Table 4 that the main cause of heart failure has turned to coronary heart disease, instead of rheumatic valvular heart disease. However, the leading cause of heart failure in Qinghai Province was plateau heart disease (53.2%). The medication of heart failure is shown in Table 5. In addition, a recent retrospective survey,[4] analyzed hospitalized chronic systolic heart failure patients in 12 hospitals in Hubei province since Jan 1st 2000 to May 31st, and described the basic characteristics of 16 681 heart failure patients in the province (Table 6). Analysis of different causes in different gender patients among all groups showed that the incidence of dilated cardiomyopathy reduced gradually with the age increasing, but it was higher in male patients than female patients; the incidence of coronary heart disease and hypertensive heart disease increased gradually with the age increasing; the incidence of rheumatic heart disease reduced gradually with the age increasing, but it was higher in female patients than male patients. The results were shown in Table 7. Scholars in Beijing 301 hospital analyzed the causes of 6949 patients hospitalized for chronic heart failure (CHF) from 1993 to 2008,[5] the top four were coronary heart disease (45.0%), hypertension (38.7%), valvular heart disease (27.5%), and diabetes (18.3%, Figure 1). More detailed analysis showed that the most common cause of CHF was valvular heart disease (34.3%) for CHF with a single disease; the top three causes of CHF were coronary heart disease (87.9%), hypertension (78.4%), and diabetes (66.3%) for patients with at least 5 kinds of disease.

Table 1. The incidence of heart failure in adults (35–74 years old) in different age and gender (%)

Age (range)	Sample size	Male†	Female†	Total†
35–44	6 065	0.3	0.5	0.4
45–54	4 255	0.6	1.3*	1.0
55–64	3 375	1.3	1.4	1.3
65–74	1 823	1.1	1.5	1.3
Total	15 518	0.7	1.0*	0.9

* male compared to female with heart failure incidence rate, $U = 2.03$, $P < 0.05$; †the incidence rate in different age groups $\chi^2 = 28.37$, $P < 0.01$

Table 2. The incidence of heart failure in adults (35–74 years old) in the north and south, the city and countryside (%)

Regional groups	Sample size	Male	Female	Total
North	7 654	1.3	1.5	1.4*
South	7 864	0.3	0.7	0.5
City	7 822	1.0	1.2	1.1
Countryside	7 636	0.6	1.0	0.8†
Total	15 518	0.7	1.0†	0.9

*The north compared to the south with heart failure incidence rate, $U = 5.08$, $P < 0.01$; †the city compared to the countryside with heart failure incidence rate, $U = 1.92$, $P < 0.054$.

Mortality of hospitalized patients

Researchers in Beijing 301 Hospital have done the retrospective analysis[5] of hospitalized CHF patients during 15 years in their hospital. The result showed that the mortality of hospitalized CHF patients was 5.4%. The in-hospital mortality rate of female patients aged between 18 and 39 years old, and over 80 years old was almost two times than male patients (3.2% vs 1.8%, $P = 0.148$ 16.1% vs 11.4%, $P = 0.086$, respectively). With the increase of age and combined disease, the in-hospital mortality rates raised both in male and female patients (Figures 2, 3).

Study of elderly patients with chronic heart failure

From January 2001 to January 2002, 1 074 patients

National Center for Cardiovascular Diseases, Fuwai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100037, China

Table 3. Basic information of heart failure patients

Research Name	Year	Sample size	Age (year)	Hospital stay(day)	Average duration (month)	NYHA Cardiac Function (%)		
						I+II	III	IV
Elderly heart failure[2]	1973–1982	218	67.06 ± 5.45	23	96	6.4	22	71.6
	1983–1992	509	68.81 ± 6.36	22	60	11.4	37.5	51.1
	1993–2002	1 929	71.39 ± 6.92	12	60	10.4	39.4	50.2
42 Hospitals[3]	1980	1 756	63.1 ± 16.1	35.1	128.9	24.5	42.5	32.4
	1990	2 181	to	31.6	88.1	26.7	–	28.8
	2000	6 777	67.8 ± 16.5	21.8	46.6	27.7	43.7	27.5

NYHA: New York Heart Association classification.

Table 4. Main causes for heart failure patients in China

Places	Year	Sample size	The Causes of heart failure (%)					
			Hypertension	Ischemic HD	Valvular HD	Pulmonary HD	Idiopathic DCM	Congenital HD
Hong Kong[6]	1995	730	37	31	15	27	4.0	–
	1980	2 178	8.5	31.1	46.8	–	6.0	–
Shanghai[7]	1990	2 178	10.3	40.6	24.2	–	6.9	–
	2000		13.9	55.7	8.9	–	7.5	–
42 Hospitals[3]	1980	1 756	8	36.8	35.5	–	6.4	3.5
	1990	2 181	10.4	33.8	37.0	–	7.4	3.1
Primary Hospitals[8]	2000	6 777	12.9	45.6	21.0	–	7.6	3.2
	2004	2 100	30.4	57.1	29.6	26.0	–	–

Table 5. Medication in patients with heart failure

Places	Year	Sample size	Medicine used in treatment (%)							
			Nitrates	Diuretics	Digoxin	ARB	ACEI	Spironolactone	BB	CCB
Tianjin[9]	1973–1982	542	30.3	58.7	61.3	–	–	5.9	9.0	14.8
	1983–1992	1 253	70.6	67.8	71.6	–	24.2	10.1	8.3	35.2
	1993–2002	3 394	91.4	75.4	67.9	4.0	70.9	23.1	25.3	21.6
42 Hospitals[3]	1980	1 756	44.7	63.7	51.7	0.4	14.0	10.0	8.5	6.1
	1990	2 181	36.0	70.2	45.5	1.4	26.4	8.4	9.5	16.4
	2000	6 777	53.0	48.6	40.3	4.5	40.4	20.0	19.0	10.5
Shanghai[6]	1980	2 178	74.4	77.1	60.0	–	0.6	–	6.8	–
	1990	–	–	–	–	–	38.9	–	5.7	41.3
Primary hospitals[10]	2000	–	–	–	–	11.5	70.8	–	25.0	14.2
	2006	2 100	–	90.0	60.0		5.8	50.0	40.0	–

BB: β-blockers; ARB: aldosterone receptor antagonist; ACEI:Angiotensin converting enzyme inhibitor; CCB: calcium antagonists.

Table 6. Basic characteristics of 16 681 heart failure patients in Hubei province

Variables	Total (*n*=16 681)	Survival group (*n*=10 228)	Death group (*n*=6 453)	*P* values
Female (*n*/%)	6 794/40.73	4 668/45.64	2 126/39.01	<0.001
Age (years)	63.42 ± 11.16	61.75 ± 11.75	65.37 ± 13.90	<0.001
Heart rate (bpm)	85.31 ± 20.14	83.57 ± 22.60	87.49 ± 23.11	<0.001
NYHA III–IV (*n*/%)	12 668/75.94	7 236/70.75	5 432/84.18	<0.001
Diabetes (*n*/%)	2 700/16.19	1 317/12.88	1 383/21.43	0.211
Hypertension (*n*/%)	7 939/47.59	4 888/47.79	3 051/47.28	0.545
Atrial fibrillation (*n*/%)	6 807/40.81	3 792/37.07	3 015/46.72	<0.001
LVEDD (mm)	53.64 ± 69.78	50.20 ± 11.72	58.01 ± 9.44	<0.001
LVEF (%)	37.96 ± 10.41	40.31 ± 7.02	30.82 ± 8.02	<0.001
ACEI (*n*/%)	8 607/51.60	4 618/48.08	3 689/57.17	<0.001
BB (*n*/%)	7 770/46.58	5 174/50.59	2 596/40.23	<0.001
ARB (*n*/%)	3 116/18.68	1 890/18.48	1 226/19.00	<0.001
Digoxin (*n*/%)	7 713/46.24	4 330/42.33	3 383/52.43	<0.001
Diuretics (*n*/%)	11 532/69.13	6 744/65.94	4 788/74.20	<0.001

LVEDD: left ventricular end-diastolic diameter; LVEF: left ventricular ejection fraction; ACEI: Angiotensin converting enzyme inhibitor; BB: β-blockers; ARB: aldosterone receptor antagonist.

Table 7. Cause analysis of 16 681 heart failure patients in Hubei province (*n* (%))

Age (year)	DCM		CHD		HT		RHD	
	Male	Female	Male	Female	Male	Female	Male	Female
<30	154/66.38	61/29.33	5/2.16	3/1.44	10/4.31	5/2.4	48/20.69	79/37.98
30–39	206/52.69	56/20.29	22/5.63	1/0.36	45/11.51	21/7.61	88/22.51	133/48.19
40–49	529/50.43	158/21.44	136/12.96	42/5.7	173/16.49	82/11.13	174/16.59	413/56.04
50–59	742/40.33	344/26.56	446/24.24	170/13.13	422/22.93	292/22.55	243/13.21	505/39.00
60–69	687/31.70	344/19.49	710/32.76	486/27.54	625/28.84	579/32.80	144/6.65	370/20.96
70–79	459/15.72	175/7.90	1482/50.75	1017/45.93	988/33.84	934/42.19	91/3.12	142/6.41
≥80	41/4.57	30/4.35	480/53.51	373/54.14	362/40.36	296/42.96	3/0.33	18/2.61

DCM: dilated cardiomyopathy; CHD: coronary heart disease; HT: hypertension; RHD: rheumatic heart disease.

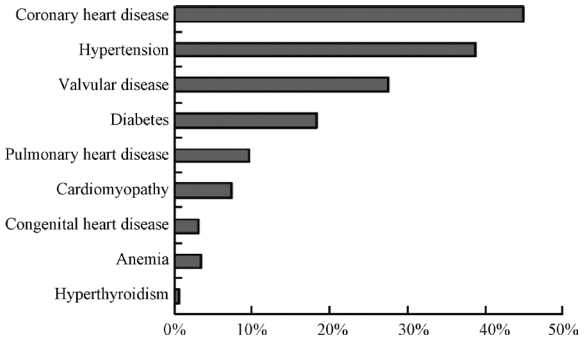

Figure 1. Etiology of hospitalized chronic heart failure patients in Beijing 301 Hospital.

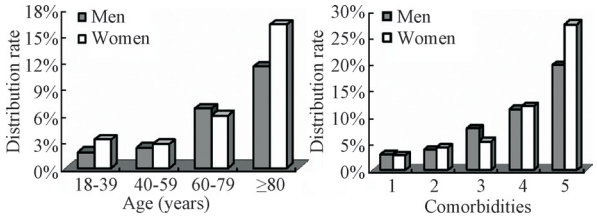

Figure 2. In-hospital mortality raised with the increase of age.
Figure 3. In-hospital mortality raised with the increase of combined disease.

Table 8. Situation of medication in hospital and discharge for elderly patients with chronic heart failure in Hong Kong

Drugs	Number of patients (*n*/%)			Number of patients (*n*/%)
Diuretics	785 (73.1)	Medication	PCI or CABG	83 (7.7)
ACEI	544 (50.7)			
Nitrates	509 (47.4)		Valvular surgery	13 (1.2)
Digoxin	267 (24.9)		Heart transplantation	1 (0.1)
CCB	158 (14.7)	Outcome	Dead	51 (4.7)
BB	105 (9.8)		Referral	476 (44.3)
Warfarin	70 (6.5)		Recover back home	547 (50.9)

CCB: calcium antagonists; BB: β-blockers; ACEI: angiotensin converting enzyme inhibitor; PCI: percutaneous coronary intervention; CABG: coronary artery bypass grafting .

aged over 60 were admitted in the university of Hong Kong, Queen Mary Hospital because of congestive heart failure.[11] The researchers analyzed the clinical features and medications of these elderly patients, the results were shown in Table 8. Researchers in mainland have analyzed the deaths of chronic heart failure in elderly patients for the recent 30 years (Table 9).[2]

Researchers made a retrospective investigation of hospitalized patients with heart failure in 42 hospitals around China in 1980, 1990, and 2000. [3] The study involved 10 714 heart failure patients, the average age was (63.1 ± 16.1) – (67.8 ± 16.5) years old, patients over 60 years old were more than 60%. The in-hospital recovery rate was increasing gradually, which was 15.5%, 19.6%, and 22.2%, respectively (P <0.001). The survival rate also raised gradually, which was 33.6 months 37.1 months, and 40.5 months, respectively. The mortality rate decreased obviously, which was 15.4%, 12.3%, and 6.2%, respectively (*P* <0.001), however, it was much higher than the cardiovascular fatality rate at the same period (8.2%, 5.6%, and 2.6%, respectively). There was no significant difference of the total cardiovascular mortality because of heart failure among the three decades, which was 39.9%, 37.7%, and 41.1%, respectively. The causes of heart failure death were pump failure (59%), arrhythmia (13%), and sudden death (13%); other causes account for about 14%.

Survey of treatment for chronic heart failure in China basic-level hospitals

In 2006, Chinese scholars performed an investigation in 2066 basic -level hospitals (Class 2 and below) in 17 regions (11 provinces, 3 autonomous regions, and 3 municipalities directly under the central government).[12] They summarized the treatment of CHF in basic-level hospitals, and found out some problems. For example, the use rate of digoxin over 0.25 mg per day was as high as 10%; the use of β-blocker was 40%, but only 1% reached the target dosage; the use of ACEI was 80%, but only 2% reached the target dosage.

Study of acute coronary syndrome (ACS) and acute heart failure (AHF)

The BRIG Study was about ACS complicating AHF patients in China which was completed in 2011.[13] The study analyzed 3 168 medical records of ACS patients with clear diagnosis in 65 hospitals in mainland China and Hong Kong special administrative region from March to June, 2006. In the study, 1 329 patients suffered ST-elevation myocardial infarction (STEMI), 348 suffered non ST-elevation myocardial infarction (NSTEMI), and 1491 suffered unstable angina. During hospitalization 706 (22.3%) patients suffered AHF, 262 (8.3%) patients no AHF happened, and 2 200 (69.4%) patients did not have heart failure.

The average age of 3 186 ACS patients was (65 ± 12) years old, of which 68.1% were male. Compared with ACS without HF, patients with HF were usually older, and were accompanied with stroke and atrial fibrillation. In HF patients, who suffered AHF during hospitalization were younger than those did not suffer AHF (67.8 ± 11.1 vs. 70.0 ± 9.3, *P* <0.01), and most patients were male (70.3% vs. 60.3%, *P* <0.01), had cigarette smoking recently (26.6% vs.

Table 9. Deaths of chronic heart failure in elderly patients for the recent 30 years in mainland

Year	Simple size	death (%)	Age (years)	The cause of death (%)					
				CAD	PHD	RHD	HTHD	CHD	Others
1973–1982	218	11.0	67.9 ± 6.1	25	45.8	8.3	4.2	4.2	12.5
1983–1992	509	16.9	69.3 ± 6.5	32.6	41.9	17.4	5.8	0.0	2.3
1993–2002	1 929	8.8	72.2 ± 7.2	46.7	36.1	12.4	1.2	1.2	1.8

CAD: coronary artery heart disease; PHD: pulmonary heart disease; RHD: rheumatic heart disease; HTHD: hypertensive heart disease; CHD: congenital heart disease.

20.2%, P <0.05), usually accompanied with STEMI (71.0% vs. 27.9%, P <0.01), and seldom had an ACS history (24.6% vs. 33.6%, P <0.01).

Compared to those without HF, ACS patients with HF had lower medication rate of β-blocker and statin (66.5% vs. 71.1%, P = 0.01, 67.4% vs. 72.2%, P <0.01 respectively), and they also had less PCI treatment (16.7% vs. 29.9%, P <0.01). For patients with AHF, the use of the above three kinds of treatment was not satisfying (which was 67.7%, 70.4%, and 17.4%, respectively).

Compared to those without HF, ACS patients with HF had longer hospitalization stay (12.5 vs. 9.9 days, P <0.01), higher mortality in hospital (8.4% vs. 0.8%, P <0.01) and higher incidence of composite end point events in hospital (24.0% vs. 8.3%, P <0.01). Patients with AHF, compared to the patients with HF but without AHF, had similar hospitalization stay (13.2 vs. 11.3 days P = 0.18), however, the former had much higher mortality and composite end point events in hospital (10.8% vs. 1.9%, P <0.01, and 30.3% vs. 6.9%, P <0.01, respectively).

Multivariate logistic regression analysis showed, after adjusting the potential factors (e.g. age, gender, hypertension, diabetes, NSTEMI, STEMI, medication during hospitalization) of ACS patients, AHF remained a strong and independent predictor of in-hospital mortality and incidence of the composite end point events for ACS patients (*OR* = 7.50, 95% *CI*: 4.32–13.02, and *OR* = 2.74, 95% *CI*: 2.15–3.48, respectively).

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Report on Cardiovascular Diseases in China 2012

Community-based prevention and control of cardiovascular diseases

Chen Weiwei, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China

The exploration and practice on community-based prevention and control of cardiovascular diseases in China have been carried out for over 40 years. We explored the way forward and achieved obvious results in this aspect. The key to prevent cardio-cerebrovascular diseases is to control hypertension. A project of standardized community-based management of hypertension in Hebei province was successful, in which blood pressure (BP) level decreased and control rate of high blood pressure (HBP) increased significantly by standardized management of HBP.

General introduction of community-based prevention and control of cardiovascular diseases

The exploration and practice on Community-Based Prevention and Control of Cardiovascular Diseases (CPCCVD) in China have been carried out for over 40 years, which is a community-based comprehensive intervention on CVD and begins with the prevention and control of HBP (HPC). The first base for CPCCVD was established in the Capital Iron and Steel Company by Fuwai Hospital in 1969 and was nominated as "Capital Iron and Steel Company Paradigm" by WHO for it's typical function on the prevention and control of CVD. Since 1970s, a series of administrative regional community bases were established for the comprehensive prevention and control of HBP and CVD throughout the country. From 1997, pilot sites of comprehensive prevention and control of non-communicable chronic disease (NCD) were established in 24 provinces, autonomous regions and metropolises such as Beijing, Tianjin, Shanghai and Zhejiang province. Ministry of health launched on the establishment of demonstration sites to prevent and control chronic non-communicable diseases nationally from 2010 and 39 sites were established by 2011. We explored the way forward and achieved obvious results in CPCCVD. In the new national policy on medicine reform launched in 2009, community-based prevention and control on HBP and diabetes mellitus were included in the fundamental public health services for the first time. The prevention and control of CVD is really held at the national population level.

During the four decades, CPCCVD in China developed into a comprehensive intervention and management strategy on hundreds of thousands of people from a much smaller size of hundreds of people. At first, only HBP patients were intervened. Now the whole community population, including normal, high-risk and sick persons and multiple NCD such as dyslipidemia, diabetes mellitus, coronary heart disease and stroke are managed comprehensively. The practice changed from the attention to the incidence, death and risk factor monitoring of CVD to emphasizing the increase of awareness, treatment and control rate in population, also from specialist-based scientific research and project to the government-based multi-sectoral collaborative prevention and control. CPCCVD in our country has been developing into standardization, scalization and informatization step by step.

Introduction of a CPCCVD case-standardized community-based management of hypertension in Hebei province

Hypertension is the most common chronic disease of Chinese people and the most important risk factor of cardio-cerebrovascular diseases. The key to prevent cardio-cerebrovascular diseases is to control hypertension. The rates of awareness, treatment and control of hypertension were 32.7%, 27.5% and 11.6%, respectively in Chinese people of 15–69 years old in 2007,[1] which were still low although improved than the indices (30.2%, 24.7%, and 6.1%[2]) acquired from people of over 18 years old in 2002. To improve control of hypertension, national standardized community-based management of hypertension program was launched in many areas of Hebei province one after another. The purpose was to carry out standard treatment and management of hypertensive patients persistently, to decrease the risk of morbidity and mortality of stroke and coronary heart diseases, to promote community-based HPC, to improve community residents' knowledge of prevention and control of hypertension, to control hypertension effectively, and to popularize the standardized community-based treatment skill of hypertension.[3]

Primary hypertensive patients who were willing to and capable of cooperate with the doctors were included in the standardized management program. The program covered 63 counties and 206 communities of eight districts including Shijiazhuang, Baoding, Cangzhou, Tangshan, Zhangjiakou, Handan, Hengshui and North China oil field. Over 1100 primary care physicians (PCP) participated standardized management program and over 7000 PCP were directed and trained. 41 800 patients were managed and 27 522 had electronic medical records (EMR) established.

National Center for Cardiovascular Diseases, Fuwai Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100037, China

Key points of project implementation

(1) An operating mode for HPC led by healthy administrative departments, organized by CDC, cooperated by clinical experts, and performed at basic health agency was established. The specific form was that healthy administrative departments formulated and issued plans, assignments and targets of HPC to the administrative areas. CDC was responsible for the organization and implementation including designing implementation plan, organizing personnel training, checking quality, and assessing and evaluating the work. Clinical experts were responsible for the technical guidance and training, in accordance to the superior requirements. Basic healthcare workers took part in the training courses, improved HBP diagnosis and treatment ability continually, and implemented the screening and managing of HBP patients.

(2) Conduct PCP training. Based on "Chinese guidelines for the management of hypertension" and "community manual for the management of hypertension", the main training contents included community-based health education, diagnosis, screening, layer-management, pharmacological and non-pharmacological treatment, referral of HBP, as well as the requirement of the project. The PCP were trained via concentrated classes and site instruction to improve their ability of performing the project and comprehensive management of HBP patients. In the several years of project implementation, frequent training courses were performed and PCP were trained for more than 7 000 person-times.

(3) Carry out campaign on HBP health education. Organize community residents to carry out various campaign to promote HPC knowledge on "China Hypertension Day ", " World Hypertension Day" and "World No-Tobacco Day", et al. The purpose is to increase residents' awareness of HBP, to modify unhealthy life styles, to improve adherence to standardized treatment and to increase control rate of HBP.

(4) Carry out standardized follow-up management. PCP register, create documents and perform follow-up management to the screened HBP patients in their areas. Follow-up frequency: Layer-management was performed according to the patients' classification of risk, once every three months to low risk patients, once every two months to moderate risk patients and monthly to high and very high risk patients. Contents of follow-up include monitoring BP and individualizing intervention and direction, modifying therapeutic measures including individualizing drug therapy, changing unhealthy lifestyle according to BP level and cardiovascular risk. Follow-up ways include clinics, telephones and door to door Interview.

Efficiency of the project

Baseline information of the enrolled patients: 27 522 EMR were analyzed, average age was (58.1 ± 10.9) years old, 10.6% of patients were below 45 years old, 39.4% were from 45 to 59 years old, and 50.0% were 60 years or older. Risk stratification was as follows: 4.5% of patients were at low risk, 42.5% were at moderate risk and 53.0% were at high and very high risk. Patients who have completed 3, 6, 9, and 12 months follow-up were 60.5%, 57.1%, 51.7% and 38.8%, respectively. 51.2% of patients were male and 48.8% were female.

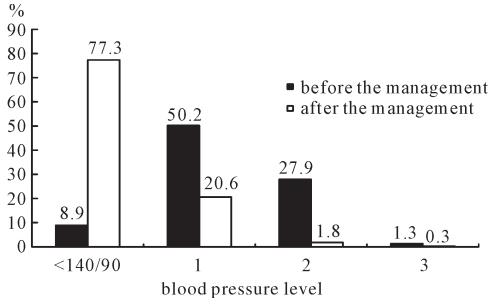

Figure 1. Change of blood pressure of the patients before and after the management

Changes of BP before and after the management were as follows. Compared with basic level, systolic blood pressure (SBP) ((146.9 ± 18.3) vs. (132.1 ± 9.3) mmHg (P <0.01)) and diastolic blood pressure (DBP) ((90.4 ± 11.5) vs. (82.1 ± 7.5) mmHg (P <0.01)) reduced significantly, control rate (8.9% vs. 77.3% (P <0.01)) of HBP increased significantly after management. Percentage of 1, 2, and 3 grade HBP decreased from 50.2%, 27.9% and 1.3% to 20.6%, 1.8% and 0.3%, respectively (Figure 1).

Conclusion

Blood pressure level decreased and control rate of HBP increased significantly after community-based standardized management of HBP. What's more, with reference to the mode and experience of this project, national basic public health services projects—HBP and diabetes mellitus management were extended successfully in Hebei province.

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Report on Cardiovascular Diseases in China 2012

Medical expenditure of cardiovascular diseases

Liu Kejun, on behalf of the Writing Committee of Annual Report on Cardiovascular Disease in China.

Since 1980, the number of diabetes and cardiovascular diseases (CVD) & cerebrovascular disease (CBVD) inpatients discharged has increased. Especially after 2000, the number of patients began to accelerate upwards. Accordingly, the expenditure of inpatients for CVD&CBVD in Chinese hospital was also rapidly increasing whose annual average growth rate was far higher than the annual average growth rate of gross domestic product (GDP). This growth came mainly from the inpatient service demand growth, as well as the irrational drug use for long-term high.

Status of Inpatient service utilization for CVD& CBVD patients in China

Total number of CVD& CBVD inpatients discharged and the trend in China

In 2011, the number of CVD & CBVD inpatients discharged was 12.896 0 million, accounting for 12.03% of all inpatients discharged in China (including all inpatient categories); amongst which 6.709 3 million were CVD patients and 6.186 7 million were CBVD patients, taking up respectively 6.26% and 5.77% of all inpatients discharged.

In 2011, CVD & CBVD inpatients discharged mainly fell into two categories, namely, ischemic heart diseases (4.462 7 million, including 0.297 0 million of acute myocardial infarction) and ischemic stroke (3.726 2 million), occupying respectively 34.61% and 28.89%; other diseases were hypertension, 2.016 3million (including 154.1 thousand cases of hypertensive heart disease and renal disease), hemorrhagic stroke, 1.199 5 million and rheumatic heart disease, 0.230 3 million. In addition, the number of inpatients discharged with diabetes mellitus (DM) was 2.127 4 million.

From 1980 to 2011, the annual average growth rate in the number of CVD & CBVD patients discharged was 9.39%, faster than that of all inpatients discharged (including all inpatient categories, 6.03%) during the same period. Among the diseases, the arrangement of average annual growth rate about each disease to cardiovascular disease were respectively ischemic stroke (12.28%), ischemic heart disease (11.56%), hemorrhagic stroke (10.46%), acute myocardial infarction (8.93%), hypertension (8.09%), hypertensive heart disease and renal disease (5.15%), while the number of discharged inpatients with rheumatic heart disease (1.30%) had not changed greatly. In addition, the annual growth rate of the patients discharged with diabetes

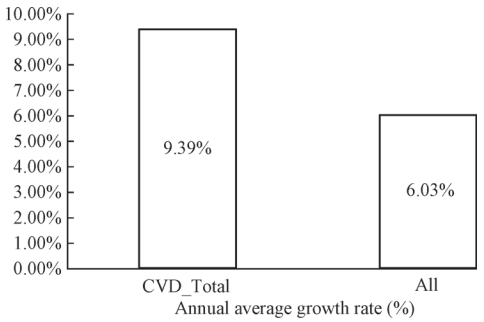

Figure 2. Annual average growth rate of CVD inpatients discharged (1980–2011).

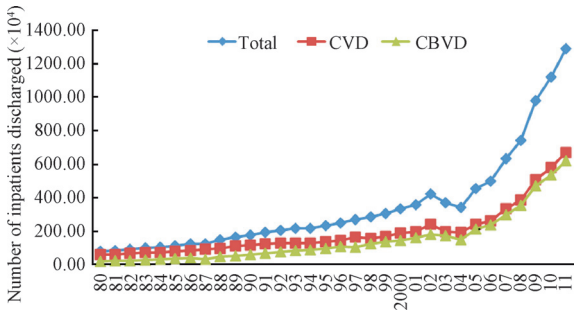

Figure 1. Trend of changes in the numbers of CVD&CBVD inpatients discharged (1980 – 2011). CVD includes ischemic heart diseases (angina pectoris, acute myocardial infarction and other ischemic heart diseases), chronic rheumatic heart disease, pulmonary heart disease, hypertension (including hypertensive heart disease and renal disease) and CBVD (hemorrhagic stroke and ischemic stroke), amongst which ischemic heart disease was named as coronary heart disease before 2002 in China Health Statistics Yearbook.

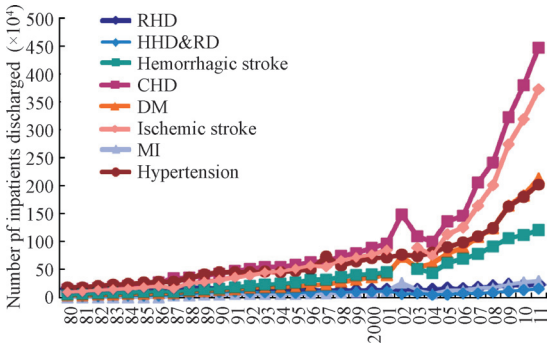

Figure 3. Inpatients with major types of heart diseases and DM discharged from Chinese hospitals, numbers and trends (1980–2011).

Department of Drug Policy, China, National Health Development Research Center, Beijing 100083, China

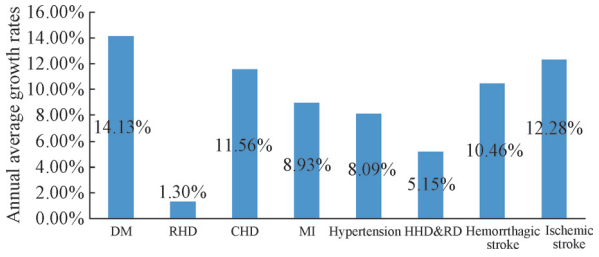

Figure 4. Annual average growth rates of numbers of CVD and diabetes inpatients discharged from hospitals (1980–2011).

was 14.13% (Figures 1–4).[1]

Expenditure of inpatients for CVD&CBVD in Chinese hospitals

In 2011, it had shown from the expenditure of inpatients for CVD&CBVD, the hospitalized cost of acute myocardial infarction was totally RMB 4.987 billion, the cost of hemorrhagic stroke was RMB 14.156 bilion, the cost of ischemic stroke was RMB 27.296 billion. Deducting the influence of price factor, from 2004 the annual average growth rates were respectively 29.62%, 21.71% and 27.65%. Such a rapid increase speed was related to the rapid growth of number of inpatients discharged and rising of the hospitalized expenditure per patient closely.

In 2011, we could find the truth from the hospitalized expenditure per capita*time with CVD&CBVD, the cost of acute myocardial infarction was totally RMB 16 793.1, the cost of hemorrhagic stroke was RMB 11 802.1, the cost of ischemic stroke was RMB 7 325.3. Deducting the influence of price factor, from 2004 the annual average growth rates

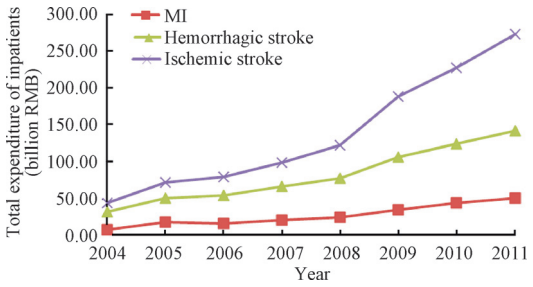

Figure 5. Trend about the total expenditure of inpatients with three kinds of disease of CVD 2004-2011 (prices for the indicated year).

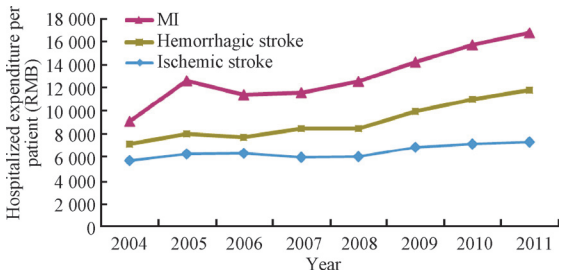

Figure 6. The trend about the hospital expenditure per patient for three kinds of disease of CVD 2004-2011 (prices for the indicated year).

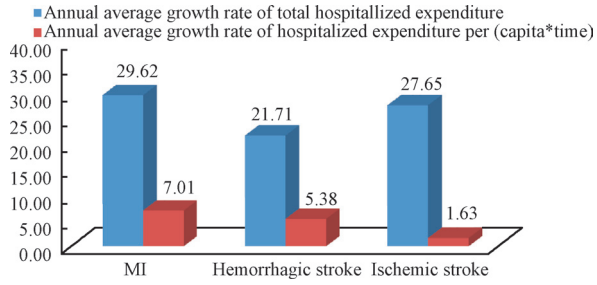

Figure 7. Annual average growth rate of total hospitalized expenditure and growth rate of hospitalized expenditure per (capita*time) about three kinds of disease of CVD. Total hospitalized expenditure = growth rate per (capita*time) of hospitalized expenditure × the number of inpatients.

Table 1. Top 15 Cardiovascular Medicine in 2011 RMB 100 million

Types of medicine	2008
Cardiovascular Medicine Total	460.74
Cereb. + Periphe. Vasotherap*	156.53
All Other Cardiac Preps	81.42
Calcium Antagonists Plain (monotherapy)	42.70
Cholest & Trigly. Regulator	34.78
Angiotens-II Antag, Plain (monotherapy)	30.87
Coronary Therapy not including Calcium Antagonists Plain and Nitrites	22.89
Nitrites & Nitrates	13.34
Treatment for phlebeurysma, systemic	12.97
Ace Inhibitors Plain (monotherapy)	11.34
Beta Blocking Agent Pln (monotherapy)	10.58
Angiotens-II Antag (combination)	6.75
Diuretics	4.07
Antihypertensive (not herb)	2.88
positive inotropic drug	2.23
Cardiac stimulant, not including cardiac glycoside	1.54
Other CVD medicine	25.85

Cereb. + Periphe. Vasotherap includes Herba Erierontis, Deproteinized Calf Blood Extractives Injection, Ginkgo Leaf Extract and Dipyridamole Injection, Ginatol, Ginkgo Biloba Extract, Egb, Interactions of Ginkgo biloba extract, Duxil, Flunarizine Hydrochloride Capsules, Mailuoning and Deproteinized Calf Blood Extractives Injection, etc.. Source: data collected by National Institute of Hospital Administration, from over 1600 hospitals with more than 100 beds all over China, including Chemicals and Chinese Traditional Patent Medicines that have proven curative effects and follow western formulation processes, such as, Salvia Miltior. Co, Ginkgo Leaf formulation and Herba Erierontis, etc.

were respectively 7.01%, 5.38% and 1.63% (Figures 5–7).[2]

Cardiovascular medicine market

In 2011, the total medicine purchase of hospitals with 100 or more beds was valued at RMB 366.024 billion; amongst which the total purchase of cardiovascular medicine was RMB 46.074 billion. The top five types of medicine are Cereb. + Periphe. Vasotherap, All Other Cardiac Preps, Calcium Antagonists Plain (monotherapy), Cholest & Trigly Regulator, and Angiotens-II Antag. Plain (monotherapy) (Table 1).

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