

**EDITORIAL**

Prevention of cardiovascular disease in modern China: Utile or futile?

Introduction

Whereas China has achieved rapid economic prosperity to become the second-largest economy in the world after the United States, the cardiovascular health of the Chinese people has deteriorated significantly over the past decade [1]. In 2005, cardiovascular disease was the leading cause of death in China [2]. Because China contributes to one fifth of the world population, this alarming situation becomes such a major issue of global concern that I was asked to organize a group of international authorities, both inside and outside China, to address various aspects of the problem in this Special Issue of CVD Prevention and Control. The articles that follow deal in detail with the magnitude of the problem and recommended preventive measures.

The changing prevalence of cardiovascular diseases in China

Coronary artery disease used to be rare in China. It constituted 6% of total hospital admissions in Shanghai in the 1940s and 1950s; but in the 1990s, it rose to 39% of total hospital admissions [3]. It climbed from fifth place to first place within just 4 decades.

Although rheumatic heart disease was the predominant cause of congestive heart failure in the 1980s, coronary artery disease is now the leading cause of congestive heart failure in China [4]. Part of the explanation for the changing pattern is, of course, more accurate diagnosis, less people dying from malnutrition and infectious diseases including rheumatic fever and rheumatic heart disease, and

more people living to an older age. But most of the increases are real, due to various risk factors that are discussed in the articles of this Special Issue.

Of the many risk factors that contribute to the rising prevalence of coronary artery disease, one is the rise in serum cholesterol. However, most of the published reports and conclusions were based upon retrospective studies. It was only very recently that such an association was conclusively proven prospectively [5]. This study was performed between 1992 and 2002 in 11 provinces in China and included 30,384 subjects between the ages of 35 and 64. The objective of the study was to evaluate the association between serum cholesterol and the risk of cardiovascular disease over a 10-year period. The findings are striking:

- (1) There is a direct association between the level of serum cholesterol and the risks of coronary heart disease and ischemic stroke.
- (2) With additional risk factors such as cigarette smoking, diabetes mellitus, obesity, low high-density-lipoprotein cholesterol (<0.91 mmol/L) and hypertension, the cardiovascular risk increases further.

The reason for the rising serum cholesterol in modern China is the recent change in dietary habits [4,6,7]. The increased fat intake in the Chinese diet, the rapid growth of fast food restaurants in China [8], increased living standards [9], decreased physical activities [10], increased obesity [4], increased cigarette smoking [4] and increased metabolic syndrome [11] all contribute to this change. China now has the largest number of diabetics over age 20, around 39 million people or about 2.7% of the

adult population, according to data released by the International Diabetes Federation in June, 2006 [12].

Myocardial infarction

Myocardial infarction, which was extremely rare in old China, has been the fifth leading cause of death in modern China [4]. Whereas mortality from coronary artery disease has decreased dramatically in Western countries during the past 3 decades, the mortality associated with coronary artery disease in China has increased significantly, particularly in urban populations [13]. At present, the Chinese population has an annual coronary mortality of one sixth of that reported in the West, an incidence of acute myocardial infarction of one tenth to one eighth, and a mortality from acute myocardial infarction of one eighth [4]. With the increasing prevalence of coronary artery disease and myocardial infarction among the general Chinese population, management has also undergone many changes in recent years. Some of these changes are described in this Special Issue by Chen and Jiang [14].

Hypertension

In China, the prevalence of hypertension has increased significantly in the past few decades [6,15]. Nearly 25–50% of new cases of hypertension could be prevented with modification of such known risk factors as increased body weight and decreased physical activities. Besides weight gain, dietary indiscretion is the most important etiology of rising hypertension in China [7].

Without a question, increased dietary sodium intake plays a major role. A large nationwide survey of blood pressure, hypertension and sodium intake in 950,356 men and women carried out in China in 1991 [16] showed a positive correlation between blood pressure and sodium intake. This positive within-population relationship between sodium intake and blood pressure has also been demonstrated in several other studies from China, using values of either dietary or urinary sodium [17,18]. Of particular interest was the observation, in a 1989 study in Guangzhou as compared with a 1985 study, of a gradual rise of both systolic and diastolic blood pressures associated with a corresponding increase in urinary sodium excretion [19]. The increase in sodium intake between these two surveys coincided with the rise in the number

of American fast-food restaurants, such as MacDonald's and Kentucky Fried Chicken, which had opened in Guangzhou during that period [7]. American fast food restaurants are now in abundance in China. Fast foods are not only rich in fat, but also high in sodium.

Because hypertension is the most important risk factor for stroke, coronary artery disease and peripheral artery disease in China, control of hypertension is of paramount importance [20,21]. To control hypertension, one must control sodium intake. There is an urgent need to reduce sodium consumption. The Chinese tended to preserve cooked food by repeated reheating, a process usually involving the addition of salt. With adequate refrigerating facilities now in every household, the Chinese have to break this bad habit.

Obesity

China used to be known for its slender people. Now China is facing an epidemic of obesity [4,22], which poses the newest health risk in modern China. The prevalence of obesity among both adults and children continues to rise in China, especially in large coastal cities [23], as in the rest of the world. As pointed out by Wu et al. [24] in their article in this Special Issue, obesity in China is not only an adult problem. Children in China are also getting fatter. Childhood obesity is a major problem among the Chinese [23–25]. Traditionally, a fat child in China meant a healthy child, one who was likely to survive the rigors of under-nourishment and diseases. This misconception still prevails today in many parts of China, which unfortunately renders China a participant in the world epidemic of childhood obesity. Fat Chinese children grow up to be fat Chinese adults [4,26].

Among the risk factors that have been identified for obesity in China are excessive caloric intake from fast food [4,7,8,10], insufficient exercise from increasing availability of and increased reliance on automobiles, which have replaced many of the bicycles that were the common means of transportation in the past [9,10], popularization of television [9,10,27] and the one-child policy [28].

China's one-child policy is conducive to obesity in two ways. First, China is strict in allowing only one child per family. There is a saying in China: "2-4-8 (pronounced as 'er', 'si' and 'ba', respectively), you get fat". With only one child in the family, doting parents (2 in number), grandparents (4 in number) and great grandparents (8 in number)

pamper their only child by overfeeding the 'little emperor' [28]. Furthermore, food, which used to be distributed among siblings, is now consumed by just one person. Second, two decades of China's strict family planning, has impacted China's labour force such that most of the labour workers now demand a less strenuous job, thereby no longer deriving the health benefits of physical exertion. Thus obesity ensues.

Another very important point regarding the prevalence of obesity in China is that the number of obese Chinese has probably been grossly underestimated by using the World Health Organization (WHO) body mass index (BMI) cut points [29]. The WHO BMI cut points are primarily based on data collected in Western populations. Chinese adults have a smaller body build, therefore the cut points based on analysis of data collected from 239,972 people in the 1990s should be 24 kg/m² for overweight and 28 kg/m² for obesity [30].

Diabetes

There is also an epidemic of diabetes in China, which goes hand in hand with the obesity epidemic [22]. There is a clear relation between urbanization and the prevalence of diabetes in China [31]. Diabetes is a risk factor for coronary artery disease in Chinese adults. The recent report from the China Heart Survey [32] confirmed the close association between coronary artery disease and abnormal glucose regulation in Chinese patients. As Chen and Wang [33] describe in this Special Issue, diabetes has an enormous impact on the cardiovascular health in contemporary China.

China is the country with the second highest number of people (next to India) estimated to have diabetes with 42.3 million projected for 2030 [34]. This projection is likely to be an underestimation, because in 2006 already 40 million people were estimated to have diabetes in China [35]. In the shadow of a growing obesity and diabetes epidemic in China, the Chinese medical community needs to take immediate action in confronting these major challenges.

Metabolic syndrome

Although the clinical use of the term 'metabolic syndrome' has been questioned in recent times [36], there is general agreement that clustering

of risk factors portends an increased risk of cardiovascular disease. The prevalence of metabolic syndrome in China was 13.3% (12.7% in male and 14.2% in female subjects) in a cohort study of 27,739 subjects from 11 provinces in China reported in 2002 [11,37], and 13.7% (9.8% in men and 17.8% in women) in a nationally representative sample of 15,540 Chinese adults reported in 2005 [38]. It was even higher in the professional population: 15.1% in men and 10.2% in women reported in 2006 [39]. The current prevalence in Chinese men and women aged 30 years or over is 18% and 29%, respectively, as reported by Schooling in this Special Issue [40]. It is highly prevalent in elderly people in Beijing, nearly every other person (46.3% in men and 54.1% in women) [41]. The prevalence rates as reported in those articles that used the criteria proposed by the US-based National Cholesterol Education Programs Adult Treatment Panel III (NCEP-ATPIII) and the WHO are all under-estimations [42]. The prevalence would be greatly enhanced if Chinese criteria were used, as mentioned earlier.

Actually, it is not obesity per se that is an important factor for the metabolic syndrome; it is where the obesity is that matters. A bulging waistline is a more sensitive predictor of cardiovascular diseases than BMI in the Chinese population [43].

Diet and lifestyle changes

As Lü and Li [44] pointed out in this Special Issue, the prevalence of coronary heart disease in China correlated well with changes in lifestyle and diet in recent years. The rapid economic development in China in the past couple of decades in combination with increased exposure to Western culture, fast food, automobiles and televisions has resulted in a rapid increase in coronary atherosclerosis, hypertension, obesity, diabetes and the metabolic syndrome. The per capita gross domestic product increased by more than 10-fold between the 1980s and 2002 [45]. The increase in family income allows Chinese people to eat out more frequently at fast food and regular restaurants. Such events were considered a luxury in the past. Consumption of food with a high sodium content and decreased physical activity due to availability of automobiles (one of 10 Beijing residents owns an automobile) and televisions (TV ownership increased from 38 sets per thousand persons in 1985 to 155 in 1990 and 270 in 1997 [30]) have led to increased obesity, diabetes and the metabolic syndrome in China.

Cigarette smoking

China is the greatest producer and consumer of cigarettes in the world [4]. One of every three cigarettes manufactured in the world is consumed in China. Even more alarming is the prevalence of teenage smoking in China [46]; three of every 5 Chinese smokers begin smoking at the age of 15–20 years. Countries such as China with its 300 million smokers are being targeted by the tobacco industry as stricter control on tobacco has begun to bite in the United States. Young smokers in China not only like to smoke foreign brands of cigarettes but also name brands. Next to Coca Cola and Mickey Mouse, Marlboro is the third best known American name in China [4].

Despite health hazard warnings on cigarette packs as required by the Ministry of Public Health and incontrovertible evidence that cigarette smoking is a major cause of death in China, a direct cause of coronary artery disease in China, and an indirect cause of coronary artery disease by causing hypertension and diabetes, many Chinese continue to smoke, including the medical profession [4,42]. Three times as many Chinese physicians smoke as their US counterparts [47]; 38% of medical students in Wuhan were smokers [48].

Despite recent unanimous approval of the global anti-tobacco treaty by all 192 countries in the World Health Organization, of which China is a member, China is still not enforcing the ban, claiming that ‘an individual’s right should be respected’ [4]. Furthermore, tobacco is the largest source of income for the Chinese government and millions of its citizens [46]. According to the Ministry of Health, China’s state-run tobacco monopoly employs more than half a million workers in factories, 10 million in farming and 13 million in retail trade. Tobacco taxes are the major source of revenue for the government and accounted for about 5 billion dollars in 1992, or about 10% of all revenue [46]. The tobacco industry is the biggest source of tax revenues in China. Thus the government that needs money to raise living standards in China is as addicted to tobacco revenue as smokers are to nicotine. It is a dilemma China has to face: wealth first or health first. There is an apparent contradiction that exists in modern China: the state wants to have the revenue from tobacco, while the Ministry of Health wants to stop people from smoking in order to protect their health [46].

Cigarette smoking is an addiction. Like other substance addicts, cigarette smokers like to rationalize their smoking habit. Just as in the United States, smokers in China continue to smoke, de-

spite the cigarette-induced cough, because they claim that a cigarette-induced cough might loosen their phlegm. Thus a vicious cycle is established: more cough, more smoking and still more cough. Another common misconception that most cigarette smokers embrace is the negative association between smoking and body weight. However, a recent study from Nanjing showed that smoking in Chinese men was negatively associated with body weight indicated by body mass index but not with central obesity based on waist circumference [49].

Smokers should realize that smoking is bad not just for the heart and blood vessels. As Sir Richard Peto and colleagues point out in their article in this Special Issue [50], smoking can cause death in Chinese people in more ways than one. One slight ray of hope is that tobacco consumption in China seems to have reached its peak in the past decade. Hopefully a downward trend will continue.

Air pollution

That air pollution is associated with adverse cardiovascular consequences was highlighted in 2004 by a scientific statement from the American Heart Association [51]. China has been called the air pollution capital of the world [52]. According to a recent World Bank ranking, India’s capital New Delhi is the world’s most polluted city, followed by Cairo, Kolkata, and Tianjin [53]. China has the dubious distinction of having 16 of the world’s 20 most polluted cities [53]. Levels of nitrogen dioxide in Beijing exceed the WHO’s clean-air guidelines by 78%; in June 2007 the city recorded its worst air-quality levels in 7 years, with three times the particulate matter of New York City [54]. Beijing’s efforts to clean up the city’s air before hosting the 2008 Olympics have highlighted China’s broader challenge in addressing the serious urban air pollution. China’s booming economic growth has been accomplished at the expense of ecological destruction, leaving China with smoggy cities and black rivers throughout the country. China gets most of its electricity from burning coal.

As Kan et al point out in their article in this Special Issue [55], air pollution has an enormous impact on cardiovascular health in China. Air pollution is also a risk factor for chronic obstructive pulmonary disease, asthma and diabetes. China has the highest number of age-adjusted deaths due to chronic obstructive pulmonary disease for the 25 most populous nations in the world [56].

Next to industrial development, environmental tobacco smoke is the second major cause of air

pollution in China. Urgent strategies are needed to reduce this exposure. Homes are now the most important source of exposure to second-hand smoke, and non-consenting minors are often exposed. At the present time, prohibition of cigarette smoking in the workplace is not required by law in China [57]. This must change. Laws to ban smoking at airports in China must be strictly enforced. It is very gratifying to see taxi drivers in Beijing posting signs to advise passengers to refrain from smoking inside their cabs.

Atrial fibrillation and stroke

Atrial fibrillation is the most commonly seen cardiac arrhythmia in clinical practice [58]. Although atrial fibrillation is less prevalent among the Chinese (0.8% in mainland China [59]), than in Western populations (7% in the Screening for Atrial Fibrillation in the Elderly study (SAFE) [60]), it is still a major health hazard in China, because of its association with stroke [59].

Atrial fibrillation in China has the same etiologic profile as in the rest of the world [61]. Its prevalence will rise further in China, not only because the population of elderly continues to expand but also because of the rise in prevalence of hypertension, diabetes and obesity. According to the article in this Special Issue by Ma and Qi [59], the estimated number of patients with atrial fibrillation in China is projected to surpass 25 million by 2045. To prevent stroke, it is essential to control atrial fibrillation.

Surgeon's role

Prevention of cardiovascular disease in China is not the sole responsibility of the Chinese cardiologists. As Hu [62] points out in his article in this Special Issue, it is also the responsibility of the Chinese cardiac surgeons. Early surgical correction of many congenital and acquired heart defects will prevent irreversible sequelae that may follow later in life even after successful repair, e.g., pulmonary hypertension in Eisenmenger syndrome and mitral stenosis, atrial fibrillation in atrial septal defect, persistent systemic hypertension in coarctation of the aorta, sudden death in tetralogy of Fallot, etc.

Conclusion

Cardiovascular health in China is deteriorating [1], and is threatening its future. Coronary heart dis-

ease, hypertensive cardiovascular disease, obesity, diabetes, metabolic syndrome, cigarette smoking, and air pollution have all reached epidemic proportions in China, which is now careening on the brink of a national crisis [63]. In 2008 the death rates (per 100,000 population) for cardiovascular diseases in China exceeded those in the United States [64]. Never in the history of China have children been likely to have a shorter life expectancy than their parents. But the Chinese word for crisis, 危機 (wei-ji), is made of two Chinese characters, 危 (wei) and 機 (ji). The first character 危 means danger; the second character 機 means opportunity. Therefore, these challenges provide an opportunity for the Chinese government and Chinese medical community to overcome this crisis by developing new policies and introducing innovative programs to face these challenges.

The answer to the title of my editorial "Prevention of cardiovascular disease in modern China: utile or futile?" is definitely in the affirmative. Because we can identify all the risk factors, it is easier to prevent than to treat these various cardiovascular diseases. If the Pathobiological Determinants of Atherosclerosis in Youth (PDAY) study could show that the goal of eliminating coronary heart disease in the United States is feasible with control of the major established risk factors beginning in youth [65], it is certainly possible to achieve this goal in China with its much shorter history of exposure to all the similar risk factors. As the Chinese Yellow Emperor, or Huang Di, said thousands of years ago, "the superior doctor prevents diseases; the mediocre doctor attends to impending diseases; the inferior doctor treats full-blown diseases". As the saying goes, one ounce of prevention is worth more than a pound of treatment. This is particularly true in China where the cost of healthcare continues to rise and the disparity in access to healthcare between the rural and urban populations continues to widen [66].

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