

BMJ Open

BMJ Open is committed to open peer review. As part of this commitment we make the peer review history of every article we publish publicly available.

When an article is published we post the peer reviewers' comments and the authors' responses online. We also post the versions of the paper that were used during peer review. These are the versions that the peer review comments apply to.

The versions of the paper that follow are the versions that were submitted during the peer review process. They are not the versions of record or the final published versions. They should not be cited or distributed as the published version of this manuscript.

BMJ Open is an open access journal and the full, final, typeset and author-corrected version of record of the manuscript is available on our site with no access controls, subscription charges or pay-per-view fees (<http://bmjopen.bmj.com>).

If you have any questions on BMJ Open's open peer review process please email info.bmjopen@bmj.com

BMJ Open

Survey of cardiovascular health and self-cognition in Chinese cardiologists (CCHS): a multicenter, large-scale cross-sectional study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-029249
Article Type:	Research
Date Submitted by the Author:	18-Jan-2019
Complete List of Authors:	Hou, Lei ; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology; Tongren hospital, Shanghai Jiaotong University, School of Medicine, Department of Cardiology Jin, Xuejuan ; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology Ma, Jianying ; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology Qian, Juying; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology Huo, Yong ; Peking University First Hospital, Department of Cardiology Ge, Junbo; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology
Keywords:	health survey, cardiovascular diseases, China, cardiologists, cross-sectional studies

SCHOLARONE™
Manuscripts

1
2
3
4 **Survey of cardiovascular health and self-cognition in Chinese cardiologists (CCHS): a**
5 **multicenter, large-scale cross-sectional study**
6
7
8
9

10
11 **Running title:** The China Cardiologist Heart Study
12
13

14
15
16 Lei Hou^{1,2¶}, Xuejuan Jin^{1¶}, Jianying Ma¹, Juying Qian¹, Yong Huo³, Junbo Ge¹
17
18
19

20
21 ¹Department of Cardiology, Shanghai Institute of Cardiovascular Diseases, Zhongshan
22 Hospital, Fudan University, Shanghai, China
23

24
25 ²Department of Cardiology, Tongren hospital, Shanghai Jiaotong University, School of
26 Medicine, Shanghai, China
27

28
29 ³Department of Cardiology, Peking University First Hospital, Beijing, China
30

31
32 [¶]These authors contributed equally to this work.
33
34
35

36
37 **Corresponding author:** Junbo Ge, No. 180 Fenglin Road, 200032, Department of
38 Cardiology, Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan
39 University, Shanghai, China. Email: gejunbo@126.com
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

ABSTRACT

Objectives: To determine the frequency of risk factors for cardiovascular diseases among Chinese cardiologists using a nationwide survey.

Design: Multicenter, cross-sectional observational study.

Setting: 2441 hospitals across China were surveyed between September 2016 and August 2017.

Participants: All cardiologists in-service were surveyed (n=28,924).

Interventions: WeChat-based electronic data capture system, a social application in China (Tencent, Nanshan, China), was used for data acquisition. Physician subscribed to the WeChat official account of the China Cardiologist Health Study, and filled out an online questionnaire that included age, gender, level of in-service hospital, professional title, academic degree, area of expertise, and cardiovascular risk factors. All information was required.

Primary and secondary outcome measures: The primary outcome was the presence of cardiovascular risk factors. The secondary outcome was the impact of factors on the occurrence of hypertension.

Results: Among 28,924 Chinese cardiologists who participated in this survey, 57.6% had blood pressure of 130-139/80-89 mmHg (5.3% were taking antihypertensive drugs) and 22.0% had blood pressure $\geq 140/\geq 90$ mmHg (36.5% were taking antihypertensive drugs). The multivariable analysis showed that age, gender, academic degree, hospital level, body mass index (BMI), smoking, and comorbidities were independently associated with hypertension among cardiologists (all $P < 0.05$). Age, female gender, BMI, smoking, family history of cardiovascular diseases, and comorbidities were independently associated with

1
2
3
4 taking antihypertensive drugs among hypertensive cardiologists (all $P < 0.05$). Age, hospital
5 level, professional title, BMI, family history of cardiovascular diseases, and comorbidities
6 were independently associated with reaching target blood pressure among hypertensive
7 cardiologists taking antihypertensive drugs.
8
9
10
11
12

13 **Conclusion:** Chinese cardiologists do not recognize and pay attention to their own
14 cardiovascular health and that their work pressure is high. The identified risk factors could
15 be used to identify cardiologists at higher risk for poor cardiovascular health and for
16 implementing preventive interventions.
17
18
19
20
21
22
23

24 **Keywords:** health survey; cardiovascular diseases; China; cardiologists; cross-sectional
25 studies.
26
27
28
29
30
31

32 **Strengths and limitations of this study**

- 33
34 - The strength of the present study lies in its large sample size (>26,000 participants) from
35 all across China.
36
37 - Because of funding and logistics, data had to be collected using a self-filled survey, which
38 could introduce bias compared to a formal epidemiological study.
39
40 - The medical system in China and the formation required to work in cardiology are
41 different from that of other countries, limiting the generalizability of the data.
42
43 - The geographical distribution of the cardiologists across China was not taken into account.
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

INTRODUCTION

Cardiologists are exposed to threats to their health, resulting in an important incidence of orthopedic problems[1 2]. In addition, there is a risk of radiation-related diseases [2 3]. Besides those obvious occupational hazards, cardiologists are exposed to stress, work overload, and bad lifestyle habits that may increase their cardiovascular risk [4 5]. A study from Italy showed that the cardiovascular profile of Italian cardiologists was far from ideal and that the perception of their own risk factors was low [4 6]. The understanding and awareness of cardiologists' cognition of their own health care are not only important for maintaining individual health and the manpower of the national medical health care system, but also directly affect their understanding and behaviors toward the patients, eventually having some impact on the prevention and treatment of cardiovascular diseases. Indeed, cardiologists serve as role models for behavioral changes [7-9].

Chinese physicians face a large number of patients and are at risk of job turnover [10]. A survey of Chinese cardiologists found that there were only 1.9 cardiologists per 100,000 people [11], compared with 8.1 per 100,000 people in the United States in 2009 [12]. Hence, there are heavy responsibilities and work burden for cardiologists in China. Faced with such a disparity in the proportion of cardiologists and patients, the working time of Chinese doctors usually exceeds the standard working time [13]. All of those factors may lead to an increase in the incidence of cardiovascular risk factors and diseases among Chinese cardiologists. Indeed, when comparing the Physicians' Health Study from the United States with the Chinese Cardiovascular Risk Evaluation (CARE) study [14 15], it was found that the prevalence of cardiovascular risk factors among Chinese cardiologists was higher than among American physicians, and that Chinese cardiologists had a poor

1
2
3
4 cognition of their own cardiovascular risk factors.
5

6
7 A recent anecdotic observation is that sudden death was observed in many young Chinese
8 cardiologists, prompting the hypothesis that Chinese cardiologists may neglect their own
9 health. Nevertheless, the factors for poor cardiovascular factors among cardiologists must
10 first be identified and understood before interventions may be implemented. Therefore, the
11 present study aimed to examine the risk factors for cardiovascular diseases among Chinese
12 cardiologists using a nationwide survey.
13
14
15
16
17
18
19
20
21

22 **SUBJECTS AND METHODS**

23 **Participants**

24
25 This was a national, multicenter, cross-sectional observational study. Cardiologists from
26 2441 hospitals across China were surveyed between September 2016 and August 2017. All
27 cardiologists in-service were surveyed. If a hospital did not have a department of
28 cardiology and only had a department of internal medicine, then the physicians engaged in
29 the cardiovascular field in the internal medicine department were included. Physicians who
30 were unwilling to participate in this survey were excluded. This study was approved by the
31 Ethics Committee of Zhongshan Hospital, Fudan University. All physicians signed the
32 informed consent form.
33
34
35
36
37
38
39
40
41
42
43
44

45 **Sampling method**

46
47 Due to the funding and lack of manpower, it was difficult to design a sampling frame
48 according to economic levels and hospital levels and randomly select hospitals nationwide.
49 Hence, the study used a two-stage sampling process, selecting hospitals using non-random
50 stratification according to regional economic levels and hospital levels during the first stage.
51
52
53
54
55
56
57
58
59
60

1
2
3
4 In the second stage, a random proportional sample from authoritative lists was created, and
5
6 all the cardiologists in this sample of hospitals were invited to participate in the study.
7

8 **Data collection**

9
10 The study was performed and coordinated under the guidance of a scientific advisory board.

11
12 Data quality was monitored by the study coordinators throughout the study.

13
14 WeChat-based electronic data capture (EDC) system, a social application in China (Tencent,
15
16 Nanshan, China), was used for data acquisition. Physician subscribed to the WeChat
17
18 official account of the China Cardiologist Health Study (Wuxi Boyankang Technology
19
20 Development Co., Ltd. was responsible for platform construction and data management),
21
22 and filled out an online questionnaire that included age, gender, level of in-service hospital,
23
24 professional title (general physicians were those with a bachelor degree; healer were those
25
26 with a junior college degree or below), academic degree, area of expertise, height, body
27
28 weight, blood pressure, heart rate, fasting blood glucose, total cholesterol (TC), low density
29
30 lipoprotein-cholesterol (LDL-C), high density lipoprotein-cholesterol (HDL-C), triglyceride
31
32 (TG), current diseases, medication status, smoking history (at least one cigarette/day in the
33
34 past 3 months: yes, no, never smoking), and family history (first-degree male relative with
35
36 a cardiovascular disease at <55 years of age or a first-degree female relative with a
37
38 cardiovascular disease at <65years of age). The questions about area of expertise and
39
40 current diseases had multiple choices. All information was required. The questionnaire with
41
42 incomplete information could not be submitted. At the same time, there were logically
43
44 possible upper and lower limits for the content to be filled in. If the limit was exceeded, it
45
46 could indicate that the data was incorrect. The staff of the project team would remind the
47
48 physician to check. The questionnaire was shown in Appendix 1.
49
50
51
52
53
54
55
56
57
58
59
60

Identification of cardiovascular risk factors

Demographic variables and risk factors for CVD were assessed according to standardized study protocols. Age was automatically generated based on the birth date. Blood pressure and heart rate were the average levels over the past 2 weeks. Fasting blood glucose and blood lipids were reviewed by the physician for the most recent results within a year. Body mass index (BMI) was calculated based on weight and height as kg/m^2 . Hypertension was defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg or taking antihypertensive drugs. Reaching the target blood pressure was defined as systolic blood pressure < 140 mmHg and diastolic blood pressure < 90 mmHg.

Statistical analysis

All data were statistically analyzed using SPSS 22.0 (IBM, Armonk, NY, USA). Continuous variables that followed the normal distribution were expressed as means \pm standard deviation (SD), and skewed continuous variables were summarized as medians (interquartile range). Categorical variables were expressed as frequencies (percentage) and chi-square tests were used for comparison between groups. Univariate and multivariate logistic regression analyses were used to analyze the factors influencing the prevalence of hypertension, rate of medicine taking, and rate of reaching the target blood pressure. For the multivariate analysis, comorbidity was defined as the presence of any other disease, or taking hypoglycemic or lipid-lowering drugs. Two-sided $P < 0.05$ was considered as statistically significant.

Patient and Public Involvement statement

Patients were not involved in the study design and implementation.

RESULTS

Characteristics of the participants

A total of 28,924 cardiologists across China participated in this survey. Tables 1, 2 and S1 presents their characteristics. Most (42.7%) were 30-39 years old, male (54.5%), with a bachelor degree (43.9%), working in a tertiary care hospital (60.1%), and were attending physicians (46.5%). Their main areas of expertise were: hypertension (63.9%), atherosclerosis and coronary artery diseases (51.1%), blood lipids and metabolism (35.1%), and heart failure (31.4%). Most had a BMI of 18.5-23.9 kg/m² (66.7%), fasting blood glucose <6.1 mmol/L (90.0%), LDL-C <2.60 mmol/L (44.6%), HDL-C ≥1.0 mmol/L (93.5%), TC <5.2 mmol/L (86.3%), and TG <1.7 mmol/L (53.8%). Among them, 57.6% had blood pressure of 130-139/80-89 mmHg (5.3% were taking antihypertensive drugs) and 22.0% had blood pressure ≥140/≥90 mmHg (36.5% were taking antihypertensive drugs). Among all cardiologists, 37.0% never smoked, 78.2% had a family history of cardiovascular diseases, 25.3% had hypertension, 6.1% had coronary heart disease, 2.1% had diabetes, 8.0% were taking antihypertensive drugs, 2.0% were taking hypoglycemic agents, and 4.2% were taking lipid-lowering drugs.

Gender differences in the prevalence of CVD risk in Chinese cardiologists

Coronary heart disease, heart failure, diabetes, chronic kidney disease, peripheral vascular disease, and hypertension were all more prevalent in male cardiologists than in females (all $P < 0.05$) (Table 3). More male cardiologists were taking antihypertensive drugs (33.5% vs. 28.8%, $P < 0.001$), but more female cardiologists were reaching the target blood pressure (44.3% vs. 39.8%, $P = 0.04$).

Age differences in the prevalence of CVD risk in Chinese cardiologists

1
2
3
4 Table 4 shows that coronary heart disease, diabetes, stroke/transient ischemic attack,
5
6 chronic kidney disease, peripheral vascular disease, and hypertension were all more
7
8 prevalent in the older age groups (all $P<0.001$). The highest proportions of cardiologists
9
10 taking antihypertensive drugs were in the 50-59 (42.0%) and 60-69 (48.8%) years of age
11
12 groups. The highest proportions of cardiologists reaching the target blood pressure were in
13
14 the 20-29 (48.4%), 30-39 (43.6%), and 40-49 (41.7%) years of age groups. Supplementary
15
16 Tables S3 and S4 show that similar patterns were observed when the analyses were
17
18 performed by gender.
19
20
21

22 **Hospital level differences in the prevalence of CVD risk in Chinese cardiologists**

23
24 Table 5 shows that the prevalence of hypertension was higher in primary hospitals (35.7%)
25
26 compared with secondary (24.9%) and tertiary (25.4%) hospitals ($P<0.001$). The rates of
27
28 taking antihypertensive drugs and reaching the target blood pressures were higher in
29
30 secondary and tertiary hospitals (both $P<0.05$). Similar patterns could be observed when
31
32 analyzing males and females cardiologists (Supplementary Tables S5 and S6).
33
34
35

36 **Professional title differences in the prevalence of CVD risk in Chinese cardiologists**

37
38 Coronary heart disease was more prevalent in residents, associated chief physicians, and
39
40 chief physicians ($P<0.001$); heart failure was more prevalent in healers and residents
41
42 ($P=0.001$); diabetes was more prevalent in chief physicians, associate chief physicians,
43
44 residents, and healers ($P<0.001$); stroke/transient ischemic attack was more prevalent in
45
46 residents and healers ($P=0.01$); chronic kidney disease was more prevalent in healers and
47
48 residents ($P<0.001$); and peripheral vascular disease was more prevalent in residents
49
50 ($P<0.001$). Hypertension was more prevalent in associate chief physicians and chief
51
52 physicians ($P<0.001$), with a correspondingly higher prevalence of taking antihypertensive
53
54
55
56
57
58
59
60

1
2
3
4 drugs ($P<0.001$). Residents, healers, and attending physicians had the highest proportions
5
6 of cardiologists achieving the target blood pressure ($P<0.001$) (Table S2). Globally, similar
7
8 patterns were observed when analyzing the data by male and female cardiologists
9
10 (Supplementary Tables S7 and S8).

11 12 13 **Factors associated with hypertension among cardiologists**

14
15 Table S9 presents the univariable and multivariable analyses of the factors associated with
16
17 hypertension among Chinese cardiologists. Age (50-59 years: OR=1.397, 95%CI: 1.164-
18
19 1.678, $P<0.001$; ≥ 60 years: OR=1.949, 95%CI: 1.534-2.476, $P<0.001$ vs. 20-29 years),
20
21 female gender (OR=0.866, 95%CI: 0.813-0.924, $P<0.001$ vs. male), academic degree
22
23 (bachelor: OR=0.629, 95%CI: 0.461-0.859, $P=0.004$; master: OR=0.722, 95%CI: 0.528-
24
25 0.988, $P=0.04$ vs. junior college), hospital level (secondary: OR=0.582, 95%CI: 0.464-
26
27 0.728, $P<0.001$; tertiary: OR=0.579, 95%CI: 0.463-0.724, $P<0.001$ vs. primary), BMI (≥ 24
28
29 kg/m^2 : OR=1.314, 95%CI: 1.233-1.400, $P<0.001$ vs. 18.5-23.9 kg/m^2), smoking (infrequent:
30
31 OR=0.568, 95%CI: 0.525-0.613, $P<0.001$; never: OR=0.469, 95%CI: 0.431-0.509, $P<0.001$
32
33 vs. frequent), and comorbidities (OR=3.158, 95%CI: 2.924-3.410, $P<0.001$) were
34
35 independently associated with hypertension among cardiologists.
36
37
38
39
40

41 42 **Factors associated with taking antihypertensive drugs among hypertensive** 43 44 **cardiologists**

45
46 Table S10 presents the univariable and multivariable analyses of the factors associated with
47
48 taking antihypertensive drugs among hypertensive cardiologists. Age (30-39 years:
49
50 OR=1.433, 95%CI: 1.055-1.945, $P=0.02$; 40-49 years: OR=1.989, 95%CI: 1.428-2.771,
51
52 $P<0.001$; 50-59 years: OR=2.282, 95%CI: 1.599-3.257, $P<0.001$; ≥ 60 years: OR=2.677,
53
54 95%CI: 1.754-4.086, $P<0.001$ vs. 20-29 years), female gender (OR=1.200, 95%CI: 1.059-
55
56
57
58
59
60

1
2
3
4 1.359, P=0.004 vs. male), BMI (≥ 24 kg/m²: OR=1.157, 95%CI: 1.031-1.299, P=0.01 vs.
5
6 18.5-23.9 kg/m²), smoking (infrequent: OR=0.502, 95%CI: 0.440-0.572, P<0.001; never:
7
8 OR=0.374, 95%CI: 0.322-0.434, P<0.001 vs. frequent), family history of cardiovascular
9
10 diseases (OR=1.400, 95%CI: 1.247-1.571, P<0.001), and comorbidities (OR=2.646, 95%CI:
11
12 2.351-2.977, P<0.001) were independently associated with taking antihypertensive drugs
13
14 among hypertensive cardiologists.
15
16

17 **Factors associated with reaching target blood pressure among hypertensive** 18 **cardiologists taking antihypertensive drugs** 19 20 21

22 Table S11 presents the univariable and multivariable analyses of the factors associated with
23
24 reaching target blood pressure among hypertensive cardiologists taking antihypertensive
25
26 drugs. Age (50-59 years: OR=0.465, 95%CI: 0.262-0.825, P=0.009 vs. 20-29 years),
27
28 hospital level (secondary: OR=2.878, 95%CI: 1.287-6.438, P=0.01; tertiary: OR=2.558,
29
30 95%CI: 1.147-5.704, P=0.02 vs. primary), professional title (residents: OR=2.768, 95%CI:
31
32 1.467-5.225, P=0.002 vs. general physicians), BMI (≥ 24 kg/m²: OR=0.657, 95%CI: 0.548-
33
34 0.787, P<0.001 vs. 18.5-23.9 kg/m²), family history of cardiovascular diseases (OR=0.746,
35
36 95%CI: 0.624-0.891, P=0.001), and comorbidities (OR=0.811, 95%CI: 0.679-0.970,
37
38 P=0.02) were independently associated with reaching target blood pressure among
39
40 hypertensive cardiologists taking antihypertensive drugs.
41
42
43
44
45
46
47

48 **DISCUSSION** 49

50 Chinese cardiologists have a poor knowledge of their own cardiovascular risk factors and
51
52 their work burden is high. The present study aimed to examine the risk factors for
53
54 cardiovascular diseases among Chinese cardiologists using a nationwide survey. The results
55
56
57
58
59
60

1
2
3
4 suggest that Chinese cardiologists do not recognize and pay attention to their own
5 cardiovascular health and that their work pressure is high. The identified risk factors could
6 be used to identify cardiologists at higher risk for poor cardiovascular health and for
7 implementing preventive interventions.
8
9

10
11
12
13 In China, the prevalence of hypertension is around 24% [16-18], leading to a significant
14 cardiovascular burden [19]. In the present study, the prevalence of hypertension was 25.3%,
15 similar to the prevalence in the general Chinese population. A previous survey of
16 cardiologists conducted in 2011 revealed participants' characteristics that were similar to
17 those of the present study [11], further supporting the representativeness of our sample. Of
18 course, there is a certain overlap between the samples of the two studies, but the exact
19 extent of this overlap cannot be confirmed.
20
21
22
23
24
25
26
27
28

29
30 In the present study, 57.6% of the cardiologists had borderline or at-risk blood pressure
31 (130-139/80-89 mmHg) and only 5.3% were taking antihypertensive drugs. In addition,
32 22.0% had blood pressure $\geq 140/\geq 90$ mmHg, but only 36.5% were taking antihypertensive
33 drugs. Despite the expected health knowledge in physicians compared with the general
34 population, this rate of treatment was surprisingly not better than in the general Chinese
35 population [20 21]. Combined data from the Chinese (CHARLS study) and the American
36 (NHANES study) general populations indicate that China had lower rates of hypertension
37 treatment than the USA, and that the awareness and treatment of dyslipidemia were 3- and
38 7-fold lower, respectively, than in the USA [17]. This is also supported by the CARE study,
39 which showed that physicians had suboptimal awareness of their own cardiovascular risk,
40 as well as suboptimal use of prophylaxis [14 15], and by the SOCRATES study, which
41 showed that the self-awareness of cardiologists' own cardiovascular risk factors was mild
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4 [6]. On the other hand, Abuissa et al. [22] showed that American cardiologists had
5
6 generally good lifestyle habits.

7
8 Age, gender, BMI, smoking, family history of cardiovascular diseases, and comorbidities
9 are well-known factors for the risk of having hypertension, compliance to treatment, and/or
10 achieving the target blood pressure across the globe [23-25]. Aboyans et al. [9] showed that
11 the awareness and management of smoking cessation strategies among smoking French
12 cardiologists were low. In the present study, those factors were not only associated with the
13 risk of having hypertension, but also with the risk of not taking the proper antihypertensive
14 medication and the risk of not achieving the target blood pressure. Even if age, gender, and
15 comorbidities are non-modifiable risk factors, they could help identify cardiologists in need
16 of more efforts for seeking the proper cardiovascular treatments. This is supported by
17 previous studies in various populations [20 26 27]. The SOCRATES study showed that the
18 rate of using lipid-lowering, antihypertensive, and cardiovascular drugs was low among
19 Italian cardiologists [6], supporting the present study.

20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
Great efforts are necessary to become a cardiologist in Western countries, but differences in
the Chinese medical system make that less efforts are necessary to become a cardiologist in
China, a situation that is currently being corrected [11 28-30]. The present study suggests
that having a bachelor or master degree led to lower risk of hypertension compared with
junior college level. This could be due to the fact that people with more advanced training
possess more skills and knowledge, leading to less stress in their work. In addition, they
have higher income, decreasing the need for working long and stressful hours. This is
supported by a study that showed that physicians with a low education level had poor
quality of life in China [13]. As more experienced physicians can have access to more

1
2
3
4 advanced hospitals, we observed that cardiologists working in secondary and tertiary
5 hospitals had a lower risk of having hypertension. This could be due to a better awareness
6 of health knowledge in general, but also to the better material and human resources in more
7 advanced hospitals, hereby lowering stress and workload [13 31]. Regarding workload, it is
8 higher in China than in the USA, with 1.9 vs. 8.1 cardiologists per 100,000 people [11 12],
9 and one study showed that the working hours of American physicians were decreasing over
10 the years [32]. It has been shown that working long hours was associated with an increased
11 cardiovascular risk [33]. Better knowledge and lower stress/workload can also be
12 associated with being properly treated or not for hypertension and taking the proper steps,
13 both on the medical and lifestyle points of view, to achieve the blood pressure targets, as
14 observed in the present study. This is supported by a number of studies in the Chinese
15 general population [20 21 34 35].

16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32 The strength of the present study lies in its large sample size (>26,000 participants) from all
33 across China. On the other hand, because of funding and logistics, data had to be collected
34 using a self-filled survey, which could introduce bias compared to a formal epidemiological
35 study. Indeed, some physicians could be tempted to provide data that are better than the
36 reality. Nevertheless, the prevalence of hypertension (based on the composite variable
37 made of blood pressure and antihypertensive drugs, not on a formal inquiry about a
38 diagnosis of hypertension) was similar to that of the general population of China,
39 suggesting data validity. Of course, the medical system in China and the formation required
40 to work in cardiology are different from that of other countries [11 28], limiting the
41 generalizability of the data. Finally, the geographical distribution of the cardiologists across
42 China was not taken into account. Additional studies are necessary to confirm those

1
2
3
4 findings.
5

6 In conclusion, the results suggest that Chinese cardiologists do not recognize and pay
7 attention to their own cardiovascular health and that their work pressure is high. The
8 identified risk factors could be used to identify cardiologists at higher risk for poor
9 cardiovascular health and for implementing preventive interventions. Our results have a
10 number of implications for the reform of health care awareness and prophylaxis in
11 cardiologists in China.
12
13
14
15
16
17
18
19
20
21

22 **APPENDIX 1**

23 The China Cardiologist Heart Study Questionnaire
24
25
26
27
28

29 **DATA SHARING STATEMENT**

30 No additional data are available.
31
32
33
34
35

36 **ACKNOWLEDGMENTS**

37 The authors acknowledge the contribution of all physicians who participated in this survey.
38
39 The study was started by the Chinese Cardiovascular Association and supported by the
40 GUSU group.
41
42
43
44
45
46
47

48 **FUNDING**

49 The study is supported by the Emerging Frontier Project of Shanghai Hospital
50 Development Center (No. SHDC12014101), the Innovative Research Group Project of
51 National Natural Science Foundation of China (No. 81521001), and National Key Research
52
53
54
55
56
57
58
59
60

1
2
3
4 and Development Project (No. 2016YFC1301200). The authors declare that they have no
5
6 conflicts of interest.
7
8
9

10 11 **CONFLICTS OF INTEREST** 12

13 The authors declare that they have no conflicts of interest.
14
15

16 17 18 **AUTHORS' CONTRIBUTIONS** 19

20 Lei Hou, Xuejuan Jin conceived and coordinated the study, designed, performed and
21
22 analyzed the experiments, wrote the paper. Jianying Ma, Juying Qian, Yong Huo carried
23
24 out the data collection, data analysis, and revised the paper. Junbo Ge designed the study,
25
26 carried out the data analysis, and revised the paper. All authors reviewed the results and
27
28 approved the final version of the manuscript.
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

REFERENCES

1. Goldstein JA, Balter S, Cowley M, et al. Occupational hazards of interventional cardiologists: prevalence of orthopedic health problems in contemporary practice. *Catheterization and cardiovascular interventions : official journal of the Society for Cardiac Angiography & Interventions* 2004;**63**:407-11.
2. Dehmer GJ. Occupational hazards for interventional cardiologists. *Catheterization and cardiovascular interventions : official journal of the Society for Cardiac Angiography & Interventions* 2006;**68**:974-6.
3. Clark DA. How much is too much? *Catheterization and cardiovascular interventions : official journal of the Society for Cardiac Angiography & Interventions* 2000;**51**:265.
4. Faggiano P, Temporelli PL, Zito G, et al. [Cardiovascular risk profile and lifestyle habits in a cohort of Italian cardiologists. Results of the SOCRATES survey]. *Monaldi archives for chest disease = Archivio Monaldi per le malattie del torace* 2013;**80**:118-25.
5. Michel JB, Sangha DM, Erwin JP, 3rd. Burnout Among Cardiologists. *The American journal of cardiology* 2017;**119**:938-40.
6. Temporelli PL, Zito G, Faggiano P, et al. Cardiovascular risk profile and lifestyle habits in a cohort of Italian cardiologists (from the SOCRATES Survey). *The American journal of cardiology* 2013;**112**:226-30.
7. Merz CN, Mensah GA, Fuster V, et al. Task force #5--the role of cardiovascular specialists as leaders in prevention: from training to champion. 33rd Bethesda Conference. *Journal of the American College of Cardiology* 2002;**40**:641-51.

- 1
2
3
4 8. O'Kelly S, Andersen K, Capewell S, et al. Bringing prevention to the population: an
5
6 important role for cardiologists in policy-making. *European heart journal*
7
8 2011;**32**:1964-7.
9
- 10
11 9. Aboyans V, Pinet P, Lacroix P, et al. Knowledge and management of smoking-cessation
12
13 strategies among cardiologists in France: a nationwide survey. *Archives of*
14
15 *cardiovascular diseases* 2009;**102**:193-9.
16
17
- 18 10. Lu Y, Hu XM, Huang XL, et al. The relationship between job satisfaction, work stress,
19
20 work-family conflict, and turnover intention among physicians in Guangdong,
21
22 China: a cross-sectional study. *BMJ open* 2017;**7**:e014894.
23
24
- 25 11. Gong YJ, Huo Y. A Survey of National Cardiology Workforce in China. *European*
26
27 *heart journal* 2016;**18**:A1-A5.
28
- 29 12. Narang A, Sinha SS, Rajagopalan B, et al. The Supply and Demand of the
30
31 Cardiovascular Workforce: Striking the Right Balance. *Journal of the American*
32
33 *College of Cardiology* 2016;**68**:1680-89.
34
35
- 36 13. Liang Y, Wang H, Tao X. Quality of life of young clinical doctors in public hospitals in
37
38 China's developed cities as measured by the Nottingham Health Profile (NHP).
39
40 *International journal for equity in health* 2015;**14**:85.
41
42
- 43 14. Steering Committee of the Physicians' Health Study Research G. Final report on the
44
45 aspirin component of the ongoing Physicians' Health Study. *The New England*
46
47 *journal of medicine* 1989;**321**:129-35.
48
49
- 50 15. Hu DY, Yu JM, Chen F, et al. The Chinese physicians' Cardiovascular Risk Evaluation
51
52 (CARE) survey: an assessment of physicians' own cardiovascular risks. *Heart Asia*
53
54 2010;**2**:89-94.
55
56
57

16. Wu J, Cheng X, Qiu L, et al. Prevalence and Clustering of Major Cardiovascular Risk Factors in China: A Recent Cross-Sectional Survey. *Medicine* 2016;**95**:e2712.
17. Lu Y, Wang P, Zhou T, et al. Comparison of Prevalence, Awareness, Treatment, and Control of Cardiovascular Risk Factors in China and the United States. *Journal of the American Heart Association* 2018;**7**.
18. Yang F, Qian D, Hu DY, et al. Prevalence of cardiovascular disease risk factor clustering in Chinese adults. *Clin Trials Regul Sci Cardiol* 2016.
19. Sui H, Chen WW, Wang W. Interpretation of Report on Cardiovascular Diseases in China 2015. *Chin J Cardiovasc Med* 2016;**21**:259-61.
20. Huang XB, Chen F, Dai W, et al. Prevalence and risk factors associated with hypertension in the Chinese Qiang population. *Clinical and experimental hypertension* 2018;**40**:427-33.
21. Hu Y, Wang Z, Wang Y, et al. Prevalence, Awareness, Treatment, and Control of Hypertension among Kazakhs with high Salt Intake in Xinjiang, China: A Community-based Cross-sectional Study. *Scientific reports* 2017;**7**:45547.
22. Abuissa H, Lavie C, Spertus J, et al. Personal health habits of American cardiologists. *The American journal of cardiology* 2006;**97**:1093-6.
23. Lloyd-Jones DM, Evans JC, Levy D. Hypertension in adults across the age spectrum: current outcomes and control in the community. *Jama* 2005;**294**:466-72.
24. James PA, Oparil S, Carter BL, et al. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the Eighth Joint National Committee (JNC 8). *Jama* 2014;**311**:507-20.
25. Leung AA, Daskalopoulou SS, Dasgupta K, et al. Hypertension Canada's 2017

- 1
2
3
4 Guidelines for Diagnosis, Risk Assessment, Prevention, and Treatment of
5
6 Hypertension in Adults. *The Canadian journal of cardiology* 2017;**33**:557-76.
7
8
9 26. Stockwell DH, Madhavan S, Cohen H, et al. The determinants of hypertension
10 awareness, treatment, and control in an insured population. *American journal of*
11
12 *public health* 1994;**84**:1768-74.
13
14
15
16 27. Berhe DF, Taxis K, Haaijer-Ruskamp FM, et al. Hypertension treatment practices and
17 its determinants among ambulatory patients: retrospective cohort study in Ethiopia.
18
19 *BMJ open* 2017;**7**:e015743.
20
21
22
23 28. Levinson W, King TE, Jr., Goldman L, et al. Clinical decisions. American Board of
24 Internal Medicine maintenance of certification program. *The New England journal*
25
26 *of medicine* 2010;**362**:948-52.
27
28
29
30 29. Song P, Jin C, Tang W. New medical education reform in China: Towards healthy
31 China 2030. *Bioscience trends* 2017;**11**:366-69.
32
33
34
35 30. The L. Medical education reform in China. *Lancet* 2017;**390**:334.
36
37
38
39 31. Chen X, Tan X, Li L. Health Problem and Occupational Stress among Chinese Doctors.
40
41 *Chin Med* 2013;**2013**:1-6.
42
43
44
45 32. Staiger DO, Auerbach DI, Buerhaus PI. Trends in the work hours of physicians in the
46 United States. *Jama* 2010;**303**:747-53.
47
48
49
50 33. Conway SH, Pompeii LA, Roberts RE, et al. Dose-Response Relation Between Work
51 Hours and Cardiovascular Disease Risk: Findings From the Panel Study of Income
52 Dynamics. *Journal of occupational and environmental medicine* 2016;**58**:221-6.
53
54
55
56 34. Wu Y, Huxley R, Li L, et al. Prevalence, awareness, treatment, and control of
57 hypertension in China: data from the China National Nutrition and Health Survey
58
59
60

1
2
3
4 2002. *Circulation* 2008;**118**:2679-86.
5

- 6
7 35. Wang J, Zhang L, Wang F, et al. Prevalence, awareness, treatment, and control of
8
9 hypertension in China: results from a national survey. *American journal of*
10
11 *hypertension* 2014;**27**:1355-61.
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

For peer review only

Table 1. Demographic characteristics, current disease and medication of the participants

Variable	Total (n=28,924)
Age (years)	37.82±9.27
20-29	5308 (18.35)
30-39	12,338 (42.66)
40-49	8019 (27.72)
50-59	2674 (9.24)
60-69	584 (2.02)
≥70	1 (0.00)
Gender	
Male	15,749 (54.45)
Female	13,175 (45.55)
Academic degree	
Junior college	225 (0.78)
Bachelor	12,704 (43.92)
Master	10,580 (36.58)
Doctor	2905 (10.04)
Post-doctor	412 (1.42)
Others	2098 (7.25)
Hospital level	
Primary	381 (1.32)
Secondary	10,823 (37.42)

1		
2		
3		
4	Tertiary	17,375 (60.07)
5		
6	Others	345 (1.19)
7		
8		
9	Professional title	
10		
11	General physician	4230 (14.62)
12		
13	Healer	540 (1.87)
14		
15	Resident physician	966 (3.34)
16		
17	Attending physician	13,448 (46.49)
18		
19	Associate chief physician	4674 (16.16)
20		
21	Chief physician	2279 (7.88)
22		
23	Others	2787 (9.64)
24		
25		
26		
27	BMI (kg/m ²)	22.35±2.51
28		
29	<18.5	1475 (5.10)
30		
31	18.5-23.9	19,304 (66.74)
32		
33		
34	≥24	8145 (28.16)
35		
36	Current disease	
37		
38	Coronary heart disease	1760 (6.08)
39		
40	Heart failure	554 (1.92)
41		
42	Diabetes	598 (2.07)
43		
44	Stroke/transient ischemic attack	167 (0.58)
45		
46	Chronic kidney disease	409 (1.41)
47		
48	Peripheral vascular disease	431 (1.49)
49		
50	Hypertension	7319 (25.30)
51		
52		
53		
54		
55		
56		
57		
58		
59		
60		

Medication

Antihypertensive drugs	2323 (8.03)
Hypoglycemic agents	574 (1.98)
Lipid-regulation drugs	1223 (4.23)

Data are expressed as mean±standard deviation or n (%). BMI, body mass index.

For peer review only

Table 2. Clinical characteristics of the participants

Variable	Total (n=28,924)
Systolic blood pressure/diastolic blood pressure (mmHg)	
Systolic blood pressure	122.74±14.27
Diastolic blood pressure	81.2±12.04
<130/<80	8802 (30.43)
Taking antihypertensive drugs	228 (2.59)
130-139/80-89	13,763 (47.58)
Taking antihypertensive drugs	732 (5.32)
≥140/≥90	6359 (21.99)
Taking antihypertensive drugs	2323 (36.53)
Heart rate (bpm)	74.11±9.26
<50	1 (0.00)
50-59	778 (2.69)
60-69	6972 (24.1)
70-79	13,033 (45.06)
80-89	6600 (22.82)
≥90	1540 (5.32)
Fasting blood glucose (mmol/L)	5.1±1.65
<6.1	26,030 (89.99)
6.1-6.9	1810 (6.26)
≥7.0	1084 (3.75)

LDL-C (mmol/L)	2.73±0.87
<2.6	12,888 (44.56)
2.6-3.3	12,058 (41.69)
3.4-4.0	2363 (8.17)
≥4.1	1614 (5.58)
Unknown	1 (0.00)
HDL-C (mmol/L)	1.85±1.02
<1.0	1879 (6.50)
≥1.0	27,043 (93.50)
Unknown	2 (0.01)
TC (mmol/L)	4.09±1.23
<5.2	24,972 (86.34)
5.2-6.1	2988 (10.33)
≥6.2	957 (3.31)
Unknown	7 (0.02)
TG (mmol/L)	1.6 (1.2,2.2)
<1.7	15,547 (53.75)
1.7-2.2	6345 (21.94)
≥2.3	7029 (24.30)
Unknown	3 (0.01)
Smoking	
Frequent	4660 (16.11)

1		
2		
3		
4	Infrequent	13,561 (46.88)
5		
6	Never	10,703 (37.00)
7		
8		
9	Family history	
10		
11	Yes	22,611 (78.17)
12		
13	No	6313 (21.83)
14		
15		

16 Data are expressed as mean±standard deviation or n (%). HDL-C, high density lipoprotein-
17 cholesterol; LDL-C, low density lipoprotein-cholesterol; TC, total cholesterol; TG,
18 triglyceride.
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 3. Prevalence of diseases, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in cardiologists with different gender

Variable	Total (n=28,924)	Male (n=15,749)	Female (n=13,175)	P
Coronary heart disease	1760 (6.08)	1071 (6.80)	689 (5.23)	<0.001
Heart failure	554 (1.92)	340 (2.16)	214 (1.62)	0.001
Diabetes	598 (2.07)	365 (2.32)	233 (1.77)	0.001
Stroke/transient ischemic attack	167 (0.58)	96 (0.61)	71 (0.54)	0.430
Chronic kidney disease	409 (1.41)	258 (1.64)	151 (1.15)	<0.001
Peripheral vascular disease	431 (1.49)	258 (1.64)	173 (1.31)	0.023
Hypertension	7319 (25.30)	4574 (29.00)	2745 (20.83)	<0.001
Taking antihypertensive drugs	2323 (31.74)	1533 (33.52)	790 (28.78)	<0.001
Reaching the target blood pressure	960 (41.33)	610 (39.79)	350 (44.30)	0.036

Data are expressed as n (%).

Table 4. Prevalence of diseases, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in cardiologists with different age

Variable	Total	20-29	30-39	40-49	50-59	60-69	≥70	P
	(n=28924)	(n=5308)	(n=12,338)	(n=8019)	(n=2674)	(n=584)	(n=1)	
Coronary heart disease	1760 (6.08)	272 (5.12)	595 (4.82)	609 (7.59)	219 (8.19)	65 (11.13)	0	<0.001
Heart failure	554 (1.92)	124 (2.34)	215 (1.74)	149 (1.86)	50 (1.87)	16 (2.74)	0	0.099
Diabetes	598 (2.07)	81 (1.53)	193 (1.56)	194 (2.42)	97 (3.63)	33 (5.65)	0	<0.001
Stroke/transient ischemic attack	167 (0.58)	36 (0.68)	54 (0.44)	49 (0.61)	18 (0.67)	10 (1.71)	0	0.004
Chronic kidney disease	409 (1.41)	63 (1.19)	142 (1.15)	151 (1.88)	42 (1.57)	11 (1.88)	0	<0.001
Peripheral vascular disease	431 (1.49)	104 (1.96)	132 (1.07)	128 (1.60)	57 (2.13)	10 (1.71)	0	<0.001
Hypertension	7319 (25.3)	1276 (24.04)	2680 (21.72)	2158 (26.91)	946 (35.38)	258 (44.18)	1 (100)	<0.001
Taking antihypertensive drugs	2323 (31.74)	256 (20.06)	738 (27.54)	806 (37.35)	397 (41.97)	126 (48.84)	0	<0.001
Reaching the target blood pressure	960 (41.33)	124 (48.44)	322 (43.63)	336 (41.69)	130 (32.75)	48 (38.10)	-	0.001

Data are expressed as n (%).

Table 5. Prevalence of diseases, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in cardiologists with different hospital level

Variable	Total	Primary	Secondary	Tertiary	Others	P
	(n=28,924)	(n=381)	(n=10,823)	(n=17,375)	(n=345)	
Coronary heart disease	1760 (6.08)	24 (6.30)	618 (5.71)	1099 (6.33)	19 (5.51)	0.199
Heart failure	554 (1.92)	4 (1.05)	219 (2.02)	326 (1.88)	5 (1.45)	0.435
Diabetes	598 (2.07)	11 (2.89)	239 (2.21)	345 (1.99)	3 (0.87)	0.148
Stroke/transient ischemic attack	167 (0.58)	4 (1.05)	61 (0.56)	100 (0.58)	2 (0.58)	0.584
Chronic kidney disease	409 (1.41)	3 (0.79)	154 (1.42)	250 (1.44)	2 (0.58)	0.411
Peripheral vascular disease	431 (1.49)	2 (0.52)	155 (1.43)	271 (1.56)	3 (0.87)	0.246
Hypertension	7319 (25.30)	136 (35.70)	2695 (24.90)	4413 (25.40)	75 (21.74)	<0.001
Taking antihypertensive drugs	2323 (31.74)	38 (27.94)	904 (33.43)	1354 (30.68)	27 (36.00)	0.049
Reaching the target blood pressure	960 (41.33)	8 (21.05)	390 (43.14)	551 (40.69)	11 (40.74)	0.048

Data are expressed as n (%).

Table S1. Area of expertise of the participants

Variable	Total (n=28,924)
Atherosclerosis and coronary heart disease	14,783 (51.11)
Hypertension	18,477 (63.88)
Arrhythmia and electrophysiology	8226 (28.44)
Blood lipid metabolism	10,147 (35.08)
Congenital heart disease	4678 (16.17)
Heart failure	9087 (31.42)
Pulmonary vascular disease	2859 (9.88)
Cardiac intensive care and monitoring	2051 (7.09)
Interventional cardiology	2526 (8.73)
Cardiovascular imaging	2742 (9.48)
Senile cardiovascular disease	0
Female cardiovascular disease	2859 (9.88)
Structural heart disease	3774 (13.05)
Basic-clinical combination	2350 (8.12)
Others	2746 (9.49)

Data are expressed as n (%).

Table S2. Prevalence of diseases, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in cardiologists with different professional title

Variable	Total (n=28,924)	General physician (n=4230)	Healer (n=540)	Resident physician (n=966)	Attending physician (n=13,448)	Associate chief physician (n=4674)	Chief physician (n=2279)	Others (n=2787)	P
Coronary heart disease	1760 (6.08)	185 (4.37)	39 (7.22)	93 (9.63)	713 (5.30)	382 (8.17)	191 (8.38)	157 (5.63)	<0.001
Heart failure	554 (1.92)	79 (1.87)	19 (3.52)	26 (2.69)	242 (1.80)	79 (1.69)	35 (1.54)	74 (2.66)	0.001
Diabetes	598 (2.07)	60 (1.42)	13 (2.41)	27 (2.80)	250 (1.86)	132 (2.82)	70 (3.07)	46 (1.65)	<0.001
Stroke/transient ischemic attack	167 (0.58)	16 (0.38)	5 (0.93)	9 (0.93)	65 (0.48)	28 (0.60)	18 (0.79)	26 (0.93)	0.013
Chronic kidney disease	409 (1.41)	41 (0.97)	15 (2.78)	28 (2.90)	167 (1.24)	80 (1.71)	30 (1.32)	48 (1.72)	<0.001
Peripheral vascular disease	431 (1.49)	62 (1.47)	8 (1.48)	25 (2.60)	159 (1.18)	76 (1.63)	37 (1.62)	64 (2.30)	<0.001
Hypertension	7319 (25.30)	896 (21.18)	139 (25.74)	263 (27.23)	3032 (22.55)	1413 (30.23)	806 (35.37)	770 (27.63)	<0.001
Taking antihypertensive drugs	2323 (31.74)	179 (19.98)	46 (33.09)	88 (33.46)	934 (30.80)	546 (38.64)	357 (44.29)	173 (22.47)	<0.001
Reaching the target blood pressure	960 (41.33)	70 (39.11)	21 (45.65)	49 (55.68)	404 (43.25)	192 (35.16)	135 (37.82)	89 (51.45)	<0.001

Data are expressed as n (%).

Table S3. Prevalence of diseases, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in male cardiologists with different age

Variable	20-29 (n=2437)	30-39 (n=6777)	40-49 (n=4521)	50-59 (n=1656)	60-69 (n=357)	≥70 (n=1)	P
Coronary heart disease	156 (6.4)	385 (5.7)	349 (7.7)	141 (8.5)	40 (11.2)	0	<0.001
Heart failure	67 (2.7)	137 (2)	94 (2.1)	33 (2.0)	9 (2.5)	0	0.389
Diabetes	44 (1.8)	116 (1.7)	120 (2.7)	66 (4.0)	19 (5.3)	0	<0.001
Stroke/transient ischemic attack	19 (0.8)	29 (0.4)	29 (0.6)	14 (0.8)	5 (1.4)	0	0.071
Chronic kidney disease	41 (1.7)	91 (1.3)	90 (2)	28 (1.7)	8 (2.2)	0	0.154
Peripheral vascular disease	58 (2.4)	82 (1.2)	76 (1.7)	36 (2.2)	6 (1.7)	0	0.002
Hypertension	684 (28.1)	1709 (25.2)	1362 (30.1)	647 (39.1)	171 (47.9)	1 (100)	<0.001
Taking antihypertensive drugs	159 (23.2)	510 (29.8)	506 (37.2)	272 (42)	86 (50.3)	0	<0.001
Reaching the target blood pressure	124 (48.4)	322 (43.6)	336 (41.7)	130 (32.7)	48 (38.1)	-	0.001

Data are expressed as n (%).

Table S4. Prevalence of diseases, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in female cardiologists with different age

Variable	20-29 (n=2871)	30-39 (n=5561)	40-49 (n=3498)	50-59 (n=1018)	60-69 (n=227)	P
Coronary heart disease	116 (4)	210 (3.8)	260 (7.4)	78 (7.7)	25 (11.0)	<0.001
Heart failure	57 (2.0)	78 (1.4)	55 (1.6)	17 (1.7)	7 (3.1)	0.128
Diabetes	37 (1.3)	77 (1.4)	74 (2.1)	31 (3)	14 (6.2)	<0.001
Stroke/transient ischemic attack	17 (0.6)	25 (0.4)	20 (0.6)	4 (0.4)	5 (2.2)	0.010
Chronic kidney disease	22 (0.8)	51 (0.9)	61 (1.7)	14 (1.4)	3 (1.3)	0.001
Peripheral vascular disease	46 (1.6)	50 (0.9)	52 (1.5)	21 (2.1)	4 (1.8)	0.005
Hypertension	592 (20.6)	971 (17.5)	796 (22.8)	299 (29.4)	87 (38.3)	<0.001
Taking antihypertensive drugs	97 (16.4)	228 (23.5)	300 (37.7)	125 (41.8)	40 (46.0)	<0.001
Reaching the target blood pressure	51 (52.6)	107 (46.9)	132 (44)	45 (36)	15 (37.5)	0.108

Data are expressed as n (%).

Table S5. Prevalence of diseases, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in male cardiologists with different hospital level

Variable	Primary (n=211)	Secondary (n=5807)	Tertiary (n=9552)	Others (n=179)	P
Coronary heart disease	12 (5.7)	361 (6.2)	687 (7.2)	11 (6.1)	0.113
Heart failure	3 (1.4)	137 (2.4)	196 (2.1)	4 (2.2)	0.561
Diabetes	5 (2.4)	156 (2.7)	201 (2.1)	3 (1.7)	0.133
Stroke/transient ischemic attack	1 (0.5)	35 (0.6)	59 (0.6)	1 (0.6)	1.000
Chronic kidney disease	2 (0.9)	94 (1.6)	160 (1.7)	2 (1.1)	0.918
Peripheral vascular disease	1 (0.5)	88 (1.5)	169 (1.8)	0	0.098
Hypertension	92 (43.6)	1674 (28.8)	2765 (28.9)	43 (24.0)	<0.001
Taking antihypertensive drugs	28 (30.4)	581 (34.7)	912 (33)	12 (27.9)	0.491
Reaching the target blood pressure	5 (17.9)	229 (39.4)	374 (41)	2 (16.7)	0.031

Data are expressed as n (%).

Table S6. Prevalence of diseases, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in female cardiologists with different hospital level

Variable	Primary (n=170)	Secondary (n=5016)	Tertiary (n=7823)	Others (n=166)	P
Coronary heart disease	12 (7.1)	257 (5.1)	412 (5.3)	8 (4.8)	0.720
Heart failure	1 (0.6)	82 (1.6)	130 (1.7)	1 (0.6)	0.677
Diabetes	6 (3.5)	83 (1.7)	144 (1.8)	0	0.071
Stroke/transient ischemic attack	3 (1.8)	26 (0.5)	41 (0.5)	1(0.6)	0.175
Chronic kidney disease	1 (0.6)	60 (1.2)	90 (1.2)	0	0.643
Peripheral vascular disease	1 (0.6)	67 (1.3)	102 (1.3)	3 (1.8)	0.782
Hypertension	44 (25.9)	1021 (20.4)	1648 (21.1)	32 (19.3)	0.281
Taking antihypertensive drugs	10 (22.7)	323 (31.6)	442 (26.8)	15 (46.9)	0.005
Reaching the target blood pressure	3 (30.0)	161 (49.8)	177 (40)	9 (60.0)	0.022

Data are expressed as n (%).

Table S7. Prevalence of diseases, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in male cardiologists with different professional title

Variable	General physician (n=2049)	Healer (n=260)	Resident physician (n=548)	Attending physician (n=7447)	Associate physician (n=2740)	chief physician (n=1447)	Chief physician (n=1258)	Others (n=1258)	P
Coronary heart disease	107 (5.2)	22 (8.5)	55 (10)	433 (5.8)	233 (8.5)	130 (9.0)	91 (7.2)	<0.001	
Heart failure	44 (2.1)	13 (5.0)	18 (3.3)	155 (2.1)	47 (1.7)	21 (1.5)	42 (3.3)	<0.001	
Diabetes	40 (2.0)	9 (3.5)	16 (2.9)	144 (1.9)	85 (3.1)	50 (3.5)	21 (1.7)	<0.001	
Stroke/transient ischemic attack	9 (0.4)	2 (0.8)	5 (0.9)	39 (0.5)	16 (0.6)	11 (0.8)	14 (1.1)	0.194	
Chronic kidney disease	27 (1.3)	8 (3.1)	13 (2.4)	103 (1.4)	52 (1.9)	23 (1.6)	32 (2.5)	0.009	
Peripheral vascular disease	35 (1.7)	7 (2.7)	18 (3.3)	97 (1.3)	43 (1.6)	21 (1.5)	37 (2.9)	<0.001	
Hypertension	507 (24.7)	82 (31.5)	159 (29)	1944 (26.1)	896 (32.7)	579 (40.0)	407 (32.4)	<0.001	
Taking antihypertensive drugs	120 (23.7)	33 (40.2)	63 (39.6)	620 (31.9)	335 (37.4)	264 (45.6)	98 (24.1)	<0.001	
Reaching the target blood pressure	43 (35.8)	11 (33.3)	32 (50.8)	259 (41.8)	117 (34.9)	96 (36.4)	52 (53.1)	0.008	

Data are expressed as n (%).

Table S8. Prevalence of diseases, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in female cardiologists with different professional title

Variable	General physician (n=2181)	Healer (n=280)	Resident physician (n=418)	Attending physician (n=6001)	Associate chief physician (n=1934)	Chief physician (n=832)	Others (n=1529)	P
Coronary heart disease	78 (3.6)	17 (6.1)	38 (9.1)	280 (4.7)	149 (7.7)	61 (7.3)	66 (4.3)	<0.001
Heart failure	35 (1.6)	6 (2.1)	8 (1.9)	87 (1.4)	32 (1.7)	14 (1.7)	32 (2.1)	0.681
Diabetes	20 (0.9)	4 (1.4)	11 (2.6)	106 (1.8)	47 (2.4)	20 (2.4)	25 (1.6)	0.006
Stroke/transient ischemic attack	7 (0.3)	3 (1.1)	4 (1)	26 (0.4)	12 (0.6)	7 (0.8)	12 (0.8)	0.085
Chronic kidney disease	14 (0.6)	7 (2.5)	15 (3.6)	64 (1.1)	28 (1.4)	7 (0.8)	16 (1.0)	<0.001
Peripheral vascular disease	27 (1.2)	1 (0.4)	7 (1.7)	62 (1.0)	33 (1.7)	16 (1.9)	27 (1.8)	0.039
Hypertension	389 (17.8)	57 (20.4)	104 (24.9)	1088 (18.1)	517 (26.7)	227 (27.3)	363 (23.7)	<0.001
Taking antihypertensive drugs	59 (15.2)	13 (22.8)	25 (24.0)	314 (28.9)	211 (40.8)	93 (41.0)	75 (20.7)	<0.001
Reaching the target blood pressure	27 (45.8)	10 (76.9)	17 (68.0)	145 (46.2)	75 (35.5)	39 (41.9)	37 (49.3)	0.004

Data are expressed as n (%).

Table S9. Univariable and multivariable logistic regressions for hypertension among cardiologists

Variable	Univariable logistic regression		Multivariable logistic regression	
	OR (95%CI)	P	OR (95%CI)	P
Age				
20-29	Reference		Reference	
30-39	0.877 (0.813,0.946)	0.001	0.915 (0.793,1.056)	0.227
40-49	1.163 (1.074,1.26)	<0.001	1.012 (0.861,1.189)	0.885
50-59	1.73 (1.563,1.914)	<0.001	1.397 (1.164,1.678)	<0.001
≥60	2.51 (2.108,2.99)	<0.001	1.949 (1.534,2.476)	<0.001
Gender				
Male	Reference			
Female	0.643 (0.609,0.679)	<0.001	0.866 (0.813,0.924)	<0.001
Academic degree				
Junior college	Reference		Reference	
Bachelor	0.631 (0.476,0.837)	0.001	0.629 (0.461,0.859)	0.004

1					
2					
3					
4					
5	Master	0.713 (0.538,0.946)	0.019	0.722 (0.528,0.988)	0.042
6					
7	Doctor	0.86 (0.643,1.149)	0.307	0.774 (0.56,1.069)	0.120
8					
9	Post-doctor	1.049 (0.742,1.482)	0.787	0.776 (0.53,1.136)	0.191
10					
11	Others	0.844 (0.628,1.133)	0.258	0.771 (0.553,1.074)	0.124
12					
13					
14	Hospital level				
15					
16	Primary	Reference		Reference	
17					
18	Secondary	0.597 (0.482,0.74)	<0.001	0.582 (0.464,0.728)	<0.001
19					
20	Tertiary	0.613 (0.496,0.758)	<0.001	0.579 (0.463,0.724)	<0.001
21					
22	Others	0.5 (0.359,0.696)	<0.001	0.508 (0.359,0.717)	<0.001
23					
24					
25	Professional title				
26					
27	General physician	Reference		Reference	
28					
29	Healer	1.29 (1.049,1.586)	0.016	1.01 (0.791,1.291)	0.934
30					
31	Resident physician	1.392 (1.187,1.633)	<0.001	1.064 (0.871,1.301)	0.542
32					
33	Attending physician	1.083 (0.996,1.178)	0.063	0.965 (0.841,1.107)	0.611
34					
35	Associate chief physician	1.612 (1.464,1.776)	<0.001	1.118 (0.948,1.317)	0.185
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

1					
2					
3					
4					
5	Chief physician	2.037 (1.819,2.281)	<0.001	1.131 (0.94,1.361)	0.192
6					
7	Others	1.42 (1.271,1.587)	<0.001	1.193 (0.99,1.438)	0.063
8					
9	BMI (kg/m ²)				
10					
11	<18.5	0.744 (0.649,0.853)	<0.001	0.919 (0.797,1.061)	0.248
12					
13	18.5-23.9	Reference		Reference	
14					
15	≥24	1.627 (1.536,1.723)	<0.001	1.314 (1.233,1.4)	<0.001
16					
17					
18	Smoking				
19					
20	Frequent	Reference		Reference	
21					
22	Infrequent	0.422 (0.394,0.453)	<0.001	0.568 (0.525,0.613)	<0.001
23					
24	Never	0.342 (0.318,0.369)	<0.001	0.469 (0.431,0.509)	<0.001
25					
26					
27	Family history				
28					
29	No	Reference		Reference	
30					
31	Yes	1.77 (1.667,1.880)	<0.001	1.261 (1.18,1.348)	<0.001
32					
33					
34	Comorbidity				
35					
36	No	Reference		Reference	
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

1
2
3
4
5 Yes 4.003 (3.723,4.304) <0.001 3.158 (2.924,3.41) <0.001
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

For peer review only

Table S10. Univariable and multivariable logistic regressions for antihypertensive drugs taking among cardiologists with hypertension

Variable	Univariable logistic regression		Multivariable logistic regression	
	OR (95%CI)	P	OR (95%CI)	P
Age				
20-29	Reference		Reference	
30-39	1.514 (1.289,1.779)	<0.001	1.433 (1.055,1.945)	0.021
40-49	2.375 (2.019,2.794)	<0.001	1.989 (1.428,2.771)	<0.001
50-59	2.881 (2.387,3.478)	<0.001	2.282 (1.599,3.257)	<0.001
≥60	3.775 (2.854,4.992)	<0.001	2.677 (1.754,4.086)	<0.001
Gender				
Male	Reference		Reference	
Female	0.802 (0.723,0.889)	<0.001	1.2 (1.059,1.359)	0.004
Academic degree				
Junior college	Reference		Reference	
Bachelor	1.565 (0.905,2.708)	0.109	1.025 (0.553,1.901)	0.938

1					
2					
3					
4					
5	Master	1.506 (0.87,2.607)	0.144	0.915 (0.491,1.705)	0.780
6					
7	Doctor	1.809 (1.033,3.168)	0.038	0.93 (0.492,1.757)	0.822
8					
9	Post-doctor	2.46 (1.298,4.659)	0.006	1.092 (0.534,2.235)	0.809
10					
11	Others	1.057 (0.596,1.876)	0.849	1.428 (0.729,2.8)	0.299
12					
13					
14	Hospital level				
15					
16	Primary	Reference			
17					
18	Secondary	1.302 (0.888,1.909)	0.177		
19					
20	Tertiary	1.142 (0.781,1.669)	0.495		
21					
22	Others	1.451 (0.794,2.649)	0.226		
23					
24					
25	Professional title				
26					
27	General physician	Reference		Reference	
28					
29	Healer	1.981 (1.342,2.925)	0.001	1.233 (0.765,1.989)	0.390
30					
31	Resident physician	2.014 (1.486,2.73)	<0.001	1.084 (0.736,1.596)	0.684
32					
33	Attending physician	1.783 (1.488,2.137)	<0.001	1.165 (0.878,1.546)	0.290
34					
35	Associate chief physician	2.523 (2.074,3.068)	<0.001	1.24 (0.898,1.711)	0.192
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

1					
2					
3					
4					
5	Chief physician	3.185 (2.569,3.948)	<0.001	1.407 (0.993,1.992)	0.055
6					
7	Others	1.161 (0.917,1.469)	0.215	0.831 (0.562,1.23)	0.356
8					
9	BMI (kg/m ²)				
10					
11	<18.5	0.628 (0.464,0.852)	0.003	0.78 (0.565,1.078)	0.132
12					
13	18.5-23.9	Reference		Reference	
14					
15	≥24	1.409 (1.272,1.561)	<0.001	1.157 (1.031,1.299)	0.013
16					
17					
18	Smoking				
19					
20	Frequent	Reference		Reference	
21					
22	Infrequent	0.446 (0.397,0.502)	<0.001	0.502 (0.44,0.572)	<0.001
23					
24	Never	0.335 (0.293,0.383)	<0.001	0.374 (0.322,0.434)	<0.001
25					
26					
27	Family history				
28					
29	No	Reference		Reference	
30					
31	Yes	0.485 (0.437,0.539)	<0.001	1.4 (1.247,1.571)	<0.001
32					
33					
34	Comorbidity				
35					
36	No	Reference		Reference	
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

1
2
3
4
5 Yes 3.185 (2.854,3.555) <0.001 2.646 (2.351,2.977) <0.001
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

For peer review only

Table S11. Univariable and multivariable logistic regressions for reaching the target blood pressure among cardiologists taking antihypertensive drugs

Variable	Univariable logistic regression		Multivariable logistic regression	
	OR (95%CI)	P	OR (95%CI)	P
Age				
20-29	Reference		Reference	
30-39	0.824 (0.62,1.096)	0.183	0.689 (0.418,1.138)	0.146
40-49	0.761 (0.574,1.009)	0.058	0.667 (0.391,1.138)	0.137
50-59	0.518 (0.375,0.716)	<0.001	0.465 (0.262,0.825)	0.009
≥60	0.655 (0.424,1.012)	0.057	0.549 (0.286,1.055)	0.072
Gender				
Male	Reference		Reference	
Female	1.204 (1.012,1.432)	0.036	1.081 (0.896,1.304)	0.415
Academic degree				
Junior college	Reference			

Bachelor	0.457 (0.172,1.211)	0.115		
Master	0.483 (0.182,1.282)	0.144		
Doctor	0.484 (0.179,1.306)	0.152		
Post-doctor	0.591 (0.198,1.762)	0.345		
Others	0.791 (0.286,2.192)	0.652		
Hospital level				
Primary	Reference		Reference	
Secondary	2.845 (1.29,6.275)	0.010	2.878 (1.287,6.438)	0.01
Tertiary	2.573 (1.171,5.655)	0.019	2.558 (1.147,5.704)	0.022
Others	2.578 (0.863,7.701)	0.090	2.179 (0.714,6.646)	0.171
Professional title				
General physician	Reference		Reference	
Healer	1.308 (0.681,2.514)	0.420	1.697 (0.8,3.603)	0.168
Resident physician	1.956 (1.167,3.28)	0.011	2.768 (1.467,5.225)	0.002
Attending physician	1.187 (0.856,1.646)	0.304	1.585 (0.982,2.558)	0.059

1					
2					
3					
4					
5	Associate chief physician	0.845 (0.596,1.196)	0.341	1.271 (0.747,2.16)	0.376
6					
7	Chief physician	0.947 (0.655,1.369)	0.772	1.623 (0.928,2.837)	0.089
8					
9	Others	1.65 (1.081,2.519)	0.020	1.599 (1.036,2.469)	0.034
10					
11	BMI (kg/m ²)				
12					
13	<18.5	0.973 (0.566,1.673)	0.922	0.872 (0.5,1.521)	0.629
14					
15	18.5-23.9	Reference		Reference	
16					
17	≥24	0.621 (0.524,0.738)	<0.001	0.657 (0.548,0.787)	<0.001
18					
19					
20	Smoking				
21					
22	Frequent	Reference			
23					
24	Infrequent	0.936 (0.777,1.128)	0.489		
25					
26	Never	1.022 (0.819,1.275)	0.848		
27					
28	Family history				
29					
30	No	Reference			
31					
32	Yes	1.445 (1.219,1.713)	<0.001	0.746 (0.624,0.891)	0.001
33					
34	Comorbidity				
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

No	Reference			
Yes	0.811 (0.685,0.96)	0.015	0.811 (0.679,0.97)	0.022

For peer review only

CCHS**QUESTIONNAIRE**

China Cardiologist Heart Study

FORM

INSTRUCTIONS: This collection of information is estimated to average 10 minutes. Name and contact information must be entered above. Please enter the number so that the last digit appears in the rightmost box. Enter leading zeros where necessary to fill all boxes. For "multiple choice" and "yes/no" type questions, circle the letter corresponding to the most appropriate response. If a letter is circled incorrectly, mark through it with an "X" and circle the correct response.

CCHS Center use onlySequence Number

1. Name: _____

2. Date of birth: /____/____(yyyy/mm)

3. Contact phone number: _____

4. Employer: Hospital name, district/county, city, province/municipality _____

A. Personal information1. Hospital level:

2. Professional title: _____

3. Academic degree: _____

4. Area of expertise (multiple choices available):

- | | |
|--|---|
| <input type="radio"/> Atherosclerosis and coronary heart disease | <input type="radio"/> Hypertension |
| <input type="radio"/> Arrhythmia and electrophysiology | <input type="radio"/> Blood lipid metabolism |
| <input type="radio"/> Congenital heart disease | <input type="radio"/> Heart failure |
| <input type="radio"/> Pulmonary vascular disease | <input type="radio"/> Structural heart disease |
| <input type="radio"/> Female cardiovascular disease | <input type="radio"/> Senile cardiovascular disease |
| <input type="radio"/> Basic-clinical combination | <input type="radio"/> Cardiovascular imaging |
| <input type="radio"/> Interventional cardiology | <input type="radio"/> Cardiac intensive care and monitoring |
| <input type="radio"/> Others | |

B. Survey information1. Gender: Male Female2. Height: cm3. Weight: kg

1
2
3 4. Are you currently taking the following medications? (multiple choices available)

- 4 ○ Antihypertensive drugs
- 5 ○ Lipid-regulation drugs
- 6 ○ Hypoglycemic agents
- 7 ○ None
- 8
- 9

10
11 5. Do you have any of the following clinical conditions? (multiple choices available)

- 12 ○ None
- 13 ○ Coronary heart disease
- 14 ○ Heart failure
- 15 ○ Diabetes
- 16 ○ Chronic kidney disease
- 17 ○ Peripheral vascular disease
- 18 ○ Stroke/transient ischemic attack
- 19
- 20
- 21
- 22
- 23
- 24

25 6. Did you smoke ≥ 1 cigarette per day in the past 3 months?

- 26 ○ Yes
- 27 ○ No
- 28 ○ Never smoked
- 29
- 30

31 7. Do you have a first-degree male relative who suffered from a cardiovascular disease at <55
32 years of age or a first-degree female relative who suffered from a cardiovascular disease at <65
33 years of age?
34

- 35 ○ No
- 36 ○ Yes
- 37
- 38
- 39
- 40
- 41

42 **C. Blood Pressure** (Please record the data in the last 2 weeks, If don't know, please fill in 999)

- 43 1. Average sitting systolic blood pressure: □□□mmHg
- 44 2. Average sitting diastolic blood pressure: □□□mmHg
- 45 3. Average heart rate: □□□bpm
- 46
- 47
- 48
- 49
- 50

51 **D. Laboratory** (Please record the data of the most recent results within a year, If don't know,
52 please fill in 999)

- 53 1. Fasting blood glucose: □□.□mmol/L
- 54 2. Total cholesterol (TC): □□.□mmol/L or □□□.□mg/dL
- 55 3. Low density lipoprotein-cholesterol (LDL-C): □□.□mmol/L or □□□.□mg/dL
- 56 4. High density lipoprotein-cholesterol (HDL-C): □□.□mmol/L or □□□.□mg/dL
- 57
- 58
- 59
- 60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

5. Triglyceride (TG): . mmol/L or . mg/dL

Thank you very much for your help!

For peer review only

STROBE Statement

Checklist of items that should be included in reports of observational studies

Section/Topic	Item No	Recommendation	Reported on Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	5
		<i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	
		<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	
Variables	7	(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed	5
		<i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	
Data sources/measurement	8*	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Bias	9	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Study size	10	Describe any efforts to address potential sources of bias	6
Quantitative variables	11	Explain how the study size was arrived at	6
Statistical methods	12	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
		(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	7
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed	7
<i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed			
		<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	7
		(e) Describe any sensitivity analyses	7

Section/Topic	Item No	Recommendation	Reported on Page No
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	9-11
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-11
		(b) Report category boundaries when continuous variables were categorized	
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	11-14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	14-15
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Perception and self-management of hypertension in Chinese cardiologists (CCHS): a multicenter, large-scale cross-sectional study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-029249.R1
Article Type:	Research
Date Submitted by the Author:	12-Jul-2019
Complete List of Authors:	Hou, Lei ; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology; Tongren hospital, Shanghai Jiaotong University, School of Medicine, Department of Cardiology Jin, Xuejuan ; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology Ma, Jianying ; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology Qian, Juying; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology Huo, Yong ; Peking University First Hospital, Department of Cardiology Ge, Junbo; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology
Primary Subject Heading:	Cardiovascular medicine
Secondary Subject Heading:	Cardiovascular medicine
Keywords:	health survey, cardiovascular diseases, China, cardiologists, cross-sectional studies

SCHOLARONE™
Manuscripts

1
2
3
4 **Perception and self-management of hypertension in Chinese cardiologists (CCHS): a**
5 **multicenter, large-scale cross-sectional study**
6
7
8
9
10

11 **Running title:** The China Cardiologist Heart Study
12
13
14

15 Lei Hou^{1,2¶}, Xuejuan Jin^{1¶}, Jianying Ma¹, Juying Qian¹, Yong Huo³, Junbo Ge¹
16
17
18
19

20 ¹Department of Cardiology, Shanghai Institute of Cardiovascular Diseases, Zhongshan
21 Hospital, Fudan University, Shanghai, China
22
23

24 ²Department of Cardiology, Tongren Hospital, Shanghai Jiaotong University, School of
25 Medicine, Shanghai, China
26
27

28 ³Department of Cardiology, Peking University First Hospital, Beijing, China
29
30

31 [¶]These authors contributed equally to this work.
32
33
34
35

36 **Corresponding author:** Junbo Ge, No. 180 Fenglin Road, 200032, Department of
37 Cardiology, Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan
38 University, Shanghai, China. Email: gejunbo@126.com
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

ABSTRACT

Objectives: To determine the frequency of risk factors for hypertension among Chinese cardiologists using a nationwide survey.

Design: Multicenter, cross-sectional observational study.

Setting: A total of 2441 hospitals across China were surveyed between September 2016 and August 2017.

Participants: All cardiologists in-service were surveyed (n=28,924).

Interventions: WeChat-based electronic data capture system, a social application in China (Tencent, Nanshan, China), was used for data acquisition. Physician subscribed to the WeChat official account of the China Cardiologist Heart Study, and filled out an online questionnaire that included age, gender, level of in-service hospital, professional title, academic degree, area of expertise, and cardiovascular risk factors. All information was required.

Primary and secondary outcome measures: The primary outcome was the presence of cardiovascular risk factors. The secondary outcome was the impact of factors on the occurrence of hypertension.

Results: Among 28,924 Chinese cardiologists who responded the questionnaire, 57.6% had blood pressure of 130-139/80-89 mmHg (5.3% were taking antihypertensive drugs) and 22.0% had blood pressure $\geq 140/\geq 90$ mmHg (36.5% were taking antihypertensive drugs). The multivariable analysis showed that age, gender, academic degree, hospital level, body mass index (BMI), smoking, and comorbidities were independently associated with hypertension among cardiologists (all $P < 0.05$). Age, female gender, BMI, smoking, family history of cardiovascular diseases, and comorbidities were independently associated with

1
2
3
4 taking antihypertensive drugs among hypertensive cardiologists (all $P < 0.05$). Age, hospital
5 level, professional title, BMI, family history of cardiovascular diseases, and comorbidities
6 were independently associated with reaching target blood pressure among hypertensive
7 cardiologists taking antihypertensive drugs.
8
9
10
11
12

13 **Conclusion:** Chinese cardiologists do not recognize and pay attention to their own blood
14 pressure. Their antihypertensive treatment level was low. The identified risk factors could
15 be used to identify cardiologists at higher risk for hypertension and for implementing
16 preventive interventions.
17
18
19
20
21
22

23
24
25 **Keywords:** health survey; cardiovascular diseases; China; cardiologists; cross-sectional
26 studies.
27
28
29
30
31

32 **Strengths and limitations of this study**

- 33
34 - The strength of the present study lies in its large sample size (>26,000 participants) from
35 all across China.
36
- 37
38 - Because of funding and logistics, data had to be collected using a self-filled survey, which
39 could introduce bias compared to a formal epidemiological study.
40
41
- 42
43 - The medical system in China and the formation required to work in cardiology are
44 different from that of other countries, limiting the generalizability of the data.
45
46
- 47
48 - The geographical distribution of the cardiologists across China was not taken into account.
49
50
51
52
53
54
55
56
57
58
59
60

INTRODUCTION

Cardiologists are exposed to threats to their health, resulting in an important incidence of orthopedic problems [1 2]. In addition, there is a risk of radiation-related diseases [2 3]. Besides those obvious occupational hazards, cardiologists are exposed to stress, work overload, and bad lifestyle habits that may increase their cardiovascular risk [4 5], and this holds true in Chinese cardiologists [6 7]. A study from Italy showed that the cardiovascular profile of Italian cardiologists was far from ideal and that the perception of their own risk factors was low [4 8]. The understanding and awareness of cardiologists' perception of their own health care are not only important for maintaining individual health and the manpower of the national medical health care system, but also directly affect their understanding and behaviors toward the patients, eventually having some impact on the prevention and treatment of cardiovascular diseases (CVDs). Indeed, cardiologists serve as role models for behavioral changes [9-11]. Their knowledge about CVD risk factors and their perception of how they treat their patients with CVD risk reflects also on their perception of their own risk factors [12].

Chinese physicians face a large number of patients and are at risk of job turnover [13]. A survey of Chinese cardiologists found that there were only 1.9 cardiologists per 100,000 people [6], compared with 8.1 per 100,000 people in the United States in 2009 [7]. Hence, there are heavy responsibilities and work burden for cardiologists in China. Faced with such a disparity in the proportion of cardiologists and patients, the working time of Chinese doctors usually exceeds the standard working time [14]. All of those factors may lead to an increase in the incidence of cardiovascular risk factors and diseases among Chinese cardiologists. Indeed, when comparing the Physicians' Health Study from the United States

1
2
3
4 with the Chinese Cardiovascular Risk Evaluation (CARE) study [15 16], it was found that
5
6 the prevalence of cardiovascular risk factors among Chinese cardiologists was higher than
7
8 among American physicians, and that Chinese cardiologists had a poor perception of their
9
10 own cardiovascular risk factors. Hypertension is a major risk factor for cardiovascular
11
12 diseases and death in China [17] and in the world in general [18 19]. Hypertension may
13
14 arise due to adverse life style habits (tobacco, alcohol, caffeine, salty foods) [20], but also
15
16 from chronic stress, work pressure, and lack of sleep [21-25].
17
18

19
20 A recent anecdotic observation is that sudden death was observed in many young Chinese
21
22 cardiologists, prompting the hypothesis that Chinese cardiologists may neglect their own
23
24 health. In addition, as stated above, Chinese cardiologists are likely to display risk factors
25
26 of hypertension, which will have a certain impact on their health. Nevertheless, the factors
27
28 for poor cardiovascular factors among cardiologists must first be identified and understood
29
30 before interventions may be implemented. Therefore, the present study aimed to examine
31
32 the risk factors for hypertension among Chinese cardiologists using a nationwide survey.
33
34
35
36
37
38

39 **SUBJECTS AND METHODS**

40 **Participants**

41
42 This was a national, multicenter, cross-sectional observational study. Cardiologists from
43
44 2441 hospitals across China were surveyed between September 2016 and August 2017. All
45
46 cardiologists in-service were eligible. If a hospital did not have a department of cardiology
47
48 and only had a department of internal medicine, then the internists engaged in the
49
50 cardiovascular field were included. Physicians who were unwilling to participate in this
51
52 survey were excluded. This study was approved by the Ethics Committee of Tongren
53
54
55
56
57
58
59
60

1
2
3
4 Hospital, Shanghai Jiaotong University, School of Medicine (approval number: 2015-017-
5
6 01). All physicians signed the informed consent form.
7

8 9 **Sampling method**

10 Due to the funding and lack of manpower, it was difficult to design a sampling frame
11 according to economic levels and hospital levels and randomly select hospitals nationwide.
12 Hence, the study used a two-stage sampling process, selecting hospitals using non-random
13 stratification according to regional economic levels and hospital levels during the first stage.
14 In the second stage, a random proportional sample from authoritative lists was created, and
15 all the cardiologists in this sample of hospitals were invited to participate in the study.
16
17
18
19
20
21
22
23
24

25 **Questionnaire**

26 The study was performed and coordinated under the guidance of a scientific advisory board.
27 Data quality was monitored by the study coordinators throughout the study.
28
29 WeChat-based electronic data capture (EDC) system, a social application in China (Tencent,
30 Nanshan, China), was used for data acquisition. Physician subscribed to the WeChat
31 official account of the China Cardiologist Heart Study (Wuxi Boyankang Technology
32 Development Co., Ltd. was responsible for platform construction and data management),
33 and filled out an online questionnaire that included age, gender, level of in-service hospital,
34 professional title (general physicians were those with a bachelor degree; healer were those
35 with a junior college degree or below), academic degree, area of expertise, height, body
36 weight, blood pressure, heart rate, fasting blood glucose, total cholesterol (TC), low density
37 lipoprotein-cholesterol (LDL-C), high density lipoprotein-cholesterol (HDL-C), triglyceride
38 (TG), current diseases, medication status, smoking history, and family history. The
39 questions about area of expertise and current diseases had multiple choices. All information
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4 was required. The questionnaire with incomplete information could not be submitted. At
5
6 the same time, there were logically possible upper and lower limits for the content to be
7
8 filled in. If the limit was exceeded, it could indicate that the data was incorrect. The staff of
9
10 the project team would remind the physician to check. The questionnaire was shown in
11
12 Appendix 1.
13
14

15 **Data collection**

16
17 Demographic variables and risk factors for CVD were assessed according to standardized
18
19 study protocols. Age was automatically generated based on the birth date. Blood pressure
20
21 and heart rate were the average levels over the past 2 weeks. Fasting blood glucose and
22
23 blood lipids were reviewed by the physician for the most recent results within a year. Body
24
25 mass index (BMI) was calculated based on weight and height as kg/m^2 . Hypertension was
26
27 defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg or
28
29 taking antihypertensive drugs. Reaching the target blood pressure was defined as systolic
30
31 blood pressure < 140 mmHg and diastolic blood pressure < 90 mmHg. Smoking history was
32
33 defined as at least one cigarette/day in the past 3 months (yes, no, never smoking). Family
34
35 history was defined as first-degree male relative with a CVD at < 55 years of age or a first-
36
37 degree female relative with a CVD at < 65 years of age.
38
39
40
41
42

43 **Statistical analysis**

44
45 All data were statistically analyzed using SPSS 22.0 (IBM, Armonk, NY, USA).
46
47 Continuous variables that followed the normal distribution were expressed as means \pm
48
49 standard deviation (SD), and skewed continuous variables were summarized as medians
50
51 (interquartile range). Categorical variables were expressed as frequencies (percentage) and
52
53 chi-square tests were used for comparison between groups. Univariable and multivariable
54
55
56
57
58
59
60

1
2
3
4 logistic regression analyses were used to analyze the factors influencing the prevalence of
5
6 hypertension, rate of medicine taking, and rate of reaching the target blood pressure. For
7
8 the multivariable analysis, comorbidity was defined as the presence of any other disease, or
9
10 taking antidiabetic or lipid-lowering drugs. Two-sided $P < 0.05$ was considered as
11
12 statistically significant.
13
14

15 **Patient and Public Involvement statement**

16 Patients were not involved in the study design and implementation.
17
18
19
20
21

22 **RESULTS**

23 **Characteristics of the participants**

24
25 A total of 30,000 cardiologists across China were invited to participate in this survey, and
26
27 28,924 filled the questionnaire, for a response rate of 96.4%. Tables 1, 2 and
28
29 Supplementary Table S1 present their characteristics. Most (42.7%) were 30-39 years old,
30
31 male (54.5%), with a bachelor degree (43.9%), working in a tertiary hospital (60.1%), and
32
33 were attending physicians (46.5%). Their main areas of expertise were: hypertension
34
35 (63.9%), atherosclerosis and coronary artery diseases (51.1%), blood lipids and metabolism
36
37 (35.1%), and heart failure (31.4%). Most had a BMI of 18.5-23.9 kg/m² (66.7%), fasting
38
39 blood glucose < 6.1 mmol/L (90.0%), LDL-C < 2.60 mmol/L (44.6%), HDL-C ≥ 1.0 mmol/L
40
41 (93.5%), TC < 5.2 mmol/L (86.3%), and TG < 1.7 mmol/L (53.8%). Among them, 57.6%
42
43 had blood pressure of 130-139/80-89 mmHg (5.3% were taking antihypertensive drugs) and
44
45 22.0% had blood pressure $\geq 140/\geq 90$ mmHg (36.5% were taking antihypertensive drugs).
46
47 Among all cardiologists, 37.0% never smoked, 78.2% had a family history of CVDs, 25.3%
48
49 had hypertension, and 8.0% were taking antihypertensive drugs.
50
51
52
53
54
55
56
57
58
59
60

Gender differences in the prevalence of hypertension in Chinese cardiologists

Hypertension was more prevalent in male cardiologists than in females ($P<0.001$) (Table 3). More male cardiologists were taking antihypertensive drugs (33.5% vs. 28.8%, $P<0.001$), but more female cardiologists achieved the target blood pressure (44.3% vs. 39.8%, $P=0.036$).

Age differences in the prevalence of hypertension in Chinese cardiologists

Table 4 shows that hypertension was more prevalent in the older age groups ($P<0.001$). The highest proportions of cardiologists taking antihypertensive drugs were in the 50-59 (42.0%) and 60-69 (48.8%) years of age groups. The highest proportions of cardiologists reaching the target blood pressure were in the 20-29 (48.4%), 30-39 (43.6%), and 40-49 (41.7%) years of age groups. Supplementary Tables S2 and S3 show that similar patterns were observed when the analyses were performed by gender.

Hospital level differences in the prevalence of hypertension in Chinese cardiologists

Table 5 shows that the prevalence of hypertension was higher in primary hospitals (35.7%) compared with secondary (24.9%) and tertiary (25.4%) hospitals ($P<0.001$). The proportions of cardiologists taking antihypertensive drugs and reaching the target blood pressure were higher in secondary and tertiary hospitals (both $P<0.05$). Similar patterns could be observed when analyzing male and female cardiologists (Supplementary Tables S4 and S5).

Professional title differences in the prevalence of hypertension in Chinese cardiologists

Hypertension was more prevalent in associate chief physicians and chief physicians ($P<0.001$), with a correspondingly higher proportion of cardiologists taking

1
2
3
4 antihypertensive drugs ($P<0.001$). Residents, healers, and attending physicians had the
5
6 highest proportions of cardiologists achieving the target blood pressure ($P<0.001$)
7
8 (Supplementary Table S6). Globally, similar patterns were observed when analyzing the
9
10 data by male and female cardiologists (Supplementary Tables S7 and S8).
11
12

13 **Factors associated with hypertension among cardiologists**

14
15 Table S9 presents the univariable and multivariable analyses of the factors associated with
16
17 hypertension among Chinese cardiologists. Age (50-59 years: odds ratio [OR]=1.397, 95%
18
19 confidence interval [CI]: 1.164-1.678, $P<0.001$; ≥ 60 years: OR=1.949, 95%CI: 1.534-2.476,
20
21 $P<0.001$ vs. 20-29 years), female gender (OR=0.866, 95%CI: 0.813-0.924, $P<0.001$ vs.
22
23 male), academic degree (bachelor: OR=0.629, 95%CI: 0.461-0.859, $P=0.004$; master:
24
25 OR=0.722, 95%CI: 0.528-0.988, $P=0.04$ vs. junior college), hospital level (secondary:
26
27 OR=0.582, 95%CI: 0.464-0.728, $P<0.001$; tertiary: OR=0.579, 95%CI: 0.463-0.724,
28
29 $P<0.001$ vs. primary), BMI (≥ 24 kg/m²: OR=1.314, 95%CI: 1.233-1.400, $P<0.001$ vs. 18.5-
30
31 23.9 kg/m²), smoking (infrequent: OR=0.568, 95%CI: 0.525-0.613, $P<0.001$; never:
32
33 OR=0.469, 95%CI: 0.431-0.509, $P<0.001$ vs. frequent), and comorbidities (OR=3.158,
34
35 95%CI: 2.924-3.410, $P<0.001$) were independently associated with hypertension among
36
37 cardiologists.
38
39
40
41
42

43 **Factors associated with taking antihypertensive drugs among hypertensive** 44 45 **cardiologists**

46
47 Table S10 presents the univariable and multivariable analyses of the factors associated with
48
49 taking antihypertensive drugs among hypertensive cardiologists. Age (30-39 years:
50
51 OR=1.433, 95%CI: 1.055-1.945, $P=0.02$; 40-49 years: OR=1.989, 95%CI: 1.428-2.771,
52
53 $P<0.001$; 50-59 years: OR=2.282, 95%CI: 1.599-3.257, $P<0.001$; ≥ 60 years: OR=2.677,
54
55
56
57
58
59
60

95%CI: 1.754-4.086, $P < 0.001$ vs. 20-29 years), female gender (OR=1.200, 95%CI: 1.059-1.359, $P = 0.004$ vs. male), BMI (≥ 24 kg/m²: OR=1.157, 95%CI: 1.031-1.299, $P = 0.01$ vs. 18.5-23.9 kg/m²), smoking (infrequent: OR=0.502, 95%CI: 0.440-0.572, $P < 0.001$; never: OR=0.374, 95%CI: 0.322-0.434, $P < 0.001$ vs. frequent), family history of CVDs (OR=1.400, 95%CI: 1.247-1.571, $P < 0.001$), and comorbidities (OR=2.646, 95%CI: 2.351-2.977, $P < 0.001$) were independently associated with taking antihypertensive drugs among hypertensive cardiologists.

Factors associated with reaching target blood pressure among hypertensive cardiologists taking antihypertensive drugs

Table S11 presents the univariable and multivariable analyses of the factors associated with reaching target blood pressure among hypertensive cardiologists taking antihypertensive drugs. Age (50-59 years: OR=0.465, 95%CI: 0.262-0.825, $P = 0.009$ vs. 20-29 years), hospital level (secondary: OR=2.878, 95%CI: 1.287-6.438, $P = 0.01$; tertiary: OR=2.558, 95%CI: 1.147-5.704, $P = 0.02$ vs. primary), professional title (residents: OR=2.768, 95%CI: 1.467-5.225, $P = 0.002$ vs. general physicians), BMI (≥ 24 kg/m²: OR=0.657, 95%CI: 0.548-0.787, $P < 0.001$ vs. 18.5-23.9 kg/m²), family history of CVDs (OR=0.746, 95%CI: 0.624-0.891, $P = 0.001$), and comorbidities (OR=0.811, 95%CI: 0.679-0.970, $P = 0.02$) were independently associated with reaching target blood pressure among hypertensive cardiologists taking antihypertensive drugs.

DISCUSSION

Chinese cardiologists have a poor knowledge of their own cardiovascular risk factors. The present study aimed to examine the risk factors for hypertension among Chinese

1
2
3
4 cardiologists using a nationwide survey. The results suggest that Chinese cardiologists do
5
6 not recognize and pay attention to their own blood pressure. Their antihypertensive
7
8 treatment level was low. The identified risk factors could be used to identify cardiologists
9
10 at higher risk for hypertension and for implementing preventive interventions.
11
12

13
14 In China, the prevalence of hypertension is around 24% [26-28], leading to a significant
15
16 cardiovascular burden [29]. In the present study, the prevalence of hypertension was 25.3%,
17
18 similar to the prevalence in the general Chinese population. A previous survey of
19
20 cardiologists conducted in 2011 revealed participants' characteristics that were similar to
21
22 those of the present study [6], further supporting the representativeness of our sample. Of
23
24 course, there is a certain overlap between the samples of the two studies, but the exact
25
26 extent of this overlap cannot be confirmed.
27
28

29
30 In the present study, 57.6% of the cardiologists had borderline or at-risk blood pressure
31
32 (130-139/80-89 mmHg) and only 5.3% were taking antihypertensive drugs. In addition,
33
34 22.0% had blood pressure $\geq 140/\geq 90$ mmHg, but only 36.5% were taking antihypertensive
35
36 drugs. Despite the expected health knowledge in physicians compared with the general
37
38 population, this rate of treatment was surprisingly not better than in the general Chinese
39
40 population [30 31]. The SOCRATES study showed that the rate of using lipid-lowering,
41
42 antihypertensive, and cardiovascular drugs was low among Italian cardiologists [8],
43
44 supporting the present study. Combined data from the Chinese (CHARLS study) and the
45
46 American (NHANES study) general populations indicate that China had lower rates of
47
48 hypertension treatment than the USA [27]. This is also supported by the CARE study,
49
50 which showed that physicians had suboptimal awareness of their own cardiovascular risk,
51
52 as well as suboptimal use of prophylaxis [15 16], and by the SOCRATES study, which
53
54
55
56
57
58
59
60

1
2
3
4 showed that the self-awareness of cardiologists' own cardiovascular risk factors was mild
5
6 [8]. On the other hand, Abuissa et al. [32] showed that American cardiologists had
7
8 generally good lifestyle habits.
9

10
11 Age, gender, BMI, smoking, family history of CVDs, and comorbidities are well-known
12
13 factors for the risk of having hypertension, compliance to treatment, and/or achieving the
14
15 target blood pressure across the globe [33-35]. Aboyans et al. [11] showed that the
16
17 awareness and management of smoking cessation strategies among smoking French
18
19 cardiologists were low. In the present study, age, gender, BMI, smoking, family history of
20
21 CVDs were associated with the risk of having hypertension and with the risk of not taking
22
23 the proper antihypertensive medication and the risk of not achieving the target blood
24
25 pressure. Even if age, gender, and comorbidities are non-modifiable risk factors, they could
26
27 help identify cardiologists in need of more efforts for seeking the proper cardiovascular
28
29 treatments. This is supported by previous studies in various populations [30 36 37].
30
31
32
33

34
35 Great efforts are necessary to become a cardiologist in Western countries, but differences in
36
37 the Chinese medical system make that less efforts are necessary to become a cardiologist in
38
39 China, a situation that is currently being corrected [6 38-40]. The present study suggests
40
41 that having a bachelor or master degree led to lower risk of hypertension compared with
42
43 junior college level. This could be due to the fact that people with more advanced training
44
45 possess more skills and knowledge, leading to less stress in their work. In addition, they
46
47 have higher income, decreasing the need for working long and stressful hours. This is
48
49 supported by a study that showed that physicians with a low education level had poor
50
51 quality of life in China [14]. As more experienced physicians can have access to more
52
53 advanced hospitals, we observed that cardiologists working in secondary and tertiary
54
55
56
57
58
59
60

1
2
3
4 hospitals had a lower risk of having hypertension. This could be due to a better awareness
5
6 of health knowledge in general, but also to the better material and human resources in more
7
8 advanced hospitals, hereby lowering stress and workload [14 41]. Workload was not
9
10 directly collected in the present study, but previous studies reported that it is higher in
11
12 China than in the USA, with 1.9 vs. 8.1 cardiologists per 100,000 people [6 7]. Considering
13
14 the large sample size in the present study, it is probable that our study population follows
15
16 the national trend. One study showed that the working hours of American physicians were
17
18 decreasing over the years [42]. It has been shown that working long hours was associated
19
20 with an increased cardiovascular risk [43]. Better knowledge and lower stress/workload can
21
22 also be associated with being properly treated or not for hypertension and taking the proper
23
24 steps, both on the medical and lifestyle points of view, to achieve the blood pressure targets,
25
26 as observed in the present study. This is supported by a number of studies in the Chinese
27
28 general population [30 31 44 45].
29
30
31
32
33

34 The strength of the present study lies in its large sample size (>26,000 participants) from all
35
36 across China. On the other hand, because of funding and logistics, data had to be collected
37
38 using a self-filled survey, which could introduce bias compared to a formal epidemiological
39
40 study. In addition, the survey was filled only by the cardiologists willing to do so. Some
41
42 physicians could be tempted to provide data that are better than the reality. Nevertheless,
43
44 the prevalence of hypertension (based on the composite variable made of blood pressure
45
46 and antihypertensive drugs, not on a formal inquiry about a diagnosis of hypertension) was
47
48 similar to that of the general population of China, suggesting data validity. Of course, the
49
50 medical system in China and the formation required to work in cardiology are different
51
52 from that of other countries [6 38], limiting the generalizability of the data. The
53
54
55
56
57
58
59
60

1
2
3
4 geographical distribution of the cardiologists across China was not taken into account.
5
6 Importantly, the survey was not an epidemiological questionnaire and it was only used for
7
8 data collection, not assessment, and validity and reliability were not verified. Finally, the
9
10 characteristics of the cardiologists who were unwilling to fill the survey were not collected.
11
12
13 Additional studies are necessary to confirm those findings.
14

15
16 In conclusion, the results suggest that Chinese cardiologists do not recognize and pay
17
18 attention to their own cardiovascular health. Their antihypertensive treatment level was low.
19
20 The identified risk factors could be used to identify cardiologists at higher risk for
21
22 hypertension and for implementing preventive interventions. Our results have a number of
23
24 implications for the reform of health care awareness and prophylaxis in cardiologists in
25
26
27 China.
28
29
30

31 32 **APPENDIX 1**

33
34 The China Cardiologist Heart Study Questionnaire
35
36
37

38 39 **DATA SHARING STATEMENT**

40
41 No additional data are available.
42
43
44

45 46 **ACKNOWLEDGMENTS**

47
48 The authors acknowledge the contribution of all physicians who participated in this survey.
49
50 The study was started by the Chinese Cardiovascular Association and supported by the
51
52 GUSU group.
53
54
55
56
57

FUNDING

The study is supported by the Emerging Frontier Project of Shanghai Hospital Development Center (No. SHDC12014101), the Innovative Research Group Project of National Natural Science Foundation of China (No. 81521001), and National Key Research and Development Project (No. 2016YFC1301200). The authors declare that they have no conflicts of interest.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

AUTHORS' CONTRIBUTIONS

Lei Hou, Xuejuan Jin conceived and coordinated the study, designed, performed and analyzed the experiments, wrote the paper. Jianying Ma, Juying Qian, Yong Huo carried out the data collection, data analysis, and revised the paper. Junbo Ge designed the study, carried out the data analysis, and revised the paper. All authors reviewed the results and approved the final version of the manuscript.

REFERENCES

1. Goldstein JA, Balter S, Cowley M, et al. Occupational hazards of interventional cardiologists: prevalence of orthopedic health problems in contemporary practice. *Catheterization and cardiovascular interventions : official journal of the Society for Cardiac Angiography & Interventions* 2004;**63**(4):407-11 doi: 10.1002/ccd.20201[published Online First: Epub Date]].
2. Dehmer GJ. Occupational hazards for interventional cardiologists. *Catheterization and cardiovascular interventions : official journal of the Society for Cardiac Angiography & Interventions* 2006;**68**(6):974-6 doi: 10.1002/ccd.21004[published Online First: Epub Date]].
3. Clark DA. How much is too much? *Catheterization and cardiovascular interventions : official journal of the Society for Cardiac Angiography & Interventions* 2000;**51**(3):265
4. Faggiano P, Temporelli PL, Zito G, et al. [Cardiovascular risk profile and lifestyle habits in a cohort of Italian cardiologists. Results of the SOCRATES survey]. *Monaldi archives for chest disease = Archivio Monaldi per le malattie del torace* 2013;**80**(3):118-25 doi: 10.4081/monaldi.2013.73[published Online First: Epub Date]].
5. Michel JB, Sangha DM, Erwin JP, 3rd. Burnout Among Cardiologists. *The American journal of cardiology* 2017;**119**(6):938-40 doi: 10.1016/j.amjcard.2016.11.052[published Online First: Epub Date]].
6. Gong YJ, Huo Y. A Survey of National Cardiology Workforce in China. *Eur Heart J* 2016;**18**(Suppl):A1-A5

- 1
2
3
4 7. Narang A, Sinha SS, Rajagopalan B, et al. The Supply and Demand of the
5
6 Cardiovascular Workforce: Striking the Right Balance. *Journal of the American*
7
8 *College of Cardiology* 2016;**68**(15):1680-89 doi:
9
10 10.1016/j.jacc.2016.06.070[published Online First: Epub Date]].
11
12
- 13
14 8. Temporelli PL, Zito G, Faggiano P, et al. Cardiovascular risk profile and lifestyle habits
15
16 in a cohort of Italian cardiologists (from the SOCRATES Survey). *The American*
17
18 *journal of cardiology* 2013;**112**(2):226-30 doi:
19
20 10.1016/j.amjcard.2013.03.020[published Online First: Epub Date]].
21
22
- 23 9. Merz CN, Mensah GA, Fuster V, et al. Task force #5--the role of cardiovascular
24
25 specialists as leaders in prevention: from training to champion. 33rd Bethesda
26
27 Conference. *Journal of the American College of Cardiology* 2002;**40**(4):641-51
28
29
- 30 10. O'Kelly S, Andersen K, Capewell S, et al. Bringing prevention to the population: an
31
32 important role for cardiologists in policy-making. *Eur Heart J* 2011;**32**(16):1964-7
33
34 doi: 10.1093/eurheartj/ehr128[published Online First: Epub Date]].
35
36
- 37 11. Aboyans V, Pinet P, Lacroix P, et al. Knowledge and management of smoking-
38
39 cessation strategies among cardiologists in France: a nationwide survey. *Archives of*
40
41 *cardiovascular diseases* 2009;**102**(3):193-9 doi:
42
43 10.1016/j.acvd.2009.01.005[published Online First: Epub Date]].
44
45
- 46 12. Reiner Z, Sonicki Z, Tedeschi-Reiner E. Physicians' perception, knowledge and
47
48 awareness of cardiovascular risk factors and adherence to prevention guidelines: the
49
50 PERCRO-DOC survey. *Atherosclerosis* 2010;**213**(2):598-603 doi:
51
52 10.1016/j.atherosclerosis.2010.09.014[published Online First: Epub Date]].
53
54
- 55 13. Lu Y, Hu XM, Huang XL, et al. The relationship between job satisfaction, work stress,
56
57

- 1
2
3
4 work-family conflict, and turnover intention among physicians in Guangdong,
5
6 China: a cross-sectional study. *BMJ open* 2017;**7**(5):e014894 doi:
7
8 10.1136/bmjopen-2016-014894[published Online First: Epub Date].
9
10
- 11 14. Liang Y, Wang H, Tao X. Quality of life of young clinical doctors in public hospitals in
12
13 China's developed cities as measured by the Nottingham Health Profile (NHP).
14
15 *International journal for equity in health* 2015;**14**:85 doi: 10.1186/s12939-015-
16
17 0199-2[published Online First: Epub Date].
18
19
- 20 15. Steering Committee of the Physicians' Health Study Research G. Final report on the
21
22 aspirin component of the ongoing Physicians' Health Study. *The New England*
23
24 *journal of medicine* 1989;**321**(3):129-35 doi:
25
26 10.1056/NEJM198907203210301[published Online First: Epub Date].
27
28
- 29 16. Hu DY, Yu JM, Chen F, et al. The Chinese physicians' Cardiovascular Risk Evaluation
30
31 (CARE) survey: an assessment of physicians' own cardiovascular risks. *Heart Asia*
32
33 2010;**2**(1):89-94 doi: 10.1136/ha.2009.001214[published Online First: Epub Date].
34
35
- 36 17. He J, Gu D, Chen J, et al. Premature deaths attributable to blood pressure in China: a
37
38 prospective cohort study. *Lancet* 2009;**374**(9703):1765-72 doi: 10.1016/S0140-
39
40 6736(09)61199-5[published Online First: Epub Date].
41
42
- 43 18. Miura K, Daviglius ML, Dyer AR, et al. Relationship of blood pressure to 25-year
44
45 mortality due to coronary heart disease, cardiovascular diseases, and all causes in
46
47 young adult men: the Chicago Heart Association Detection Project in Industry.
48
49 *Archives of internal medicine* 2001;**161**(12):1501-8
50
51
- 52 19. Franco OH, Peeters A, Bonneux L, et al. Blood pressure in adulthood and life
53
54 expectancy with cardiovascular disease in men and women: life course analysis.
55
56
57
58
59
60

- 1
2
3
4 Hypertension 2005;**46**(2):280-6 doi:
5
6 10.1161/01.HYP.0000173433.67426.9b[published Online First: Epub Date]].
7
8
9 20. Whelton PK, Carey RM, Aronow WS, et al. 2017
10 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline
11 for the Prevention, Detection, Evaluation, and Management of High Blood Pressure
12 in Adults: A Report of the American College of Cardiology/American Heart
13 Association Task Force on Clinical Practice Guidelines. Journal of the American
14 College of Cardiology 2018;**71**(19):e127-e248 doi:
15
16 10.1016/j.jacc.2017.11.006[published Online First: Epub Date]].
17
18
19
20
21
22
23
24
25 21. Spruill TM. Chronic psychosocial stress and hypertension. Current hypertension reports
26 2010;**12**(1):10-6 doi: 10.1007/s11906-009-0084-8[published Online First: Epub
27 Date]].
28
29
30
31
32 22. Vrijkotte TG, van Doornen LJ, de Geus EJ. Effects of work stress on ambulatory blood
33 pressure, heart rate, and heart rate variability. Hypertension 2000;**35**(4):880-6
34
35
36
37 23. Trudel X, Brisson C, Milot A, et al. Adverse psychosocial work factors, blood pressure
38 and hypertension incidence: repeated exposure in a 5-year prospective cohort study.
39 Journal of epidemiology and community health 2016;**70**(4):402-8 doi:
40 10.1136/jech-2014-204914[published Online First: Epub Date]].
41
42
43
44
45
46 24. Calhoun DA, Harding SM. Sleep and hypertension. Chest 2010;**138**(2):434-43 doi:
47 10.1378/chest.09-2954[published Online First: Epub Date]].
48
49
50
51 25. Wang Y, Mei H, Jiang YR, et al. Relationship between Duration of Sleep and
52 Hypertension in Adults: A Meta-Analysis. Journal of clinical sleep medicine :
53 JCSM : official publication of the American Academy of Sleep Medicine
54
55
56
57
58
59
60

- 2015;**11**(9):1047-56 doi: 10.5664/jcsm.5024[published Online First: Epub Date]].
26. Wu J, Cheng X, Qiu L, et al. Prevalence and Clustering of Major Cardiovascular Risk Factors in China: A Recent Cross-Sectional Survey. *Medicine* 2016;**95**(10):e2712 doi: 10.1097/MD.0000000000002712[published Online First: Epub Date]].
27. Lu Y, Wang P, Zhou T, et al. Comparison of Prevalence, Awareness, Treatment, and Control of Cardiovascular Risk Factors in China and the United States. *Journal of the American Heart Association* 2018;**7**(3) doi: 10.1161/JAHA.117.007462[published Online First: Epub Date]].
28. Yang F, Qian D, Hu DY, et al. Prevalence of cardiovascular disease risk factor clustering in Chinese adults. *Clin Trials Regul Sci Cardiol* 2016
29. Sui H, Chen WW, Wang W. Interpretation of Report on Cardiovascular Diseases in China 2015. *Chin J Cardiovasc Med* 2016;**21**(4):259-61
30. Huang XB, Chen F, Dai W, et al. Prevalence and risk factors associated with hypertension in the Chinese Qiang population. *Clinical and experimental hypertension* 2018;**40**(5):427-33 doi: 10.1080/10641963.2017.1392553[published Online First: Epub Date]].
31. Hu Y, Wang Z, Wang Y, et al. Prevalence, Awareness, Treatment, and Control of Hypertension among Kazakhs with high Salt Intake in Xinjiang, China: A Community-based Cross-sectional Study. *Scientific reports* 2017;**7**:45547 doi: 10.1038/srep45547[published Online First: Epub Date]].
32. Abuissa H, Lavie C, Spertus J, et al. Personal health habits of American cardiologists. *The American journal of cardiology* 2006;**97**(7):1093-6 doi: 10.1016/j.amjcard.2005.10.057[published Online First: Epub Date]].

- 1
2
3
4 33. Lloyd-Jones DM, Evans JC, Levy D. Hypertension in adults across the age spectrum:
5 current outcomes and control in the community. *Jama* 2005;**294**(4):466-72 doi:
6 10.1001/jama.294.4.466[published Online First: Epub Date]].
7
8
9
10
11 34. James PA, Oparil S, Carter BL, et al. 2014 evidence-based guideline for the
12 management of high blood pressure in adults: report from the panel members
13 appointed to the Eighth Joint National Committee (JNC 8). *Jama* 2014;**311**(5):507-
14 20 doi: 10.1001/jama.2013.284427[published Online First: Epub Date]].
15
16
17
18
19
20
21 35. Leung AA, Daskalopoulou SS, Dasgupta K, et al. Hypertension Canada's 2017
22 Guidelines for Diagnosis, Risk Assessment, Prevention, and Treatment of
23 Hypertension in Adults. *The Canadian journal of cardiology* 2017;**33**(5):557-76 doi:
24 10.1016/j.cjca.2017.03.005[published Online First: Epub Date]].
25
26
27
28
29
30 36. Stockwell DH, Madhavan S, Cohen H, et al. The determinants of hypertension
31 awareness, treatment, and control in an insured population. *American journal of*
32 *public health* 1994;**84**(11):1768-74
33
34
35
36
37 37. Berhe DF, Taxis K, Haaijer-Ruskamp FM, et al. Hypertension treatment practices and
38 its determinants among ambulatory patients: retrospective cohort study in Ethiopia.
39 *BMJ open* 2017;**7**(8):e015743 doi: 10.1136/bmjopen-2016-015743[published
40 Online First: Epub Date]].
41
42
43
44
45
46 38. Levinson W, King TE, Jr., Goldman L, et al. Clinical decisions. American Board of
47 Internal Medicine maintenance of certification program. *The New England journal*
48 *of medicine* 2010;**362**(10):948-52 doi: 10.1056/NEJMclde0911205[published
49 Online First: Epub Date]].
50
51
52
53
54
55 39. Song P, Jin C, Tang W. New medical education reform in China: Towards healthy
56
57
58
59
60

- 1
2
3
4 China 2030. Bioscience trends 2017;**11**(4):366-69 doi:
5
6 10.5582/bst.2017.01198[published Online First: Epub Date]].
7
8
9 40. The L. Medical education reform in China. Lancet 2017;**390**(10092):334 doi:
10
11 10.1016/S0140-6736(17)31921-9[published Online First: Epub Date]].
12
13 41. Chen X, Tan X, Li L. Health Problem and Occupational Stress among Chinese Doctors.
14
15 Chin Med 2013;**2013**(4):1-6
16
17 42. Staiger DO, Auerbach DI, Buerhaus PI. Trends in the work hours of physicians in the
18
19 United States. Jama 2010;**303**(8):747-53 doi: 10.1001/jama.2010.168[published
20
21 Online First: Epub Date]].
22
23 43. Conway SH, Pompeii LA, Roberts RE, et al. Dose-Response Relation Between Work
24
25 Hours and Cardiovascular Disease Risk: Findings From the Panel Study of Income
26
27 Dynamics. Journal of occupational and environmental medicine 2016;**58**(3):221-6
28
29 doi: 10.1097/JOM.0000000000000654[published Online First: Epub Date]].
30
31
32 44. Wu Y, Huxley R, Li L, et al. Prevalence, awareness, treatment, and control of
33
34 hypertension in China: data from the China National Nutrition and Health Survey
35
36 2002. Circulation 2008;**118**(25):2679-86 doi:
37
38 10.1161/CIRCULATIONAHA.108.788166[published Online First: Epub Date]].
39
40
41 45. Wang J, Zhang L, Wang F, et al. Prevalence, awareness, treatment, and control of
42
43 hypertension in China: results from a national survey. American journal of
44
45 hypertension 2014;**27**(11):1355-61 doi: 10.1093/ajh/hpu053[published Online First:
46
47 Epub Date]].
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 1. Demographic characteristics, current disease and medication of the participants

Variable	Total (n=28,924)
Age (years)	37.82±9.27
20-29	5308 (18.35)
30-39	12,338 (42.66)
40-49	8019 (27.72)
50-59	2674 (9.24)
60-69	584 (2.02)
≥70	1 (0.00)
Gender	
Male	15,749 (54.45)
Female	13,175 (45.55)
Academic degree	
Junior college	225 (0.78)
Bachelor	12,704 (43.92)
Master	10,580 (36.58)
Doctor	2905 (10.04)
Post-doctor	412 (1.42)
Others	2098 (7.25)
Hospital level	
Primary	381 (1.32)
Secondary	10,823 (37.42)

1		
2		
3		
4	Tertiary	17,375 (60.07)
5		
6	Others	345 (1.19)
7		
8		
9	Professional title	
10		
11	General physician	4230 (14.62)
12		
13	Healer	540 (1.87)
14		
15	Resident physician	966 (3.34)
16		
17	Attending physician	13,448 (46.49)
18		
19	Associate chief physician	4674 (16.16)
20		
21	Chief physician	2279 (7.88)
22		
23	Others	2787 (9.64)
24		
25		
26		
27	BMI (kg/m ²)	22.35±2.51
28		
29	<18.5	1475 (5.10)
30		
31	18.5-23.9	19,304 (66.74)
32		
33	≥24	8145 (28.16)
34		
35		
36	Current disease	
37		
38	Coronary heart disease	1760 (6.08)
39		
40	Heart failure	554 (1.92)
41		
42	Diabetes	598 (2.07)
43		
44	Stroke/transient ischemic attack	167 (0.58)
45		
46	Chronic kidney disease	409 (1.41)
47		
48	Peripheral vascular disease	431 (1.49)
49		
50	Hypertension	7319 (25.30)
51		
52		
53		
54		
55		
56		
57		
58		
59		
60		

Medication

Antihypertensive drugs	2323 (8.03)
Antidiabetic drugs	574 (1.98)
Lipid-lowering drugs	1223 (4.23)

Data are expressed as mean±standard deviation or n (%). BMI, body mass index.

For peer review only

Table 2. Clinical characteristics of the participants

Variable	Total (n=28,924)
SBP/DBP (mmHg)	
SBP	122.74±14.27
DBP	81.2±12.04
<130/<80	8802 (30.43)
Taking antihypertensive drugs	228 (2.59)
130-139/80-89	13,763 (47.58)
Taking antihypertensive drugs	732 (5.32)
≥140/≥90	6359 (21.99)
Taking antihypertensive drugs	2323 (36.53)
Heart rate (bpm)	74.11±9.26
<50	1 (0.00)
50-59	778 (2.69)
60-69	6972 (24.1)
70-79	13,033 (45.06)
80-89	6600 (22.82)
≥90	1540 (5.32)
Fasting blood glucose (mmol/L)	5.1±1.65
<6.1	26,030 (89.99)
6.1-6.9	1810 (6.26)
≥7.0	1084 (3.75)

LDL-C (mmol/L)	2.73±0.87
<2.6	12,888 (44.56)
2.6-3.3	12,058 (41.69)
3.4-4.0	2363 (8.17)
≥4.1	1614 (5.58)
Unknown	1 (0.00)
HDL-C (mmol/L)	1.85±1.02
<1.0	1879 (6.50)
≥1.0	27,043 (93.50)
Unknown	2 (0.01)
TC (mmol/L)	4.09±1.23
<5.2	24,972 (86.34)
5.2-6.1	2988 (10.33)
≥6.2	957 (3.31)
Unknown	7 (0.02)
TG (mmol/L)	1.6 (1.2,2.2)
<1.7	15,547 (53.75)
1.7-2.2	6345 (21.94)
≥2.3	7029 (24.30)
Unknown	3 (0.01)
Smoking	
Frequent	4660 (16.11)

1		
2		
3		
4	Infrequent	13,561 (46.88)
5		
6	Never	10,703 (37.00)
7		
8		
9	Family history	
10		
11	Yes	22,611 (78.17)
12		
13	No	6313 (21.83)
14		
15		

16 Data are expressed as mean±standard deviation or n (%). DBP, diastolic blood pressure;
17
18 HDL-C, high density lipoprotein-cholesterol; LDL-C, low density lipoprotein-cholesterol;
19
20 SBP, systolic blood pressure; TC, total cholesterol; TG, triglyceride.
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 3. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in cardiologists with different gender

Variable	Total (n=28,924)	Male (n=15,749)	Female (n=13,175)	P
Hypertension	7319 (25.30)	4574 (29.00)	2745 (20.83)	<0.001
Taking antihypertensive drugs	2323 (31.74)	1533 (33.52)	790 (28.78)	<0.001
Reaching the target blood pressure	960 (41.33)	610 (39.79)	350 (44.30)	0.036

Data are expressed as n (%).

Table 4. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in cardiologists with different age

Variable	Total	20-29	30-39	40-49	50-59	60-69	≥70	P
	(n=28924)	(n=5308)	(n=12,338)	(n=8019)	(n=2674)	(n=584)	(n=1)	
Hypertension	7319 (25.3)	1276 (24.04)	2680 (21.72)	2158 (26.91)	946 (35.38)	258 (44.18)	1 (100)	<0.001
Taking antihypertensive drugs	2323 (31.74)	256 (20.06)	738 (27.54)	806 (37.35)	397 (41.97)	126 (48.84)	0	<0.001
Reaching the target blood pressure	960 (41.33)	124 (48.44)	322 (43.63)	336 (41.69)	130 (32.75)	48 (38.10)	-	0.001

Data are expressed as n (%).

Table 5. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in cardiologists with different hospital level

Variable	Total (n=28,924)	Primary (n=381)	Secondary (n=10,823)	Tertiary (n=17,375)	Others (n=345)	P
Hypertension	7319 (25.30)	136 (35.70)	2695 (24.90)	4413 (25.40)	75 (21.74)	<0.001
Taking antihypertensive drugs	2323 (31.74)	38 (27.94)	904 (33.43)	1354 (30.68)	27 (36.00)	0.049
Reaching the target blood pressure	960 (41.33)	8 (21.05)	390 (43.14)	551 (40.69)	11 (40.74)	0.048

Data are expressed as n (%).

CCHS**QUESTIONNAIRE**

China Cardiologist Heart Study

FORM

INSTRUCTIONS: This collection of information is estimated to average 10 minutes. Name and contact information must be entered above. Please enter the number so that the last digit appears in the rightmost box. Enter leading zeros where necessary to fill all boxes. For "multiple choice" and "yes/no" type questions, circle the letter corresponding to the most appropriate response. If a letter is circled incorrectly, mark through it with an "X" and circle the correct response.

CCHS Center use onlySequence Number

1. Name: _____

2. Date of birth: / (yyyy/mm)

3. Contact phone number: _____

4. Employer: Hospital name, district/county, city, province/municipality _____

A. Personal information1. Hospital level:

2. Professional title: _____

3. Academic degree: _____

4. Area of expertise (multiple choices available):

- | | |
|--|---|
| <input type="radio"/> Atherosclerosis and coronary heart disease | <input type="radio"/> Hypertension |
| <input type="radio"/> Arrhythmia and electrophysiology | <input type="radio"/> Blood lipid metabolism |
| <input type="radio"/> Congenital heart disease | <input type="radio"/> Heart failure |
| <input type="radio"/> Pulmonary vascular disease | <input type="radio"/> Structural heart disease |
| <input type="radio"/> Female cardiovascular disease | <input type="radio"/> Senile cardiovascular disease |
| <input type="radio"/> Basic-clinical combination | <input type="radio"/> Cardiovascular imaging |
| <input type="radio"/> Interventional cardiology | <input type="radio"/> Cardiac intensive care and monitoring |
| <input type="radio"/> Others | |

B. Survey information1. Gender: Male Female2. Height: . cm3. Weight: . kg

1
2
3
4. Are you currently taking the following medications? (multiple choices available)

- 4 ○ Antihypertensive drugs
- 5 ○ Lipid-lowering drugs
- 6 ○ Antidiabetic drugs
- 7 ○ None

8
9
10
11 5. Do you have any of the following clinical conditions? (multiple choices available)

- 12 ○ None
- 13 ○ Coronary heart disease
- 14 ○ Heart failure
- 15 ○ Diabetes
- 16 ○ Chronic kidney disease
- 17 ○ Peripheral vascular disease
- 18 ○ Stroke/transient ischemic attack

19
20
21
22
23
24
25 6. Did you smoke ≥ 1 cigarette per day in the past 3 months?

- 26 ○ Yes
- 27 ○ No
- 28 ○ Never smoked

29
30
31
32 7. Do you have a first-degree male relative who suffered from a cardiovascular disease at <55
33 years of age or a first-degree female relative who suffered from a cardiovascular disease at <65
34 years of age?

- 35 ○ No
- 36 ○ Yes

37
38
39
40
41
42 **C. Blood Pressure** (Please record the data in the last 2 weeks, If don't know, please fill in 999)

43 1. Average sitting systolic blood pressure: mmHg

44 2. Average sitting diastolic blood pressure: mmHg

45 3. Average heart rate: bpm

46
47
48
49
50
51 **D. Laboratory** (Please record the data of the most recent results within a year, If don't know,
52 please fill in 999)

53 1. Fasting blood glucose: .mmol/L

54 2. Total cholesterol (TC): .mmol/L or .mg/dL

55 3. Low density lipoprotein-cholesterol (LDL-C): .mmol/L or .mg/dL

56 4. High density lipoprotein-cholesterol (HDL-C): .mmol/L or .mg/dL

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

5. Triglyceride (TG): . mmol/L or . mg/dL

Thank you very much for your help!

For peer review only

Table S1. Area of expertise of the participants

Variable	Total (n=28,924)
Atherosclerosis and coronary heart disease	14,783 (51.11)
Hypertension	18,477 (63.88)
Arrhythmia and electrophysiology	8226 (28.44)
Blood lipid metabolism	10,147 (35.08)
Congenital heart disease	4678 (16.17)
Heart failure	9087 (31.42)
Pulmonary vascular disease	2859 (9.88)
Cardiac intensive care and monitoring	2051 (7.09)
Interventional cardiology	2526 (8.73)
Cardiovascular imaging	2742 (9.48)
Senile cardiovascular disease	0
Female cardiovascular disease	2859 (9.88)
Structural heart disease	3774 (13.05)
Basic-clinical combination	2350 (8.12)
Others	2746 (9.49)

Data are expressed as n (%).

Table S2. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in male cardiologists with different age

Variable	20-29	30-39	40-49	50-59	60-69	≥70	P
	(n=2437)	(n=6777)	(n=4521)	(n=1656)	(n=357)	(n=1)	
Hypertension	684 (28.1)	1709 (25.2)	1362 (30.1)	647 (39.1)	171 (47.9)	1 (100)	<0.001
Taking antihypertensive drugs	159 (23.2)	510 (29.8)	506 (37.2)	272 (42)	86 (50.3)	0	<0.001
Reaching the target blood pressure	124 (48.4)	322 (43.6)	336 (41.7)	130 (32.7)	48 (38.1)	-	0.001

Data are expressed as n (%).

Table S3. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in female cardiologists with different age

Variable	20-29	30-39	40-49	50-59	60-69	P
	(n=2871)	(n=5561)	(n=3498)	(n=1018)	(n=227)	
Hypertension	592 (20.6)	971 (17.5)	796 (22.8)	299 (29.4)	87 (38.3)	<0.001
Taking antihypertensive drugs	97 (16.4)	228 (23.5)	300 (37.7)	125 (41.8)	40 (46.0)	<0.001
Reaching the target blood pressure	51 (52.6)	107 (46.9)	132 (44)	45 (36)	15 (37.5)	0.108

Data are expressed as n (%).

Table S4. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in male cardiologists with different hospital level

Variable	Primary (n=211)	Secondary (n=5807)	Tertiary (n=9552)	Others (n=179)	P
Hypertension	92 (43.6)	1674 (28.8)	2765 (28.9)	43 (24.0)	<0.001
Taking antihypertensive drugs	28 (30.4)	581 (34.7)	912 (33)	12 (27.9)	0.491
Reaching the target blood pressure	5 (17.9)	229 (39.4)	374 (41)	2 (16.7)	0.031

Data are expressed as n (%).

Table S5. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in female cardiologists with different hospital level

Variable	Primary (n=170)	Secondary (n=5016)	Tertiary (n=7823)	Others (n=166)	P
Hypertension	44 (25.9)	1021 (20.4)	1648 (21.1)	32 (19.3)	0.281
Taking antihypertensive drugs	10 (22.7)	323 (31.6)	442 (26.8)	15 (46.9)	0.005
Reaching the target blood pressure	3 (30.0)	161 (49.8)	177 (40)	9 (60.0)	0.022

Data are expressed as n (%).

Table S6. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in cardiologists with different professional title

Variable	Total	General	Healer	Resident	Attending	Associate chief	Chief	Others	P
	(n=28,924)	physician (n=4230)	(n=540)	physician (n=966)	physician (n=13,448)	physician (n=4674)	physician (n=2279)	(n=2787)	
Hypertension	7319 (25.30)	896 (21.18)	139 (25.74)	263 (27.23)	3032 (22.55)	1413 (30.23)	806 (35.37)	770 (27.63)	<0.001
Taking antihypertensive drugs	2323 (31.74)	179 (19.98)	46 (33.09)	88 (33.46)	934 (30.80)	546 (38.64)	357 (44.29)	173 (22.47)	<0.001
Reaching the target blood pressure	960 (41.33)	70 (39.11)	21 (45.65)	49 (55.68)	404 (43.25)	192 (35.16)	135 (37.82)	89 (51.45)	<0.001

Data are expressed as n (%).

Table S7. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in male cardiologists with different professional title

Variable	General physician (n=2049)	Healer (n=260)	Resident physician (n=548)	Attending physician (n=7447)	Associate physician (n=2740)	chief physician (n=1447)	Chief physician (n=1258)	Others (n=1258)	P
Hypertension	507 (24.7)	82 (31.5)	159 (29)	1944 (26.1)	896 (32.7)	579 (40.0)	407 (32.4)	<0.001	
Taking antihypertensive drugs	120 (23.7)	33 (40.2)	63 (39.6)	620 (31.9)	335 (37.4)	264 (45.6)	98 (24.1)	<0.001	
Reaching the target blood pressure	43 (35.8)	11 (33.3)	32 (50.8)	259 (41.8)	117 (34.9)	96 (36.4)	52 (53.1)	0.008	

Data are expressed as n (%).

Table S8. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in female cardiologists with different professional title

Variable	General physician (n=2181)	Healer (n=280)	Resident physician (n=418)	Attending physician (n=6001)	Associate chief physician (n=1934)	Chief physician (n=832)	Others (n=1529)	P
Hypertension	389 (17.8)	57 (20.4)	104 (24.9)	1088 (18.1)	517 (26.7)	227 (27.3)	363 (23.7)	<0.001
Taking antihypertensive drugs	59 (15.2)	13 (22.8)	25 (24.0)	314 (28.9)	211 (40.8)	93 (41.0)	75 (20.7)	<0.001
Reaching the target blood pressure	27 (45.8)	10 (76.9)	17 (68.0)	145 (46.2)	75 (35.5)	39 (41.9)	37 (49.3)	0.004

Data are expressed as n (%).

Table S9. Univariable and multivariable logistic regressions for hypertension among cardiologists

Variable	Univariable logistic regression		Multivariable logistic regression	
	OR (95%CI)	P	OR (95%CI)	P
Age (years)				
20-29	Reference		Reference	
30-39	0.877 (0.813,0.946)	0.001	0.915 (0.793,1.056)	0.227
40-49	1.163 (1.074,1.26)	<0.001	1.012 (0.861,1.189)	0.885
50-59	1.73 (1.563,1.914)	<0.001	1.397 (1.164,1.678)	<0.001
≥60	2.51 (2.108,2.99)	<0.001	1.949 (1.534,2.476)	<0.001
Gender				
Male	Reference			
Female	0.643 (0.609,0.679)	<0.001	0.866 (0.813,0.924)	<0.001
Academic degree				
Junior college	Reference		Reference	
Bachelor	0.631 (0.476,0.837)	0.001	0.629 (0.461,0.859)	0.004

1					
2					
3					
4					
5	Master	0.713 (0.538,0.946)	0.019	0.722 (0.528,0.988)	0.042
6					
7	Doctor	0.86 (0.643,1.149)	0.307	0.774 (0.56,1.069)	0.120
8					
9	Post-doctor	1.049 (0.742,1.482)	0.787	0.776 (0.53,1.136)	0.191
10					
11	Others	0.844 (0.628,1.133)	0.258	0.771 (0.553,1.074)	0.124
12					
13					
14	Hospital level				
15					
16	Primary	Reference		Reference	
17					
18	Secondary	0.597 (0.482,0.74)	<0.001	0.582 (0.464,0.728)	<0.001
19					
20	Tertiary	0.613 (0.496,0.758)	<0.001	0.579 (0.463,0.724)	<0.001
21					
22	Others	0.5 (0.359,0.696)	<0.001	0.508 (0.359,0.717)	<0.001
23					
24					
25	Professional title				
26					
27	General physician	Reference		Reference	
28					
29	Healer	1.29 (1.049,1.586)	0.016	1.01 (0.791,1.291)	0.934
30					
31	Resident physician	1.392 (1.187,1.633)	<0.001	1.064 (0.871,1.301)	0.542
32					
33	Attending physician	1.083 (0.996,1.178)	0.063	0.965 (0.841,1.107)	0.611
34					
35	Associate chief physician	1.612 (1.464,1.776)	<0.001	1.118 (0.948,1.317)	0.185
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

Chief physician	2.037 (1.819,2.281)	<0.001	1.131 (0.94,1.361)	0.192
Others	1.42 (1.271,1.587)	<0.001	1.193 (0.99,1.438)	0.063
BMI (kg/m²)				
<18.5	0.744 (0.649,0.853)	<0.001	0.919 (0.797,1.061)	0.248
18.5-23.9	Reference		Reference	
≥24	1.627 (1.536,1.723)	<0.001	1.314 (1.233,1.4)	<0.001
Smoking				
Frequent	Reference		Reference	
Infrequent	0.422 (0.394,0.453)	<0.001	0.568 (0.525,0.613)	<0.001
Never	0.342 (0.318,0.369)	<0.001	0.469 (0.431,0.509)	<0.001
Family history				
No	Reference		Reference	
Yes	1.77 (1.667,1.880)	<0.001	1.261 (1.18,1.348)	<0.001
Comorbidity				
No	Reference		Reference	

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

Yes	4.003 (3.723,4.304)	<0.001	3.158 (2.924,3.41)	<0.001
-----	---------------------	--------	--------------------	--------

For peer review only

Table S10. Univariable and multivariable logistic regressions for antihypertensive drugs taking among cardiologists with hypertension

Variable	Univariable logistic regression		Multivariable logistic regression	
	OR (95%CI)	P	OR (95%CI)	P
Age (years)				
20-29	Reference		Reference	
30-39	1.514 (1.289,1.779)	<0.001	1.433 (1.055,1.945)	0.021
40-49	2.375 (2.019,2.794)	<0.001	1.989 (1.428,2.771)	<0.001
50-59	2.881 (2.387,3.478)	<0.001	2.282 (1.599,3.257)	<0.001
≥60	3.775 (2.854,4.992)	<0.001	2.677 (1.754,4.086)	<0.001
Gender				
Male	Reference		Reference	
Female	0.802 (0.723,0.889)	<0.001	1.2 (1.059,1.359)	0.004
Academic degree				
Junior college	Reference		Reference	
Bachelor	1.565 (0.905,2.708)	0.109	1.025 (0.553,1.901)	0.938

1					
2					
3					
4					
5	Master	1.506 (0.87,2.607)	0.144	0.915 (0.491,1.705)	0.780
6					
7	Doctor	1.809 (1.033,3.168)	0.038	0.93 (0.492,1.757)	0.822
8					
9	Post-doctor	2.46 (1.298,4.659)	0.006	1.092 (0.534,2.235)	0.809
10					
11	Others	1.057 (0.596,1.876)	0.849	1.428 (0.729,2.8)	0.299
12					
13					
14	Hospital level				
15					
16	Primary	Reference			
17					
18	Secondary	1.302 (0.888,1.909)	0.177		
19					
20	Tertiary	1.142 (0.781,1.669)	0.495		
21					
22	Others	1.451 (0.794,2.649)	0.226		
23					
24					
25	Professional title				
26					
27	General physician	Reference		Reference	
28					
29	Healer	1.981 (1.342,2.925)	0.001	1.233 (0.765,1.989)	0.390
30					
31	Resident physician	2.014 (1.486,2.73)	<0.001	1.084 (0.736,1.596)	0.684
32					
33	Attending physician	1.783 (1.488,2.137)	<0.001	1.165 (0.878,1.546)	0.290
34					
35	Associate chief physician	2.523 (2.074,3.068)	<0.001	1.24 (0.898,1.711)	0.192
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

1					
2					
3					
4	Chief physician	3.185 (2.569,3.948)	<0.001	1.407 (0.993,1.992)	0.055
5					
6	Others	1.161 (0.917,1.469)	0.215	0.831 (0.562,1.23)	0.356
7					
8					
9	BMI (kg/m ²)				
10					
11	<18.5	0.628 (0.464,0.852)	0.003	0.78 (0.565,1.078)	0.132
12					
13	18.5-23.9	Reference		Reference	
14					
15	≥24	1.409 (1.272,1.561)	<0.001	1.157 (1.031,1.299)	0.013
16					
17					
18	Smoking				
19					
20	Frequent	Reference		Reference	
21					
22	Infrequent	0.446 (0.397,0.502)	<0.001	0.502 (0.44,0.572)	<0.001
23					
24	Never	0.335 (0.293,0.383)	<0.001	0.374 (0.322,0.434)	<0.001
25					
26					
27	Family history				
28					
29	No	Reference		Reference	
30					
31	Yes	0.485 (0.437,0.539)	<0.001	1.4 (1.247,1.571)	<0.001
32					
33					
34	Comorbidity				
35					
36	No	Reference		Reference	
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

Yes	3.185 (2.854,3.555)	<0.001	2.646 (2.351,2.977)	<0.001
-----	---------------------	--------	---------------------	--------

For peer review only

Table S11. Univariable and multivariable logistic regressions for reaching the target blood pressure among cardiologists taking antihypertensive drugs

Variable	Univariable logistic regression		Multivariable logistic regression	
	OR (95%CI)	P	OR (95%CI)	P
Age (years)				
20-29	Reference		Reference	
30-39	0.824 (0.62,1.096)	0.183	0.689 (0.418,1.138)	0.146
40-49	0.761 (0.574,1.009)	0.058	0.667 (0.391,1.138)	0.137
50-59	0.518 (0.375,0.716)	<0.001	0.465 (0.262,0.825)	0.009
≥60	0.655 (0.424,1.012)	0.057	0.549 (0.286,1.055)	0.072
Gender				
Male	Reference		Reference	
Female	1.204 (1.012,1.432)	0.036	1.081 (0.896,1.304)	0.415
Academic degree				
Junior college	Reference			

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

Bachelor	0.457 (0.172,1.211)	0.115		
Master	0.483 (0.182,1.282)	0.144		
Doctor	0.484 (0.179,1.306)	0.152		
Post-doctor	0.591 (0.198,1.762)	0.345		
Others	0.791 (0.286,2.192)	0.652		
Hospital level				
Primary	Reference		Reference	
Secondary	2.845 (1.29,6.275)	0.010	2.878 (1.287,6.438)	0.01
Tertiary	2.573 (1.171,5.655)	0.019	2.558 (1.147,5.704)	0.022
Others	2.578 (0.863,7.701)	0.090	2.179 (0.714,6.646)	0.171
Professional title				
General physician	Reference		Reference	
Healer	1.308 (0.681,2.514)	0.420	1.697 (0.8,3.603)	0.168
Resident physician	1.956 (1.167,3.28)	0.011	2.768 (1.467,5.225)	0.002
Attending physician	1.187 (0.856,1.646)	0.304	1.585 (0.982,2.558)	0.059

Associate chief physician	0.845 (0.596,1.196)	0.341	1.271 (0.747,2.16)	0.376
Chief physician	0.947 (0.655,1.369)	0.772	1.623 (0.928,2.837)	0.089
Others	1.65 (1.081,2.519)	0.020	1.599 (1.036,2.469)	0.034
BMI (kg/m²)				
<18.5	0.973 (0.566,1.673)	0.922	0.872 (0.5,1.521)	0.629
18.5-23.9	Reference		Reference	
≥24	0.621 (0.524,0.738)	<0.001	0.657 (0.548,0.787)	<0.001
Smoking				
Frequent	Reference			
Infrequent	0.936 (0.777,1.128)	0.489		
Never	1.022 (0.819,1.275)	0.848		
Family history				
No	Reference			
Yes	1.445 (1.219,1.713)	<0.001	0.746 (0.624,0.891)	0.001
Comorbidity				

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

No	Reference			
Yes	0.811 (0.685,0.96)	0.015	0.811 (0.679,0.97)	0.022

For peer review only

STROBE Statement

Checklist of items that should be included in reports of observational studies

Section/Topic	Item No	Recommendation	Reported on Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	5
		<i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	
		<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	
Variables	7	(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed	5
		<i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	
Data sources/measurement	8*	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Bias	9	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Study size	10	Describe any efforts to address potential sources of bias	6
Quantitative variables	11	Explain how the study size was arrived at	6
Statistical methods	12	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
		(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	7
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed	7
<i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed			
		<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	7
		(e) Describe any sensitivity analyses	7

Section/Topic	Item No	Recommendation	Reported on Page No
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	9-11
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-11
		(b) Report category boundaries when continuous variables were categorized	
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	11-14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	14-15
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

Perception and self-management of hypertension in Chinese cardiologists (CCHS): a multicenter, large-scale cross-sectional study

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2019-029249.R2
Article Type:	Research
Date Submitted by the Author:	05-Aug-2019
Complete List of Authors:	Hou, Lei ; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology; Tongren hospital, Shanghai Jiaotong University, School of Medicine, Department of Cardiology Jin, Xuejuan ; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology Ma, Jianying ; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology Qian, Juying; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology Huo, Yong ; Peking University First Hospital, Department of Cardiology Ge, Junbo; Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan University, Department of Cardiology
Primary Subject Heading:	Cardiovascular medicine
Secondary Subject Heading:	Cardiovascular medicine
Keywords:	health survey, cardiovascular diseases, China, cardiologists, cross-sectional studies

SCHOLARONE™
Manuscripts

1
2
3
4 **Perception and self-management of hypertension in Chinese cardiologists (CCHS): a**
5 **multicenter, large-scale cross-sectional study**
6
7
8
9
10

11 **Running title:** The China Cardiologist Heart Study
12
13
14

15 Lei Hou^{1,2¶}, Xuejuan Jin^{1¶}, Jianying Ma¹, Juying Qian¹, Yong Huo³, Junbo Ge¹
16
17
18
19

20 ¹Department of Cardiology, Shanghai Institute of Cardiovascular Diseases, Zhongshan
21 Hospital, Fudan University, Shanghai, China
22
23

24 ²Department of Cardiology, Tongren Hospital, Shanghai Jiaotong University, School of
25 Medicine, Shanghai, China
26
27

28 ³Department of Cardiology, Peking University First Hospital, Beijing, China
29
30

31 [¶]These authors contributed equally to this work.
32
33
34
35

36 **Corresponding author:** Junbo Ge, No. 180 Fenglin Road, 200032, Department of
37 Cardiology, Shanghai Institute of Cardiovascular Diseases, Zhongshan Hospital, Fudan
38 University, Shanghai, China. Email: gejunbo@126.com
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

ABSTRACT

Objectives: To determine the frequency of risk factors for hypertension among Chinese cardiologists using a nationwide survey.

Design: Multicenter, cross-sectional observational study.

Setting: 2441 hospitals across China were surveyed between September 2016 and August 2017.

Participants: All in-service cardiologists were surveyed (n=28,924).

Interventions: WeChat-based electronic data capture system, a social application in China (Tencent, Nanshan, China), was used for data acquisition. Physician subscribed to the WeChat official account of the China Cardiologist Heart Study, and filled out an online questionnaire that included age, gender, level of in-service hospital, professional title, academic degree, area of expertise, and cardiovascular risk factors. All information was required.

Primary and secondary outcome measures: The primary outcome was the presence of cardiovascular risk factors. The secondary outcome was the impact of the risk factors on the occurrence of hypertension.

Results: Among 28,924 Chinese cardiologists who completed the questionnaire, 57.6% had blood pressure of 130-139/80-89 mmHg (5.3% were taking antihypertensive drugs) and 22.0% had blood pressure $\geq 140/\geq 90$ mmHg (36.5% were taking antihypertensive drugs). The multivariable analysis showed that age, gender, academic degree, hospital level, body mass index (BMI), smoking, and comorbidities were independently associated with hypertension among cardiologists (all $P < 0.05$). Age, female gender, BMI, smoking, family history of cardiovascular diseases, and comorbidities were independently associated with

1
2
3
4 taking antihypertensive drugs among hypertensive cardiologists (all $P < 0.05$). Age, hospital
5 level, professional title, BMI, family history of cardiovascular diseases, and comorbidities
6 were independently associated with reaching target blood pressure among hypertensive
7 cardiologists taking antihypertensive drugs.
8
9
10
11
12

13 **Conclusion:** Chinese cardiologists do not recognize and pay attention to their own blood
14 pressure. Their rate of antihypertensive treatment was low. The identified risk factors could
15 be used to identify cardiologists at higher risk for hypertension and for implementing
16 preventive interventions.
17
18
19
20
21
22
23

24 **Keywords:** health survey; cardiovascular diseases; China; cardiologists; cross-sectional
25 studies.
26
27
28
29
30
31

32 **Strengths and limitations of this study**

- 33 - The strength of the present study lies in its large sample size (>26,000 participants) from
34 all across China.
35
- 36 - Because of funding and logistics, data had to be collected using a self-filled survey, which
37 could introduce bias compared with a formal epidemiological study.
38
- 39 - The medical system in China and the formation required to work in cardiology are
40 different from that of other countries, limiting the generalizability of the data.
41
- 42 - The geographical distribution of the cardiologists across China was not taken into account.
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

INTRODUCTION

Cardiologists are exposed to threats to their health, resulting in an important incidence of orthopedic problems [1 2]. In addition, there is a risk of radiation-related diseases [2 3]. Besides those obvious occupational hazards, cardiologists are exposed to stress, work overload, and bad lifestyle habits that may increase their cardiovascular risk [4 5], and this is observed in Chinese cardiologists [6 7]. A study from Italy showed that the cardiovascular profile of Italian cardiologists was far from ideal and that the perception of their own risk factors was low [4 8]. The understanding and awareness of cardiologists' perception of their own health are not only important for maintaining individual health and the manpower of the national medical health care system, but also directly affect their understanding and behaviors toward the patients, eventually having some impact on the prevention and treatment of cardiovascular diseases (CVDs). Indeed, for many patients, cardiologists are role models for behavioral changes [9-11]. Cardiologists' knowledge about CVD risk factors and their perception of how they treat their patients with CVD risk factors have an impact on their perception of their own risk factors [12].

Chinese physicians face a large number of patients and are at risk of job turnover [13]. A survey of Chinese cardiologists found that there were only 1.9 cardiologists per 100,000 people [6], compared with 8.1 per 100,000 people in the United States in 2009 [7]. Hence, cardiologists in China have heavy responsibilities and high work burden. Faced with such a disparity in the proportion of cardiologists and patients, the working time of Chinese doctors usually exceeds the standard working time [14]. All those factors may lead to an increase in the incidence of cardiovascular risk factors and diseases among Chinese cardiologists. Indeed, comparing the Physicians' Health Study from the United States with

1
2
3
4 the Chinese Cardiovascular Risk Evaluation (CARE) study [15 16], it was found that the
5 prevalence of cardiovascular risk factors among Chinese cardiologists was higher than
6 among American physicians, and that Chinese cardiologists had a poor perception of their
7 own cardiovascular risk factors. Hypertension is a major risk factor for cardiovascular
8 diseases and death in China [17], as well as in the world in general [18 19]. Hypertension
9 may arise due to adverse life style habits (tobacco, alcohol, caffeine, and salty foods) [20],
10 but also due to chronic stress, work pressure, and lack of sleep [21-25].

11
12
13
14
15
16
17
18
19
20 A recent anecdotic observation is that sudden death was observed in many young Chinese
21 cardiologists, prompting the hypothesis that Chinese cardiologists may neglect their own
22 health. In addition, as stated above, Chinese cardiologists are likely to display risk factors
23 of hypertension, which will have a certain impact on their health. Nevertheless, the factors
24 for poor cardiovascular factors among cardiologists must first be identified and understood
25 before interventions can be implemented. Therefore, the present study aimed to examine
26 the risk factors for hypertension among Chinese cardiologists using a nationwide survey.
27
28
29
30
31
32
33
34
35
36
37
38

39 **SUBJECTS AND METHODS**

40 **Participants**

41
42 This was a national, multicenter, cross-sectional observational study. Cardiologists from
43 2441 hospitals across China were surveyed between September 2016 and August 2017. All
44 in-service cardiologists were eligible. If a hospital did not have a department of cardiology
45 and only had a department of internal medicine, then the internists working in the
46 cardiovascular field were included. Physicians who were unwilling to participate in this
47 survey were excluded. This study was approved by the Ethics Committee of Tongren
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4 Hospital, Shanghai Jiaotong University, School of Medicine (approval number: 2015-017-
5
6 01). All physicians signed the informed consent form before completing the questionnaire.
7

8 9 **Sampling method**

10
11 Due to the study funding and lack of manpower, it was difficult to design a sampling frame
12
13 according to the economic and hospital levels and randomly select hospitals nationwide.
14
15 Hence, the study used a two-stage sampling process. In the first stage, hospitals were
16
17 selected using non-random stratification according to regional economic and hospital levels.
18
19 In the second stage, a random proportional sample from authoritative lists was created, and
20
21 all the cardiologists in this sample of hospitals were invited to participate in the study.
22
23

24 25 **Questionnaire**

26
27 The study was carried out and coordinated under the guidance of a scientific advisory board.
28
29 Data quality was monitored by the study coordinators throughout the study.
30
31 WeChat-based electronic data capture (EDC) system, a social application in China (Tencent,
32
33 Nanshan, China), was used for data acquisition. Physician subscribed to the WeChat
34
35 official account of the China Cardiologist Heart Study (Wuxi Boyankang Technology
36
37 Development Co., Ltd. was responsible for platform construction and data management),
38
39 and filled out an online questionnaire that included age, gender, level of hospital,
40
41 professional title (general physicians were those with a bachelor degree; healer were those
42
43 with a junior college degree or below), academic degree, area of expertise, height, body
44
45 weight, blood pressure, heart rate, fasting blood glucose, total cholesterol (TC), low density
46
47 lipoprotein-cholesterol (LDL-C), high density lipoprotein-cholesterol (HDL-C), triglyceride
48
49 (TG), current diseases, medication status, smoking history, and family history. The
50
51 questions about area of expertise and current diseases had multiple choices. All information
52
53
54
55
56
57
58
59
60

1
2
3
4 was required. Questionnaires with incomplete information could not be submitted. There
5
6 were logically possible upper and lower limits for the content to be filled in. If the limit was
7
8 exceeded, it could indicate that the data was incorrect. The staff of the project team would
9
10 remind the physician to check. The questionnaire is shown in Appendix 1.
11
12

13 **Data collection**

14
15 Demographic variables and risk factors for CVD were assessed according to standardized
16
17 study protocols. Age was automatically generated based on the birth date. Blood pressure
18
19 and heart rate were the average levels over the past 2 weeks. Fasting blood glucose and
20
21 blood lipids were reviewed by the physician for the most recent results within a year. Body
22
23 mass index (BMI) was calculated based on weight and height as kg/m². Hypertension was
24
25 defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg or
26
27 taking antihypertensive drugs. Reaching the target blood pressure was defined as systolic
28
29 blood pressure < 140 mmHg and diastolic blood pressure < 90 mmHg. Smoking history was
30
31 defined as at least one cigarette/day in the past 3 months (yes, no, never smoking). Family
32
33 history was defined as first-degree male relative with a CVD at < 55 years of age or a first-
34
35 degree female relative with a CVD at < 65 years of age.
36
37
38
39
40

41 **Statistical analysis**

42
43 All data were analyzed using SPSS 22.0 (IBM, Armonk, NY, USA). Continuous variables
44
45 that followed the normal distribution were expressed as means \pm standard deviation (SD),
46
47 and skewed continuous variables were summarized as medians (interquartile range).
48
49 Categorical variables were expressed as frequencies (percentage) and chi-square tests were
50
51 used for comparison between groups. Univariable and multivariable logistic regression
52
53 analyses were used to analyze the factors influencing the prevalence of hypertension, rate
54
55
56
57
58
59
60

1
2
3
4 of medicine taking, and rate of reaching the target blood pressure. For the multivariable
5
6 analysis, comorbidity was defined as the presence of any other disease, or taking
7
8 antidiabetic or lipid-lowering drugs. Two-sided $P < 0.05$ was considered as statistically
9
10 significant.
11

12 13 **Patient and Public Involvement statement**

14
15
16 Patients were not involved in the study design and implementation.
17

18 19 20 **RESULTS**

21 22 **Characteristics of the participants**

23
24
25 A total of 30,000 cardiologists across China were invited to participate in this survey, and
26
27 28,924 completed the questionnaire, for a response rate of 96.4%. Tables 1 and 2 and
28
29 Supplementary Table S1 present their characteristics. Most (42.7%) were 30-39 years old,
30
31 male (54.5%), with a bachelor degree (43.9%), working at a tertiary hospital (60.1%), and
32
33 were attending physicians (46.5%). Their main areas of expertise were: hypertension
34
35 (63.9%), atherosclerosis and coronary artery diseases (51.1%), blood lipids and metabolism
36
37 (35.1%), and heart failure (31.4%). Most had a BMI of 18.5-23.9 kg/m² (66.7%), fasting
38
39 blood glucose < 6.1 mmol/L (90.0%), LDL-C < 2.60 mmol/L (44.6%), HDL-C ≥ 1.0 mmol/L
40
41 (93.5%), TC < 5.2 mmol/L (86.3%), and TG < 1.7 mmol/L (53.8%). Among them, 57.6%
42
43 had blood pressure of 130-139/80-89 mmHg (5.3% were taking antihypertensive drugs) and
44
45 22.0% had blood pressure $\geq 140/\geq 90$ mmHg (36.5% were taking antihypertensive drugs).
46
47
48 Among all cardiologists, 37.0% never smoked, 78.2% had a family history of CVDs, 25.3%
49
50 had hypertension, and 8.0% were taking antihypertensive drugs.
51
52
53

54 55 **Gender differences in the prevalence of hypertension in Chinese cardiologists**

1
2
3
4 Hypertension was more prevalent in male cardiologists than in females ($P<0.001$) (Table 3).
5
6 More male cardiologists were taking antihypertensive drugs (33.5% vs. 28.8%, $P<0.001$),
7
8 but more female cardiologists achieved the target blood pressure (44.3% vs. 39.8%,
9
10 $P=0.036$).
11
12

13 **Age differences in the prevalence of hypertension in Chinese cardiologists**

14
15 Table 4 shows that hypertension was more prevalent in the older age groups ($P<0.001$). The
16
17 highest proportions of cardiologists taking antihypertensive drugs were found in the 50-59
18
19 (42.0%) and 60-69 (48.8%) years age groups. The highest proportions of cardiologists
20
21 reaching the target blood pressure were found in the 20-29 (48.4%), 30-39 (43.6%), and 40-
22
23 49 (41.7%) years age groups. Supplementary Tables S2 and S3 show that similar patterns
24
25 were observed when the analyses were performed by gender.
26
27
28

29 **Hospital level differences in the prevalence of hypertension in Chinese cardiologists**

30
31 Table 5 shows that the prevalence of hypertension was higher in cardiologists working at
32
33 primary hospitals (35.7%) compared with secondary (24.9%) and tertiary (25.4%) hospitals
34
35 ($P<0.001$). The proportions of cardiologists taking antihypertensive drugs and reaching the
36
37 target blood pressure were higher in secondary and tertiary hospitals (both $P<0.05$). Similar
38
39 patterns could be observed when analyzing male and female cardiologists (Supplementary
40
41 Tables S4 and S5).
42
43
44

45 **Professional title differences in the prevalence of hypertension in Chinese cardiologists**

46
47 Hypertension was more prevalent in associate chief physicians and chief physicians
48
49 ($P<0.001$), with a correspondingly higher proportion of cardiologists taking
50
51 antihypertensive drugs ($P<0.001$). Residents, healers, and attending physicians had the
52
53
54
55
56
57
58
59
60

1
2
3
4 highest proportions of cardiologists achieving the target blood pressure ($P<0.001$)
5
6 (Supplementary Table S6). Globally, similar patterns were observed when analyzing the
7
8 data by male and female cardiologists (Supplementary Tables S7 and S8).
9

10 **Factors associated with hypertension among cardiologists**

11
12 Table S9 presents the univariable and multivariable analyses of the factors associated with
13
14 hypertension among Chinese cardiologists. Age (50-59 years: odds ratio [OR]=1.397, 95%
15
16 confidence interval [CI]: 1.164-1.678, $P<0.001$; ≥ 60 years: OR=1.949, 95%CI: 1.534-2.476,
17
18 $P<0.001$ vs. 20-29 years), female gender (OR=0.866, 95%CI: 0.813-0.924, $P<0.001$ vs.
19
20 male), academic degree (bachelor: OR=0.629, 95%CI: 0.461-0.859, $P=0.004$; master:
21
22 OR=0.722, 95%CI: 0.528-0.988, $P=0.04$ vs. junior college), hospital level (secondary:
23
24 OR=0.582, 95%CI: 0.464-0.728, $P<0.001$; tertiary: OR=0.579, 95%CI: 0.463-0.724,
25
26 $P<0.001$ vs. primary), BMI (≥ 24 kg/m²: OR=1.314, 95%CI: 1.233-1.400, $P<0.001$ vs. 18.5-
27
28 23.9 kg/m²), smoking (infrequent: OR=0.568, 95%CI: 0.525-0.613, $P<0.001$; never:
29
30 OR=0.469, 95%CI: 0.431-0.509, $P<0.001$ vs. frequent), and comorbidities (OR=3.158,
31
32 95%CI: 2.924-3.410, $P<0.001$) were independently associated with hypertension among
33
34 cardiologists.
35
36
37
38
39
40

41 **Factors associated with taking antihypertensive drugs among hypertensive** 42 **cardiologists**

43
44 Table S10 presents the univariable and multivariable analyses of the factors associated with
45
46 taking antihypertensive drugs among hypertensive cardiologists. Age (30-39 years:
47
48 OR=1.433, 95%CI: 1.055-1.945, $P=0.02$; 40-49 years: OR=1.989, 95%CI: 1.428-2.771,
49
50 $P<0.001$; 50-59 years: OR=2.282, 95%CI: 1.599-3.257, $P<0.001$; ≥ 60 years: OR=2.677,
51
52 95%CI: 1.754-4.086, $P<0.001$ vs. 20-29 years), female gender (OR=1.200, 95%CI: 1.059-
53
54
55
56
57
58
59
60

1
2
3
4 1.359, P=0.004 vs. male), BMI (≥ 24 kg/m²: OR=1.157, 95%CI: 1.031-1.299, P=0.01 vs.
5
6 18.5-23.9 kg/m²), smoking (infrequent: OR=0.502, 95%CI: 0.440-0.572, P<0.001; never:
7
8 OR=0.374, 95%CI: 0.322-0.434, P<0.001 vs. frequent), family history of CVDs
9
10 (OR=1.400, 95%CI: 1.247-1.571, P<0.001), and comorbidities (OR=2.646, 95%CI: 2.351-
11
12 2.977, P<0.001) were independently associated with taking antihypertensive drugs among
13
14 hypertensive cardiologists.
15
16

17 **Factors associated with reaching target blood pressure among hypertensive** 18 **cardiologists taking antihypertensive drugs** 19 20 21

22 Table S11 presents the univariable and multivariable analyses of the factors associated with
23
24 reaching target blood pressure among hypertensive cardiologists taking antihypertensive
25
26 drugs. Age (50-59 years: OR=0.465, 95%CI: 0.262-0.825, P=0.009 vs. 20-29 years),
27
28 hospital level (secondary: OR=2.878, 95%CI: 1.287-6.438, P=0.01; tertiary: OR=2.558,
29
30 95%CI: 1.147-5.704, P=0.02 vs. primary), professional title (residents: OR=2.768, 95%CI:
31
32 1.467-5.225, P=0.002 vs. general physicians), BMI (≥ 24 kg/m²: OR=0.657, 95%CI: 0.548-
33
34 0.787, P<0.001 vs. 18.5-23.9 kg/m²), family history of CVDs (OR=0.746, 95%CI: 0.624-
35
36 0.891, P=0.001), and comorbidities (OR=0.811, 95%CI: 0.679-0.970, P=0.02) were
37
38 independently associated with reaching target blood pressure among hypertensive
39
40 cardiologists taking antihypertensive drugs.
41
42
43
44
45
46
47

48 **DISCUSSION** 49

50 Chinese cardiologists have a poor knowledge of their own cardiovascular risk factors. The
51
52 present study aimed to examine the risk factors for hypertension among Chinese
53
54 cardiologists using a nationwide survey. The results suggest that Chinese cardiologists do
55
56
57
58
59
60

1
2
3
4 not recognize and pay attention to their own blood pressure. Their rate of taking
5
6 antihypertensive drugs was low. The identified risk factors could be used to identify
7
8 cardiologists at higher risk for hypertension and for implementing preventive interventions.
9
10 In China, the prevalence of hypertension is around 24% [26-28], leading to a significant
11
12 cardiovascular burden [29]. In the present study, the prevalence of hypertension was 25.3%,
13
14 similar to the prevalence in the general Chinese population. A previous survey of
15
16 cardiologists conducted in 2011 revealed participants' characteristics that were similar to
17
18 those of the present study [6], further supporting the representativeness of our sample. Of
19
20 course, there is a certain overlap between the samples of the two studies, but the exact
21
22 extent of this overlap cannot be confirmed.
23
24
25

26
27 In the present study, 57.6% of the cardiologists had borderline or at-risk blood pressure
28
29 (130-139/80-89 mmHg) and only 5.3% were taking antihypertensive drugs. In addition,
30
31 22.0% had blood pressure $\geq 140/\geq 90$ mmHg, but only 36.5% were taking antihypertensive
32
33 drugs. Despite the expected health knowledge in physicians compared with the general
34
35 population, this rate of treatment was surprisingly not better than in the general Chinese
36
37 population [30 31]. The SOCRATES study showed that the rate of using lipid-lowering,
38
39 antihypertensive, and cardiovascular drugs was low among Italian cardiologists [8],
40
41 supporting the present study. Data from the Chinese (CHARLS study) and the American
42
43 (NHANES study) general populations indicate that China had lower rates of hypertension
44
45 treatment than the USA [27]. This is also supported by the CARE study, which showed that
46
47 physicians had suboptimal awareness of their own cardiovascular risk, as well as
48
49 suboptimal use of prophylaxis [15 16], and by the SOCRATES study, which showed that
50
51 the self-awareness of cardiologists' own cardiovascular risk factors was low [8]. On the
52
53
54
55
56
57
58
59
60

1
2
3
4 other hand, Abuissa et al. [32] showed that American cardiologists had generally good
5
6 lifestyle habits.

7
8 Age, gender, BMI, smoking, family history of CVDs, and comorbidities are well-known
9
10 risk factors for hypertension, compliance to treatment, and/or achieving target blood
11
12 pressure [33-35]. Aboyans et al. [11] showed that the awareness and management of
13
14 smoking cessation strategies among smoking French cardiologists were low. In the present
15
16 study, age, gender, BMI, smoking, and family history of CVDs were associated with the
17
18 risk of having hypertension, with the risk of not taking the proper antihypertensive
19
20 medication, and with the risk of not achieving the target blood pressure. Even if age, gender,
21
22 and comorbidities are non-modifiable risk factors, they could help identify cardiologists in
23
24 need of more efforts for seeking the proper cardiovascular treatments. This is supported by
25
26 previous studies in various populations [30 36 37].

27
28
29
30
31 Great efforts are necessary to become a cardiologist in Western countries, but because of
32
33 differences in the Chinese medical system, it takes less efforts to become a cardiologist in
34
35 China than in Western countries, a situation that is currently being corrected [6 38-40]. The
36
37 present study suggests that having a bachelor or master degree led to lower risk of
38
39 hypertension compared with junior college level. This could be due to the fact that people
40
41 with more advanced training possess more skills and knowledge, leading to less stress in
42
43 their work. In addition, they have higher income, decreasing the need for working long and
44
45 stressful hours. This is supported by a study that showed that physicians with a low
46
47 education level had poor quality of life in China [14]. As more experienced physicians can
48
49 have access to more advanced hospitals, we observed that cardiologists working in
50
51 secondary and tertiary hospitals had a lower risk of having hypertension. This could be due
52
53
54
55
56
57
58
59
60

1
2
3
4 to a better awareness of health knowledge in general, but also to the better material and
5 human resources in more advanced hospitals, hereby lowering stress and workload [14 41].
6
7
8
9 Workload was not directly collected in the present study, but previous studies reported that
10 it is higher in China than in the USA, with 1.9 vs. 8.1 cardiologists per 100,000 people [6 7].
11
12
13 Considering the large sample size in the present study, it is probable that our study
14 population follows the national trend. One study showed that the working hours of
15 American physicians were decreasing over the years [42]. It has been shown that working
16 long hours was associated with an increased cardiovascular risk [43]. Better knowledge and
17 lower stress/workload can also be associated with being properly treated or not for
18 hypertension and taking the proper steps, both on the medical and lifestyle points of view,
19 to achieve the blood pressure targets, as observed in the present study. This is supported by
20 a number of studies in the Chinese general population [30 31 44 45].
21
22
23
24
25
26
27
28
29
30

31
32 The strength of the present study lies in its large sample size (>26,000 participants) from all
33 across China. On the other hand, because of funding and logistics, data had to be collected
34 using a self-filled survey, which could introduce bias compared to a formal epidemiological
35 study. In addition, the survey was filled only by the cardiologists willing to do so. Some
36 physicians could be tempted to provide data that are better than the reality. Nevertheless,
37 the prevalence of hypertension (based on the composite variable made of blood pressure
38 and antihypertensive drugs, not on a formal inquiry about a diagnosis of hypertension) was
39 similar to that of the general population of China, suggesting data validity. Of course, the
40 medical system in China and the formation required to work in cardiology are different
41 from that of other countries [6 38], limiting the generalizability of the data. The
42 geographical distribution of the cardiologists across China was not taken into account.
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4 Importantly, the survey was not an epidemiological questionnaire and it was only used for
5 data collection, not assessment; validity and reliability were not verified. Finally, the
6 characteristics of the cardiologists who were unwilling to fill the survey were not collected.
7
8
9 Additional studies are necessary to confirm those findings.
10
11

12
13 In conclusion, the results suggest that Chinese cardiologists do not recognize and pay
14 attention to their own blood pressure. Their rate of antihypertensive treatment was low. The
15 identified risk factors could be used to identify cardiologists at higher risk for hypertension
16 and for implementing preventive interventions. Our results have a number of implications
17 for the reform of health care awareness and prevention in cardiologists in China.
18
19
20
21
22
23
24
25
26

27 **APPENDIX 1**

28
29 The China Cardiologist Heart Study Questionnaire
30
31
32
33

34 **DATA SHARING STATEMENT**

35
36 No additional data are available.
37
38
39
40

41 **ACKNOWLEDGMENTS**

42
43 The authors acknowledge the contribution of all physicians who participated in this survey.
44
45 The study was started by the Chinese Cardiovascular Association and supported by the
46 GUSU group.
47
48
49
50
51

52 **FUNDING**

53
54
55 The study is supported by the Emerging Frontier Project of Shanghai Hospital
56
57
58
59
60

1
2
3
4 Development Center (No. SHDC12014101), the Innovative Research Group Project of
5
6 National Natural Science Foundation of China (No. 81521001), and National Key Research
7
8 and Development Project (No. 2016YFC1301200). The authors declare that they have no
9
10 conflicts of interest.
11
12

13 14 15 16 **CONFLICTS OF INTEREST**

17
18 The authors declare that they have no conflicts of interest.
19
20

21 22 23 **AUTHORS' CONTRIBUTIONS**

24
25 Lei Hou, Xuejuan Jin conceived and coordinated the study, designed, performed and
26
27 analyzed the experiments, wrote the paper. Jianying Ma, Juying Qian, Yong Huo carried
28
29 out the data collection, data analysis, and revised the paper. Junbo Ge designed the study,
30
31 carried out the data analysis, and revised the paper. All authors reviewed the results and
32
33 approved the final version of the manuscript.
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

REFERENCES

1. Goldstein JA, Balter S, Cowley M, et al. Occupational hazards of interventional cardiologists: prevalence of orthopedic health problems in contemporary practice. *Catheterization and cardiovascular interventions : official journal of the Society for Cardiac Angiography & Interventions* 2004;**63**(4):407-11 doi: 10.1002/ccd.20201[published Online First: Epub Date]].
2. Dehmer GJ. Occupational hazards for interventional cardiologists. *Catheterization and cardiovascular interventions : official journal of the Society for Cardiac Angiography & Interventions* 2006;**68**(6):974-6 doi: 10.1002/ccd.21004[published Online First: Epub Date]].
3. Clark DA. How much is too much? *Catheterization and cardiovascular interventions : official journal of the Society for Cardiac Angiography & Interventions* 2000;**51**(3):265
4. Faggiano P, Temporelli PL, Zito G, et al. [Cardiovascular risk profile and lifestyle habits in a cohort of Italian cardiologists. Results of the SOCRATES survey]. *Monaldi archives for chest disease = Archivio Monaldi per le malattie del torace* 2013;**80**(3):118-25 doi: 10.4081/monaldi.2013.73[published Online First: Epub Date]].
5. Michel JB, Sangha DM, Erwin JP, 3rd. Burnout Among Cardiologists. *The American journal of cardiology* 2017;**119**(6):938-40 doi: 10.1016/j.amjcard.2016.11.052[published Online First: Epub Date]].
6. Gong YJ, Huo Y. A Survey of National Cardiology Workforce in China. *Eur Heart J* 2016;**18**(Suppl):A1-A5

- 1
2
3
4 7. Narang A, Sinha SS, Rajagopalan B, et al. The Supply and Demand of the
5
6 Cardiovascular Workforce: Striking the Right Balance. *Journal of the American*
7
8 *College of Cardiology* 2016;**68**(15):1680-89 doi:
9
10 10.1016/j.jacc.2016.06.070[published Online First: Epub Date]].
11
12
- 13
14 8. Temporelli PL, Zito G, Faggiano P, et al. Cardiovascular risk profile and lifestyle habits
15
16 in a cohort of Italian cardiologists (from the SOCRATES Survey). *The American*
17
18 *journal of cardiology* 2013;**112**(2):226-30 doi:
19
20 10.1016/j.amjcard.2013.03.020[published Online First: Epub Date]].
21
22
- 23 9. Merz CN, Mensah GA, Fuster V, et al. Task force #5--the role of cardiovascular
24
25 specialists as leaders in prevention: from training to champion. 33rd Bethesda
26
27 Conference. *Journal of the American College of Cardiology* 2002;**40**(4):641-51
28
29
- 30 10. O'Kelly S, Andersen K, Capewell S, et al. Bringing prevention to the population: an
31
32 important role for cardiologists in policy-making. *Eur Heart J* 2011;**32**(16):1964-7
33
34 doi: 10.1093/eurheartj/ehr128[published Online First: Epub Date]].
35
36
- 37 11. Aboyans V, Pinet P, Lacroix P, et al. Knowledge and management of smoking-
38
39 cessation strategies among cardiologists in France: a nationwide survey. *Archives of*
40
41 *cardiovascular diseases* 2009;**102**(3):193-9 doi:
42
43 10.1016/j.acvd.2009.01.005[published Online First: Epub Date]].
44
45
- 46 12. Reiner Z, Sonicki Z, Tedeschi-Reiner E. Physicians' perception, knowledge and
47
48 awareness of cardiovascular risk factors and adherence to prevention guidelines: the
49
50 PERCRO-DOC survey. *Atherosclerosis* 2010;**213**(2):598-603 doi:
51
52 10.1016/j.atherosclerosis.2010.09.014[published Online First: Epub Date]].
53
54
- 55 13. Lu Y, Hu XM, Huang XL, et al. The relationship between job satisfaction, work stress,
56
57

- 1
2
3
4 work-family conflict, and turnover intention among physicians in Guangdong,
5
6 China: a cross-sectional study. *BMJ open* 2017;**7**(5):e014894 doi:
7
8 10.1136/bmjopen-2016-014894[published Online First: Epub Date].
9
10
- 11 14. Liang Y, Wang H, Tao X. Quality of life of young clinical doctors in public hospitals in
12
13 China's developed cities as measured by the Nottingham Health Profile (NHP).
14
15 *International journal for equity in health* 2015;**14**:85 doi: 10.1186/s12939-015-
16
17 0199-2[published Online First: Epub Date].
18
19
- 20 15. Steering Committee of the Physicians' Health Study Research G. Final report on the
21
22 aspirin component of the ongoing Physicians' Health Study. *The New England*
23
24 *journal of medicine* 1989;**321**(3):129-35 doi:
25
26 10.1056/NEJM198907203210301[published Online First: Epub Date].
27
28
- 29 16. Hu DY, Yu JM, Chen F, et al. The Chinese physicians' Cardiovascular Risk Evaluation
30
31 (CARE) survey: an assessment of physicians' own cardiovascular risks. *Heart Asia*
32
33 2010;**2**(1):89-94 doi: 10.1136/ha.2009.001214[published Online First: Epub Date].
34
35
- 36 17. He J, Gu D, Chen J, et al. Premature deaths attributable to blood pressure in China: a
37
38 prospective cohort study. *Lancet* 2009;**374**(9703):1765-72 doi: 10.1016/S0140-
39
40 6736(09)61199-5[published Online First: Epub Date].
41
42
- 43 18. Miura K, Daviglius ML, Dyer AR, et al. Relationship of blood pressure to 25-year
44
45 mortality due to coronary heart disease, cardiovascular diseases, and all causes in
46
47 young adult men: the Chicago Heart Association Detection Project in Industry.
48
49 *Archives of internal medicine* 2001;**161**(12):1501-8
50
51
- 52 19. Franco OH, Peeters A, Bonneux L, et al. Blood pressure in adulthood and life
53
54 expectancy with cardiovascular disease in men and women: life course analysis.
55
56
57
58
59
60

- 1
2
3
4 Hypertension 2005;**46**(2):280-6 doi:
5
6 10.1161/01.HYP.0000173433.67426.9b[published Online First: Epub Date]].
7
8
9 20. Whelton PK, Carey RM, Aronow WS, et al. 2017
10 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline
11 for the Prevention, Detection, Evaluation, and Management of High Blood Pressure
12 in Adults: A Report of the American College of Cardiology/American Heart
13 Association Task Force on Clinical Practice Guidelines. Journal of the American
14 College of Cardiology 2018;**71**(19):e127-e248 doi:
15
16 10.1016/j.jacc.2017.11.006[published Online First: Epub Date]].
17
18
19
20
21
22
23
24
25 21. Spruill TM. Chronic psychosocial stress and hypertension. Current hypertension reports
26 2010;**12**(1):10-6 doi: 10.1007/s11906-009-0084-8[published Online First: Epub
27 Date]].
28
29
30
31
32 22. Vrijkotte TG, van Doornen LJ, de Geus EJ. Effects of work stress on ambulatory blood
33 pressure, heart rate, and heart rate variability. Hypertension 2000;**35**(4):880-6
34
35
36
37 23. Trudel X, Brisson C, Milot A, et al. Adverse psychosocial work factors, blood pressure
38 and hypertension incidence: repeated exposure in a 5-year prospective cohort study.
39 Journal of epidemiology and community health 2016;**70**(4):402-8 doi:
40 10.1136/jech-2014-204914[published Online First: Epub Date]].
41
42
43
44
45
46 24. Calhoun DA, Harding SM. Sleep and hypertension. Chest 2010;**138**(2):434-43 doi:
47 10.1378/chest.09-2954[published Online First: Epub Date]].
48
49
50
51 25. Wang Y, Mei H, Jiang YR, et al. Relationship between Duration of Sleep and
52 Hypertension in Adults: A Meta-Analysis. Journal of clinical sleep medicine :
53 JCSM : official publication of the American Academy of Sleep Medicine
54
55
56
57
58
59
60

- 2015;**11**(9):1047-56 doi: 10.5664/jcsm.5024[published Online First: Epub Date]].
26. Wu J, Cheng X, Qiu L, et al. Prevalence and Clustering of Major Cardiovascular Risk Factors in China: A Recent Cross-Sectional Survey. *Medicine* 2016;**95**(10):e2712 doi: 10.1097/MD.0000000000002712[published Online First: Epub Date]].
27. Lu Y, Wang P, Zhou T, et al. Comparison of Prevalence, Awareness, Treatment, and Control of Cardiovascular Risk Factors in China and the United States. *Journal of the American Heart Association* 2018;**7**(3) doi: 10.1161/JAHA.117.007462[published Online First: Epub Date]].
28. Yang F, Qian D, Hu DY, et al. Prevalence of cardiovascular disease risk factor clustering in Chinese adults. *Clin Trials Regul Sci Cardiol* 2016
29. Sui H, Chen WW, Wang W. Interpretation of Report on Cardiovascular Diseases in China 2015. *Chin J Cardiovasc Med* 2016;**21**(4):259-61
30. Huang XB, Chen F, Dai W, et al. Prevalence and risk factors associated with hypertension in the Chinese Qiang population. *Clinical and experimental hypertension* 2018;**40**(5):427-33 doi: 10.1080/10641963.2017.1392553[published Online First: Epub Date]].
31. Hu Y, Wang Z, Wang Y, et al. Prevalence, Awareness, Treatment, and Control of Hypertension among Kazakhs with high Salt Intake in Xinjiang, China: A Community-based Cross-sectional Study. *Scientific reports* 2017;**7**:45547 doi: 10.1038/srep45547[published Online First: Epub Date]].
32. Abuissa H, Lavie C, Spertus J, et al. Personal health habits of American cardiologists. *The American journal of cardiology* 2006;**97**(7):1093-6 doi: 10.1016/j.amjcard.2005.10.057[published Online First: Epub Date]].

- 1
2
3
4 33. Lloyd-Jones DM, Evans JC, Levy D. Hypertension in adults across the age spectrum:
5 current outcomes and control in the community. *Jama* 2005;**294**(4):466-72 doi:
6 10.1001/jama.294.4.466[published Online First: Epub Date]].
7
8
9
10
11 34. James PA, Oparil S, Carter BL, et al. 2014 evidence-based guideline for the
12 management of high blood pressure in adults: report from the panel members
13 appointed to the Eighth Joint National Committee (JNC 8). *Jama* 2014;**311**(5):507-
14 20 doi: 10.1001/jama.2013.284427[published Online First: Epub Date]].
15
16
17
18
19
20
21 35. Leung AA, Daskalopoulou SS, Dasgupta K, et al. Hypertension Canada's 2017
22 Guidelines for Diagnosis, Risk Assessment, Prevention, and Treatment of
23 Hypertension in Adults. *The Canadian journal of cardiology* 2017;**33**(5):557-76 doi:
24 10.1016/j.cjca.2017.03.005[published Online First: Epub Date]].
25
26
27
28
29
30 36. Stockwell DH, Madhavan S, Cohen H, et al. The determinants of hypertension
31 awareness, treatment, and control in an insured population. *American journal of*
32 *public health* 1994;**84**(11):1768-74
33
34
35
36
37 37. Berhe DF, Taxis K, Haaijer-Ruskamp FM, et al. Hypertension treatment practices and
38 its determinants among ambulatory patients: retrospective cohort study in Ethiopia.
39 *BMJ open* 2017;**7**(8):e015743 doi: 10.1136/bmjopen-2016-015743[published
40 Online First: Epub Date]].
41
42
43
44
45
46 38. Levinson W, King TE, Jr., Goldman L, et al. Clinical decisions. American Board of
47 Internal Medicine maintenance of certification program. *The New England journal*
48 *of medicine* 2010;**362**(10):948-52 doi: 10.1056/NEJMclde0911205[published
49 Online First: Epub Date]].
50
51
52
53
54
55 39. Song P, Jin C, Tang W. New medical education reform in China: Towards healthy
56
57
58
59
60

- 1
2
3
4 China 2030. Bioscience trends 2017;**11**(4):366-69 doi:
5
6 10.5582/bst.2017.01198[published Online First: Epub Date]].
7
8
9 40. The L. Medical education reform in China. Lancet 2017;**390**(10092):334 doi:
10
11 10.1016/S0140-6736(17)31921-9[published Online First: Epub Date]].
12
13 41. Chen X, Tan X, Li L. Health Problem and Occupational Stress among Chinese Doctors.
14
15 Chin Med 2013;**2013**(4):1-6
16
17 42. Staiger DO, Auerbach DI, Buerhaus PI. Trends in the work hours of physicians in the
18
19 United States. Jama 2010;**303**(8):747-53 doi: 10.1001/jama.2010.168[published
20
21 Online First: Epub Date]].
22
23 43. Conway SH, Pompeii LA, Roberts RE, et al. Dose-Response Relation Between Work
24
25 Hours and Cardiovascular Disease Risk: Findings From the Panel Study of Income
26
27 Dynamics. Journal of occupational and environmental medicine 2016;**58**(3):221-6
28
29 doi: 10.1097/JOM.0000000000000654[published Online First: Epub Date]].
30
31
32 44. Wu Y, Huxley R, Li L, et al. Prevalence, awareness, treatment, and control of
33
34 hypertension in China: data from the China National Nutrition and Health Survey
35
36 2002. Circulation 2008;**118**(25):2679-86 doi:
37
38 10.1161/CIRCULATIONAHA.108.788166[published Online First: Epub Date]].
39
40
41 45. Wang J, Zhang L, Wang F, et al. Prevalence, awareness, treatment, and control of
42
43 hypertension in China: results from a national survey. American journal of
44
45 hypertension 2014;**27**(11):1355-61 doi: 10.1093/ajh/hpu053[published Online First:
46
47 Epub Date]].
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 1. Demographic characteristics, current disease and medication of the participants

Variable	Total (n=28,924)
Age (years)	37.82±9.27
20-29	5308 (18.35)
30-39	12,338 (42.66)
40-49	8019 (27.72)
50-59	2674 (9.24)
60-69	584 (2.02)
≥70	1 (0.00)
Gender	
Male	15,749 (54.45)
Female	13,175 (45.55)
Academic degree	
Junior college	225 (0.78)
Bachelor	12,704 (43.92)
Master	10,580 (36.58)
Doctor	2905 (10.04)
Post-doctor	412 (1.42)
Others	2098 (7.25)
Hospital level	
Primary	381 (1.32)
Secondary	10,823 (37.42)

1		
2		
3		
4	Tertiary	17,375 (60.07)
5		
6	Others	345 (1.19)
7		
8		
9	Professional title	
10		
11	General physician	4230 (14.62)
12		
13	Healer	540 (1.87)
14		
15	Resident physician	966 (3.34)
16		
17	Attending physician	13,448 (46.49)
18		
19	Associate chief physician	4674 (16.16)
20		
21	Chief physician	2279 (7.88)
22		
23	Others	2787 (9.64)
24		
25		
26		
27	BMI (kg/m ²)	22.35±2.51
28		
29	<18.5	1475 (5.10)
30		
31	18.5-23.9	19,304 (66.74)
32		
33	≥24	8145 (28.16)
34		
35		
36	Current disease	
37		
38	Coronary heart disease	1760 (6.08)
39		
40	Heart failure	554 (1.92)
41		
42	Diabetes	598 (2.07)
43		
44	Stroke/transient ischemic attack	167 (0.58)
45		
46	Chronic kidney disease	409 (1.41)
47		
48	Peripheral vascular disease	431 (1.49)
49		
50	Hypertension	7319 (25.30)
51		
52		
53		
54		
55		
56		
57		
58		
59		
60		

Medication

Antihypertensive drugs	2323 (8.03)
Antidiabetic drugs	574 (1.98)
Lipid-lowering drugs	1223 (4.23)

Data are expressed as mean±standard deviation or n (%). BMI, body mass index.

For peer review only

Table 2. Clinical characteristics of the participants

Variable	Total (n=28,924)
SBP/DBP (mmHg)	
SBP	122.74±14.27
DBP	81.2±12.04
<130/<80	8802 (30.43)
Taking antihypertensive drugs	228 (2.59)
130-139/80-89	13,763 (47.58)
Taking antihypertensive drugs	732 (5.32)
≥140/≥90	6359 (21.99)
Taking antihypertensive drugs	2323 (36.53)
Heart rate (bpm)	74.11±9.26
<50	1 (0.00)
50-59	778 (2.69)
60-69	6972 (24.1)
70-79	13,033 (45.06)
80-89	6600 (22.82)
≥90	1540 (5.32)
Fasting blood glucose (mmol/L)	5.1±1.65
<6.1	26,030 (89.99)
6.1-6.9	1810 (6.26)
≥7.0	1084 (3.75)

LDL-C (mmol/L)	2.73±0.87
<2.6	12,888 (44.56)
2.6-3.3	12,058 (41.69)
3.4-4.0	2363 (8.17)
≥4.1	1614 (5.58)
Unknown	1 (0.00)
HDL-C (mmol/L)	1.85±1.02
<1.0	1879 (6.50)
≥1.0	27,043 (93.50)
Unknown	2 (0.01)
TC (mmol/L)	4.09±1.23
<5.2	24,972 (86.34)
5.2-6.1	2988 (10.33)
≥6.2	957 (3.31)
Unknown	7 (0.02)
TG (mmol/L)	1.6 (1.2,2.2)
<1.7	15,547 (53.75)
1.7-2.2	6345 (21.94)
≥2.3	7029 (24.30)
Unknown	3 (0.01)
Smoking	
Frequent	4660 (16.11)

1		
2		
3		
4	Infrequent	13,561 (46.88)
5		
6	Never	10,703 (37.00)
7		
8		
9	Family history	
10		
11	Yes	22,611 (78.17)
12		
13	No	6313 (21.83)
14		
15		

16 Data are expressed as mean±standard deviation or n (%). DBP, diastolic blood pressure;
17
18 HDL-C, high density lipoprotein-cholesterol; LDL-C, low density lipoprotein-cholesterol;
19
20 SBP, systolic blood pressure; TC, total cholesterol; TG, triglyceride.
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 3. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in cardiologists with different gender

Variable	Total (n=28,924)	Male (n=15,749)	Female (n=13,175)	P
Hypertension	7319 (25.30)	4574 (29.00)	2745 (20.83)	<0.001
Taking antihypertensive drugs	2323 (31.74)	1533 (33.52)	790 (28.78)	<0.001
Reaching the target blood pressure	960 (41.33)	610 (39.79)	350 (44.30)	0.036

Data are expressed as n (%).

Table 4. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in cardiologists with different age

Variable	Total	20-29	30-39	40-49	50-59	60-69	≥70	P
	(n=28924)	(n=5308)	(n=12,338)	(n=8019)	(n=2674)	(n=584)	(n=1)	
Hypertension	7319 (25.3)	1276 (24.04)	2680 (21.72)	2158 (26.91)	946 (35.38)	258 (44.18)	1 (100)	<0.001
Taking antihypertensive drugs	2323 (31.74)	256 (20.06)	738 (27.54)	806 (37.35)	397 (41.97)	126 (48.84)	0	<0.001
Reaching the target blood pressure	960 (41.33)	124 (48.44)	322 (43.63)	336 (41.69)	130 (32.75)	48 (38.10)	-	0.001

Data are expressed as n (%).

Table 5. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in cardiologists with different hospital level

Variable	Total (n=28,924)	Primary (n=381)	Secondary (n=10,823)	Tertiary (n=17,375)	Others (n=345)	P
Hypertension	7319 (25.30)	136 (35.70)	2695 (24.90)	4413 (25.40)	75 (21.74)	<0.001
Taking antihypertensive drugs	2323 (31.74)	38 (27.94)	904 (33.43)	1354 (30.68)	27 (36.00)	0.049
Reaching the target blood pressure	960 (41.33)	8 (21.05)	390 (43.14)	551 (40.69)	11 (40.74)	0.048

Data are expressed as n (%).

Table S1. Area of expertise of the participants

Variable	Total (n=28,924)
Atherosclerosis and coronary heart disease	14,783 (51.11)
Hypertension	18,477 (63.88)
Arrhythmia and electrophysiology	8226 (28.44)
Blood lipid metabolism	10,147 (35.08)
Congenital heart disease	4678 (16.17)
Heart failure	9087 (31.42)
Pulmonary vascular disease	2859 (9.88)
Cardiac intensive care and monitoring	2051 (7.09)
Interventional cardiology	2526 (8.73)
Cardiovascular imaging	2742 (9.48)
Senile cardiovascular disease	0
Female cardiovascular disease	2859 (9.88)
Structural heart disease	3774 (13.05)
Basic-clinical combination	2350 (8.12)
Others	2746 (9.49)

Data are expressed as n (%).

Table S2. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in male cardiologists with different age

Variable	20-29	30-39	40-49	50-59	60-69	≥70	P
	(n=2437)	(n=6777)	(n=4521)	(n=1656)	(n=357)	(n=1)	
Hypertension	684 (28.1)	1709 (25.2)	1362 (30.1)	647 (39.1)	171 (47.9)	1 (100)	<0.001
Taking antihypertensive drugs	159 (23.2)	510 (29.8)	506 (37.2)	272 (42)	86 (50.3)	0	<0.001
Reaching the target blood pressure	124 (48.4)	322 (43.6)	336 (41.7)	130 (32.7)	48 (38.1)	-	0.001

Data are expressed as n (%).

Table S3. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in female cardiologists with different age

Variable	20-29	30-39	40-49	50-59	60-69	P
	(n=2871)	(n=5561)	(n=3498)	(n=1018)	(n=227)	
Hypertension	592 (20.6)	971 (17.5)	796 (22.8)	299 (29.4)	87 (38.3)	<0.001
Taking antihypertensive drugs	97 (16.4)	228 (23.5)	300 (37.7)	125 (41.8)	40 (46.0)	<0.001
Reaching the target blood pressure	51 (52.6)	107 (46.9)	132 (44)	45 (36)	15 (37.5)	0.108

Data are expressed as n (%).

Table S4. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in male cardiologists with different hospital level

Variable	Primary (n=211)	Secondary (n=5807)	Tertiary (n=9552)	Others (n=179)	P
Hypertension	92 (43.6)	1674 (28.8)	2765 (28.9)	43 (24.0)	<0.001
Taking antihypertensive drugs	28 (30.4)	581 (34.7)	912 (33)	12 (27.9)	0.491
Reaching the target blood pressure	5 (17.9)	229 (39.4)	374 (41)	2 (16.7)	0.031

Data are expressed as n (%).

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46

Table S5. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in female cardiologists with different hospital level

Variable	Primary (n=170)	Secondary (n=5016)	Tertiary (n=7823)	Others (n=166)	P
Hypertension	44 (25.9)	1021 (20.4)	1648 (21.1)	32 (19.3)	0.281
Taking antihypertensive drugs	10 (22.7)	323 (31.6)	442 (26.8)	15 (46.9)	0.005
Reaching the target blood pressure	3 (30.0)	161 (49.8)	177 (40)	9 (60.0)	0.022

Data are expressed as n (%).

Table S6. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in cardiologists with different professional title

Variable	Total	General	Healer	Resident	Attending	Associate chief	Chief	Others	P
	(n=28,924)	physician (n=4230)	(n=540)	physician (n=966)	physician (n=13,448)	physician (n=4674)	physician (n=2279)	(n=2787)	
Hypertension	7319 (25.30)	896 (21.18)	139 (25.74)	263 (27.23)	3032 (22.55)	1413 (30.23)	806 (35.37)	770 (27.63)	<0.001
Taking antihypertensive drugs	2323 (31.74)	179 (19.98)	46 (33.09)	88 (33.46)	934 (30.80)	546 (38.64)	357 (44.29)	173 (22.47)	<0.001
Reaching the target blood pressure	960 (41.33)	70 (39.11)	21 (45.65)	49 (55.68)	404 (43.25)	192 (35.16)	135 (37.82)	89 (51.45)	<0.001

Data are expressed as n (%).

Table S7. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in male cardiologists with different professional title

Variable	General physician (n=2049)	Healer (n=260)	Resident physician (n=548)	Attending physician (n=7447)	Associate physician (n=2740)	chief physician (n=1447)	Chief physician (n=1258)	Others (n=1258)	P
Hypertension	507 (24.7)	82 (31.5)	159 (29)	1944 (26.1)	896 (32.7)	579 (40.0)	407 (32.4)	<0.001	
Taking antihypertensive drugs	120 (23.7)	33 (40.2)	63 (39.6)	620 (31.9)	335 (37.4)	264 (45.6)	98 (24.1)	<0.001	
Reaching the target blood pressure	43 (35.8)	11 (33.3)	32 (50.8)	259 (41.8)	117 (34.9)	96 (36.4)	52 (53.1)	0.008	

Data are expressed as n (%).

Table S8. Prevalence of hypertension, rate of antihypertensive drugs taking, and rate of reaching the target blood pressure in female cardiologists with different professional title

Variable	General physician (n=2181)	Healer (n=280)	Resident physician (n=418)	Attending physician (n=6001)	Associate chief physician (n=1934)	Chief physician (n=832)	Others (n=1529)	P
Hypertension	389 (17.8)	57 (20.4)	104 (24.9)	1088 (18.1)	517 (26.7)	227 (27.3)	363 (23.7)	<0.001
Taking antihypertensive drugs	59 (15.2)	13 (22.8)	25 (24.0)	314 (28.9)	211 (40.8)	93 (41.0)	75 (20.7)	<0.001
Reaching the target blood pressure	27 (45.8)	10 (76.9)	17 (68.0)	145 (46.2)	75 (35.5)	39 (41.9)	37 (49.3)	0.004

Data are expressed as n (%).

Table S9. Univariable and multivariable logistic regressions for hypertension among cardiologists

Variable	Univariable logistic regression		Multivariable logistic regression	
	OR (95%CI)	P	OR (95%CI)	P
Age (years)				
20-29	Reference		Reference	
30-39	0.877 (0.813,0.946)	0.001	0.915 (0.793,1.056)	0.227
40-49	1.163 (1.074,1.26)	<0.001	1.012 (0.861,1.189)	0.885
50-59	1.73 (1.563,1.914)	<0.001	1.397 (1.164,1.678)	<0.001
≥60	2.51 (2.108,2.99)	<0.001	1.949 (1.534,2.476)	<0.001
Gender				
Male	Reference			
Female	0.643 (0.609,0.679)	<0.001	0.866 (0.813,0.924)	<0.001
Academic degree				
Junior college	Reference		Reference	
Bachelor	0.631 (0.476,0.837)	0.001	0.629 (0.461,0.859)	0.004

1					
2					
3					
4					
5	Master	0.713 (0.538,0.946)	0.019	0.722 (0.528,0.988)	0.042
6					
7	Doctor	0.86 (0.643,1.149)	0.307	0.774 (0.56,1.069)	0.120
8					
9	Post-doctor	1.049 (0.742,1.482)	0.787	0.776 (0.53,1.136)	0.191
10					
11	Others	0.844 (0.628,1.133)	0.258	0.771 (0.553,1.074)	0.124
12					
13					
14	Hospital level				
15					
16	Primary	Reference		Reference	
17					
18	Secondary	0.597 (0.482,0.74)	<0.001	0.582 (0.464,0.728)	<0.001
19					
20	Tertiary	0.613 (0.496,0.758)	<0.001	0.579 (0.463,0.724)	<0.001
21					
22	Others	0.5 (0.359,0.696)	<0.001	0.508 (0.359,0.717)	<0.001
23					
24					
25	Professional title				
26					
27	General physician	Reference		Reference	
28					
29	Healer	1.29 (1.049,1.586)	0.016	1.01 (0.791,1.291)	0.934
30					
31	Resident physician	1.392 (1.187,1.633)	<0.001	1.064 (0.871,1.301)	0.542
32					
33	Attending physician	1.083 (0.996,1.178)	0.063	0.965 (0.841,1.107)	0.611
34					
35	Associate chief physician	1.612 (1.464,1.776)	<0.001	1.118 (0.948,1.317)	0.185
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

1					
2					
3					
4					
5	Chief physician	2.037 (1.819,2.281)	<0.001	1.131 (0.94,1.361)	0.192
6					
7	Others	1.42 (1.271,1.587)	<0.001	1.193 (0.99,1.438)	0.063
8					
9	BMI (kg/m ²)				
10					
11	<18.5	0.744 (0.649,0.853)	<0.001	0.919 (0.797,1.061)	0.248
12					
13	18.5-23.9	Reference		Reference	
14					
15	≥24	1.627 (1.536,1.723)	<0.001	1.314 (1.233,1.4)	<0.001
16					
17					
18	Smoking				
19					
20	Frequent	Reference		Reference	
21					
22	Infrequent	0.422 (0.394,0.453)	<0.001	0.568 (0.525,0.613)	<0.001
23					
24	Never	0.342 (0.318,0.369)	<0.001	0.469 (0.431,0.509)	<0.001
25					
26					
27	Family history				
28					
29	No	Reference		Reference	
30					
31	Yes	1.77 (1.667,1.880)	<0.001	1.261 (1.18,1.348)	<0.001
32					
33					
34	Comorbidity				
35					
36	No	Reference		Reference	
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

1				
2				
3				
4				
5	Yes	4.003 (3.723,4.304)	<0.001	3.158 (2.924,3.41)
6				<0.001
7	<hr/>			
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				

For peer review only

Table S10. Univariable and multivariable logistic regressions for antihypertensive drugs taking among cardiologists with hypertension

Variable	Univariable logistic regression		Multivariable logistic regression	
	OR (95%CI)	P	OR (95%CI)	P
Age (years)				
20-29	Reference		Reference	
30-39	1.514 (1.289,1.779)	<0.001	1.433 (1.055,1.945)	0.021
40-49	2.375 (2.019,2.794)	<0.001	1.989 (1.428,2.771)	<0.001
50-59	2.881 (2.387,3.478)	<0.001	2.282 (1.599,3.257)	<0.001
≥60	3.775 (2.854,4.992)	<0.001	2.677 (1.754,4.086)	<0.001
Gender				
Male	Reference		Reference	
Female	0.802 (0.723,0.889)	<0.001	1.2 (1.059,1.359)	0.004
Academic degree				
Junior college	Reference		Reference	
Bachelor	1.565 (0.905,2.708)	0.109	1.025 (0.553,1.901)	0.938

1					
2					
3					
4					
5	Master	1.506 (0.87,2.607)	0.144	0.915 (0.491,1.705)	0.780
6					
7	Doctor	1.809 (1.033,3.168)	0.038	0.93 (0.492,1.757)	0.822
8					
9	Post-doctor	2.46 (1.298,4.659)	0.006	1.092 (0.534,2.235)	0.809
10					
11	Others	1.057 (0.596,1.876)	0.849	1.428 (0.729,2.8)	0.299
12					
13					
14	Hospital level				
15					
16	Primary	Reference			
17					
18	Secondary	1.302 (0.888,1.909)	0.177		
19					
20	Tertiary	1.142 (0.781,1.669)	0.495		
21					
22	Others	1.451 (0.794,2.649)	0.226		
23					
24					
25	Professional title				
26					
27	General physician	Reference		Reference	
28					
29	Healer	1.981 (1.342,2.925)	0.001	1.233 (0.765,1.989)	0.390
30					
31	Resident physician	2.014 (1.486,2.73)	<0.001	1.084 (0.736,1.596)	0.684
32					
33	Attending physician	1.783 (1.488,2.137)	<0.001	1.165 (0.878,1.546)	0.290
34					
35	Associate chief physician	2.523 (2.074,3.068)	<0.001	1.24 (0.898,1.711)	0.192
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

1					
2					
3					
4	Chief physician	3.185 (2.569,3.948)	<0.001	1.407 (0.993,1.992)	0.055
5					
6	Others	1.161 (0.917,1.469)	0.215	0.831 (0.562,1.23)	0.356
7					
8					
9	BMI (kg/m ²)				
10					
11	<18.5	0.628 (0.464,0.852)	0.003	0.78 (0.565,1.078)	0.132
12					
13	18.5-23.9	Reference		Reference	
14					
15	≥24	1.409 (1.272,1.561)	<0.001	1.157 (1.031,1.299)	0.013
16					
17					
18	Smoking				
19					
20	Frequent	Reference		Reference	
21					
22	Infrequent	0.446 (0.397,0.502)	<0.001	0.502 (0.44,0.572)	<0.001
23					
24	Never	0.335 (0.293,0.383)	<0.001	0.374 (0.322,0.434)	<0.001
25					
26					
27	Family history				
28					
29	No	Reference		Reference	
30					
31	Yes	0.485 (0.437,0.539)	<0.001	1.4 (1.247,1.571)	<0.001
32					
33					
34	Comorbidity				
35					
36	No	Reference		Reference	
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

1				
2				
3				
4				
5	Yes	3.185 (2.854,3.555)	<0.001	2.646 (2.351,2.977)
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				
38				
39				
40				
41				
42				
43				
44				
45				
46				

For peer review only

Table S11. Univariable and multivariable logistic regressions for reaching the target blood pressure among cardiologists taking antihypertensive drugs

Variable	Univariable logistic regression		Multivariable logistic regression	
	OR (95%CI)	P	OR (95%CI)	P
Age (years)				
20-29	Reference		Reference	
30-39	0.824 (0.62,1.096)	0.183	0.689 (0.418,1.138)	0.146
40-49	0.761 (0.574,1.009)	0.058	0.667 (0.391,1.138)	0.137
50-59	0.518 (0.375,0.716)	<0.001	0.465 (0.262,0.825)	0.009
≥60	0.655 (0.424,1.012)	0.057	0.549 (0.286,1.055)	0.072
Gender				
Male	Reference		Reference	
Female	1.204 (1.012,1.432)	0.036	1.081 (0.896,1.304)	0.415
Academic degree				
Junior college	Reference			

Bachelor	0.457 (0.172,1.211)	0.115		
Master	0.483 (0.182,1.282)	0.144		
Doctor	0.484 (0.179,1.306)	0.152		
Post-doctor	0.591 (0.198,1.762)	0.345		
Others	0.791 (0.286,2.192)	0.652		
Hospital level				
Primary	Reference		Reference	
Secondary	2.845 (1.29,6.275)	0.010	2.878 (1.287,6.438)	0.01
Tertiary	2.573 (1.171,5.655)	0.019	2.558 (1.147,5.704)	0.022
Others	2.578 (0.863,7.701)	0.090	2.179 (0.714,6.646)	0.171
Professional title				
General physician	Reference		Reference	
Healer	1.308 (0.681,2.514)	0.420	1.697 (0.8,3.603)	0.168
Resident physician	1.956 (1.167,3.28)	0.011	2.768 (1.467,5.225)	0.002
Attending physician	1.187 (0.856,1.646)	0.304	1.585 (0.982,2.558)	0.059

1					
2					
3					
4					
5	Associate chief physician	0.845 (0.596,1.196)	0.341	1.271 (0.747,2.16)	0.376
6					
7	Chief physician	0.947 (0.655,1.369)	0.772	1.623 (0.928,2.837)	0.089
8					
9	Others	1.65 (1.081,2.519)	0.020	1.599 (1.036,2.469)	0.034
10					
11	BMI (kg/m ²)				
12					
13	<18.5	0.973 (0.566,1.673)	0.922	0.872 (0.5,1.521)	0.629
14					
15	18.5-23.9	Reference		Reference	
16					
17	≥24	0.621 (0.524,0.738)	<0.001	0.657 (0.548,0.787)	<0.001
18					
19					
20	Smoking				
21					
22	Frequent	Reference			
23					
24	Infrequent	0.936 (0.777,1.128)	0.489		
25					
26	Never	1.022 (0.819,1.275)	0.848		
27					
28	Family history				
29					
30	No	Reference			
31					
32	Yes	1.445 (1.219,1.713)	<0.001	0.746 (0.624,0.891)	0.001
33					
34	Comorbidity				
35					
36					
37					
38					
39					
40					
41					
42					
43					
44					
45					
46					

No	Reference			
Yes	0.811 (0.685,0.96)	0.015	0.811 (0.679,0.97)	0.022

For peer review only

CCHS**QUESTIONNAIRE**

China Cardiologist Heart Study

FORM

INSTRUCTIONS: This collection of information is estimated to average **10** minutes. Name and contact information must be entered above. Please enter the number so that the last digit appears in the rightmost box. Enter leading zeros where necessary to fill all boxes. For "multiple choice" and "yes/no" type questions, circle the letter corresponding to the most appropriate response. If a letter is circled incorrectly, mark through it with an "X" and circle the correct response.

CCHS Center use onlySequence Number

1. Name: _____

2. Date of birth: / (yyyy/mm)

3. Contact phone number: _____

4. Employer: Hospital name, district/county, city, province/municipality _____

A. Personal information1. Hospital level:

2. Professional title: _____

3. Academic degree: _____

4. Area of expertise (multiple choices available):

- | | |
|--|---|
| <input type="radio"/> Atherosclerosis and coronary heart disease | <input type="radio"/> Hypertension |
| <input type="radio"/> Arrhythmia and electrophysiology | <input type="radio"/> Blood lipid metabolism |
| <input type="radio"/> Congenital heart disease | <input type="radio"/> Heart failure |
| <input type="radio"/> Pulmonary vascular disease | <input type="radio"/> Structural heart disease |
| <input type="radio"/> Female cardiovascular disease | <input type="radio"/> Senile cardiovascular disease |
| <input type="radio"/> Basic-clinical combination | <input type="radio"/> Cardiovascular imaging |
| <input type="radio"/> Interventional cardiology | <input type="radio"/> Cardiac intensive care and monitoring |
| <input type="radio"/> Others | |

B. Survey information1. Gender: Male Female2. Height: . cm3. Weight: . kg

1
2
3
4. Are you currently taking the following medications? (multiple choices available)

- 4 ○ Antihypertensive drugs
- 5 ○ Lipid-lowering drugs
- 6 ○ Antidiabetic drugs
- 7 ○ None

8
9
10
11 5. Do you have any of the following clinical conditions? (multiple choices available)

- 12 ○ None
- 13 ○ Coronary heart disease
- 14 ○ Heart failure
- 15 ○ Diabetes
- 16 ○ Chronic kidney disease
- 17 ○ Peripheral vascular disease
- 18 ○ Stroke/transient ischemic attack

19
20
21
22
23
24
25 6. Did you smoke ≥ 1 cigarette per day in the past 3 months?

- 26 ○ Yes
- 27 ○ No
- 28 ○ Never smoked

29
30
31
32 7. Do you have a first-degree male relative who suffered from a cardiovascular disease at <55
33 years of age or a first-degree female relative who suffered from a cardiovascular disease at <65
34 years of age?

- 35 ○ No
- 36 ○ Yes

37
38
39
40
41
42 **C. Blood Pressure** (Please record the data in the last 2 weeks, If don't know, please fill in 999)

43 1. Average sitting systolic blood pressure: mmHg

44 2. Average sitting diastolic blood pressure: mmHg

45 3. Average heart rate: bpm

46
47
48
49
50
51 **D. Laboratory** (Please record the data of the most recent results within a year, If don't know,
52 please fill in 999)

53 1. Fasting blood glucose: .mmol/L

54 2. Total cholesterol (TC): .mmol/L or .mg/dL

55 3. Low density lipoprotein-cholesterol (LDL-C): .mmol/L or .mg/dL

56 4. High density lipoprotein-cholesterol (HDL-C): .mmol/L or .mg/dL

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

5. Triglyceride (TG): . mmol/L or . mg/dL

Thank you very much for your help!

For peer review only

STROBE Statement

Checklist of items that should be included in reports of observational studies

Section/Topic	Item No	Recommendation	Reported on Page No
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2-3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(a) <i>Cohort study</i> —Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	5
		<i>Case-control study</i> —Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	
		<i>Cross-sectional study</i> —Give the eligibility criteria, and the sources and methods of selection of participants	
Variables	7	(b) <i>Cohort study</i> —For matched studies, give matching criteria and number of exposed and unexposed	5
		<i>Case-control study</i> —For matched studies, give matching criteria and the number of controls per case	
Data sources/measurement	8*	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	5
Bias	9	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6
Study size	10	Describe any efforts to address potential sources of bias	6
Quantitative variables	11	Explain how the study size was arrived at	6
Statistical methods	12	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6
		(a) Describe all statistical methods, including those used to control for confounding	7
		(b) Describe any methods used to examine subgroups and interactions	7
		(c) Explain how missing data were addressed	7
		(d) <i>Cohort study</i> —If applicable, explain how loss to follow-up was addressed	7
<i>Case-control study</i> —If applicable, explain how matching of cases and controls was addressed			
		<i>Cross-sectional study</i> —If applicable, describe analytical methods taking account of sampling strategy	7
		(e) Describe any sensitivity analyses	7

Section/Topic	Item No	Recommendation	Reported on Page No
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8
		(b) Indicate number of participants with missing data for each variable of interest	
		(c) <i>Cohort study</i> —Summarise follow-up time (eg, average and total amount)	
Outcome data	15*	<i>Cohort study</i> —Report numbers of outcome events or summary measures over time	
		<i>Case-control study</i> —Report numbers in each exposure category, or summary measures of exposure	
		<i>Cross-sectional study</i> —Report numbers of outcome events or summary measures	9-11
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-11
		(b) Report category boundaries when continuous variables were categorized	
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	11-14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-15
Generalisability	21	Discuss the generalisability (external validity) of the study results	14-15
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.