

## Research Article

## Stroke and (or) myocardial infarction attributable to modifiable risk factors in Henan, China

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**Abstract**

Estimating population attributable risks of potential modifiable risk factors for stroke and (or) myocardial infarction may be useful for planning cardiovascular disease (CVD) preventive strategies. A population of 17,292 adults aged 18 years and older from a cross-sectional survey was included in the study. The binary logistic regression was used to evaluate the association between risk factors with disease events, then population attributable fraction according to prevalence and odds ratios were calculated to identify and compare the effects at different subpopulations. We found that the main risk factor for CVD events was hypertension with about 50% of population attributable fraction; prehypertension (22.24%) only acts at rural older females; the efficiency of low- and moderate-level physical activities were higher in males (over 20%) than females (under 20%); ever smoked contributed to CVDs in rural older populations (males, 19.25%; females, 5.57%) and urban younger males (54.52%); while as for high body mass index, overweight (12.59%) only made contribution to rural males over 60 years. In conclusion, hypertension control in the whole population, physical activity increasing in males and older females, smoking prevention in rural elders and urban younger males, and slimming in rural elder males might be effective to reduce the burden of CVDs in Henan. *J Am Soc Hypertens* 2018; ■(■):1–10. © 2018 American Heart Association. All rights reserved.

**Keywords:** Modifiable risk factor; myocardial infarction; population attributable risk; Stroke.

**Introduction**

Cardiovascular disease (CVD) is not only the leading cause of death in the United States but also for Chinese.<sup>1</sup> Specifically, most of these are caused by stroke and myocardial infarction (MI) and other cerebrovascular diseases.<sup>2,3</sup> Namely, stroke and MI are emergent threat to public health in China.

At the population level, the potential impact of a risk factor depends on both the strength of associations between

risk factors with disease and the prevalence of the risk factors in the population. It is more useful to estimate population attributable risk (PAR) of modifiable factors for CVD events such as blood pressure (BP), physical activity (PA), smoking, and body mass index (BMI) than unmodifiable factors including age, gender, and family history for establishing control strategies.<sup>4–6</sup> What's more, the impact of risk factors on CVD events is not equal between different residence areas, gender, or age groups.<sup>7–9</sup> Accordingly, CVD prevention strategies in specific populations will be more available if they are designed based on knowledge of the PARs of risk factors in residence-, gender-, and age-specific subpopulations.

Henan is located at the center of China with a resident population of over 95 million, effective prevention need policy action based on knowledge of the importance of

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modifiable risk factors for CVDs in populations with different demographic characteristics. The aim of this study was to illustrate the associations of potential risk factors with stroke and (or) MI, the population attributable fractions (PAFs) of modifiable risk factors including smoking, physical inactivity, high BP, and high BMI, were calculated to guide public health interventions and ease the burden of diseases.

## Methods

The study population came from a cross-sectional study in Henan Province, which is one part of a Chinese national survey on the prevalence of CVD covering 31 provinces with 262 counties across China supported by the National Key R&D Program in the Twelfth Five-year Plan (No. 2011BAI11B01) with details presented in a published article.<sup>10</sup> A stratified multistage random sampling method was used to select representative samples from permanent residents, which lived in the administrative divisions. Finally, 19,000 representative samples were selected. The written informed consent was obtained from each participant before the data collection. This study was approved by the Ethical Committee of the Chinese Ministry of Science and Technology.

Data on demographic characteristics (such as gender, date of birth, nation, educational level), behavior (concluding alcohol drinking status, smoking status, PA), as well as personal and family history of CVD were collected with detailed questionnaire interviews by trained research staff. At the same time, physical examination which containing height, weight, waist circumference, basal metabolism, body fat percentage, visceral fat index, heart rate, systolic blood pressure (SBP), and diastolic blood pressure (DBP) was carried out.

Participants aged <18 years, uncompleted the questionnaire, or physical examination were excluded, leaving 17,292 subjects available for the research. Patients with CVD were diagnosed based on the medical certificate of MI or stroke issued by the hospital. Age was categorized into two groups as younger (<60 years old) and older ( $\geq 60$  years old).<sup>11</sup> PA score was calculated by multiplying the metabolic equivalent level for the activity by minutes exercised per week, and total values were assigned across three levels: walking, moderate activity, and vigorous activity of 3.3 mets, 4.0 mets, and 8.0 mets, respectively, in accordance with the levels recommended by International Physical Activity Questionnaire; then total PA score was further grouped into low, moderate, and high levels based on the guidelines provided in International Physical Activity Questionnaire long form.<sup>12</sup> BMI was calculated on height and weight:  $\text{weight}/\text{height}^2$  (kilograms/meters<sup>2</sup>) and then categorized into three levels: normal weight for  $<24 \text{ kg}/\text{m}^2$ , overweight for  $24\sim 27.9 \text{ kg}/\text{m}^2$ , and obesity for  $\geq 28 \text{ kg}/\text{m}^2$ .<sup>13</sup> BP was divided into three groups based

on SBP and DBP, as well as history of hypertension: normotension: SBP  $<120 \text{ mmHg}$  and/or DBP  $<80 \text{ mmHg}$  and without history of hypertension; prehypertension:  $120 \text{ mmHg} \leq \text{SBP} <140 \text{ mmHg}$  and/or  $80 \text{ mmHg} \leq \text{DBP} <90 \text{ mmHg}$  and without history of hypertension; hypertension: SBP  $\geq 140 \text{ mmHg}$  and/or DBP  $\geq 90 \text{ mmHg}$  and/or with a history of hypertension. Smoking status was classified into never and ever. Alcohol drinking was categorized into never and ever, and ever drank was further classified as yearly, seasonally, monthly, weekly, and daily. Family history of CVDs was defined as individuals who had either one of the family history of hypertension, hyperlipidemia, diabetes, stroke, and coronary heart disease.

The data were analyzed by Statistical package for the Social Sciences version 21.0. Relevant characteristics were described and stratified according to the CVD events. The categorical variables were expressed as frequencies and percentages and compared with chi-square ( $\chi^2$ ) test. The continuous data were presented as mean  $\pm$  standard deviation and compared by Student's *t* test. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated by binary logistic regression to assess the relationship among potential modifiable risk factors with CVD; the PAR was represented as PAF and estimated using the formula  $\text{PAF} = p(\text{OR} - 1)/(1 + p[\text{OR} - 1])$ , as *P* is the prevalence of risk factors in the population.  $P < .05$  with two-side tests was considered statistically significant.

## Results

The prevalence was 5.44% for stroke and 1.52% for MI, respectively. Then the prevalence of combined stroke and (or) MI was 6.62% in the study population, 7.78% in males, 5.80% in females, 7.18% in rural areas, 5.92% in urban areas, 3.02% in youngsters, and 12.76% in elders, respectively. Also, the prevalence of stroke and (or) MI events in different characteristic levels is shown in Table 1 in detail; the mean values of age, BMI, DBP, SBP were higher in disease event group than normal group; there were also significant differences in age groups, educational levels, PA levels, family history of CVD, smoking status, BMI groups, and BP groups with *P* values less than 0.05.

In the total population, hypertension was the most frequent risk factor (38.54%), followed by overweight (37.71%), prehypertension (30.18%), moderate-level PA (29.01%), ever smoked (28.23%), then obesity (21.02%) and low-level PA (13.47%). When combined with OR values, hypertension still ranked the highest risk with the greatest PAF (PAF = 45.99%, 95% CI = 37.55%–53.79%), than ever smoked (PAF = 15.30%, 95% CI = 8.76%–21.01%), prehypertension (PAF = 13.79%, 95% CI = 5.42%–22.28%), low-level (PAF = 12.67%, 95% CI = 8.01%–17.48%) and moderate-level PA (PAF = 12.31%, 95% CI = 9.19%–16.09%) all contributed

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