

# ACC/AHA risk score for predicting the presence and severity of coronary artery disease in a Chinese population: a cross-sectional Study

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Coronary artery disease (CAD), the most common type of cardiovascular disease (CVD), remains the leading cause of mortality in both developing and developed countries, accounting for approximately 17.3 million deaths in 2013, higher than the data in 1990.<sup>[1]</sup> The American College of Cardiology (ACC)/American Heart Association (AHA) score is one of the typical and accurate model to evaluate the 10-year risk of a first hard atherosclerotic cardiovascular disease (ASCVD) event based on a sex-and-race large Pooled Cohort study. Moreover, the present study aimed to investigate the association between the ACC/AHA risk score and the Gensini Score (GS) system, and determine whether ACC/AHA score could predict the presence and severity of CAD.

In this single-center cross-sectional observational study, data of 16,155 subjects were collected at our hospital from January 2007 to July 2019. The inclusion criteria were as follows: (1) age between 40 and 79 years old; (3) did not receive any coronary angiography test before the inpatient period. Patients with severe valve diseases, severe heart failure, acute coronary artery syndrome, stroke, previous myocardial infarction or other procedures were excluded. And the participants were divided into different groups according to their GS values [Supplementary Figure 1, <http://links.lww.com/CM9/A343>]. The study protocol was in accordance with the *Declaration of Helsinki* and was approved by the Ethics Committee of the Sir Run Run Shaw Hospital of Zhejiang University. Written informed consent was all patients before enrolment.

All data were collected and analyzed by Statistical Package for the Social Science (SPSS) for Windows, version 22 (SPSS Inc., Chicago, IL, USA). Area under curves (AUC)

was calculated using MedCalc version 15.2.2 (MedCalc Software, Ostend, Belgium) for Windows. A *P* value of less than 0.05 was considered statistically significant, which expressed as  $<0.05$  in the table.

According to our results, this study enrolled 16,155 subjects (10,402 men, 5,753 women; mean age  $64.06 \pm 8.85$  years) in total. Moreover, the advanced relationship between clinical variables and different GS groups were determined using both univariate and multivariate logistic regression analyses. Negative and Positive Groups were selected for evaluating the presence of CAD, whereas Low and High Groups were selected for the severity of CAD. Notably, gender, age, systolic blood pressure (BP), hypertension, smoking, diabetes mellitus (DM), total cholesterol (TC), low density lipid cholesterol (LDL-C), triglyceride (TG), total bilirubin (TB), white blood cell (WBC), mean platelet volume (MPV) and C-reactive protein (CRP) were the independent indicators for the presence of CAD; while gender, age, hypertension, hypertension treatment, smoking, DM, high density lipid cholesterol (HDL), LDL, TG, TB, uric acid (UA), WBC, MPV, and CRP were the independent indicators for the severity of CAD.

The risk scores of ACC/AHA were calculated by white and black coefficients, respectively. Figure 1A illustrates the results of ACC/AHA risk scores. Moreover, linear and logistic regressions were applied to identify the causal association of ACC/AHA risk score with the presence and severity of CAD. Regardless of white or black coefficient, the regression results indicated that ACC/AHA risk score was an independent model to predict the presence and severity of CAD.

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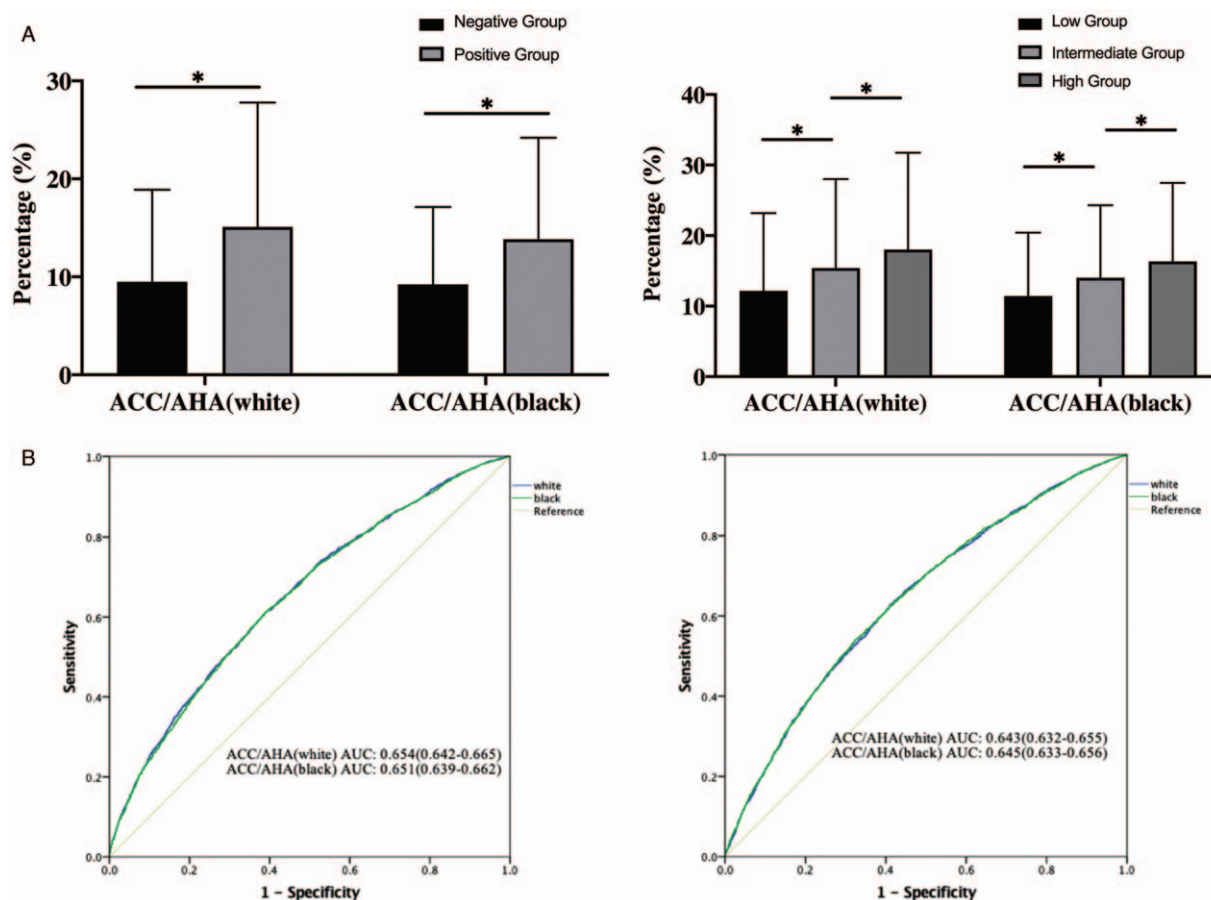
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**Figure 1:** Comparison between different Gensini Score groups (Left panel for presence; Right panel for severity (A); Receiver operating curve in presence (Left panel) and severity (Right panel) of CAD (B). CAD: Coronary artery disease.

Furthermore, to verify the power of ACC/AHA for predicting the presence and severity of CAD, the AUC values of ROC were calculated to estimate the potential power to discriminate negative and positive CAD patients as well as mild and severe CAD patients [Figure 1B]. As for the differences in AUC values between ACC/AHA and Framingham risk scores were compared. For the presence of CAD, ACC/AHA risk score (FRS) exhibited a better performance than FRS ( $P < 0.05$ ); while for the severity of CAD, FRS was superior compared to ACC/AHA risk score ( $P < 0.05$ ).

The major findings of this study indicated that ACC/AHA score could predict the presence and severity of CAD. More importantly, 8.45% (white) or 8.76% (black) of ACC/AHA score could serve as a potential cut-off value for deciding the presence of CAD, while 10.71% (white) or 12.74% (black) could serve as a potential cut-off value for receiving a PCI treatment.

Apart from identifying the single indicator, no studies have been conducted on the relationship of ACC/AHA risk score with the presence and severity of CAD like our study. Moreover, the sample size in this study was larger compared to others.<sup>[2-4]</sup> Hence, the cut-off values of ACC/AHA risk in Chinese population in this study were credible enough to estimate the presence and severity of CAD. Just like our present results, several studies have

explored some risk scoring systems with the presence and severity of CAD, such as Framingham risk score,<sup>[5]</sup> MESA,<sup>[6]</sup> SCORE,<sup>[4]</sup> and so on. Besides for models from CVD risk prediction, some research groups combine different risk factors to construct a novel statistical model for predicting the presence and severity of CAD. For example, the severe prediction scoring is a novel model to predict CAD severity based on Age, Gender, aortic valve calcification, echocardiography, DM status and lipid levels.<sup>[7]</sup> Another modified Framingham score shows its power in estimating the probability of CAD in relatively stable patients with suspected CAD.<sup>[8]</sup>

Additionally, in comparison with FRS model, ACC/AHA risk score exhibited a better performance for the prediction of CAD presence, but not for CAD severity. In a Turkish study,<sup>[9]</sup> the SCORE risk model has a slightly better performance than the Framingham risk model. In another Chinese study,<sup>[6]</sup> MESA had a better performance than the FRS model in predicting the severity of CAD in the overall population. Another study in Netherlands, the study<sup>[2]</sup> shows that in a stable chest pain population, the ability of FRS and SCORE to predict for CAD was similar and better compared to PROCAM risk score and Diamond Forrester. These mentioned models would definitely categorize the patients into a more accurate risk stratification before PCI treatment. Moreover, ACC/AHA risk score may have the power to

combine inflammatory factors to predict acute coronary syndrome in the future.<sup>[10]</sup>

In conclusion, this ACC/AHA scoring system can serve as a novel model for predicting the presence and severity of CAD. It is noteworthy that 8.45% (white) or 8.76% (black) of ACC/AHA score could serve as a potential cut-off value for deciding the presence of CAD, while 10.71% (white) or 12.74% (black) could serve as a potential cut-off value for receiving a PCI treatment, in 40 to 79 years' Chinese population.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/ have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

None.

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