ORIGINAL RESEARCH

Evaluation of Atherosclerotic Cardiovascular Risk Prediction Models in China
Results From the CHERRY Study

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ABSTRACT

BACKGROUND Updated American or Chinese guidelines recommended calculating atherosclerotic cardiovascular disease (ASCVD) risk using the Pooled Cohort Equations (PCE) or Prediction for Atherosclerotic Cardiovascular Disease Risk in China (China-PAR) models; however, evidence on performance of both models in Asian populations is limited.

OBJECTIVES The authors aimed to evaluate the accuracy of the PCE or China-PAR models in a Chinese contemporary cohort.

METHODS Data were extracted from the CHERRY (CHinese Electronic health Records Research in Yinzhou) study. Participants aged 40 to 79 years without prior ASCVD at baseline from 2010 to 2016 were included. ASCVD was defined as nonfatal or fatal stroke, nonfatal myocardial infarction, and cardiovascular death. Models were assessed for discrimination and calibration.

RESULTS Among 226,406 participants, 5362 (2.37%) adults developed a first ASCVD event during a median of 4.60 years of follow-up. Both models had good discrimination: C-statistics in men were 0.763 (95% confidence interval [CI]: 0.754-0.773) for PCE and 0.758 (95% CI: 0.749-0.767) for China-PAR; C-statistics in women were 0.820 (95% CI: 0.812-0.829) for PCE and 0.811 (95% CI: 0.802-0.819) for China-PAR. The China-PAR model underpredicted risk by 20% in men and by 40% in women, especially in the highest-risk groups. However, PCE overestimated by 63% in men and inversely underestimated the risk by 34% in women with poor calibration (both \( P < 0.001 \)). After recalibration, observed and predicted risks by recalibrated PCE were better aligned.

CONCLUSIONS In this large-scale population-based study, both PCE and China-PAR had good discrimination in 5-year ASCVD risk prediction. China-PAR outperformed PCE in calibration, whereas recalibration equalized the performance of PCE and China-PAR. Further specific models are needed to improve accuracy in the highest-risk groups. (JACC: Asia 2022;2:33–43) © 2022 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
Cardiovascular disease is the leading global cause of premature death, especially in China (1). Risk assessment is the cornerstone of primary prevention of atherosclerotic cardiovascular disease (ASCVD), and accurate risk prediction models could appropriately guide preventive interventions (eg, statin therapy) based on guidelines (2). For example, the updated 2019 American College of Cardiology/American Heart Association (ACC/AHA) guideline recommended routinely assessing 10-year ASCVD risk for adults by using the Pooled Cohort Equations (PCE), and consider statin therapy for those with intermediate risk (≥7.5% to <20%) (3). Although a risk-based prevention paradigm has also been adopted by Chinese guidelines, no specific quantitative risk assessment models have been recommended by guidelines before 2019 (4), let alone appropriate preventive strategies for statin therapy.

Recently, the China-PAR (Prediction for ASCVD Risk in China) project published a new risk prediction model designed for Chinese adults in multiple contemporary cohorts (5). The China-PAR models were recommended by the updated guideline on the assessment and management of cardiovascular risk in China in 2019 (6); however, China-PAR models have not been sufficiently validated externally so far, and the performance in diverse populations for primary prevention was in doubt. In addition, because the China-PAR models used the same definition of ASCVD outcomes as the PCE, direct comparisons for PCE and China-PAR models might contribute to the understanding of disparities in cardiovascular risk assessment for diverse populations and facilitate the recalibration and implementation of the risk prediction models into clinical practice (7).

On the other hand, the increasing availability of electronic health records (EHRs) offers the unique opportunity for validating or refining cardiovascular risk prediction models using large-scale real-world data (8). In this study, we used EHRs from a population of 226,406 adults aged 40 to 79 years who were enrolled in the CHERRY (Chinese Electronic health Records Research in Yinzhou) study between 2010 and 2016 to evaluate the accuracy of both PCE and China-PAR models. Specific aims included determining: 1) whether PCE could predict ASCVD risk in a Chinese population; 2) if not, whether recalibration of PCE to the local population could be feasible for general risk assessment; and 3) what is the performance of China-PAR model in real-world clinical practice for primary prevention in China.

METHODS

STUDY DESIGN. The CHERRY study is a general population-based cohort study focused on cardiovascular care and outcomes research. Individual participant data were extracted from the regional health information system in Yinzhou, a developed area of southeastern China. A detailed description of the data sources and the cohort profile was published previously (9). Specific data sources essential to the current study included the following: 1) the population census and registered health insurance database for individuals’ demographic characteristics; 2) health check databases, including health checks from the New Rural Cooperative Medical Scheme, older adults and adults with hypertension and diabetes; 3) inpatient and outpatient electronic medical records (EMRs); 4) disease surveillance and management database that captured the incidence of ASCVD, hypertension, and diabetes (where cases were required to be reported for disease management by local general practitioners on confirmation of diagnosis); and 5) death certificates database where attribution of death refers to the primary cause provided by cause-specific mortality. All health-related activities (eg, inpatient and outpatient visits) within the region were recorded in this integrated health information system. For patients receiving care outside (eg, patients may go to tertiary referral centers in urban areas outside of the health information system), major nonfatal cardiovascular disease events were also tracked through the disease surveillance system. All fatal events were recorded from the death registry. Meanwhile, patients must report to local general practitioners afterward for drug prescription. Thus, cardiovascular endpoints of interest for permanent residents (which is our study population) could be captured. This study was approved by the Peking University Institutional Review Board (IRB00001052-16011).

STUDY PARTICIPANTS. Individuals were included in the current study if they met all the following criteria: 1) aged 40 to 79 years at the entry date and registered in the health information system from January 1, 2010, to December 31, 2016; 2) had completed information on date of birth, sex, and a valid health care identifier; 3) had been living in Yinzhou for at least 6 months; and 4) had Chinese nationality. In total, 647,164 adults were originally enrolled in the CHERRY study. In this study, we chose January 1, 2010, as the date of inception to bypass the integration and preliminary test period of the EHR system and allow for better coverage of regional disease management services. Participants were excluded if they had no measurements of serum lipids or had preexisting
cardiovascular disease at cohort entry. Individual-specific entry date was determined as the latest of 40th birthday, the date of serum lipid measured, or the study start date (January 1, 2010). Follow-up in the health information system is generally continuous, and the CHERRY study updates information for all cohort members annually from the health information system. Follow-up was censored when one was diagnosed of outcome of interest, died from any cause, or the study ended (December 31, 2016), whichever occurred first. Applying these inclusion and exclusion criteria to the original CHERRY study yielded a total of 226,406 subjects in the final analysis (Figure 1).

**Risk Factor Ascertainment.** Age, sex, geographic area (urban/rural) and self-reported smoking status were collected from administrative records. Predictors for both PCE and China-PAR models were compared in Table 1. Diagnosis of diabetes mellitus (International Classification of Diseases-10th Revision [ICD-10] codes: E10-E14) and hypertension (I10-I15) was retrieved from EMRs, health check databases, and disease surveillance and management database. Antihypertensive treatment was defined based on usage of any 1 or more of the following drug categories before the entry date: alpha-blockers, beta-blockers, calcium blockers, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, vasodilators, diuretics, or polypill. Systolic blood pressure, body mass index, waist circumference, serum total cholesterol, and high-density lipoprotein cholesterol were extracted from EMRs and health
Comparisons of Predictors Used in the PCE and China-PAR Models

| Predictors                  | Men          | Women        |
|-----------------------------|--------------|--------------|
| Age                         | ✓            | ✓            |
| Smoking status              | ✓            | ✓            |
| Diabetes                    | ✓            | ✓            |
| Hypertension treatment      | ✓            | ✓            |
| SBP                         | ✓            | ✓            |
| TC                          | ✓            | ✓            |
| HDL-C                       | ✓            | ✓            |
| Waist circumference         | ✓            | ✓            |
| North China                 | ✓            | ✓            |
| Urban                       | ✓            | ✓            |
| Family history of ASCVD     | ✓            | ✓            |
| Age × Age                   | ✓            | ✓            |
| Age × Smoking status        | ✓            | ✓            |
| Age × SBP                   | ✓            | ✓            |
| Age × TC                    | ✓            | ✓            |
| Age × HDL-C                 | ✓            | ✓            |
| Age × Family history of ASCVD| ✓            | ✓            |

ASCVD = atherosclerotic cardiovascular disease; China-PAR = Prediction for ASCVD Risk in China; HDL-C = high-density lipoprotein cholesterol; PCE = Pooled Cohort Equations; SBP = systolic blood pressure; TC = total cholesterol.

check databases. For each risk factor with multiple measurements, values closest to the entry date for each participant were chosen for analysis and time to event were defined as the period from the entry date to the time when outcome occurred (10). Baseline values for blood pressure (13.1%), waist circumference (17.3%), smoking status (6.9%), and geographic area (0.7%) were missing for some subjects. Missing values were imputed where necessary, described as follows.

OUTCOMES. According to the 2013 ACC/AHA guideline (11), the primary outcome in our study is the first-ever hard ASCVD events between January 1, 2010, and December 31, 2016, including nonfatal or fatal stroke (ICD-10 codes: I60, I61, I63, I64), nonfatal myocardial infarction (I21, I22), and coronary heart disease death (I20-I25). Diagnoses of nonfatal outcomes were sought from the disease surveillance and management database and EMRs, and stroke with definite clinical signs of focal or global disturbances in cerebral function and lasting more than 24 hours were included. The disease surveillance database was considered as the gold standard and confirmed by the independent physicians for adjudication to ascertain the date of diagnosis for conflicting records (9). Cause-specific (cardiovascular-related or other) death was confirmed by death certificate in the health information system.

RISK PREDICTION MODELS. Because our study was followed for <10 years, we evaluated the capability of risk prediction at 5 years. The parameters of China-PAR models were consistent with those in the original published paper by Yang et al (5), in which the $S(t)$ was obtained from 5-year Kaplan-Meier ASCVD rate of China-PAR derivation cohorts. We also calculated 5-year ASCVD risk using original PCE (white) (12) (Supplemental Table 1). Furthermore, the recalibrated PCE models were also applied by adjusting the intercept to our CHERRY study population (ie, using the survival rate and the mean score of risk factors) and keeping other coefficient parameters the same as the original models, which did not affect the discriminatory ability of models. Besides, we refitted the PCE and China-PAR models by updating the intercept and regression coefficient of each risk factor to our CHERRY study population for comparison (13).

STATISTICAL ANALYSES. Continuous and categorical baseline characteristics of participants were summarized by mean (standard deviation) or numbers (percentage), respectively. Considering differences in health status and survival for participants with and without missing data (Supplemental Table 2), our main analysis was conducted on the dataset by imputation to reduce selection bias. We used the multiple imputation by chained equations (MICE) method to replace missing values and it had good convergence after 10 imputations with 10 iterations. All model validations were done within each imputation set and then estimated effects and standard errors were pooled with Rubin’s rules (14). The standard MICE method is commonly used for EHR-based studies, such as the QRISK3 equations in the United Kingdom QRResearch database (10).

For each participant, observed ASCVD risk was calculated using the Kaplan-Meier method with 95% confidence interval (CI) and predicted ASCVD risk was calculated using original or recalibrated PCE (white) and China-PAR models for men and women. The performance of the above models was assessed by Harrell’s C-statistics for discrimination and Hosmer-Lemeshow chi-square for calibration (15). Calibration was also evaluated using calibration slope, a shrinkage factor that closed to 1 for well-calibrated equations and visualized by plotting the predicted risk against the observed risk for each decile of the predicted risk. According to the 2013 ACC/AHA guideline (11), participants were divided into 5 clinical risk categories with cut points of 2.5%, 3.75%, 5.0% and 10% based on the predicted 5-year risk. Within each category we calculated ratios of expected to observed events, which >1.0 suggested overestimation and <1.0 indicated underestimation (16).
All analyses were conducted using Stata, version 16.0 (StataCorp) with a statistical significance level of $P < 0.05$. This study followed the TRIPOD (Transparent Reporting of a Multivariable Prediction Model for Individual Prognosis or Diagnosis) statement for reporting (17) (Supplemental Appendix).

**SENSITIVITY ANALYSES.** To assess the robustness of the results, we excluded participants with missing data of any predictors included in both models (n = 62,738) and then evaluated the performance of the PCE and China-PAR models in sensitivity analyses with the same procedures. We further restricted the analyses to participants without diabetes, with low-density cholesterol of 70 to 189 mg/dL, not taking any lipid-lowering medications at baseline to evaluate their effects on the discordance between observed and predicted risk (12) (Supplemental Figure 1).

**RESULTS**

Among 226,406 participants without prior ASCVD eligible for the main analysis, the mean age of participants was 54.98 ± 9.73 years, and 53.25% were women. Men were slightly older, had a higher prevalence of diabetes and higher levels of blood pressure and waist circumference, and women had higher levels of lipids (all $P < 0.05$) (Table 2). During 946,866 person years of follow-up, 5362 (2.37%) participants (2847 men and 2515 women) had their first ASCVD event.

Sex-specific C-statistics for China-PAR were 0.758 (95% CI: 0.749-0.767) in men and 0.811 (95% CI: 0.802-0.819) in women, which were similar to those of 0.763 (95% CI: 0.754-0.773) in men and 0.820 (95% CI: 0.812-0.829) in women using both original and recalibrated PCE (Table 3). The original PCE overestimated 5-year risk of ASCVD by 63% in men, while inversely underestimated the risk by 34% in women with poor calibration (both $P < 0.001$). However, after recalibration to our local Chinese population, overall calibration of the PCE was moderately improved with less underestimation (19% in men and 20% in women). The China-PAR model underpredicted ASCVD risk by 20% in men, and it underestimated by 40% in women. Refitted PCE and China-PAR models showed better discrimination and overall calibration than the original models (Supplemental Table 3).

As illustrated in Figure 2, in predicted 5-year ASCVD risk categories using original PCE, the observed rates in those categories were substantially lower than the predicted risk in men and inversely higher in women. Underestimation mainly occurred in high-risk categories using China-PAR for men and women. In comparison with original PCE, predicted risks by recalibrated PCE were better aligned with observed risks. The calibration plots also illustrated obvious overestimation across all risk groups in men, and slight underestimation in the highest-risk group in women using the PCE. In contrast, there were no substantial differences between observed and predicted rate except the top high-risk groups using China-PAR or recalibrated PCE (Central Illustration). Among the top decile, China-PAR underestimated risk

**TABLE 2** General Characteristics and ASCVD Events of Participants by Sex in the CHERRY Study

|                        | Overall (N = 226,406) | Men (n = 105,848) | Women (n = 120,558) |
|------------------------|-----------------------|-------------------|---------------------|
| **Age, y**             | 54.98 ± 9.73          | 55.52 ± 9.90      | 54.50 ± 9.55        |
| **Rural**              | 154,453 (68.22)       | 73,336 (69.28)    | 81,117 (67.28)      |
| **Current smokers**    | 41,869 (18.49)        | 20,286 (19.10)    | 21,583 (17.89)      |
| **Waist circumference, cm** | 81.29 ± 8.34         | 83.45 ± 7.93      | 79.39 ± 8.22        |
| **BMI, kg/m²**         | 23.28 ± 2.85          | 23.35 ± 2.72      | 23.23 ± 2.95        |
| **SBP, mm Hg**         | 131.18 ± 16.34        | 131.83 ± 15.87    | 130.62 ± 16.72      |
| **DBP, mm Hg**         | 82.03 ± 9.62          | 82.85 ± 9.56      | 81.32 ± 9.61        |
| **Hypertension**       | 74,319 (32.83)        | 35,014 (33.08)    | 39,305 (32.60)      |
| **Antihypertensive treatment** | 31,872 (14.08)      | 16,634 (15.71)    | 15,238 (12.64)      |
| **Diabetes mellitus**  | 19,701 (8.70)         | 9,226 (8.72)      | 10,475 (8.69)       |
| **Family history of ASCVD** | 1,486 (0.66)        | 795 (0.75)        | 691 (0.57)          |
| **Total cholesterol, mg/dL** | 190.22 ± 37.77     | 185.60 ± 37.27    | 194.28 ± 37.74      |
| **HDL-C, mg/dL**       | 50.35 ± 12.86         | 48.47 ± 13.08     | 52.00 ± 12.44       |
| **Incident ASCVD events** | 5,362 (2.37)         | 2,847 (2.69)      | 2,515 (2.09)        |
| **Incidence of ASCVD, n/100,000 person-year** | 2.72 (2.64-2.80)   | 3.20 (3.07-3.33)  | 2.32 (2.22-2.80)    |

Values are mean ± SD or n (%) unless otherwise noted. To convert cholesterol to mmol/L, multiply values by 0.0259. BMI = body mass index; CHERRY = Chinese Electronic health Records Research in Yinzhou; CI = confidence interval; DBP = diastolic blood pressure; other abbreviations as in Table 1.
TABLE 3  External Validation of 5-Year ASCVD Risk Prediction by PCE and China-PAR Models in the CHERRY Study

|                        | Predicted ASCVD Events (n) | Expected-Observed Ratio | Calibration Slope | Calibration Chi-Square (P Value) | Discrimination C-Statistic (95% CI) |
|------------------------|-----------------------------|--------------------------|-------------------|---------------------------------|-----------------------------------|
| **Men (2,381 cases/105,848 participants during 5 y)** |                             |                          |                   |                                 |                                   |
| Original PCE (White)   | 5,224.84                    | 1.63                     | 1.18              | 953.23 (<0.001)              | 0.763 (0.754-0.773)               |
| Recalibrated PCE (White) by CHERRY  | 2,575.96                    | 0.81                     | 1.18              | 335.79 (<0.001)              | 0.763 (0.754-0.773)               |
| China-PAR              | 2,554.73                    | 0.80                     | 1.38              | 433.01 (<0.001)              | 0.758 (0.749-0.767)               |
| **Women (2,037 cases/120,558 participants during 5 y)** |                             |                          |                   |                                 |                                   |
| Original PCE (White)   | 1,855.84                    | 0.66                     | 1.08              | 341.64 (<0.001)              | 0.820 (0.812-0.829)               |
| Recalibrated PCE (White) by CHERRY  | 2,248.25                    | 0.80                     | 1.08              | 99.33 (<0.001)              | 0.820 (0.812-0.829)               |
| China-PAR              | 1,665.53                    | 0.60                     | 1.58              | 1,755.55 (<0.001)             | 0.811 (0.802-0.819)               |

*Expected number of events based on the 5-year ASCVD risk equations provided in the Supplemental Table 1. †5-year observed number of events after Kaplan-Meier adjustment was 3,196.61 for men and 2,796.95 for women, respectively. *Recalibrated models were estimated by remaining coefficients of original models but replacing mean values of risk factors and S0(t) at 5 years of the CHERRY study. Abbreviations as in Tables 1 and 2.

by approximately 41% and 57% for men and women, respectively.

In sensitivity analyses, 163,668 participants without missing data for risk factors were at higher risk of ASCVD (Supplemental Table 4). Nevertheless, model performance in this population was broadly similar (Supplemental Table 5, Supplemental Figures 2 and 3). Further analyses that were restricted to participants for which initiating statin use are considered, indicated good discrimination (C-statistics: 0.755 for men and 0.793 for women) and modest underestimation using China-PAR (Supplemental Table 4, Supplemental Figures 4 and 5).

DISCUSSION

To our knowledge, this study is the largest to evaluate the performance of PCE and China-PAR models in contemporary Chinese populations. Using real-world data collected in routine clinical practice, the current analyses indicated that original PCE largely overestimated 5-year ASCVD risk across all risk groups for men while moderately underestimated risk in the highest-risk group for women in this Chinese population, despite good discrimination.

Limited research demonstrated that performance of the PCE in Asian populations varied in degrees of calibration and accuracy (18-20). PCE provided moderate discrimination in Hong Kong Chinese, and underestimated risk in the low- and intermediate-risk range for both sexes but overestimated risk in the high-risk range for men (20). As one of the validation cohorts for China-PAR models, the CIMIC (Community intervention for Metabolic Syndrome in China) cohort indicated PCE overestimated 5-year ASCVD risk by 67.2% for men and underestimated risk by 9.8% for women (5). In contrast, using 11,169 rural Northern Chinese adults in the “stroke belt,” which referred to 9 provincial regions of north and west China with high stroke incidence (21), our previous Fangshan Cohort Study found PCE underestimated 5-year risk by 76.2% in men and 88.2% in women with poor calibration (22). Our findings further suggested that PCE might not be directly applied to the Chinese population, because the PCE was not derived for Asian populations. Moreover, disparities on distribution of risk factors existed between Chinese and Western populations (Supplemental Table 6).

To our surprise, the recalibrated PCE showed substantial improvement in predictive capacity in our population. Under the real-world circumstances, most clinicians do not have access to a refitted model (a new model, indeed) for each type of population setting they are working in, due to lack of individual participant data. In contrast, recalibration of the PCE to local population might be feasible to reach a compromise in general risk assessment for primary prevention in clinical practice. Sufficient improvement of recalibrated PCE also supports the advocacy on tailoring published models instead of developing new ones while applying to diverse populations (23).

The China-PAR model was derived from multiple contemporary Chinese cohorts, and has been adopted as the ASCVD risk calculator by the Chinese guidelines in 2019 (6). In the CIMIC cohort, China-PAR overestimated 5-year risk by 11.9% for men and 27.5% for women (5). Similar to our previous findings in a Northern Chinese population that China-PAR fairly predicted risk in men but misestimated risk in women (22), the current study in a Southern Chinese population further confirmed the finding. On the contrary, China-PAR underestimated risk for women in a Southern Chinese population. A potential reason for the discrepancy in diverse Chinese populations is the regional disparity. High levels of heterogeneity in cardiovascular mortality at the provincial level have been reported in China (24). A relatively clear north-
Predicted 5-year ASCVD risk was calculated using original PCE (A, B), recalibrated PCE (C, D), and China-PAR (E, F) for men and women in the CHERRY study, respectively. Observed risk (95% confidence interval) was calculated after Kaplan-Meier adjustment. Abbreviations as in Figure 1.
To compare the predictive accuracy of the PCE by ACC/AHA guideline and China-PAR models by Chinese guidelines using real-world data in primary care

Highlight: Although the PCE was not derived for Asian populations, recalibration to local populations seems feasible for general risk assessment in primary prevention of ASCVD

Perspective: Further investigations for improving model performance need to be focused on specific populations with the highest risk

Calibration of original PCE, recalibrated PCE, and China-PAR by sex was visualized by plotting the predicted 5-year risk against the observed risk for each decile of the predicted risk. Both PCE and China-PAR models provided adequate discrimination in the Chinese population. Recalibrated PCE to the local population showed similar calibration to China-PAR, whereas both models underestimated risk for the highest-risk groups. ASCVD = atherosclerotic cardiovascular disease; CHERRY = CHinese Electronic health Records Research in Yinzhou; China-PAR = Prediction for ASCVD Risk in China; PCE = Pooled Cohort Equations.

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to-south gradient exists, with the higher cardiovascular disease risk in North China (25). The CHERRY study enrolled participants in a relatively developed area of southeastern China (9). Therefore, risk of ASCVD in this population might be similar to that in Western populations, which to some extent explained overestimation in men when the PCE was directly applied to this population.

Furthermore, our results also indicated that both recalibrated PCE and China-PAR fairly estimated 5-year ASCVD risk in low- and medium-risk groups but underestimated risk mainly in the highest-risk group. It is worth mentioning that participants in the highest-risk group were mostly the older (mean age of 69.42 vs 54.98 overall in our population), socioeconomically disadvantaged (less education of primary school and below: 69.78% vs 42.01% overall), with higher prevalence of diabetes mellitus (34.1% vs 8.70% overall), and with higher proportion of lipid-lowering medications (7.02% vs 6.01% overall) in our study. Among these participants, cardiovascular prediction models for general populations might not be appropriate to evaluate their risks. For example, effect of age would be increasing when the effect of risk factors diminishes in the elder population. PCE for women included an age-squared term, which might explain relatively better calibration of PCE in the highest-risk group in women. Moreover, similar to results found in the REGARDS (Reasons for Geographic and Racial Differences in Stroke) study (26), PCE also underestimated risk among individuals with lower education levels. In addition, it has been reported that people with type 2 diabetes have a 2-fold increased risk of CVD (27). Consistent with the REGARDS study, overall discordance on observed and predicted risk for the prediction models was slightly diminished when our populations were restricted to those without diabetes or any lipid-lowering therapy in further sensitivity analyses (12). Thus, specific cardiovascular risk prediction models for people with diabetes are warranted in these high-risk populations (28).

**CONCLUSIONS**

In this large EHR-based contemporary Chinese cohort, both PCE and China-PAR models provided adequate discrimination in 5-year ASCVD risk prediction, whereas China-PAR outperformed PCE in overall calibration. However, recalibration to the local population equalized performance of PCE and China-PAR for general risk assessment. Further investigations for improving model performance need to be focused on specific populations with the highest risk. These findings may have important implications for the use of risk prediction models and EHR-based data in routine clinical practice for primary prevention across diverse populations.

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COMPETENCY IN PRACTICE-BASED LEARNING:
Using large-scale EHR-based data, this study compared the performance of 5-year ASCVD risk prediction models (the PCE by ACC/AHA guidelines and China-PAR models by Chinese guidelines) in a Chinese population. In the real-world scenario, adequate discrimination for both PCE and China-PAR models were shown, and recalibration to the local population equalized performance of PCE and China-PAR.

TRANSLATIONAL OUTLOOK: For primary prevention of ASCVD, established risk prediction models might be sufficiently applicable for general risk assessment, and further studies should focus on improving predictive capacity for a high-risk population.

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