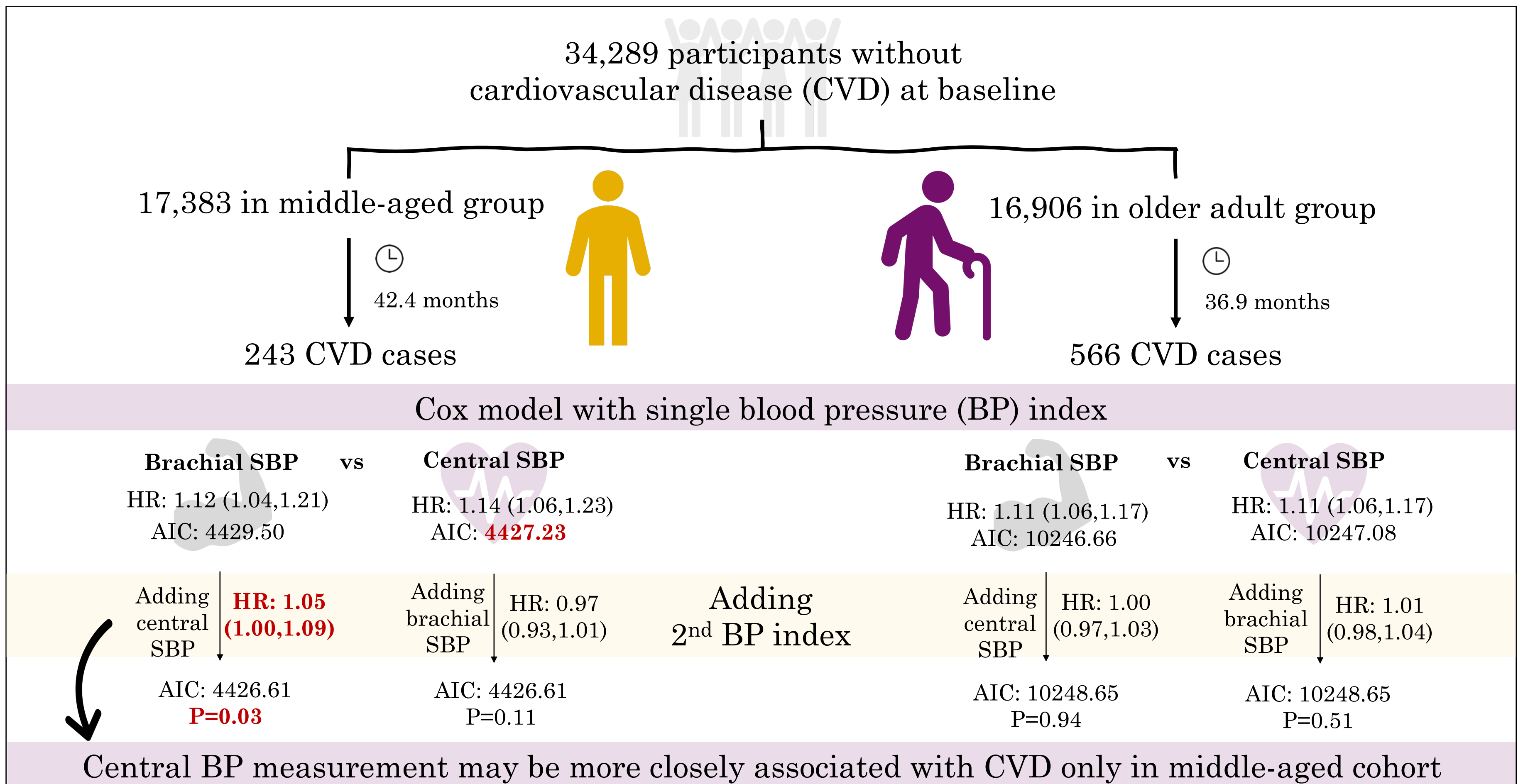


Age-dependent association of central blood pressure with cardiovascular outcomes: a cohort study involving 34,289 participants using the UK biobank



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Background

It remained unclear whether central BP was more closely associated with CVD than brachial BP in different age groups.

Aim

To explore the age-stratified association of CVD with brachial and central BPs, and to evaluate the improvement in risk prediction.

Methods

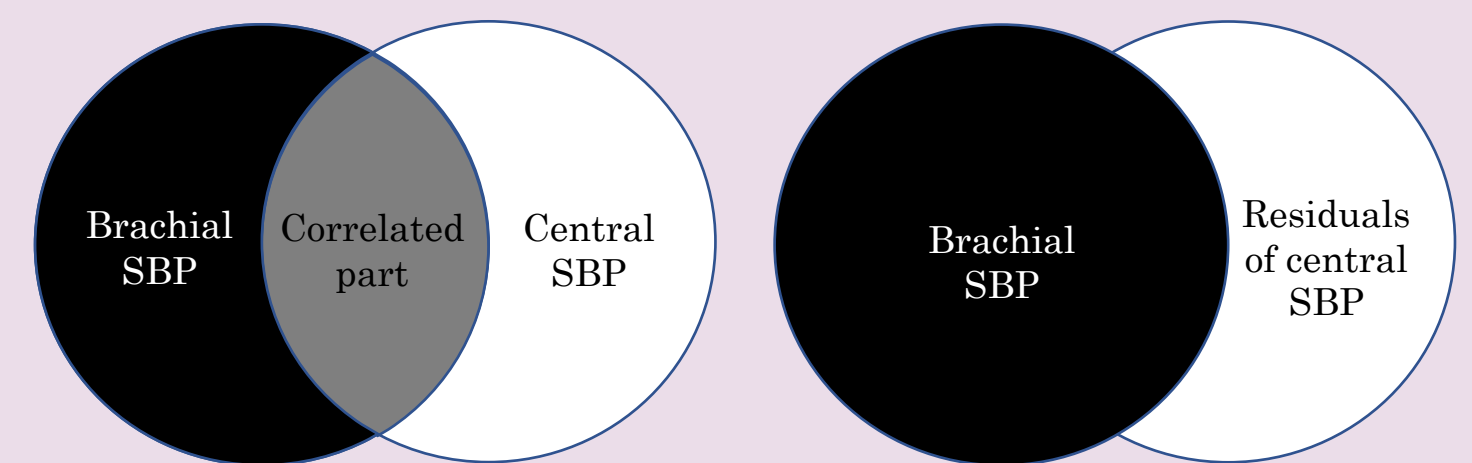
- Data source: UK Biobank, a large-scale biomedical database containing in-depth health information from half a million UK participants.
- BP measurement: Brachial systolic BP (SBP), pulse pressure (PP), central SBP and PP were measured by validated Vicorder system.
- Primary endpoint: a composite CVD outcome consisting of CV mortality combined with non-fatal coronary events, heart failure and stroke.
- Covariates: sex, age, BMI, whether current smoker, history of diabetes mellitus, hyperlipidemia, chronic kidney disease, the use of anti-hypertensive agents, heart rate during pulse wave analysis
- Participants were categorized into middle-aged and older-aged groups using the cut-off of age 65 (common cutoff for older adults).
- Hazard ratios (HRs) expressed per BP increments of 10 mmHg.
- Four Cox proportional-hazard models were constructed to examine association relating CV outcomes with brachial and central SBP
 - Model 1: CV outcome ~ brachial SBP, covariates
 - Model 2: central SBP was added to model 1
 - Model 3: CV outcome ~ central SBP, covariates
 - Model 4: brachial SBP was added to model 3
- Residual method was used to address collinearity issues (Figure 1).
- Akaike Information Criteria (AIC) was used for model comparison.

Results

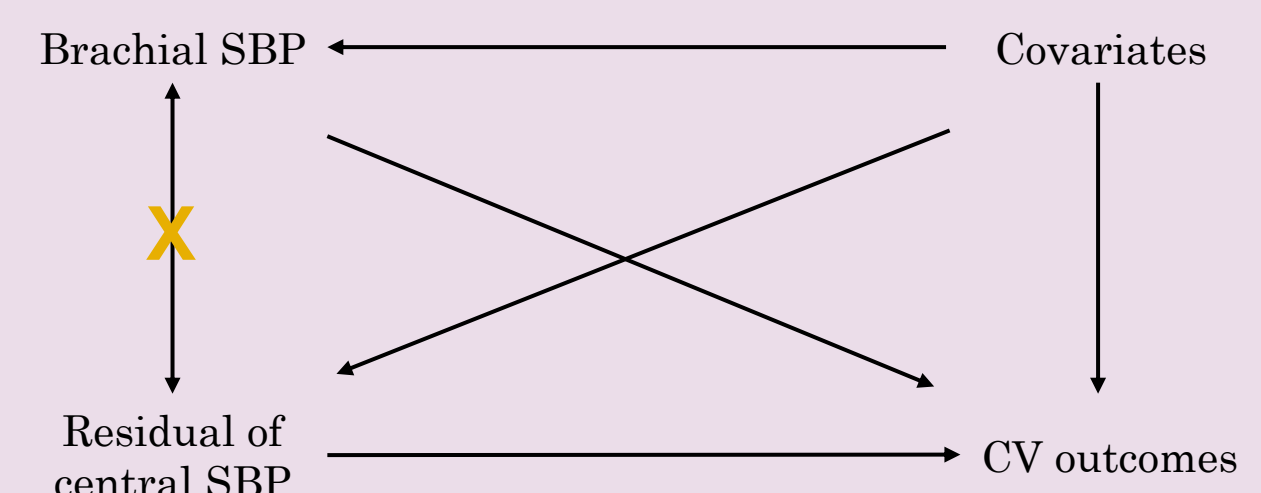
- In models including single BP index (model 1 and 3)
 - In both groups, CVD events were associated with brachial or central SBP ($p \leq 0.002$).
 - In middle-aged adults, model fit was better for central SBP (AIC 4427.2 vs 4429.5), while in older adults, model fit was better for brachial SBP (AIC 10246.7 vs 10247.1).
- In models including two BP indices (model 2 and 4)
 - Only in middle-aged adults, central SBP was significantly associated to CVD (HR=1.05; 95% CI: 1.0-1.1) and improved model fit (AIC=4426.6) after adjustment of brachial SBP.
 - These results were consistent for pulse pressure.

Figure 1. Residual method (take model 2 for example)

Step 1: residual was obtained from regressing central SBP on brachial SBP i.e., $\text{central SBP} = \alpha + \beta * (\text{brachial SBP}) + \sigma$ (σ is independent of brachial SBP)



Step 2: BP residuals was used to compute HRs and to assess model performance, as the residual of central SBP was uncorrelated with brachial SBP



Conclusion

- In middle-aged adults, higher central BPs were associated with greater risks of CVD events, even after adjusting for brachial BP indices.
- For older adults, the superiority of central BP was not observed.
- Additional trials with adequate follow-up time will confirm the role of central BP in estimating CVD risk for middle-aged individuals.