Anthropometric measures in prediction of cardiovascular disease, a comparison of laboratory-based versus non-laboratory-based model: the Rotterdam Study

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Purpose

We aim to compare two risk prediction models:

1. Laboratory-based model, which required blood testing.
2. Non-laboratory-based model, which required only history and physical examination measures.

First, we examined different anthropometric measures in association with cardiovascular disease (CVD). Secondly, we constructed a non-laboratory-based model by substituting total and HDL cholesterol with the most informative anthropometric measure associated with CVD.

Conclusions

In our population-based study of middle-aged and elderly adults where the ability of BMI to predict CVD might decline, the non-laboratory-based model, based on ABSI, could predict the risk of CVD as accurately as the laboratory-based model among men.

We do not support use of BMI instead of lipid measures in risk prediction models in the middle-aged and elderly adults but give further support to simplify the risk prediction models by substituting lipid levels with ABSI.

Methods

The study included 4,755 participants aged 55-79 years from the prospective population-based Rotterdam Study.

We used Cox proportional hazards regression models to estimate the association of anthropometric measures and CVD. We studied the following anthropometric measures:

- **Body shape index (ABSI)***
- **Body mass index (BMI)**
- **Waist circumference (WC)**
- **Waist-to-hip ratio (WHR)**
- **Combined BMI and WC**

For anthropometric measures that were significantly associated with CVD in multivariable adjusted models, we further assessed the ‘‘informativeness’’.

The predictive performance of the two models was assessed by studying: Discrimination, Calibration, and Agreement.

Correlation of risk predictions between the two models was calculated by the Spearman correlation.

Analyses were performed separately in men and women.

* ABSI = WC / ($BMI^{2/3}$ * $Height^{1/2}$)

Results

Multivariable adjusted hazard ratios for association of anthropometric measures with CVD are presented in **Table 1**.

The model containing ABSI [χ^2 ABSI = 7.9 (p=0.005)] was more informative than the model including BMI and WC together [χ^2 BMI_WC = 6.9 (p= 0.031)] in men.

We constructed a non-laboratory-based model in men by replacing total and HDL cholesterol levels with ABSI.

Among women, none of the anthropometric measures were significantly associated with incident CVD, therefore we didn’t proceed with a non-laboratory model in women.

Among men, the c-statistic (95%CI) was 0.684 (0.653-0.715) for the laboratory-based model, and 0.682 (0.652-0.711) for the non-laboratory-based model. P=0.68

The average 10-year predicted risks of CVD were 16.6% by the laboratory-based model and 16.4% by the non-laboratory-based model, compared with the observed cumulative incidence of 15.3%, among men.

Figure 1 plots individuals based on their predicted risk of CVD using the non-laboratory-based model (vertical axis) and the laboratory-based model (horizontal axis).

Using the 7.5% 10-year CVD risk threshold by the ACC/AHA guidelines, there was 91.7% agreement in risk predictions between the laboratory-based and the non-laboratory-based models.

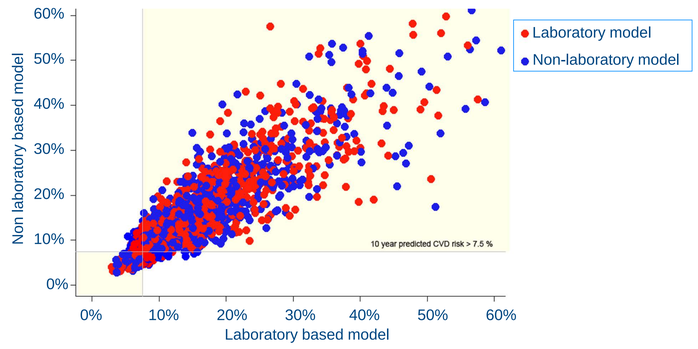
Spearman rank correlation for the risk predictions based on the laboratory and the non-laboratory models was 0.90 (p < 0.001).

Table 1. Multivariate HR (95% CI) for 10-year risk of CVD

		Men	Women
ABSI		1.19 (1.05-1.34)	1.09 (0.97-1.22)
BMI		0.99 (0.88-1.12)	0.96 (0.85-1.09)
WC		1.09 (0.96-1.23)	1.02 (0.90-1.16)
WHR		1.11 (0.99-1.26)	1.09 (0.97-1.23)
BMIWC*	BMI	0.77 (0.62-0.97)	0.87 (0.72-1.06)
	WC	1.34 (1.08-1.67)	1.13 (0.91-1.37)

Adjusted by age, current smoking, history of diabetes mellitus, systolic blood pressure and antihypertensive treatment. HR for 1 log standard deviation increase.
* BMI and WC are combined i.e. added simultaneously in the same multivariate model.

Figure 1. Agreement in risk prediction for CVD



Conflict of interest
Nothing to declare

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