

## Simple cardiovascular risk stratification using anthropometric measures instead of serum cholesterol. The MORGAM Prospective Cohort Project

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On behalf of MORGAM Project

**Funding Acknowledgement:** Type of funding source: None

**Background:** Body composition predicts cardiovascular outcomes, but it is uncertain whether anthropometric measures can replace the more expensive serum total cholesterol for cardiovascular risk stratification in low resource settings.

**Purpose:** The purpose of the study was to compare the additive prognostic ability of serum total cholesterol with that of body mass index (BMI), waist/hip ratio (WHR), and estimated fat mass (EFM, calculated using a validated prediction equation), individually and combined.

**Methods:** We used data from the MORGAM (MONICA, Risk, Genetics, Archiving, and Monograph) Prospective Cohort Project, an international pooling of cardiovascular cohorts, to determine the relationship between anthropometric measures, serum cholesterol, and cardiovascular events, using multivariable Cox proportional-hazards regression analysis. We further investigated the ability of these measures to enhance prognostication beyond a simpler prediction model, consisting of age, sex, smoking status, systolic blood pressures, and country, using comparison of area under the receiver operating characteristics curve (AUCROC) derived from binary logistic regression models. The primary endpoint was major adverse cardiovascular events (MACE), defined as a composite of death from coronary heart disease, myocardial infarction, or stroke.

**Results:** The study population consisted of 52,188 apparently healthy subjects (56.3% men) aged 47±12 years ranging from 20 to 84, derived from

37 European cohorts, with baseline between 1982–2002 all followed for 10 years during which MACE occurred in 2465 (4.7%) subjects. All anthropometric measures (BMI: hazard ratio (HR) 1.04 [95% confidence interval (CI): 1.03–1.05] per kg/m<sup>2</sup>; WHR: HR 7.5 [4.0–14.0] per unit; EFM: HR 1.02 [1.01–1.02] per kg) as well as serum total cholesterol (HR 1.20 [1.16–1.24] per mmol/l) were significantly associated with MACE (P<0.001 for all), independently of age, sex, smoking status, systolic blood pressures, and country. The addition of serum cholesterol significantly improved the predictive ability of the simple model (AUCROC 0.818 vs. 0.814, P<0.001), as did the combination of WHR, BMI, and EFM (AUCROC 0.817 vs. 0.814, P=0.004). When assessed individually, BMI (AUCROC 0.816 vs. 0.814, P=0.004) and WHR (AUCROC 0.815 vs. 0.814, P=0.02) improved model performance, while EFM narrowly missed significance (AUCROC 0.815 vs. 0.814, P=0.06). There was no significant difference in the predictive ability of a model including serum cholesterol versus that including all three anthropometric measures (AUCROC 0.818 vs. 0.817, P=0.13). The figure shows the pertinent areas under the ROC curve in predicting MACE.

**Conclusion:** In this large population-based cohort study, the addition of a combination of anthropometric measures, i.e. BMI, WHR, and EFM, raised the predictive ability of a simple prognostic model comparable to that obtained by the addition of serum total cholesterol.

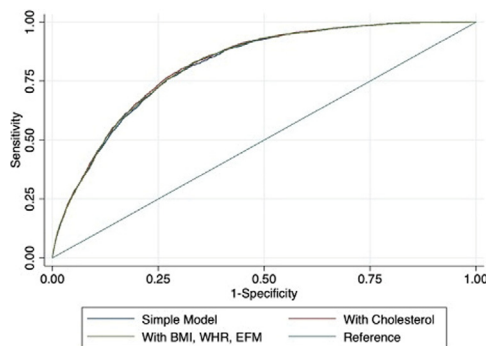


Figure 1