QRESEARCH data were missing completely at random within age-sex strata—an assumption acknowledged as incorrect when the developers of QRESEARCH revised their equation. It also implies that observed QRESEARCH data reflect age-sex norms in the population—an assumption questioned by the developers’ comparison of their data with the health survey for England. We call for additional validation using data from bespoke cohort studies in which much greater attention has been paid to completeness of data. Deprivation indices by their nature quickly become outdated, the Townsend index in particular being based on data from the 2001 census. It should be replaced with variables whose meaning is less context dependent, and which reflect underlying causes of inequalities in cardiovascular disease. For example, subcategorising non-smokers as either “ex-smokers” or “never smokers” would perhaps diminish some of the apparent predictive power of the Townsend index (since former smoking is likely to be more common among more deprived communities) and would allow QRESEARCH to be more portable in its future use.

ASSIGN, QRISK, and validation

We challenge the recent QRESEARCH validation and editorial concluding that QRESEARCH is the cardiovascular risk score for the United Kingdom. ASSIGN, QRISK’s precursor, was launched in Scotland before QRESEARCH appeared. Predicting that scores omitting social deprivation (socioeconomic status) as a risk factor could exacerbate social gradients in disease, we developed ASSIGN to include it. ASSIGN was adopted without external validation because it correlated highly with the gold standard Framingham score. Discriminating rather better, even after adjustment for self-testing bias, it removed Framingham’s social inequity. Subsequent to ASSIGN’s launch, QRISK authors told us that they were developing their own score. Our offer of collaborative comparison was not accepted, and QRISK coefficients were kept secret after its launch. The initial partisan publication, however, did show that ASSIGN discriminated better than Framingham in the QRESEARCH database where QRESEARCH originated.

We have not seen how QRESEARCH deals with social deprivation in analyses similar to ours—possibly because we have full 10 year follow-up of our cohort. QRESEARCH and the validation THIN database do not. Both these databases are missing 70% of data on lipids, and probably more on family history of cardiovascular disease.

Collins and Altman inappropriately criticise the National Institute for Health and Clinical Excellence (NICE) for not choosing QRESEARCH to predict cardiovascular risk. In doing so, they do not distinguish between assessing individual cardiovascular risk (as used by clinicians) and predicting risk of cardiovascular events in an actively managed population (as used in public health planning). As most tools predicting cardiovascular risk were developed in actively managed populations, they will underestimate the risk that clinicians and patients are initially interested in: the risk if no further treatment is initiated. This distinction seems to be overlooked in most discussion of cardiovascular risk.

Most doctors would expect to explain the risk to patients were they left untreated. As with several other tools, however, QRESEARCH was derived from a population cohort that may start additional treatments once found to have high rates of risk factors. Hence it is not surprising that it underpredicts cardiovascular risk. The Framingham study was conducted before the widespread use of effective treatment for cardiovascular risk factors and therefore its equations seem to overpredict cardiovascular risk when assessed in a population with active management of risk factors.

QRESEARCH tried to adjust for baseline antihypertensive treatment, but its investigators admitted that this was a crude measure of blood pressure treatment. Furthermore, it did not adjust for patients who started treatment between baseline and the end of the study. Although QRESEARCH seems to be more accurate in predicting cardiovascular events in a contemporary UK population, it may be less accurate in communicating risk to patients. For risk communication and individual decisions, cardiovascular risk should be based on study populations that do not receive additional treatment for cardiovascular disease.

Competing interests: None declared.

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Collins and Altman’m re-analysis of data from the THIN database to validate the QRESEARCH equation for predicting cardiovascular disease, adoption of QRESEARCH in primary care is premature because key issues about the handling of missing data and the use of social deprivation indices remain unresolved.

Collins and Altman again highlight that complete data were available for just over a quarter of subjects. We appreciate that imputation methods were applied, but we question use of age-sex means of QRESEARCH data for lipid concentrations and blood pressures. This implies that QRESEARCH data were missing completely at random within age-sex strata—an assumption acknowledged as incorrect when the developers of QRESEARCH revised their equation. It also implies that observed QRESEARCH data reflect age-sex norms in the population—an assumption questioned by the developers’ comparison of their data with the health survey for England. We call for additional validation using data from bespoke cohort studies in which much greater attention has been paid to completeness of data. Deprivation indices by their nature quickly become outdated, the Townsend index in particular being based on data from the 2001 census. It should be replaced with variables whose meaning is less context dependent, and which reflect underlying causes of inequalities in cardiovascular disease. For example, subcategorising non-smokers as either “ex-smokers” or “never smokers” would perhaps diminish some of the apparent predictive power of the Townsend index (since former smoking is likely to be more common among more deprived communities) and would allow QRESEARCH to be more portable in its future use.


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of predominantly white middle class people in the United States. Patient characteristics have since changed (falling blood pressure, increasing obesity, reduced smoking), and health outcomes have improved. Liew and Glaziou point out that some patients in the QRSK derivation and validation cohorts may have started additional treatments once they have been identified as having high risk factors. Obtaining treatment naïve population cohorts, such as the Framingham cohort, to develop risk scores is now practically and ethically impossible. Also, while natural history is important, it is not clear that prognosis is best assessed from an untreated population.

Morris and colleagues call for further validation of QRSK on bespoke cohorts, where greater attention to data collection and cleaning will enhance the completeness of data. However, such high quality cohorts, if they exist, will be highly selective and not as representative of the UK population. The Department of Health vascular risk assessment programme is designed to be applied to the whole UK population with emphasis on primary prevention of vascular disease. QRSK was developed and validated in large cohorts of patients from UK general practices.1,3

Morris and colleagues and Tunstall-Pedoe and colleagues mention the low level of completeness of data. The high level of unrecorded values for one component of the QRSK risk score, total serum cholesterol/HDL ratio, dramatically reduced the proportion of people with complete data.

Few risk models have undergone such extensive validation and scrutiny as QRSK on such large cohorts that are truly representative of the target population. By contrast, little attention has been paid to the unexplained and validated inclusion of adjustment factors currently recommended by NICE to adjust the risk for men of South Asian origin and those with a family history of coronary heart disease.

The Townsend score used in QRSK is outdated. Although our role was to provide an independent and objective evaluation of the performance of QRSK, we are aware from the QRESEARCH website (www.qresearch.org) that QRSK is designed to reflect current practice in recording of clinical information. QRSK will be updated to reflect changes and improvements in recording of information and changing patterns of population characteristics, as well as availability of more sophisticated statistical methods. For example, Morris and colleagues question the use of age-sex reference values to replace missing data; a more sophisticated multiple imputation approach was used for QRSK2, the successor of QRSK.4

**Authors’ reply**

The Framingham model currently recommended by the National Institute for Health and Clinical Excellence (NICE) to predict cardiovascular risk has stood the test of time. However, it was developed several decades ago from a relatively small cohort...