

Improving medical prediction by comparing disease risk models



Medical risk prediction models estimate the likelihood of disease occurring in the future, taking into account relevant risk factors such as age, sex, and clinical measures such as BMI, blood pressure, or cholesterol levels. These factors and their importance vary between different diseases, and as our understanding grows, the value of any one factor in predicting the risk of a given disease may change over time.

Risk prediction models are becoming more common and influential - but how do we know when a model is fit for purpose and ready for clinical use? The simple answer is that we don't. The complexity and diversity of risk models and of the clinical and public health issues they address makes a standardised approach to their assessment impossible.

Recent work by the PHG Foundation with international experts has identified a new framework for evaluating any type of medical risk prediction model, which will be of enormous value in allowing doctors to compare new and changed models with existing ones to see how well they perform.

Previous analysis of the impact of emerging genetic and molecular biomarkers on risk prediction models for coronary heart disease (CHD) underlined the need for an effective means of comparing risk prediction models. These new factors may eventually help us to assess CHD risk more accurately - but the evidence shows that they do not yet significantly improve current risk prediction models relying on more conventional risk markers.

“Prediction is very difficult - especially about the future”

Niels Bohr

Why do quality standards matter?

The use of risk prediction models is growing and as more risk factors are identified, the models are becoming increasingly complex.

Health professionals, policymakers and consumers are making critical decisions about the best means to predict future risk of disease. However, they lack the tools for effective assessment and comparison of the expanding repertoire of different models. A reliable method for evaluation of models in a given context is therefore urgently needed.

Example - coronary heart disease

Prior to our development of a general framework for the evaluation of medical risk prediction models, we explored the impact of new genetic and molecular biomarkers on risk prediction for coronary heart disease (CHD). This is a major public health problem, and risk prediction is an important element in effective prevention. We found that:

- There is considerable scope to improve risk assessment models for CHD
- New biomarkers do not yet offer improved risk prediction
- There is an urgent need for a reliable, systematic approach to appraising risk prediction models

Moving towards a system to compare risk prediction models

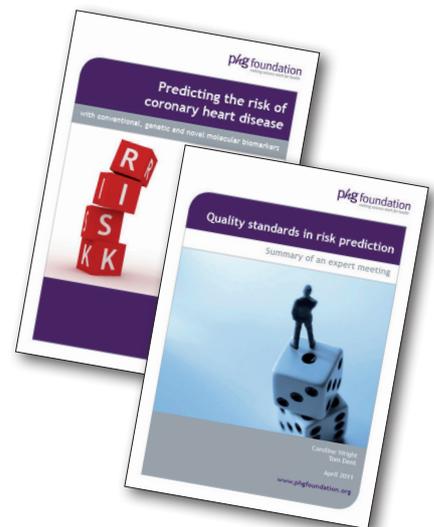
To address this problem, we held a workshop where international experts examined current risk models, shared their own perspectives and approaches to risk prediction, and discussed why quality standards are needed. We also considered case studies and example risk prediction frameworks for the fields of coronary heart disease and dementia.

Key criteria for new models

Our work sets out what needs to be known before a model is recommended for general medical use. Notably, a series of questions must be answered from three key three domains:

- **The medical context in which the model is to be used**
e.g. its purpose, the target condition, availability of effective interventions
- **An appraisal of the model itself**
e.g. performance metrics, quality of dataset, external validation
- **Issues relating to implementation of the model in practice**
e.g. cost-effectiveness, harms and benefits

Quality standards in risk prediction and **Predicting the risk of coronary heart disease** are both available for purchase or free electronic download from the PHG Foundation website.



The PHG Foundation is an independent, non-profit organisation working to ensure that biomedical innovations are put to the best use in health services.

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