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Editorials

Cardiovascular risk models

The moral implications of models based on absolute risk need to be better understood

Risk scores based on the Framingham heart study reflect the higher risks of cardiovascular disease in the 1970s and 1980s and tend to overpredict current risks. They do not include family history, body mass index, use of antihypertensive drugs, or measures of social class. Omitting socioeconomic status as a predictor increases the health gap between rich and poor: the risks in poor people are underestimated and undertreated, and risks in rich people are overestimated and overtreated.

In this week's *BMJ* Hippisley-Cox and colleagues derive a new cardiovascular disease risk score (QRISK) for the United Kingdom and validate its performance against the Framingham cardiovascular disease algorithm and a newly developed Scottish score (ASSIGN).[1] They found that QRISK provided more appropriate risk estimates to help identify high risk patients on the basis of age, sex, and social deprivation. The QRISK score indicates that in the United Kingdom about 3.2 million men and women aged 35-74 are likely to be at high risk, compared with 4.7 million predicted by Framingham and 5.1 million with ASSIGN.

In rationing the use of statins for primary prevention, cardiovascular disease risk scores were developed to produce the biggest effect at minimum cost.[2] However, the distribution of risk of cardiovascular disease in healthy populations is determined largely by the age, sex, lifestyle, and socioeconomic class distribution in the population. Treatment decisions and resource allocation based on age, sex, and lifestyle have moral implications, depending on what is included in the model and what is left out. The point made by Hippisley-Cox and colleagues, that omission of socioeconomic class from risk prediction models increases health inequities between poor and rich, is correct.[1 3] But absolute risk scores also label male sex, old age, and risky lifestyles as diseases to be treated, while denying life extending drugs to women, younger people, and those living healthily. To facilitate more equitable and transparent decisions, these moral implications of cardiovascular disease risk models have to be better understood.

Firstly, all cause mortality is reduced more by moderate consumption of alcohol than by taking statins.[4] A bottle of red wine a week seems to be a health investment that increases quality adjusted life expectancy more.[5] Under a wide range of assumptions, the cost utility of red wine in primary prevention is higher than of statins—so risk models ought to target selectively reimbursed prescriptions of bottles of inexpensive red wine. On the other hand, evidence of the benefits of statins is stronger than that of nutraceuticals such as phytosterols or omega 3 fatty acids,[6 7] so why should doctors recommend nutraceuticals, for which the effectiveness of hard clinical outcomes has not been proved, and not statins, for which we have evidence?

Secondly, absolute risk scores reduce all highly individual risk taking behaviours to a single value. In most population screening programmes for cancer, the 10 year absolute risk of death is 0.5% and numbers needed to treat are higher than 1000.[8 9] NICE (National Institute for Health and Clinical Excellence) guidelines advise that primary prevention should reduce the risk of cardiovascular disease by 20%, comparable to a 7% risk of death.[10] The number needed to treat to avoid a cardiovascular event is 20; to prevent a death it is 50. An alternative strategy is mass treatment, championed by proponents of the "polypill."[11] At all existing levels of cardiovascular disease risk over age 40, mass treatment with statins alone is always more effective than cancer screening.

Thirdly, absolute risk scores prioritise elderly people to the detriment of younger people. But ageing is part of the finite life course. These are healthy elderly people, not patients. Risk comprises the probability of an event happening and the adverse consequences of that event. The ethically and scientifically most unacceptable aspect of management by absolute risk is the ignoring of the relative importance of loss of life at different ages.[3 12] No modern society with a low risk of mortality places equal value on a death at age 45 and one at age 75.

Fourthly, absolute risk scores select those with a risky lifestyle to the detriment of those with a healthy lifestyle. Healthy smokers who refuse to quit are eligible for statins, yet smokers who quit should be denied them as quitting will lower cardiovascular disease risk. The more you choose a healthy lifestyle, the less you are supposed to wish to extend healthy life. Non-smokers, paradoxically, reap more benefits from statins than smokers. Statins reduce the probability of an event more among smokers. But if you take into account the adverse consequences of that event, statins save more life years among non-smokers, because non-smokers live much longer.[3 13]

What does this mean for clinicians faced with prioritising which patients to treat? For an individual patient, the information provided by risk models should be interpreted with caution. There is little medical or scientific justification that risk calculations with arbitrary thresholds should supersede informed choice. From a societal perspective, treating healthy people competes with other investments in health, such as reducing poverty or promoting a healthy environment. It also competes with investments in the treatment of disease, such as new cancer drugs or innovative technology, and with expensive long term care for increasing numbers of disabled elderly people. Absolute risk scores do not offer an easy escape from moral choices.

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References

1. Hippisley-Cox J, Coupland C, Vinogradova Y, Robson J, May M, Brindle P. Derivation and validation of QRISK. A new cardiovascular disease risk score for the UK. *BMJ* 2007 doi: 10.1136/bmj.39261.471806.55[Abstract/Free Full Text]

2. Haq IU, Jackson PR, Yeo WW, Ramsay LE. Sheffield risk and treatment table for cholesterol lowering for primary prevention of coronary heart disease. *Lancet* 1995;346:1467-71.[CrossRef][ISI][Medline]

3. Essink-Bot ML, Kruijshaar ME, Barendregt JJ, Bonneux LG. Evidence-based guidelines, time-based health outcomes, and the Matthew effect. *Eur J Public Health* 2007;17:314-7.[Abstract/Free Full Text]

4. Flesch M, Rosenkranz S, Erdmann E, Bohm M. Alcohol and the risk of myocardial infarction. *Basic Res Cardiol* 2001;96:128-35.[CrossRef][ISI][Medline]

5. Franco OH, Bonneux L, de Laet C, Peeters A, Steyerberg EW, Mackenbach JP. The polymeal: a more natural, safer, and probably tastier (than the polypill) strategy to reduce cardiovascular disease by more than 75%. *BMJ* 2004;329:1447-50.[Abstract/Free Full Text]

6. Castro IA, Barroso LP, Sinnecker P. Functional foods for coronary heart disease risk reduction: a meta-analysis using a multivariate approach. *Am J Clin Nutr* 2005;82:32-40.[Abstract/Free Full Text]

7. Hooper L, Thompson RL, Harrison RA, Summerbell CD, Ness AR, Moore HJ, et al. Risks and benefits of omega 3 fats for mortality, cardiovascular disease, and cancer: systematic review. *BMJ* 2006;332:752-60.[Abstract/Free Full Text]

8. Hewitson P, Glasziou P, Irwig L, Towler B, Watson E. Screening for colorectal cancer using the faecal occult blood test, Hemoccult. Cochrane Database Syst Rev 2007;(1):CD001216. www.cochrane.org/reviews/en/ab001216.html

9. Gotzsche PC, Nielsen M. Screening for breast cancer with mammography. Cochrane Database Syst Rev 2006;(4):CD001877. www.cochrane.org/reviews/en/ab001877.html

10. National Institute for Health and Clinical Excellence. Statins for the prevention of cardiovascular events in patients at increased risk of developing cardiovascular disease or those with established cardiovascular disease. January 2006. www.nice.org.uk/TA094

11. Wald NJ, Law MR. A strategy to reduce cardiovascular disease by more than 80%. *BMJ* 2003;326:1419-23.[Abstract/Free Full Text]

12. Bonneux L. How to measure the burden of mortality? *J Epidemiol Community Health* 2002;56:128-31.[Abstract/Free Full Text]

13. Bonneux L. Cholesterol-lowering therapy for smokers and non-smokers: a life-table analysis. *Lancet* 2000;356:2004-6.[CrossRef][ISI][Medline]

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