Calculating cardiovascular risk with online calculators – scope for improvement?

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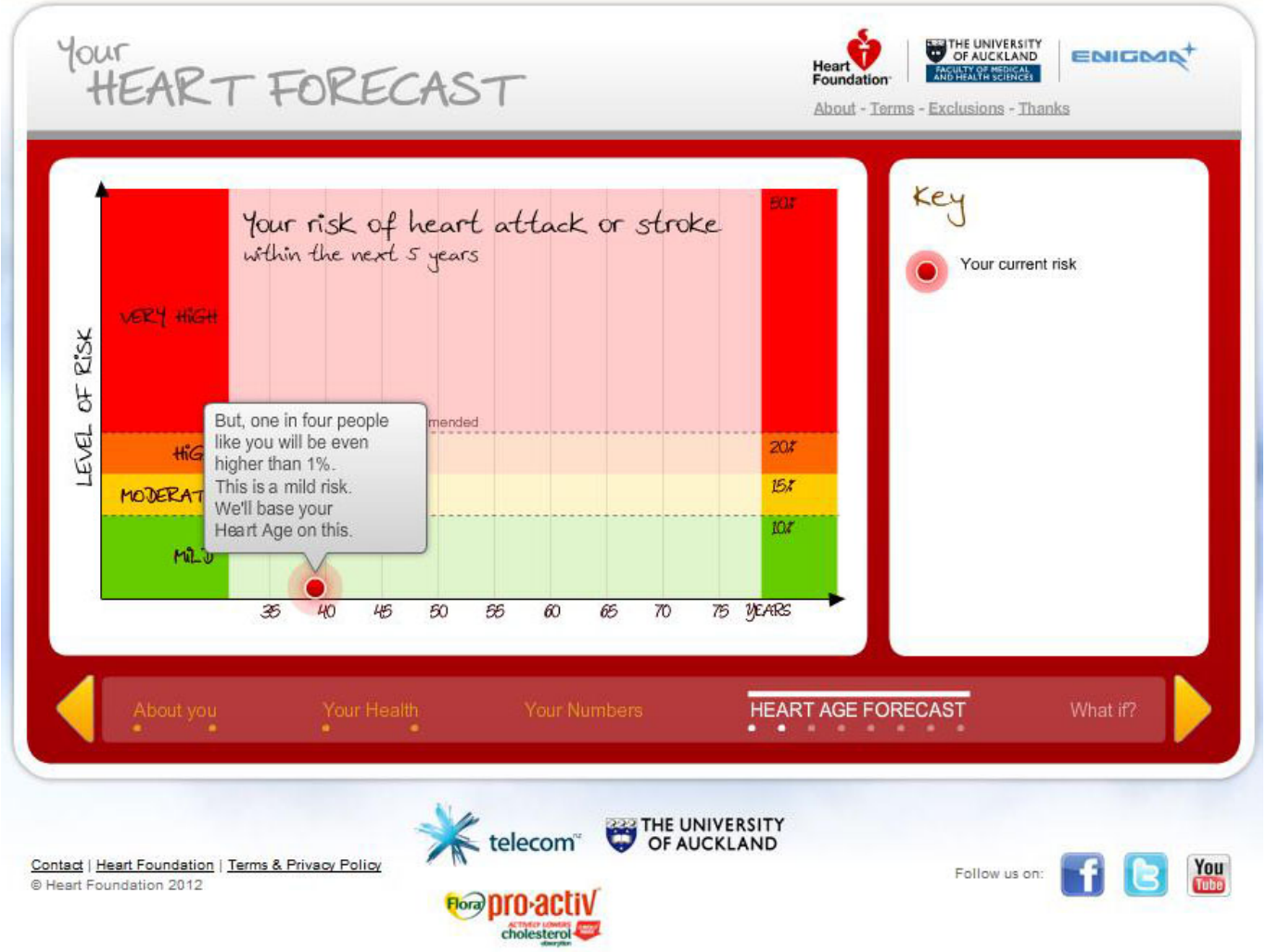

It is now possible to readily estimate individual risk of future cardiovascular events with a large number of online calculators – including a NZ-specific calculator that has been available for some years (“Know Your Numbers”). In this blog we consider if such risk calculators could be improved upon. The clear answer being “yes” – and in many ways.

There are many ways to prevent cardiovascular disease (CVD) – with public health measures being particularly critical. These include such strategies as enhanced tobacco control (e.g., higher tobacco taxes (1)) and regulations to improve the quality of the food supply (e.g., to limit salt (2)). But individual measures are also important – with health workers providing targeted advice on lifestyle change and the use of medications to lower blood pressure, lower cholesterol levels (via statins), and to prevent clotting (e.g., via low-dose aspirin).

A large number of online CVD risk calculators currently exist (e.g., see these reviews (3,4)) and these can be used by citizens and in discussion with their GPs to make more informed decisions about how this risk can be reduced. They should not be regarded as providing highly precise risk estimates (3) but there is some evidence that they may stimulate lifestyle changes (e.g., Bonner et al (5)). Nevertheless, some researchers have highlighted the complex responses of users and suggest that such calculators "may best be used in conjunction with health professionals who can guide the user through the calculator" (6).

Such a freely available online CVD risk calculator has been designed for the NZ setting (with epidemiological input from one of us: Jackson). Example results are shown in the table below.

Table 1: Example results from the online cardiovascular disease (CVD) risk calculator designed for NZ: "Know Your Numbers" (NZ) http://www.knowyournumbers.co.nz/

Individual characteristics*	Calculated 5-year risk of a CVD event	Recommendations produced by the calculator
Man 70y, Māori	25%	Medication "strongly recommended" & general lifestyle changes mentioned (around smoking, diet and physical activity).
Man 70y, European	20%	As above.
Woman 70y, Māori	17%	"Consider medications" (and lifestyle changes mentioned above).
Woman 70y, European	12%	As above.

*** All for non-smokers, no diabetes, no family history of CVD, but high blood pressure (165/90) and raised total cholesterol to HDL ratio (4.5). CVD events include both heart attacks and strokes.**

Can such calculators be improved for the public and clinicians?

The NZ calculator has many desirable features (see the table in the Appendix) and compares favourably with other online calculators in our view. But this and other calculators could potentially be improved in two key ways as we detail below.

Extending the age range: This improvement is particularly important given that the current NZ calculator is really only designed for the <75 year age group. A more sophisticated calculator would also take into account "competing mortality" – the increased risk of death from other causes at older years. (At the moment, CVD calculators give absolute percentages *as though there was no risk of dying of any other cause.*) This probably starts to matter quite a lot for older people in their 80s and 90s (7).

Other background epidemiological refinements: These are desirable since there is a steady year-on-year downward trend in CVD risk for the whole NZ population. Adding in an option for those with past CVD events (8) and for socioeconomic status are other possible refinements (the latter being potentially derived using NZDep scores – based on a person's residential area).

Showing the risk concept graphically: To help with understanding risk, it is desirable to show graphically how many cases of heart attacks and strokes are prevented "in 100 people like me" who adopt risk reduction efforts. This is already being done in some such calculators (e.g., for QRisk2, and a Mayo Clinic one for statin use). The JBS3 risk calculator graphically displays the average survival time that is free of a CVD event – and how this can be extended with reductions in blood pressure etc. Again, this should ideally be improved to allow for competing mortality risk.

What about risk calculators for policy-makers and guideline developers?

There may also be a case for additional CVD risk calculators to inform policy-makers and those developing guidelines for CVD risk reduction. Such calculators could cover the following issues:

1. ***Showing healthy or quality-adjusted years of life saved.*** The bottom line with CVD risk reduction is gaining extra years of healthy life. Some of us have already produced software tools that consider interventions that generate QALYs (quality-adjusted life-years) gained from saving the lives of New Zealanders at different ages (see this article (9) and this online calculator). Ideally this approach could be taken to CVD risk reduction. It should also include a variable time preference option that allows for "discounted" years of healthy life gained from any CVD risk reduction measure.
2. ***Medication issues:*** Some risk calculators (e.g., the Mayo Clinic one) go into detail about the benefits and risks of particular medications e.g., of statins. This can help with decision-making and could be extended to aspirin – where the risk of adverse effects change with age (i.e., higher risk of gastric bleeding in older age groups). Some people also simply don't like the idea of taking daily CVD preventive medications – as described in the literature on "medication disutility" (10-12). So a really sophisticated calculator could possibly allow users to incorporate various levels of medication disutility.
3. ***Aspirin for cancer prevention:*** There is growing evidence that not only does aspirin prevent CVD – but it also may prevent some cancers, especially colon cancer (13) (also see this previous PHE blog). A really sophisticated calculator could add such cancer prevention benefits, to the benefits from CVD prevention.
4. ***Cost-effectiveness:*** The issue of cost-effectiveness is relevant for policy-makers who should be striving to get the maximum health gain from the taxpayer funded public health budget. So a CVD risk calculator could determine the cost-effectiveness of different interventions for people at different levels of CVD risk. That is, is the most

cost-effective action for a clinician to support: medication, stopping smoking, or reducing salt intake? Or which packages of interventions are the most cost-effective such as stopping smoking and exercising together (e.g., there is some suggestive Cochrane review evidence for exercise assisting with smoking cessation (14)).

Conclusion

With "Know Your Numbers", NZ has already got a relatively high quality CVD risk calculator (available online and for free). But as we have outlined, there are a number of ways that this and other such publicly-available calculators could be further improved. This would help to better inform individuals and to assist their doctors in tailoring proven CVD interventions to lower their risk of heart attacks and strokes. Calculators developed for policy-makers would also help them consider the most effective and cost-effective approaches for the population to gain healthy life-years from CVD risk reduction interventions.

Appendix Table: Comment on selected features of the online "Know Your Numbers" CVD risk calculator designed for the NZ setting

Domain	Further detail
Time horizon	The calculator provides 5-year risk – which seems to us to be more relevant for clinical decision-making than the 10-year timeframe used by most such calculators (for more details see this article (15)).
Ethnicity	Relatively detailed ethnicity input options are available (i.e., Māori, various Pacific and Asian populations). But adding in the NZ-based Chinese population could be a good addition.
Graphical features	The output provides projections in a graphic form and there are also dynamic graphic options that show current risk and future risk at different settings. There is also a comparison with an "ideal" trajectory and also what the likely trajectory is for the person if no CVD risk reduction efforts are made.
Calculator tools	The calculator has sliding scales to allow the user to see the implications of reductions in blood pressure (BP) and cholesterol ratio changes on their CVD risk. This can be used to show visually the relatively large importance of high BP in driving CVD risk.
"Heart age"	The calculator estimates the person's "heart age". This might help motivate some people – but more research on this is probably needed on this issue (e.g., one study found that participants who were told that they had an older heart age found it "confronting" Bonner et al (5)).
Recommendations	For those at high risk, the calculator provides information about seeing a doctor about CVD medications. The user can also proceed to creating a somewhat personalised "heart health plan". There is also discussion of the importance of stopping smoking and making dietary changes.

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