Using disease risk estimates to guide risk factor interventions: field test of a patient workbook for self-assessing coronary risk

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Abstract

Objective To assess the feasibility and acceptability of a patient workbook for self-assessing coronary risk.

Design Pilot study, with post-study physician and patient interviews.

Setting and subjects Twenty southern Ontario family doctors and 40 patients for whom they would have used the workbook under normal practice conditions.

Interventions The study involved convening two sequential groups of family physicians: the first ($n = 10$) attended focus group meetings to help develop the workbook (using algorithms from the Framingham Heart Study); the second ($n = 20$) used the workbook in practice with 40 patients. Follow-up interviews were by interviewer-administered questionnaire.

Main outcome measures Physicians' and patients' opinions of the workbook's format, content, helpfulness, feasibility, and potential for broad application, as well as patients' perceived 10-year risk of a coronary event measured before and after using the workbook.

Results It took an average of 18 minutes of physician time to use the workbook: roughly 7 minutes to introduce it to patients, and about 11 minutes to discuss the results. Assessments of the workbook were generally favourable. Most patients were able to complete it on their own (78%), felt they had learned something (80%) and were willing to recommend it to someone else (98%). Similarly, 19 of 20 physicians found it helpful and would use it in practice with an average of 18% of their patients (range: 1–80%). The workbook helped to correct misperceptions patients had about their personal risk of a coronary event over the next 10 years (pre-workbook (mean (SD) %): 35.2 (16.9) vs. post-workbook: 17.3 (13.5), $P < 0.0001$; estimate according to algorithm: 10.6 (7.6)).

Conclusions Given a simple tool, patients can and will assess their own risk of CHD. Such tools could help inform otherwise healthy individuals that their risk is increased, allowing them to make more informed decisions about their behaviours and treatment.

Introduction

Despite important gains in the fight against coronary heart disease (CHD) over the last few decades, CHD remains a major cause of premature death and disability in many developed countries. While many of the key risk factors for CHD, such as cigarette smoking and raised blood pressure and blood cholesterol, are readily detectable and can be modified to reduce patients' risk of premature disease, for many busy clinicians properly measuring and managing this risk can be challenging. Factors contributing to this challenge include the multifactorial nature of CHD,[1] recommendations that objective risk estimates be used to guide therapeutic decisions,[2,3] the need to actively involve patients in such decisions,[4–9] and constraints on time.[10,11] Unaided, many family doctors overestimate their patients' risk of CHD and the potential benefits of risk factor interventions,[12] suggesting that at least some patients are prescribed preventive therapies with only a marginal chance for short-term benefit. Given that a third of patients might refuse such medications if they were fully informed of the potential risks and benefits of therapy,[13,14] the need for simple, feasible risk assessment methods seems clear.

Various tools have been developed to help clinicians estimate their patients' risk of CHD.[1,2,15–23] However, while many of these aids have been available and promoted for some time, little is known about whether they are used or even feasible in primary care settings.[11,15,24–26] In one survey of Ontario family doctors, a third of respondents cited lack of time or remuneration as key barriers to providing the kind of counselling these tools require.[11] One approach to this challenge in other contexts has been the development of self-administered decision aids: interactive videodiscs or workbooks that patients review on their own, and then return to their doctor prepared for consultation.[27–29] Other advantages of self-administered decision aids have been their ability to correct misperceptions patients have about personal risks and benefits, and to facilitate patients' participation in treatment decisions.[27,28]

Recently, we surveyed Ontario family doctors to assess whether there was need for 'a workbook that would allow adults without symptoms of CHD to estimate their 10-year risk of a coronary event'; 89% believed there was such a need.[11] Accordingly, we set out to develop a simple, inexpensive booklet using algorithms from the Framingham Heart Study.[1] Here we report on the feasibility and acceptability of the workbook as judged by 20 community-based family doctors and 40 patients for whom they would have used the workbook under normal practice conditions. In addition, given evidence of how peoples' misperceptions can affect preventive health behaviour,[30] we assessed whether using the workbook had an effect on patients' self-perceived risk of CHD.

Methods

The workbook

Scientific basis for Heartcheck

The workbook, which we tentatively called *Heartcheck*, was an adaptation of the American Heart Association's CHD Risk Factor Prediction Chart.[1] Like most other Framingham-based aids, this chart uses a person's age, sex and risk factor values to estimate the individual's 10-year risk of a coronary event (angina pectoris, myocardial infarction or coronary death) based on the experience of the original and offspring cohorts of the Framingham Heart Study.[1] Accordingly, patients were eligible to use *Heartcheck* if they met essentially the same

criteria that governed entry into the Framingham cohorts:

(1) Age 30–74 years.
(2) Measurements for systolic (SBP) and diastolic blood pressure (DBP) (mmHg), cigarette smoking status (i.e. current smoker or quit within the last year), total and high density lipoprotein (HDL) cholesterol (mmol/L), and diagnoses (yes or no) of diabetes (i.e. on treatment with insulin or oral agents, or a fasting glucose of >7.8 mmol/L) and ECG-detectable left ventricular hypertrophy (LVH) (when information about diabetes or LVH was not available, diagnoses were presumed negative).
(3) Freedom from cardiovascular disease (i.e. stroke, transient ischemia, CHD (angina pectoris, myocardial infarction), congestive heart failure and intermittent claudication). For patients who did not know their blood cholesterol values, age/sex-specific population values were provided in the workbook.[31]

Comparisons of Framingham-based risk estimates with the results of other cohort studies and clinical trials show the prediction models to be reasonably accurate and valid.[23,25,32] However, the models do have some limitations, particularly when used for estimating the benefits of specific risk factor interventions. First, projections based on observational data represent the average benefit expected among a group of similar individuals; in reality, individual gains will vary. Secondly, the predictions assume immediate intervention effects on CHD risk, when in fact the effects are delayed by periods that vary by risk factor. Previously reported lag periods for smoking cessation, cholesterol-lowering and antihypertensive therapy are 2–4 years, 2–3 years and 1 year, respectively.[32] Thirdly, sufficiently large randomized trials against which CHD benefit projections can be validated are few and have only rarely included women or the elderly. Projections for smoking cessation programmes, for example, presently cannot be validated, and those for antihypertensive therapy and cholesterol-lowering therapy with statins may over- and under-estimate benefits, respectively.[33,34]

Developing Heartcheck

The study protocol, which was approved by an Ethics Review Board at Sunnybrook Health Science Centre in Toronto, Ontario, involved convening two sequential groups of family physicians: the first attended focus group meetings to help develop *Heartcheck* and an accompanying practitioners' guide; the second used the workbook and guide in practice.

The focus groups were two convenience samples of five family physicians in community practice recruited by mail from Sunnybrook Health Science Centre's Department of Family and Community Medicine. Prior to meetings, participants' initial reactions to draft versions of the workbook and guide were captured on an evaluation form and summarized for presentation during the meetings. The objectives of the meetings were to: (a) learn about participants' overall impressions of the workbook and guide; (b) discuss their responses to the more detailed questions on the evaluation form; and (c) provide a forum for participants to share their ideas for revisions, further evaluation and implementation. Subsequently, participants were supplied with revised versions of both documents and were contacted by telephone to confirm whether the prototypes were suitable for field testing. This call also was used to obtain advice regarding the evaluative questions to be asked of physicians and patients involved in the field test.

Format and content of Heartcheck

Heartcheck was a 15-page, 14.0×21.6 cm booklet written in English at a grade 8 reading level. It had three main sections. Section one defined CHD and the concepts of risk and risk factor, identified who was eligible to use the workbook, and described three 'other risk factors' excluded from the formal risk calculation (obesity, physical inactivity and family history of premature CHD), indicating why they were excluded. Section two used a separate page to described each major risk factor and present a table for translating the patient's risk factor value into a corresponding point score.[1] For patients who did not know their blood cholesterol values,

population-based values were supplied.[31] A fold-out page at the end of section two provided space for recording each risk factor point score and tallying the total point score. This page also included a table for translating the total point score into the patient's risk estimate. We defined the estimate as representing '… the number of people, out of 100 people just like you, who are likely to have angina or a heart attack (which may or may not be fatal) sometime over the next 10 years'. Finally, section three included a table for assessing the patient's relative risk, a page listing the names and telephone numbers of organizations providing further information about CHD, and a fold-out 'Risk Factor Log' which provided space for patients to record their risk factor values and corresponding risk estimates for future reference.

The field test: subjects and methods

The field test, which took place between September 1996 and January 1997, involved a new sample of 20 family physicians in community practice recruited by mail from the Department of Family and Community Medicine, Sunnybrook Health Science Centre, Toronto ($n = 10$) and the Teaching Practices Network (Network) of the University of Toronto's Department of Family Medicine ($n = 10$). All Network members within 2-hours' driving distance from Toronto were approached. The first 20 doctors who responded to our mailing were enrolled.

For physicians, participation involved: (a) meeting with a project coordinator to review the study protocol; (b) using *Heartcheck* in consultations with two patients; and (c) discussing their experiences with *Heartcheck* during a 30-minute follow-up interview with the coordinator. Basic demographic and practice information also was collected during the interview. For their participation, physicians received an honorarium (at a rate recommended by the Ontario Medical Association) for the time they spent preparing for and meeting with the coordinator, and for study-related consultations with patients. Patients' travel expenses also were paid.

Physicians were instructed to enrol two patients who met the study entry criteria (30–74 years of age and no symptoms of CHD), and for whom they would be likely to use *Heartcheck* under normal practice conditions. In addition, they were asked to consider some basic procedural guidelines recommended by the focus groups (Table 1).

For patients, participation involved: (a) making an office visit (or extending one previously arranged) to discuss study participation, provide informed consent and estimate their perceived 10-year risk of CHD; (b) completing *Heartcheck* and meeting with their doctors to discuss the results; and (c) participating in a 30-minute follow-up interview with the project coordinator. Perceived risk was assessed during the patient's initial physician visit and again at the beginning of the follow-up interview with the project coordinator using a standardized, self-

Table 1 Procedural guidelines for using *Heartcheck*

1. Rather than distribute *Heartcheck en masse*, use it selectively with patients who are perceived to be at higher risk.
2. Introduce *Heartcheck* either during a periodic health exam or opportunistically, then follow-up within several weeks to discuss the results.
3. Along with a copy of *Heartcheck*, provide patients with any available risk factor data. Only systolic blood pressure (preferably the mean of at least two readings) is absolutely required. (For test purposes, patient enrolment kits contained optional no-carbon-required 'Risk Factor Data' sheets on which to record patients' risk factor values.)
4. At follow-up, confirm the risk estimate, review its limitations, and answer any questions the patient may have. If risk factor changes are deemed necessary, use *Heartcheck* to: (a) illustrate the absolute CHD risk reductions that might accompany such changes; and (b) set priorities among multiple risk factors that require modification.
5. Base decisions about treatment on patients' baseline risk of CHD and address those factors that, if changed, will reduce risk most. Also use patients' risk status to guide intensity of treatment (i.e. at a given risk factor level, those at higher risk of CHD should receive more aggressive therapy than those at lower risk).

Box 1 Question used to assess patients' self-perceived coronary risk

What do you think your chance is of getting coronary heart disease?

We would like you to think about your chance of getting coronary heart disease.

Out of 100 people just like you, how many do you think will have angina (i.e., chest pain due to coronary heart disease) or a heart attack (which may or may not be fatal) sometime over the next 10 years?

Start at the bottom of this list and read up. When you reach your best estimate, please circle it.

(Between 96 and 100 people will have angina or a heart attack sometime over the next 10 years.)

96–100
91–95
86–90
81–85
76–80
71–75
66–70
61–65
56–60
51–55
46–50
41–45
36–40
31–35
26–30
21–25
16–20
11–15
6–10
1–5
0

(None of the 100 people will have angina or a heart attack sometime over the next 10 years.)

administered questionnaire (Box 1). Copies of the questions used in the physician and patient interviews are available on request.

Sample size and data analysis

To help judge the acceptability of the workbook, we predefined some performance criteria based on discussions with the focus groups. Their key concern was whether the workbook would be truly self-administered. We assumed that most physicians would be willing to try the workbook if at least 70% of patients could complete it unassisted. Thus, we aimed for a sample size that would allow us to detect an 80% rate of self-administration within 10% and with 90% confidence.[35]

Proportions and means (with standard deviations (SD)) were used to summarize the study results. Comments on the workbook were grouped into categories and reported as frequency counts and proportions. Finally, a paired *t*-test was used to test for a difference between patients' mean pre- and

post-*Heartcheck* risk perceptions, setting Type I error (alpha) at 0.05. Data were managed and analyzed using Foxpro® and SAS® software.

Results

Characteristics of participants

Table 2 summarizes the characteristics of the study physicians and practices. The age and sex distributions of the doctors were similar to those of a random sample of primary care physicians drawn from the College of Physicians and Surgeons of Ontario's Registrant Database for an earlier survey.[11] They also were similar to survey respondents in terms of the number of hours they worked and the number of patients they saw during a typical work week.[11] However, given our sampling frame, it is not surprising that our subjects were more likely to both be certified family physicians (as opposed to general practitioners) and practice in an urban or suburban area.

Patients' risk factor data and CHD risk estimates are presented in Table 3, along with other information we collected during our follow-up interviews (conducted an average of 12.8 (SD: 13.1) days after patients' second physician visit). Because we did not have access to patients' charts, we did not confirm the accuracy of the risk factor data that patients reported or whether they had clinical evidence of CHD that would have made them ineligible for study.

The focus groups recommended using *Heartcheck* mainly with high-risk patients. However, as shown in Table 3, patients' risk estimates varied considerably, ranging from 1% to 33%, half with 10-year CHD risks of less than 10%. Subjects were well educated, perceived themselves to be in good health compared with others their age, and were described by study physicians as being representative of patients for whom they would use *Heartcheck* under normal practice conditions. Physicians estimated the size of the target population to be about 18% of their patients on average (median: 10%; range: 79%).

Feasibility and perceived helpfulness of *Heartcheck*

Table 4 presents some measures of feasibility and helpfulness. Excluding trial-related discussion, it took study physicians an average of 7.6 (SD: 4.4) minutes to introduce *Heartcheck* and a further 11.3 (SD: 5.8) minutes to discuss the results, for an average overall time commitment of 18.9 (SD: 9.1) minutes: roughly equivalent to physicians' average consultation time during a typical work week (Table 2). Thirty-one (78%) patients reported completing the workbook without assistance.

Heartcheck's reviews were generally favourable. Thirty-two (80%) patients felt they had learned something from the workbook and all but one indicated they would recommend it to someone else. Similarly, only one physician did

Table 2 Characteristics of physicians and their practices. $n = 20$

Characteristic	*n* (%) or mean (SD), as appropriate
Age (mean (SD) years)	41.4 (8.1) (range: 31–63)
Sex (*n*,% female)	6 (30.0)
Years in clinical practice (mean (SD))	12.1 (7.1) (range: 2–30)
Hospital appointment (*n*,% yes)	20 (100)
Certificant of the College of Family Physicians of Canada (*n*,% yes)	20 (100)
Number of physicians at current practice setting (mean (SD))	3.4 (1.5) (range: 1–6)
Practice employs an office nurse (RN, RPN; *n*,% yes)	9 (45.0)
Patients predominantly from an urban or suburban area (*n*,% yes)	17 (85.0)
Number of hours spent in office practice(s) in a typical work week (mean (SD))	39.1 (10.1) (range: 20–55)
Number of patient encounters in a typical work week (mean (SD))	133.5 (26.5) (range: 90–175)
Calculated average work time per patient (based on above; mean (SD) minutes)	17.8 (4.4)
Prior use of a formal CHD risk appraisal instrument (*n*,% yes)	3 (15.0)

Table 3 Characteristics of patients. $n = 40$, unless otherwise indicated

Characteristic	*n* (%) or mean (SD), as appropriate
Age (mean (SD) years)	50.0 (10.7) (range: 31–72)
Sex (*n*, % female)	13 (32.5)
Some post-secondary education (*n*, % yes)	25 (62.5)
Employed (*n*, % yes)	27 (67.5)
Self-perceived health status (*n*,% good or very good)	31 (77.5)
Overweight (i.e. BMI >27; *n*, % yes)	19 (47.5)
Physically inactive (i.e. '<20 min aerobic activity 3 times weekly'; % yes)	18 (45.0)
Family history of premature CHD (i.e. 'angina or a heart attack before age 55 in parents, brothers/sisters, or aunts/uncles'; *n*, % yes)	14 (35.0)
Cigarette smoker (*n*, % yes)	10 (25.0)
Diabetes mellitus (*n*, % yes)	3 (7.5)
Systolic blood pressure (mmHg; mean (SD))	129.8 (13.2)
Total cholesterol (mmol/L; mean (SD))	6.1 (1.1)
HDL cholesterol (mmol/L; mean (SD); $n = 34$)	1.27 (0.42)
Estimated 10-year risk of angina or MI (mean percentage (SD))	10.4 (7.5) (range: 1–33)
Average 10-year risk for age and sex (mean percentage (SD))	10.8 (6.9) (range: 1–30)
Taking medication(s) for cardiovascular disease (i.e. 'for your heart, blood pressure, etc.') at study entry (*n*, %)	14 (35.0)
Antihypertensive(s)	9 (22.5)
Cholesterol-lowering	3 (7.5)
ASA	2 (5.0)

Table 4 Feasibility and perceived helpfulness of *Heartcheck*

Outcome measure	*n* (%) or mean (SD), as appropriate
Feasibility	
Time to introduce *Heartcheck* (excluding trial-related discussion), according to physicians (mean (SD) minutes; $n = 20$)	7.6 (4.4) (range: 2–18)
Time to complete *Heartcheck*, according to patients (mean (SD) minutes; $n = 40$)	13.3 (7.2) (range: 4–30)
Time to discuss the results of *Heartcheck*, according to physicians (mean (SD) minutes; $n = 20$)	11.3 (5.8) (range: 5–30)
Number (%) completed without assistance:	
According to physicians	28 (70.0)
According to patients	31 (77.5)
Percentage of practice population suitable for Heartcheck, according to physicians (mean (SD); $n = 19$)	17.7 (18.8) (range: 1–80)
Helpfulness	
According to physicians ($n = 20$)	
Was *Heartcheck* helpful? (*n*, % yes)	19 (95.0)
If a revised version of *Heartcheck* were to be made widely available, would you use it? (*n*, % yes)	19 (95.0)
According to patients ($n = 40$)	
Did you learn anything from *Heartcheck*? (*n*, % yes)	32 (80.0)
Would you recommend *Heartcheck* to someone else? (*n*, % yes)	39 (97.5)

not consider the workbook helpful. Most said they would use it essentially as recommended by the focus groups (Table 1). Physicians' specific concerns are listed in Table 5. Key issues were the absence of 'family history of premature CHD' from the algorithm, and the perceived usefulness of *Heartcheck* for younger patients (e.g. those under 45 years of age) and those with low reading or numeracy levels. Concerns raised by at least two patients were: difficulties with the

Table 5 Physicians' concerns about and perceived barriers to using *Heartcheck*. $n = 16$ respondents; multiple responses permitted

Response category	*n* (% of responses)
Concerns	
Absence of 'other' risk factors from risk estimate, particularly 'family history' of CHD	5 (26.3)
Focus on 10-year time window for risk estimates; given this, questioned suitability for younger adults (e.g. those aged <45 years)	5 (26.3)
Validity of risk estimates	3 (15.8)
Lack of adjustment for diabetic control, number of cigarettes smoked	2 (10.5)
Favours SBP, while DBP is used heavily in practice	2 (10.5)
Patients' understanding of the concept of 'risk'	2 (10.5)
Perceived barriers	
Patients' level of education, literacy, numeracy	7 (30.4)
Patients' lack of preparedness to take 'charge of'/'responsibility for' their health	5 (21.7)
Cost: generally, would not use it if physicians or patients must bear cost	5 (21.7)
Time: finding time to use it, for physicians or patients. (In contrast, 3 believed *Heartcheck* might improve efficiency of counselling practice.)	4 (17.4)
Availability of support staff to assist patients, if necessary	2 (8.7)

arithmetic; difficulty understanding the concept of 'risk'; confusion about the meaning of SBP and DBP (e.g. 'definition of 'high' BP differs from my physician's'); and difficulty extracting appropriate age/sex-specific risk data from the table provided in the workbook.

Patients' perceived vs. objective risk of CHD

Thirty-seven patients gave an assessment of their perceived coronary risk both before and after using *Heartcheck*. As shown in Fig. 1, prior to using the workbook patients almost universally overestimated their risk, some by a considerable margin. A mean of 12.8 (SD: 13.1) days after using *Heartcheck*, this gap was significantly reduced ($t = 6.886$; $P < 0.0001$). Self-perceived risk fell in 28 subjects, remained unchanged in seven subjects and rose slightly in two.

When asked what their immediate reaction was on learning their risk estimate, given their perceptions, not surprisingly, most patients were relieved. The full range of their reactions is listed in Table 6.

Patients' intentions on using *Heartcheck*

Twenty-seven patients (68%) identified a total of 50 actions they would take as a result of using the workbook. These are summarized in Table 7. The most prevalent intentions were to increase activity levels, lower blood cholesterol levels, quit smoking and lose weight. Importantly, two subjects reported they were less inclined to change risky behaviours; both were male and less than 45 years of age.

Discussion

Although various risk assessment tools are now widely available and promoted,[1,2,15–23] few studies have assessed whether they are used or even feasible in primary care settings.[15,24,26,36,37] In this study of 20 largely urban teaching practices, only three physicians (15%) had used a coronary risk prediction chart before. Might doctors make better use of risk/benefit data if they were easier to access? To test this hypothesis, Lowensteyn and colleagues offered 455 Ontario and Quebec family doctors an opportunity to use a free, centralized CHD risk appraisal service.[26] To obtain a risk estimate, physicians were asked to record a patient's risk factor data on a standardized form and submit it to the study centre at least 1 week prior to the patient's office visit. In return, they received a one-page printout that displayed the patient's estimated 8-year risk of CHD and the amount by which this risk would be reduced if risk

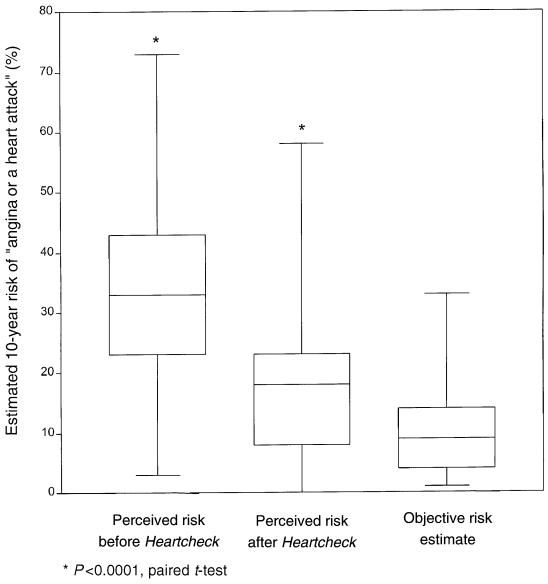

Figure 1 Patients' objective vs. perceived coronary risk before and after using *Heartcheck*.

factors were modified. By the end of the 6-month study, only half of the physicians who were offered the service had used it. Among the authors' recommendations was a call to get patients more involved.[26]

Here we provide some preliminary evidence for the feasibility and acceptability of one approach to involving patients in the risk assessment process. Most of the patients who were given *Heartcheck* completed it on their own, claimed they had learned something, and were willing to recommend it to someone else. Using *Heartcheck* also largely corrected misperceptions patients had about their personal risk. Similarly, all but one physician found *Heartcheck* helpful, and the remainder were willing to use it with an average of 18% of their patients. While our subjects were a select group, even half this proportion represents an important opportunity for education.

That said, physicians believed that *Heartcheck* had some practical limitations. Most important was a lack of formal recognition of the contribution of family history of premature CHD to coronary risk. Although Framingham researchers have not identified 'family history' as an independent risk factor,[38] other groups, such as the US National Cholesterol Education Program, have recommended that physicians consider it when appraising risk in individual patients.[39] This led reviewers to conclude that *Heartcheck* was at odds with current practice and teaching. One possible solution is to simply add 'family history' to the formal risk calculation by assigning it a 'token' weight and appropriately highlighting the caveats. This change would somewhat compromise the accuracy of the risk estimates, but the trade-off in terms of improved utilization may be worthwhile. Larger studies would be needed to determine whether such revisions are justified. A second criticism of the workbook was its reliance on systolic rather than diastolic blood pressure. This also was seen as contrary to

Table 6 Patients' immediate reactions to learning their estimated risk of CHD. $n = 40$ respondents; multiple responses permitted

Response	*n* (% of responses)
Relieved/pleased/comforted	18 (30.5)
Surprised	8 (13.6)
Thought it would be higher	7 (11.9)
None	5 (8.5)
Not surprised	4 (6.8)
Higher than I'd like	3 (5.1)
Thought it would be lower; comfortable after seeing average risk for my age/sex; nice to have verification; surprised that I'm below average risk given that I'm overweight and/or don't exercise	2 (3.4) each
More determined to get my risk down; makes me think; makes me focus on what I need to do; not great encouragement to discover it's lower than expected; seems a lot of effort will reduce my risk very little; seems wrong, I'm a healthy person	1 (1.7) each

Table 7 Patients' intentions on using *Heartcheck* $n = 27$ respondents; multiple responses permitted

Response	*n* (% of responses)
Increase level of exercise	11 (22.0)
Concentrate on lowering cholesterol levels	9 (18.0)
Quit (or not return to) smoking cigarettes	8 (16.0)
Lose weight	7 (14.0)
Watch diet	4 (8.0)
Periodically reassess risk	3 (6.0)
Periodically remeasure BP; begin to take a cholesterol-lowering medication; begin to take an antihypertensive medication	2 (4.0) each
Periodically remeasure blood cholesterol; contact sources listed in workbook to obtain further information	1 (2.0) each

current practice, despite the fact that SBP is a better predictor of vascular events.[38] Finally, several physicians were concerned about the validity of the risk estimates given the workbook's failure to discriminate between light and heavy smokers, or between well-controlled and uncontrolled diabetics. As a group, these concerns, some of which could be mitigated through better physician education materials, apply equally well to most other risk assessment tools based on the Framingham equations.[1,2,16–23] Although both physicians and patients identified literacy and numeracy as potential barriers to *Heartcheck*'s broader application, we did achieve our target self-administration rate of 70%. Whether and how we can improve upon this rate remains to be explored.

One issue that deserves further study is the potential for adverse effects on patients who have multiple risk factors but who, by virtue of their age, are at low absolute risk of a coronary event in the short term. Experience using the workbook with these individuals led physicians to believe that *Heartcheck* might reassure rather than motivate, a phenomenon independently confirmed by our patient interviews (Table 6), and reported by others.[40] One suggestion was to restrict the workbook to patients over 45 years of age, unless they are particularly anxious about their risk. Since high levels of anxiety can interfere with health-seeking behaviour,[30] this could be an unintended but potentially useful role for the workbook.

Ours is not the first study to show that people commonly misperceive their risk of CHD,[41–44] or that these misperceptions can be corrected.[41,45] On the other hand, it may be the first to report such high levels of overestimation. In studies of population samples[41–43] and people screened for CHD risk factors,[44] subjects have been more likely to underestimate than overestimate their risk. Possible reasons for this discrepancy include the fact that prior studies assessed relative risk rather than absolute risk and none involved patients approached by their physicians specifically for the purpose of risk factor counselling. Although we know that providing personalized risk information can help correct people's misperceptions, surprisingly little is known about its effects on subsequent health behaviour. This is due largely to a shortage of well-designed, well-conducted trials.[40] However, other potential problems include the typically weak messages imparted by most health risk appraisal (HRA) instruments (e.g. 'If you adhere to an exercise program prescribed by your doctor, your risk of dying from heart disease will be reduced and you will extend your useful life expectancy by 0.1 years') and a trend towards using HRAs in non-clinical settings, without the support of risk factor counselling.[40]

In the trial by Lowensteyn and colleagues, patients whose counselling sessions were accompanied by coronary risk profiles showed significantly greater 3-month reductions in both blood cholesterol levels and estimated coronary risk, relative to controls.[26] In another trial, Kreuter and Strecher found that, among smokers who received no information about their risk, those who had accurate stroke risk

perceptions at baseline were more likely to have quit smoking 6 months later than smokers whose risk perceptions were overly optimistic.[45] Similarly, those who had pessimistic perceptions of cancer risk were more likely at follow-up to have seen their doctor at least twice in the preceding 2 months than those who had accurate risk perceptions. In this particular study, personal health risk information reduced optimistic bias for perceived stroke risk and pessimistic bias for perceived cancer risk, but had no effect on pessimistic perceptions of stroke risk, optimistic perceptions of cancer risk, or any risk perception biases related to heart attacks or motor vehicle accidents.[45] Taken together, these findings suggest that although individualized risk data may increase the likelihood of certain positive behaviours in some people, perceptions of risk for different diseases also may interact in complex ways. More work is needed to help identify those most likely to benefit from *Heartcheck* and tools like it.

For physicians, one potential benefit of *Heartcheck* may be more efficient use of resources for counselling and follow-up. In the trial by Lowensteyn *et al.* relative to control physicians, those who had access to risk profiles reassessed a larger proportion of higher-risk patients within 6 months of study entry, implying that the profiles improved doctors' ability to target their counselling efforts and/or selectively motivated the higher-risk patients to return.[26] This finding has important implications for practice. Related questions are whether using the workbook affects physicians' actual contact time with patients and what effect, if any, it has on patients' decisions about and adherence to preventive medications. Here we paid physicians to introduce the workbook and to obtain patients' consent to participate. Excluding trial-related discussion, this took an average of about 7 minutes or roughly 40% of the total time physicians spent with subjects. While this kind of commitment would seriously limit the usefulness of *Heartcheck* in actual practice, we believe that strategies to reduce or eliminate this burden could be found, particularly with the help of office staff. Identifying these strategies would be another important objective for future research. If absolute risk thresholds for cholesterol testing or preventive drug therapy were to accompany *Heartcheck*, the resource implications of such thresholds would have to be explored.[46,47]

While this is one of few studies to assess the feasibility of coronary risk appraisal in primary care practice, the study's size and sampling strategy prevent us from drawing firm conclusions about the workbook's broader application. Nevertheless, our results are encouraging. We have shown that, given a simple tool, patients can and will assess their own risk of CHD. At the very least, such tools could help inform otherwise healthy individuals that their risk is increased, allowing them to make more informed decisions about their behaviours and treatment. More work is needed to help identify those most likely to benefit from these tools.

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