

ORIGINAL ARTICLE

## **Patients with acute myocardial infarction have an inaccurate understanding of their risk of a future cardiac event**

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### **Abstract**

**Background:** Accurate perceptions of future cardiac risk are important to ensure informed treatment choices and lifestyle adaptation in patients following myocardial infarction (MI). The aim of this study was to investigate whether risk perceptions of patients with MI were accurate compared with an established clinical risk model.

**Methods:** Seventy-nine consecutive patients with acute MI admitted to the Coronary Care Unit, Auckland Hospital, completed a questionnaire assessing risk perceptions. Clinical data were used to calculate patients' Thrombolysis In Myocardial Infarction (TIMI) risk scores, a validated predictive model of prognosis. The main outcome measures were the associations between perceived risk, TIMI risk scores and troponin T.

**Results:** Patients' risk perceptions showed no correlation with thrombolysis in myocardial infarction risk scores ( $r = -0.06$ ;  $P = 0.61$ ) or with troponin T ( $r = -0.07$ ;  $P = 0.53$ ). Patients' risk perceptions were not significantly associated with age or sex, and were not significantly higher in those who had experienced a previous MI, a family history of coronary heart disease, diabetes or smokers. Higher perceived risk was significantly associated with a number of illness perceptions, including worse consequences of the MI and lower beliefs in the benefit of treatment. Patients who overestimated their risk were more anxious than other patients ( $F(2, 73) = 22.97$ ;  $P = 0.0001$ ).

**Conclusion:** Patients with MI ideas about their personal risk of future MI are not congruent with their clinical risk assessments. Inpatient hospital care appears to be unsuccessful in communicating prognosis effectively to patients. Improving the accuracy of risk perceptions may help decrease unnecessary cardiac anxiety and invalidism in some patients and prompt risk-reducing behaviours in others.

### **Introduction**

Patients need to know the risks associated with their condition and with the treatment options so that they can make informed health-care decisions. A critical part of the medical professional's role is to help patients understand those risks.<sup>1</sup> Patients' personal assessment of the

threat their illness holds for their future health is central to their adherence to treatment and other behaviours perceived to reduce risk.<sup>2</sup> For patients with myocardial infarction (MI), the perceived likelihood of a future MI is a powerful motivating factor in the acceptance of more aggressive cardiology treatments and the subsequent adoption of a change in lifestyle.

But how accurate are MI patients' assessment of their risk of a future MI? Patients' illness beliefs are, by their nature, private and patients are rarely asked in medical consultations for their own assessments of the threat of their current illness to their health and long-term survival.

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In this study, we investigated the correlation between patients' perceptions of risk of a future MI and their actual risk, based on an established prognostic model.

The Thrombolysis In Myocardial Infarction (TIMI) risk score is an established risk stratification tool for patients presenting with acute MI.<sup>3</sup> The TIMI score is based on the sum of several emergency room indicators for both non-ST-elevation myocardial infarction (non-STEMI) and ST-elevation myocardial infarction (STEMI). Risk of future cardiac events increases in a linear fashion with increasing TIMI scores and this has been validated in several studies.<sup>3-7</sup> We also compared patients' risk perceptions with their cardiac troponin T levels, another important indicator of cardiac risk.<sup>8</sup>

Optimally, patients being discharged from a coronary care unit after treatment for acute MI would have developed an accurate idea of their future risk from their interactions with clinical staff and the information provided during their hospital stay. This perception of risk would form the basis for their decisions about future treatment and for assessing the subsequent effect of the illness on their life. The assessment of risk also influences the emotional response and reaction to the illness in the patients and their families. In this study, we aimed to investigate whether patients with MI at discharge from hospital had an accurate perception of their future risk of MI compared with TIMI risk assessments and troponin T levels.

## Methods

### Study group

One hundred consecutive patients admitted for acute MI to the Coronary Care Unit at Auckland Hospital, New Zealand were informed about the study and were invited to participate in it. Four patients declined and 96 consented. The consenting patients were given the questionnaire to complete on the morning of their discharge (median length of stay was 7 days; interquartile range was 5–10 days). Seventeen of these patients did not return their questionnaire to the researcher before leaving the hospital. Of the 79 participants who returned their questionnaire, 64 were men and 15 were women. The mean age was 59 years (standard deviation (SD) 11.6). An independent samples *t*-test showed that there were no significant differences in age between participants and non-participants (mean 58.9 (SD, 11.6) vs mean 62.9 (SD, 14.7); *t*(97) = -1.29; *P* = 0.20. There were also no significant differences in sex between groups (64 men/79 participants vs 16 men/20 non-participants (no information was recorded for one non-participant)),  $\chi^2(1, n = 99) = 0.04$ , *P* = 0.84. The ethnicities of the non-

participants were European (16), Maori (1), Pacific Islanders (1) and Asians (2).

The study was designed to detect moderate agreement (correlation of at least 0.3) between clinical risk and the perception of risk.<sup>9</sup> Assuming conventional power (80%) at the 5% significance level, at least 67 individuals would be required. More patients were recruited to allow for non-return of questionnaires.

Most participants were European (72%; 57/79), 13% (10/79) were Asian or Indian and 15% (12/79) were Maori or Pacific Islanders. Fifty-seven participants had experienced a non-STEMI and 22 had experienced a STEMI. Nineteen participants had already had a previous MI, 33 were current smokers, 17 had diabetes mellitus and 40 had a family history of coronary heart disease. Forty of the patients were revascularized during their hospital stay. On 28 of them, an angioplasty was carried out whereas 12 underwent bypass surgery.

Auckland Public Hospital is a secondary referral centre for cardiac patients. In addition to being in contact with medical staff, patients admitted with an acute coronary syndrome have an in-hospital cardiac rehabilitation bedside visit from a dedicated cardiac rehabilitation nurse, which lasts for approximately 30 min. During the session, patients are given a number of pamphlets on exercise, diet, cholesterol management and angina and a chart on risk factors, including smoking, blood pressure, cholesterol, weight, diabetes, exercise, stress, family history and age. Patients are routinely invited to attend a post-discharge 6-week outpatient cardiac rehabilitation course.

Ethical approval for the study was granted by the New Zealand Ministry of Health Ethics Committee. Written informed consent was obtained from all patients.

### Perceived risk and illness perceptions

Perceived risk was assessed by the following question, 'What do you feel is the likelihood of you having a heart attack over the next 12 months?' Patients responded on an 11-point Likert scale ranging from 0, 'not at all likely' to 10, 'completely certain'. We also assessed patients' perceptions of their ability to reduce future personal risk, 'How much do you feel you can help reduce your risk of having another heart attack?' from 0, 'not at all' to 10, 'a great deal' and their perceptions of the need to reduce their future activities, 'How much do you think you will have to restrict your activities in the long term due to your heart condition?' from 0, 'not at all' to 10, 'enormously'.

In the Common Sense Model of illness, patients' hold cognitive representations of the threat their illness holds for them and these representations determine illness behaviour.<sup>10</sup> We assessed patients' illness representations using the Brief Illness Perception Questionnaire, which

assesses ideas about illness identity (symptoms associated with the illness), time-line of the illness, personal ability to control the illness, beliefs about the ability of treatment to control the illness, consequences of the illness, as well as overall understanding and concern about the illness and the emotional response, including anger, fear, depression and distress.<sup>11</sup>

### TIMI scores

TIMI risk scores were calculated for each patient using medical notes by researchers blind to patient responses on the rating scales. The TIMI score is based on the sum of several emergency room indicators for patients of both STEMI (e.g. age, history of diabetes or hypertension or angina, systolic blood pressure, heart rate, Killip class, weight, anterior STEMI or left bundle branch block and time to treatment) and non-STEMI (e.g. age, risk factors for coronary artery disease (CAD), known CAD, severe angina symptoms, aspirin use in the past 7 days, ST segment deviation and elevated serum cardiac markers).<sup>3,4</sup>

### Troponin T

Patients' peak troponin T levels from blood specimens were recorded as independent markers of risk.<sup>8</sup>

### Statistical analysis

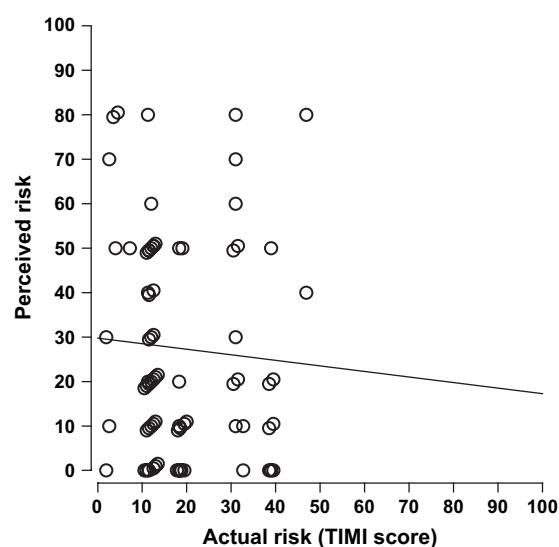
Data were analysed using SPSS version 11.5 (Chicago, IL, USA). Non-STEMI and STEMI patients were combined into a single sample for statistical analysis. We investigated the influence of sex, traditional risk factors and revascularization treatment on the perceived risks of patients with MI by conducting Student's *t*-tests for pairwise comparisons and one-way ANOVA with post-hoc Tukey tests for multiple comparisons between groups. TIMI risk scores were converted into rates of mortality/non-fatal re-infarction based on previous 12-month outcome trials.<sup>4,6</sup> Patients' risk perceptions on a 0–10 scale were multiplied by 10 to allow comparison between perceived risk and calculated risk from TIMI scores. Pearson correlations were calculated to investigate the correlations between perceived risk, TIMI risk assessment, troponin T and other illness perceptions. Accuracy scores were calculated by subtracting the patients' perceptions of risk from their calculated risk based on TIMI scores.

## Results

We first investigated the association between patients' perceived risk and their TIMI risk scores. We found no relationship between perceived risk and TIMI risk scores

( $r = -0.06$ ;  $P = 0.61$ ) as shown in Figure 1. Similarly, there was no relationship between perceived risk and troponin T levels ( $r = -0.07$ ;  $P = 0.53$ ). The patients' ages were also unrelated to their perceived risk ( $r = -0.04$ ;  $P = 0.70$ ). Neither were there differences in perceived risk between men and women nor between those with or without traditional risk factors (Table 1). The treatment was unrelated to perceived risk, with no significant differences in risk perceptions between those who received medication only, angioplasty or bypass surgery (Table 1). Length of hospital stay was not significantly related to risk perceptions ( $r = -0.17$ ;  $P = 0.14$ ).

We then investigated how perceived risk and TIMI risk scores were related to illnesses perceptions held by patients with MI. Patients' perceptions of their MI were in most instances unrelated to TIMI risk scores and troponin T levels, except in two cases; higher TIMI risk scores were associated with lower emotional distress and a lower belief in the benefits of treatment (Table 2). However, illness perceptions were consistently related to the perceived risk of a future MI. Higher risk perceptions were significantly associated with a longer perceived duration of their heart condition, higher perceived consequences of the heart attack on their lives, lower perceptions of personal control, lower perceptions that treatment would be helpful, poorer understanding of their condition, higher emotional distress about the MI, a lower belief in own ability to reduce risk and higher perceptions of need to restrict activities. Consistent with the finding that patients' risk perceptions were unrelated to their clinical risk, their risk perceptions were also unrelated to their reported severity of symptoms.



**Figure 1** Plot of patients' perceptions of risk compared with calculated TIMI risk scores.

**Table 1** Perceptions of risk between groups on sex, ethnicity, smoking, family history, previous MI, STEMI/non-STEMI and revascularization treatment

Factor	Perceived risk (mean (95%CI))	Significance
Male	2.7 (2.1–3.3)	0.74
Female	2.9 (1.3–4.5)	
European	2.8 (2.2–3.4)	0.73
Non-European	2.6 (1.5–4.7)	
Smoker	2.4 (1.6–3.2)	0.31
Non-smoker	3.0 (2.2–3.7)	
Positive family history	2.7 (2.0–3.4)	0.88
Negative family history	2.8 (1.8–3.7)	
Previous MI	2.9 (1.6–4.2)	0.76
No previous MI	2.7 (2.1–3.3)	
Diabetes mellitus	2.0 (0.7–3.3)	0.15
No diabetes mellitus	3.0 (2.3–3.6)	
STEMI	3.4 (1.9–4.8)	0.13
Non-STEMI	2.5 (1.9–3.1)	
Medication only	2.6 (1.8–3.3)	0.90
Angioplasty	2.8 (1.9–3.7)	
Bypass surgery	2.7 (1.4–4.1)	

MI, myocardial infarction; STEMI, ST-elevation myocardial infarction.

The mean perceived likelihood of a heart attack within the next 12 months was 2.74 (range, 0–8; SD, 2.38). The accuracy of the patients' risk perceptions, calculated by subtracting perception from TIMI risk score, produced an approximately normal distribution with almost equal numbers of those who underestimated their risk and those who overestimated theirs. To investigate how anxiety was related to the perception of risk, patients were split into three equal groups; an overestimating group, a broadly accurate group and an underestimating group. A one-way ANOVA showed a significant difference between groups on mean reported worry about a future heart attack,  $F(2, 73) = 22.97$ ;  $P = 0.0001$ . Tukey post-hoc comparisons showed that overestimators were significantly more anxious about another heart attack (Mean = 6.52; SD = 2.07)

**Table 2** Pearson's correlations between TIMI scores, troponin T, perceived risk and other illness perceptions

Perception	TIMI risk	Troponin T	Perceived risk
Ability to reduce risk	-0.13	-0.20	-0.29*
Need to restrict activities	0.17	0.09	0.40**
Brief illness perception questionnaire			
Identity (symptoms)	0.01	-0.15	0.11
Timeline	0.07	-0.13	0.36**
Consequences	0.13	0.03	0.33**
Treatment control	-0.25*	0.02	-0.34**
Personal control	-0.07	-0.14	-0.27*
Understanding	0.00	-0.14	-0.27*
Concern	0.22	-0.14	0.16
Emotional representation	-0.27*	-0.11	0.37**

\* $P < 0.05$ ; \*\* $P < 0.01$ .

than both underestimators (Mean = 1.78; SD = 2.17) and those who were more accurate (Mean = 3.28; SD = 3.21).

## Discussion

This study found that patients' perceptions of risk were unrelated to their risk assessments from established clinical indicators. Perceived risk was also not associated with traditional risk factors, such as being a smoker, having a family history of coronary disease or even having had a previous MI. These results are not explained by an optimistic bias where individuals tend to systematically underestimate threats to their health.<sup>12</sup> Instead, these results show no relationship at all between patient and clinical risk assessment. A number of patients with a good prognosis and a low likely risk of a future MI believe that they are at high risk. Perhaps, of more concern is the number of patients with higher TIMI scores who perceive themselves to be of low risk of a future MI.

It is important to note that patients' subsequent adoption of treatment and changes in lifestyle will be based on their own perception of risk rather than clinician assessments of risk and TIMI scores. The strong associations between patients' perception of risk and their perceptions of their illness emphasize this point. These data show patients' perceptions of risk, although inaccurate, are logically consistent. Thus, patients with a higher perceived risk also assess their illness as lasting longer, having a greater effect on their life, being less amenable to control through personal effort or treatment and have a greater perceived need to restrict activity.

It is worth considering how, after spending a median of 7 days in hospital, the MI patients' perceptions of risk could be so inaccurate. There are at least three possible reasons for this finding. First, we know from previous research that illness perceptions are formed early in the hospital stay and these perceptions may act as a strong cognitive schema through which subsequent information is evaluated and may be discarded as being inconsistent with the patients' perceptions of the illness.<sup>13</sup> Second, mood can be a source of information in its own right as people rely on their feelings about a future MI when making judgements about their risk.<sup>14</sup> Those who have highly negative feelings about having another heart attack associate the event with greater risk. Finally, clinicians may be ineffective in communicating risk. Many doctors, as well as patients, have difficulty in understanding statistical information and few doctors have any training in risk communication.<sup>15,16</sup> Many doctors working in cardiac wards will not realize how inaccurate their patients' perceptions of future risk are.

Efforts to improve patients' understanding of risk may help prompt behavioural change in patients who do not

realize their high-risk status. High-risk perceptions have been linked to both desire to change and actual behavioural change, including smoking cessation, exercise and medication compliance.<sup>2,17,18</sup> At the other end of the scale, improving patients' understanding of risk will probably reduce anxiety and invalidism in patients who perceive their risk to be much higher than is clinically indicated. Symptoms of anxiety are a prevalent persisting problem in patients following MI.<sup>19</sup>

Clinical risk in this study was assessed by the TIMI score and troponin T level, two of the best prognostic indicators available following MI. However, it should be noted that the TIMI score is calculated from admission markers and does not include events during the course of hospitalization, which is a limitation of the TIMI score. It is interesting that patients' perceptions were not only unrelated to clinical risk, but were also unrelated to length of hospital stay and revascularization treatment received. The study was conducted at New Zealand's largest hospital, where patients receive cardiac care of international standards. The results are therefore likely to be highly generalizable to other cardiac units as well as general hospitals with no specialist cardiac units.

A limitation of this research is that we do not know how patients form their risk perceptions. Further research could investigate the reasoning (or lack of reasoning) behind patients' perceptions and their understanding of any information provided by medical staff.

The study is an important base for further action. A challenge for future research is to find ways to present information in a manner patients understand. There are many strategies available that can improve the communication of risk; yet, few studies have investigated whether these strategies can improve patients' understanding.<sup>15</sup> It needs to be investigated whether a targeted in-hospital intervention to educate patients about their personal risk from calculated TIMI scores can improve the accuracy of risk perceptions. Research also needs to monitor the effects of such an intervention on cardiac anxiety and health behaviours, such as adherence to medicines and lifestyle changes.

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