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# Comparative optimism among patients with coronary heart disease (CHD) is associated with fewer adverse clinical events 12 months later

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**Abstract** The current study evaluates the levels of comparative optimism among patients with coronary heart disease (CHD) and examines its relationship to health outcomes 12 months later. 164 patients completed self-report questionnaires at the end of cardiac rehabilitation and the number of adverse clinical events in the following 12 months were recorded. Comparative optimism was assessed in relation to a typical other who has not had cardiac event, a typical other who has had the same cardiac event as the respondent, and a typical member of the cardiac rehabilitation class. Clinical-demographic details and distress were assessed. Participants were comparatively optimistic in all three ratings. Logistic regression (controlling for age, gender, co-morbidities, and distress) revealed that higher levels of adverse events were associated with older age, being male, and lower levels of overall comparative optimism. Comparative optimism was associated with decreased risk of adverse clinical events in the year following cardiac rehabilitation attendance.

**Keywords** Comparative optimism · Unrealistic optimism · Coronary heart disease · Cardiac rehabilitation

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## Introduction

A considerable number of self-related biases in social comparison and social cognition have been identified within the psychological literature (Hoorens, 1993). For example, people tend to estimate their own probability of experiencing adverse outcomes, including illness, to be lower than that of the average person (Weinstein, 1984). This tendency has been referred to as "comparative optimism" as the majority of individuals should not be at lower than average risk in comparison to members of the same population, assuming the risks are characterised by a normal probability distribution. Although the phrases unrealistic optimism and comparative optimism are used interchangeably to describe this bias, in line with Radcliffe and Klein (2002) the present papers uses the term comparative optimism as some individuals who rate their risk as below average will have a risk factor profile that puts them at below average risk, and consequently it would be inappropriate to label them as unrealistic.

Optimistic biases also include dispositional optimism, which is a generalized positive expectancy that one will experience good outcomes and attain one's goals successfully (Peterson, 2000); it is a relatively stable trait that is consistent across time and situations (Carver et al., 2010). Dispositional optimism has been significantly associated with various health outcomes, including lower levels of mortality and cardiovascular events (Rasmussen et al., 2009). In addition to this general expectancy, people can have situational optimism, i.e., have optimistic expectancies about specific events (Armor & Taylor, 2002). Comparative optimism involves a social comparison as one must judge how one's susceptibility compares with that of other people; consequently dispositional optimism is an orientation that cannot be said to be accurate or inaccurate, whereas comparative optimism may reflect a biased perception (Radcliffe & Klein, 2002).

There is some evidence that the degree of comparative optimism is related to dispositional optimism (Radcliffe & Klein, 2002). For example, Hamid (1990) found that, compared to students with low dispositional optimism scores, students with high optimism scores felt that they were less likely to contract the flu in the next 6 months. Similarly, O'Brien et al. (1995) found that compared to participants with lower dispositional optimism scores, participants with higher optimism scores felt that they were less likely to experience hypertension. However, other studies have reported only small or no relationships between dispositional optimism and optimism about specific events (e.g., Davidson & Prkachin, 1997; Goodman et al., 1995; Nezlek & Zebrowski, 2001; Taylor et al., 1992). For example, dispositional optimists did not display more comparative optimism that non-optimists (Lipkus et al., 1993). Armor & Taylor (2002) noted that in general, the relationship between dispositional and situational optimism was modest; for example, the correlation between optimistic risk perceptions and global optimism is weak, ranging from $r = 0.14$ to 0.33 (Klein & Zajac, 2008).

Even when provided with modest (Massey et al., 2011) and large (Simmons & Massey, 2012) monetary incentives to be accurate, people judge a preferred outcome to be more likely than a non-preferred outcome: such optimism persists despite extensive provision of feedback on judgements. It has been reported that CO is stronger for negative than for positive events (e.g., Eiser et al., 2001) and characterizes expectations about both spontaneously generated and researcher-selected events (Hoorens et al., 2008). However, at times people can demonstrate comparative pessimism when making comparative ratings on both direct (e.g., Kruger, 1999) and indirect rating scales (e.g., Johansson & Allwood, 2007) in diverse domains, including competitive situations (Windschitl et al., 2003), coping with negative life events (Blanton et al., 2001) and games of chance (Lin et al., 2004).

Cognitive and motivational explanations have been put forth for comparative optimism (e.g., Shepperd et al., 2002). Believing that one is not as likely to experience negative events as typical others is ego-defensive and promotes positive self-esteem (Taylor & Brown, 1988). In support of such an explanation, high levels of comparative optimism are reported for negative events with severe consequences (e.g., Helweg-Larsen & Shepperd, 2001). It should be noted that motivational accounts cannot explain findings for comparative pessimism; for example Moore and Small (2007) propose a differential information explanation to account for such findings, based on the fact that that people typically have better information about themselves than they do about others. Sweeny et al. (2006) note that departures from optimism can arise in response to information and/or the possibility that things might not turn out as hoped.

Non-motivational accounts of comparative judgements have focused on how information for the self and others is represented and processed by the individual (Chambers & Windschitl, 2004). Egocentric biases mean that people attend to factors that affect their own standing but fail to make allowances for the impact of the same factors on others (Kruger, 1999). For example, people tend to believe that their levels of personal control over events can be changed, whereas perceptions of the average person's control are not as changeable (Menon et al., 2009). The degree of comparative optimism generally decreases as the target with whom participants are comparing themselves becomes more specific; for example, higher levels are generally produced when the target is a generic "typical other" than when the target is a close friend.

Recent research has begun to examine the neurobiological basis of optimistic biases; for example, activity in rostral anterior cingulate cortex (rACC) and amygdale mediated optimistic beliefs about positive future events (Sharot et al., 2007). Brain areas involved in emotional processing selectively reduce their activity when people think about negative future events, and coordinate activity when people think about positive future events (Schacter & Addis, 2007). Optimism in response to new information regarding the risk of future negative events was related to a failure to generate a learning signal in a region of the frontal cortex (right IFG) when confronted with the evidence that negative events are more likely to occur than predicted (Sharot et al., 2011). Sharot et al. (2012) recently reported that the incorporation of undesirable information into one's forecasts of the future is impaired when dopamine levels are enhanced, resulting in an underestimation of the likelihood of negative events and increasing optimistic bias.

Although comparative optimism may be beneficial insofar as it may promote positive affect (Taylor & Brown, 1988), it may inhibit motivation to change health behaviours. Those high on comparative optimism report low interest in adopting precautionary health behaviour (e.g., Hoorens, 1995; Kulik & Mahler, 1987). Comparatively optimistic middle-age adults report poorer CHD health behaviour profiles (Radcliffe & Klein, 2002) and comparative optimism predicted decreases in exercise over time in college students (Davidson & Prkachin, 1997). Dillard et al. (2006) reported that those with comparative optimism were less likely to plan on quitting smoking; Zlatev et al. (2010) note that comparative optimism presents smoking cessation campaigns with a problem because people will think any negative health-related messages apply more to other smokers than themselves, which may result in message discounting.

In one of the few studies to examine comparative optimism among a chronically ill population, more than one-third of those with CHD assessed themselves to be at lower

risk of Myocardial Infarction (MI) than an average person of the same age and sex; nearly half of women and more than half of men regarded themselves to be at lower risk for MI compared to an average person with CHD (Aalto et al., 2007). The consequences of comparative optimism among cardiac patients remain unclear. Therefore, the aim of the current study is to to evaluate the levels of comparative optimism among patients with CHD and to examine their relationship to health outcomes 12 months later. In addition, comparative optimism in relation to three targets, varying in specificity, is investigated.

## Method

### Participants

Cardiac patients (i.e., those who experienced a MI, Coronary Artery Bypass Surgery (CABG), Percutaneous Coronary Intervention (PCI), valve surgery, or diagnosed with stable angina) eligible for standard cardiac rehabilitation (CR) were invited to participate. There were no age or gender restrictions. Patients were excluded on the basis of underlying significant orthopaedic, neuromuscular, visual, cognitive or psychiatric condition that would preclude CR participation. In addition, participants were excluded if they could not speak or read English, or if they had already participated in an outpatient CR programme. Of those eligible for CR in the hospital, the uptake rate during study recruitment was 72 % (n = 257). The majority of patients met the inclusion criteria (n = 236) and of those excluded (n = 21) most were excluded on the basis of having already participated in a CR programme (n = 19).

### Procedure

The study was based at a large hospital that routinely provides multifactorial CR including group-based exercise training, psychological sessions, educational sessions, dietary sessions, and pharmacological sessions. Patients completed a questionnaire at the end of a cardiac rehabilitation programme and a second questionnaire 12 months later. Ethical approval for the study was obtained from the relevant Institutional Review Boards in both the Hospital and University.

### Measures

A variety of demographic details (gender, age, education history, employment, occupation) and medical information regarding the participant's most recent cardiac event and previous event history were recorded.

#### *Comparative risk questions*

Using three items, participants were asked to rate their perceived risk of experiencing a cardiac event in comparison to three targets: (1) a typical other who has not had cardiac event, (2) a typical other who has had the same cardiac event as the respondent, and (3) a typical member of the cardiac rehabilitation class. Responses were recorded on a 7 point scale, ranging from "extremely less likely" to "extremely more likely". Data were coded so that negative numbers represent comparative optimism, zero represents a neutral response, and positive numbers represent comparative pessimism. Test–retest reliability for the items over a 3 month period post-CR was as follows: typical other without cardiac event $r = .57$; typical other with CHD $r = .65$; and typical other in CR class $r = .63$.

#### *Psychological distress*

The Hospital Anxiety and Depression Scale (HADS) is a widely used 14-item instrument developed to detect states of anxiety (7 items) and depression (7 items) in medical outpatients (Zigmond & Snaith, 1983). The psychometric properties and the clinical utility of the HADS in cardiac populations have been established (Bjelland et al., 2002). In the present study, Cronbach's alphas (depression $\alpha = .74$; anxiety $\alpha = .83$) were satisfactory.

#### *Health outcomes*

At time 1, participants completed a questionnaire assessing medication status, smoking status, dietary and exercise behaviour. At time 2, adverse cardiac events (ACEs) during the past 12 months were recorded from hospital medical records and GP records. Adverse clinical events included: readmitted to hospital for chest pain/angina, experience a fatal or non-fatal MI, require coronary intervention (PCI or CABG).

### Analysis

To test for differences between those who completed the study versus those who dropped out, MANOVAs and *t* tests were conducted on continuous data and Chi square tests on categorical data. Similar analyses examine differences in the comparative optimism items based on gender, type of cardiac event or education level. Pearson correlations quantified the relationships between variables. One sample *t* tests were conducted to determine if the mean for each of the three comparative optimism items was significantly different to a neutral mean of 0. A repeated measures ANOVA examined differences in the ratings across the

three comparison targets. Independent samples $t$ tests compared the mean comparative optimism ratings for the three items between those who experienced an ACE versus those who did not.

To determine the unique predictive power of comparative optimism in terms of experiencing an ACE, a hierarchal logistic regression was conducted. Given the potential for multicollinearity between the three comparative optimism items, a composite measure was formed by combining the items[1]. On the first block of the regression, age, gender, co-morbidities, and initial distress (total HADS score) were entered as covariates. On the second block, the comparative optimism composite was entered to determine if it enhanced the model's predictive ability.[1] The model was examined in terms of statistical significance, the amount of variance in ACE status explained (both Cox & Snell and Nagelkerke estimates are reported) and the classification accuracy of the model (see O'Connell & Amico, 2010) as it offers additional information to that included in the measures of association.

## Results

Of the 236 consecutive CR patients invited to participate in the study, 201 provided time 1 data, and 164 patients provided time 2 data. MANOVA revealed no significant difference between those who completed the study versus those who dropped out in relation to the three CO items and psychological distress (anxiety and depression), Wilk's $\lambda = 0.99$, $F(5,191) = .40$, $p = .85$; similarly, no differences were found in relation to age, $t(199) = -1.15$, $p = .25$, or gender, $\chi^2(1, n = 201) = 0.89$, $p = .35$. The sample (n = 164), with a mean age of 61.7 years (SD = 8.7), was predominantly male (76 %). Approximately half (47 %) of the participants completed only primary level of education and a further third (32 %) completed secondary level. Over one-third (37 %) were in full-time employment. On average patients started rehabilitation 11 weeks (SD = 6.8 weeks) post their most recent event, which included CABG (50 %), PCI (22 %), MI (16 %) or valve surgery (12 %). Of note, approximately one-third (31 %) reported having a previous cardiac event and 15 % had previous history of angina; the vast majority of patients were in either NYHA class I (54 %) or II (35 %), with the remainder being in class III (11 %). Thirty percent had a Body Mass Index greater than 30, almost two-thirds (61 %) had hyperlipidemia, one third had hypertension and 8 % had diabetes. At time 1, the mean depression scores was 4.3 (SD = 3.1) and anxiety score was 7.67 (SD = 4.7).

One-sample $t$ tests revealed that the means for the three comparative risk (typical other without cardiac event: $M = -0.36$ [SD = 1.76], $t(163) = 2.62$, $p < .01$; typical other who has had the same cardiac event: $M = -0.54$ [SD = 1.53], $t(163) = 4.50$, $p < .001$; typical other members of the CR class: $M = -0.71$ [SD = 1.48], $t(163) = 6.14$, $p < .001$) questions were statistically significantly different to the neutral value of zero, indicating a comparatively optimistic bias in the sample. A repeated measures ANOVA found significant differences in the CO ratings across the three targets, $F(2,292.09) = 3.81$, $p < .05$, $\eta^2 = .03$; post hoc Bonferroni tests revealed that participants were significantly ($p < .05$) more comparatively optimistic relative to the member of CR class than to the member of the public who has not had a cardiac event. No other differences emerged.

There were no significant differences in any of the comparative risk items based on gender, type of cardiac event or education level; Table 1 presents the correlations between age, the comparative optimism items, and mood.

Neither age nor depression were significantly associated with any of the items. However, anxiety was significantly associated ($r = .20$, $p < .05$) with lower levels of comparative optimism in relation to a member of the cardiac rehabilitation class.

### Adverse clinical events

Medical records revealed that 24 % (n = 39) experienced an ACE (e.g., readmitted for chest pain/angina: n = 22, PCI: n = 8, fatal MI: n = 4; non-fatal MI: n = 3; CABG: n = 2). Those who experienced an ACE were significantly less optimistic at time 1 about their future risks than those who were event free ($M = 0.02$ vs. $M = -0.77$ respectively) in relation to typical other who had the same cardiac event, $t(162) = 6.12$, $p < .001$, Cohen's $d = 0.49$, and ($M = 0.05$ vs. $M = -0.74$) compared to other members of the cardiac rehabilitation class, $t(162) = 5.74$, $p < .001$, Cohen's $d = 0.53$. In comparison to the event-free group, at time 1 those who experienced an event were significantly more depressed ($M = 9.89$ vs. $M = 6.80$), $t(154) = 3.80$, $p < .001$, Cohen's $d = 0.78$, and more anxious ($M = 6.11$ vs. $M = 3.94$), $t(158) = 3.75$, $p < .001$, Cohen's $d = 0.67$. There was no difference between the groups in relation to the comparative item for a typical other who has not had cardiac event, $t(162) = 1.01$, $p =$ NS, Cohen's $d = 0.19$.

Logistic regression, controlling for age, gender, co-morbidities, and initial distress (anxiety and depression), examined the unique predictive power of the comparative optimism index in terms of experiencing an ACE. The comparative optimism index was based on a Principal

[1] We wish to thank an anonymous reviewer for suggesting such an approach.

**Table 1** Correlations between age, CO items and mood

| | CO1 | CO2 | CO3 | Anxiety | Depression |
|---|---|---|---|---|---|
| Age | .02 | −.04 | −.13 | −.14 | −.23 |
| CO1: typical other no cardiac event | – | .69*** | .55*** | .03 | .07 |
| CO2: typical other same cardiac event | | – | .59*** | .11 | .12 |
| CO3: typical other in CR class | | | – | .20* | .15 |
| Anxiety | | | | – | .52 |

*CO* comparative optimism item

* $p < .05$, *** $p < .001$

**Table 2** Logistic regression results

| Variable | B (SE) | OR | 95 % CI |
|---|---|---|---|
| Age | 0.08 (0.03)* | 1.09 | 1.06,1.19 |
| Gender[a] | 1.26 (0.52)* | 2.96 | 1.33,7.88 |
| Comorbidities[b] | 1.04 (0.60) | 2.42 | 0.77,9.06 |
| Distress | 0.04 (0.05) | 1.01 | 0.88,1.14 |
| Comparative optimism composite | −0.89 (0.29)** | 0.44 | 0.15,0.64 |

* $p < .05$; ** $p < .01$

[a] Female is the reference class

[b] Having no co-morbidities is the reference class

Axis Factor analysis, which extracted one factor that accounted for 68 % of the variance, and had a high internal consistency ($\alpha = .86$). Prior to including the comparative risk items, the model was significant: $\chi^2(4, n = 156) = 33.25$, $p < .001$, and estimates of the amount of variance accounted for in ACE classification ranged between 18 % (Cox & Snell) and 27 % (Nagelkerke). The model correctly classified 77 % of cases as having experienced an ACE or not. The model remained significant after including the comparative optimism measure: $\chi^2(5, n = 156) = 50.44$, $p < .001$, and the amount of variance explained ranged between 26 % (Cox & Snell) and 39 % (Nagelkerke); the model accurately predicted 81 % of the participants' ACE status (See Table 2). Higher levels of adverse events were associated with older age, being male, and less comparative optimism.

## Discussion

The current sample of patients with CHD were characterised by comparative optimism in relation to three targets: a typical other who has not had cardiac event, a typical other who has had the same cardiac event as the respondent, and a typical member of their CR class. Participants were significantly more comparatively optimistic relative to the more specific target figure (member of CR class) than to the more abstract general target (member of the public who has not had a cardiac event). Contrary to previous evidence, the tendency for optimistic comparisons was not reduced when a more specific and concrete target was used (e.g., Harris & Hahn, 2011; Klein & Weinstein, 1997). In order to maintain favourable perceptions of their own risks respondents may have focused on high-risk others in the reference categories; however, the actual target figures and their characteristics selected by the respondents is not known. Contrary to past research (see Helweg-Larsen & Shepperd, 2001) past experience with CHD did not decrease optimism; however the present findings are in line with those of Aalto et al. (2007) who documented comparative optimism among cardiac patients relative to an average person of the same age and sex and an average person with CHD. Think aloud methods may provide insight into what information people draw on to arrive at such comparative ratings (e.g., French & Hevey, 2008).

Low levels of comparative optimism were associated with increased risk of experiencing an ACE. This relationship held after controlling for gender, age, co-morbidities and distress. Consequently those participants who thought they were less at risk relative to general and specific targets turned out to be less at risk. Those who experienced an ACE appear to have had a more realistic appraisal of their risk of future negative events. Of note, realistic acceptance, based on disease-specific expectancies, was associated with increased mortality among patients with AIDS (Reed et al., 1994). A realistic perspective in judgments of self versus other has been associated with depressive realism wherein healthy people have a positive bias towards self ratings compared to other ratings, whereas those with depression/depressive tendencies are more positive about others than self, and have a relatively realistic perceptions of self ratings (e.g., Pyszczynski et al., 1987). For example, those classified as dysphoric are more accurate in predicting which negative life events they experience than non-dysphoric participants (Kapçi & Cramer, 1998). However, recent meta-

analysis, although finding a small effect of depressive realism, notes that the contextual and individual factors that underpin depressive realism remain to be determined (Moore & Fresco, 2012). The realistic appraisal of health risk may be related to findings elsewhere that self-rated health predicts mortality among various populations (Idler & Benyamini, 1997), with some studies reporting that the short-term association is stronger than long-term association (e.g., Singh-Manoux et al., 2007). Consequently it appears as if some cardiac patients were accurate in not being comparatively optimistic regarding their chances of experiencing an ACE.

Those who were realistic may have failed to engage in appropriate precautionary health behaviours; comparative optimism regarding progression of the AIDS virus was associated with higher levels of health-enhancing behaviours (Taylor et al., 1992). Menon et al. (2009) found that when people felt more control over their outcomes, they were more optimistic about their prospects and hence more likely to act. In contrast, people who are not optimistic are likely to feel less control and hence are less likely to take action. Thus, low comparative optimism driven by perceptions of low control may be de-motivating, resulting in low levels of precautionary health behaviours that may have placed the present sample at increased risk.

To date most of the literature on comparative optimism has focused on the extent to which it reflects motivational versus non-motivational processes. More recently, research has begun to examine the neurobiological basis of optimistic biases. However the existence itself of comparative optimism has been challenged by Harris and Hahn's (2011) suggestion that reports of comparative optimism may reflect statistical artefacts rather than a genuine bias. They note that as many studies ask people about the likelihood of experiencing rare negative events, it is indeed realistic, rather than optimistic, for the majority of respondents to report that their chance of experiencing the event is less than the average person's chance. In the present context, it is notable that majority of the sample (over three quarters) did not experience an ACE. Harris and Hahn also highlight how the choice of an attenuated response scale (typically 7-point scale) could be responsible for the results most commonly interpreted as demonstrating unrealistic optimism: if the event is rare, then the response options should capture potential extreme responses, which require scales with much larger ranges than 7 points. For example, greater optimism was observed when participants are given an attenuated (9 point scale) scale than when they are given a larger (201 point) scale (Otten & van der Pligt, 1996). In addition, they note that base rate regression, wherein people generally overestimate the frequency of rare events and underestimate the frequency of common events, can produce averages for samples that suggest relative optimism. To overcome these limitations the authors suggest that research on comparative optimism can be strengthened by using scales with broader ranges (e.g., −100 to 100) to reduce the confounding impact of scale attenuation. In addition, provision of accurate base rate statistics for the population against whom participants are to compare themselves. Furthermore, the authors endorse longitudinal studies to compare individuals' expectations with the outcomes experienced.

The present study is one of the few longitudinal studies on comparative optimism in a chronic illness population. The findings suggest that although the sample overall displayed comparative optimism, those who experienced an ACE actually had a realistic appraisal of their risk. As an ACE was rare negative event, such findings are in line with Harris and Hahn interpretations that it was realistic, rather than optimistic, for the majority of respondents to report that their chance of experiencing ACE as being less than the average person's chance.[2] Future research should be cognisant of the methodological issues and potential solutions offered by Harris and Hahn to further examine under which circumstance realistic and biased (both optimistic and pessimistic) future expectancies emerge.

Limitations of the present study include the use of a convenience sample, and issues of generalisability arise. Three individual items were used to rate comparative optimism towards different target figures. Such single-item assessment has well documented limitations and in the absence of formal psychometric examination of the items, it is not clear if the items were valid indicators of the comparative optimism. The present measure used a standard 7-point Likert scale and consequently Harris and Hahn's critique of such scales is applicable to the present data. Future research should use scales with a broader range. The results obtained may not generalise from those experiencing a different chronic illness; for example, patients with type 2 diabetes were unrealistically pessimistic about their risks CHD and stroke (e.g., Asimakopoulou et al., 2008). It remains to be determined if comparative optimism is associated with better outcome in the long term, as the present study only examined the initial 12 months post-CR.

In conclusion, the absence of comparative optimism predicted future ACEs among a sample of patients with CHD. Although the present findings may support the benefits of positive beliefs about the self during the early adaptation phase to chronic illness, as Kemeny et al. (1994) note in the context of HIV, it is unclear whether unrealistically optimistic beliefs protect one's health or more "realistic" beliefs are associated with worse health outcomes. Additional research, adopting recommendations by Harris and Hahn, is required to examine potential mediators of the relationship between comparative ratings of future health and actual health outcomes.

[2] We wish to thank an anonymous reviewer for highlighting this possibility.

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