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Post-Traumatic Growth After a Myocardial Infarction: A Matter of Personality, Psychological Health, or Cognitive Coping?

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Abstract The aim of the present study was to focus on the relative contributions of personality, psychological health and cognitive coping to post-traumatic growth in patients with recent myocardial infarction (MI). The sample consisted of 139 patients who had experienced a first-time acute MI between 3 and 12 months before data assessment. Multivariate relationships were tested by means of Structural Equation Modeling. The results showed that besides the contribution of personality and psychological health, a significant amount of variance in growth was explained by the cognitive coping strategies people used to handle their MI. As cognitive coping strategies are generally assumed to be mechanisms that are subject to potential influence and change, this provides us with important targets for intervention.

Keywords Myocardial infarction ·
Psychological well-being · Cognitive coping ·
Emotion-regulation · Depression

Experiencing a life-threatening illness such as a myocardial infarction (MI) can have important consequences for a patient's well-being and future life perspectives. Thus far, most research has focused on the negative psychological impact of an MI, including depression and a decreased quality of life. Recently, however, research has given emphasis to the notion that trauma can also produce specific psychological benefits. It has increasingly been reported that people with traumatic experiences may also report positive changes in response to negative events (see the reviews of Helgeson, Reynolds, & Tomich, 2006; Linley & Joseph, 2004; Park & Helgeson, 2006). These positive changes are most frequently referred to as post-traumatic growth, stress-related growth, or benefit finding. In the present article we use the term post-traumatic growth, which can be defined as a positive change in one's previous level of functioning following a traumatic event (Tedeschi & Calhoun, 1996).

Post-traumatic growth (PTG) has also been the subject of study in people who have experienced chronic illnesses or medical events, of which cancer, spinal cord injury, multiple sclerosis, and rheumatic diseases are the most intensively studied (Helgeson et al., 2006). PTG in MI patients, however, has been an understudied area. Only three of the 87 studies that were identified in a recent meta-analysis on the relationships between physical and mental health and PTG, had focused on growth following heart diseases (Helgeson et al., 2006). One study showed that about 60% of MI patients reported positive changes in response to their illness (Petrie, Buick, Weinman, & Booth, 1999). Another study showed that patients who perceived positive changes after their first MI were less likely to have another MI and more likely to have lower levels of morbidity 8 years later (Affleck, Tennen, Croog, & Levine, 1987). Because of these observations, the identification of

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factors that are associated with PTG after an MI is of importance. The present study will investigate the relative contribution of three possible factors to PTG: personality, psychological health, and cognitive coping in patients with a recent MI.

Post-Traumatic Growth and Personality

The first goal of this study was to investigate the extent to which the experience of PTG in MI patients could be explained by one's personality. Knowledge about the relationship between personality and growth could provide information regarding the extent that PTG in this particular group refers to stable and enduring dispositions that are relatively resistant to change. In their meta-analytic review, Helgeson et al., (2006) concluded (on the basis of an effect-size calculated over seven studies) that neuroticism was unrelated to PTG. In other studies, however, an inverse significant relationship was found between neuroticism and PTG (Evers et al., 2001). Also other major personality traits (extraversion, openness to experience, agreeableness and conscientiousness) have been found to be associated with growth (for a review see Linley & Joseph, 2004). In the context of heart disease, only two studies to date have addressed the role of major personality dimensions with regard to PTG (Tedeschi & Calhoun, 1996; Sheikh, 2004). Both studies showed a significant relationship between extraversion and PTG. In the present study the five major personality dimensions were included: neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness.

Post-Traumatic Growth and Psychological Health

Second, the extent to which PTG is related to general psychological health, such as positive well-being or depressive symptoms was examined. Knowledge about the relationship between growth and psychological health would provide information regarding how much PTG reflects a correlate of 'other' psychological health dimensions. In the meta-analysis of the Helgeson et al., (2006) study described earlier which evaluated the relationship of PTG and neuroticism based on 7 studies, effect sizes based on 17 studies showed that both higher positive well-being and lower depression scores were related to PTG. Also the review of Linley and Joseph (2004) confirmed significant relationships between lower depression scores, higher positive well-being, and more PTG. However, there are also studies that found distress and growth to be unrelated (see Tedeschi & Calhoun, 2004). Generally speaking, where relationships were observed, higher levels of growth clearly

tended to be related to lower levels of distress. In the present study the two psychological health dimensions of depressive symptoms and positive well-being were included.

Post-Traumatic Growth and Cognitive Coping

Third, the present study evaluated the extent to which PTG might be explained by an individual's cognitive coping strategies used to handle the emotions associated with their MI. Cognitive coping strategies are generally assumed to be mechanisms that are subject to potential influence and change. Understanding the links between cognitive coping strategies and PTG could therefore provide important information regarding clinical interventions.

In general, PTG has been found to be related to more adaptive coping (e.g., Linley & Joseph; Park & Helgeson, 2006) and a higher persistence of cognitive processing (Tedeschi & Calhoun, 2004). More specifically, the cognitive coping strategies of positive reappraisal and acceptance (Helgeson et al., 2006) and rumination (Helgeson et al., 2006; Linley & Joseph, 2004) have all been found to be positively associated with growth in samples other than heart disease patients, while the relationships of PTG with other cognitive coping strategies such as self-blame, blaming others, catastrophizing, planning, putting into perspective, and positive refocusing (for an elaboration on the domains of cognitive coping, see Garnefski, Kraaij, & Spinhoven, 2001) have not been studied in any medical patient population. Subsequently, all nine cognitive coping strategies mentioned above were included in the present study.

In summary, the present study focused on the relative contributions of personality, psychological health and cognitive coping to PTG. To obtain a parsimonious model, multivariate relationships were tested by means of Structural Equation Modeling. We hypothesized that besides the contribution of personality and psychological health, a significant amount of the variance would be explained by the cognitive coping strategies people used to handle their MI, providing clues for intervention.

Method

Sample

The study sample consisted of 139 patients (114 males) ranging from 35 to 70 years ($M = 56.39$; $SD = 8.19$) who had experienced their first-time acute MI between 3 and 12 months prior to the study. Patients were recruited from the Cardiology outpatient clinic of a large teaching hospital (The Onze Lieve Vrouw Gasthuis in Amsterdam, the Netherlands) in the period from September–November

2006. All patients had been subjected to a primary Percutaneous Coronary Intervention (PCI).

With regard to demographic variables: 75.4% was married or lived together with a partner, while 7.2% was unmarried, 14.5% was divorced and 1.4% was widowed, and 1.4% otherwise, not specified; 15.2% had received only primary education (no secondary education at all), 15.9% had completed lower vocational education (3 years of secondary education), 15.8% lower general secondary education (4 years of secondary education), 24.6% intermediate vocational education (continuing education after finishing secondary education), 6.5% higher general secondary or pre-university education (respectively 5 and 6 years of secondary education), and 21.7% higher vocational education or university.

Procedure

Eligible participants were patients who had undergone a PCI 3–12 months earlier, were over the age of 30 and below the age of 70. After permission was obtained from the Medical Ethics Committee, a database of 246 eligible persons was generated from the OLVG Medical Center. Patients were contacted by phone and given information about the study. A written questionnaire was sent to those who agreed to participate and completion of the 25 min questionnaire was deemed as informed consent. Two weeks later, a reminder was sent. In total, 160 completed questionnaires were returned, giving a response rate of 65%. For the purpose of the present study, a further selection was made of patients for whom it had been their first-time MI. In total, 139 patients fulfilled this criterion.

Instruments

Post-Traumatic Growth

Post-traumatic growth was assessed by the Personal Growth Scale (PGS). The PGS consists of five items, assessing perceived positive changes in the appreciation of life and personal strengths after the experience of threatening or stressful events. The five items reflect slightly modified items from the Personal Strength and Appreciation of Life subscales of the Post-traumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996). Respondents were given five statements and were asked to indicate the extent to which these were applicable to them:

By having had a myocardial infarction:

- ... I feel stronger in life than I did before
- ... I have discovered my priorities about what is important in life
- ... I know that I can handle difficulties better

- ... I know better how to value small things
- ... I have a greater appreciation for the value of life

Item scores ranged from 1 (not at all) to 5 (definitely) and the overall score is obtained by summing up the five items (range 5–25). The higher the score, the more personal growth is reported. Principal Component Analysis confirmed the one-dimensional structure of the scale: both the scree criterion and the number-of-eigenvalues-larger-than-one criterion indicated a one factor solution. Alpha reliability of the scale in the present study was high (.90). Mean scale score in the present sample was 15.46 (SD = 5.65).

Personality

Personality was assessed by the Neuroticism Extraversion Openness-Five Factor Inventory (NEO-FFI), which was developed by Costa and McCrae (1992). It contains 60 items that measure the five personality factors (extraversion, agreeableness, conscientiousness, neuroticism, and openness). Each subscale consists of 12 items endorsed on a 5-point Likert scale (strongly disagree to strongly agree) with a range from 1 to 5. Individual subscale scores are obtained by summing up the 12 items belonging to the particular subscale. The NEO has been shown to have good psychometric properties. In the present study, alpha reliabilities ranged from .65 (agreeableness) to .89 (neuroticism).

Depression Symptoms

Depression symptoms were measured by the Hospital Anxiety and Depression Scale (HADS). The HADS is a 14-item self-report screening scale originally designed to assess the presence of anxiety and depressive states in the setting of a medical out-patient clinic (Zigmond & Snaith, 1983). The HADS contains two subscales, one for anxiety and one for depression. For the purpose of the present study, only the depression subscale was used. It consists of seven items, to be scored on 4 point scales (1–4), while a total score is obtained by summing up the seven items (4–28). Higher scores indicate higher symptoms of depression. Reliability and validity for the HADS have been shown to be good (Spinoven et al., 1997). In the present study an alpha reliability of .86 was found.

Positive Well-Being

Positive well-being was measured by the WHO-5 Well-being Questionnaire, developed by the WHO Collaborating Centre for Mental Health in Denmark (Bech, 1998). The

questionnaire consists of five items covering positive mood (good spirits, relaxation), vitality (being active and waking up fresh and rested), and general interests (being interested in things). The items are scored on 6 point scales (0–5) with higher scores indicating a more positive well-being. The questionnaire has good psychometric properties. In the present sample an alpha reliability of .94 was found.

Cognitive Coping

Cognitive coping strategies used in response to MI, was assessed by the Cognitive Emotion Regulation Questionnaire (CERQ) (Garnefski, Kraaij, & Spinhoven, 2002). The CERQ is a 36-item questionnaire, consisting of the following 9 conceptually distinct subscales: self-blame, other-blame, rumination, catastrophizing, putting into perspective, positive refocusing, positive reappraisal, acceptance, and planning. Each of the scales consists of four items and each refers to what someone thinks after the experience of a stressful life event:

The CERQ can be used to measure either a more general cognitive coping style or a specific cognitive response to a specific event. In the present study, the latter approach was used. Respondents were asked which *current* cognitive coping strategies they used in relation to their MI. Cognitive coping strategies were measured on a 5-point Likert scale ranging from 1 [(almost) never] to 5 [(almost) always]. Individual subscale scores were obtained by summing up the scores belonging to the particular subscale (ranging from 4 to 20). Previous research on cognitive coping strategies has shown that all subscales have good psychometric properties (Garnefski et al., 2002). In the present study, alpha reliabilities of the nine CERQ scales ranged from .76 (planning) to .88 (self-blame).

Statistical Analysis

Relationships between psychological health, personality, and cognitive coping on the one hand and PTG on the other were tested by means of Structural Equation Modeling (SEM), using the statistical modeling program EQS (Bentler, 1992). This approach integrates factor analysis, multiple regression and path analysis into one comprehensive framework, thereby comprising several advantages (such as dealing with multicollinearity) as compared to more traditional multivariate analyses. In this analysis, PTG was considered as the dependent variable and the other groups of variables as the ‘predictors’.

To determine which variables had to be included into the SEM model, some preliminary analyses were performed. Pearson correlations were calculated and only ‘predictor’ variables that were significantly related to PTG were selected for inclusion into the model. In case of high

Pearson inter-correlations (.60 and higher) among variables belonging to one and the same construct (psychological well-being or personality or coping), Principal Component analyses (PCA) were performed to test the existence of an underlying factor. If underlying factors were confirmed by PCA, variables were included in the model as *manifest* indicators of a *latent* construct. If no underlying factors were found, variables were included as freestanding *manifest* variable. In addition, to be sure that the associations that came across were independent of age, gender and post-MI time, the latter variables were included as control variables.

Results

As Table 1 shows significant correlations were found between PTG and depressive symptoms (–.39) and PTG and positive well-being (.38). As the correlation between depressive symptoms and positive well-being was high (–.81), the existence of one underlying factor (Psychological health) was investigated. This was confirmed by PCA with factor loadings of .95 and –.95 for depressive symptoms and positive well-being, respectively.

Additionally, significant correlations were found among PTG and the personality variables neuroticism (–.22), extraversion (.30) and conscientiousness (.34). As the correlations among these three variables also were high and significant, PCA was performed again, indicating one underlying factor (Personality) with loadings of –.88, .86 and .86, respectively.

With regard to the nine cognitive coping variables, only significant correlations were found between PTG and positive refocusing (.22), positive reappraisal (.48), and putting into perspective (.22). Also here the existence of one underlying factor was confirmed (Cognitive coping) with factor loadings of .82, .86 and .88, respectively.

Although low non-significant correlations were found between PTG and gender, age and post-MI time, we included these variables as control variables in the next step, in order to be sure that the results with regard to psychological health, personality and cognitive coping would be independent of the influences of these variables.

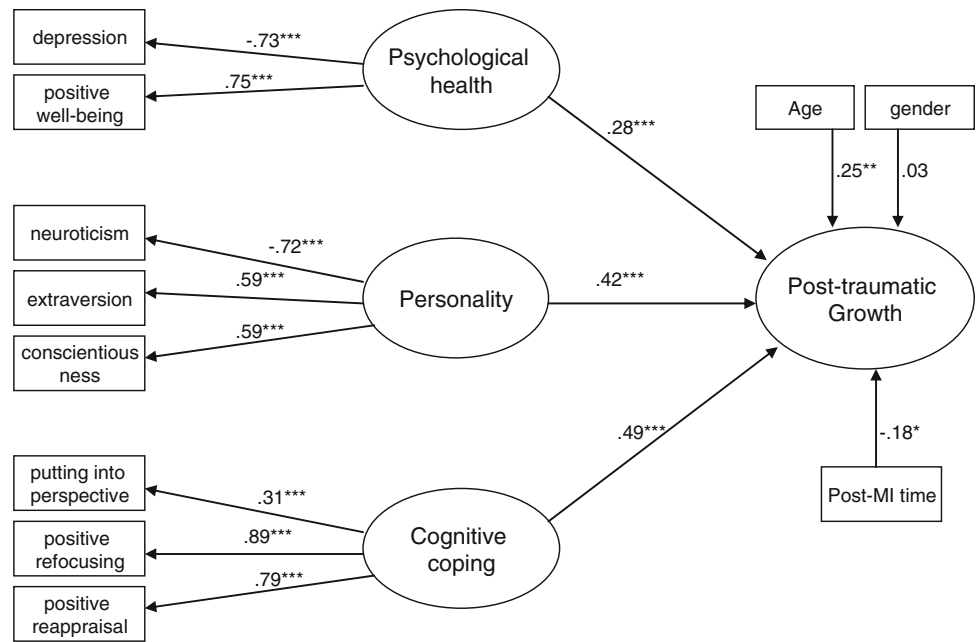
Subsequently, *manifest* and *latent* variables were selected for inclusion in the model. Based on the above correlations and PCA results, three latent constructs were included in the model: Psychological health, Personality and Cognitive coping. Depressive symptoms and positive well-being were considered as the manifest indicators of the *latent* construct *Psychological health*. Neuroticism, extraversion and conscientiousness were considered as *manifest* indicators of the *latent* construct *Personality*. Finally, the *latent* construct of *Cognitive coping* was

Table 1 Pearson correlations study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Post-traumatic growth	.01	.13	-.22**	-.39***	.38***	-.22*	.30***	-.03	.09	.34***	.03	.07	.03	.22*	.15	.48***	.22**	.02	-.09
<i>Background variables</i>																			
1. Gender		.04	.03	-.06	-.02	.07	-.05	-.09	.14	-.13	-.12	-.22**	-.07	-.10	-.13	-.08	-.15	-.08	-.10
2. Age		-.25***	.02	-.07	.02	-.07	-.05	-.01	.08	-.03	-.19*	-.09	-.05	.15	-.07	.00	.09	-.07	-.02
3. Post-MI time			-.07	.04	-.04	.04	-.14	-.02	.02	-.11	-.06	-.16	-.10	-.09	-.11	-.16	-.13	-.04	-.01
<i>Psychological health</i>																			
4. Depression					-.81***	.71***	-.62***	-.05	-.32***	-.49***	.12	.01	.44***	-.33***	.15	-.21*	-.12	.43***	.26**
5. Positive well-being						-.75***	.60***	-.10	.25**	.58***	-.17	.04	-.45***	.37***	-.15	.29**	.15	-.31***	-.15
<i>Personality</i>																			
6. Neuroticism							-.65***	-.03	-.33***	-.64***	.20*	-.04	.47***	-.34***	.16	-.24**	-.14	.42***	.11
7. Extraversion								.16	.33***	.61***	.06	.13	-.18*	.46***	.09	.35***	.30***	-.15	-.02
8. Openness									.12	-.17	.04	.19*	.15	.08	.20*	.18*	.08	-.07	-.04
9. Agreeableness										.31***	-.20*	-.10	-.02	.16	.09	.15	-.07	-.14	-.04
10. Conscientiousness											-.07	.06	-.18*	.31***	.05	.25**	.20*	-.13	.00
<i>Cognitive coping</i>																			
11. Self-blame												.43***	.37***	.12	.40***	.27***	.35***	.17*	.12
12. Acceptance													.40***	.33***	.56***	.50***	.69***	.10	.06
13. Rumination														.02	.60***	.25**	.19*	.60***	.18*
14. Positive refocusing															.34***	.54***	.58***	-.12	.00
15. Planning																.61***	.51***	.28***	.16
16. Positive reappraisal																	.66***	.06	.05
17. Putting into perspective																		.06	.05
18. Catastrophizing																			.25**
19. Other-blame																			

* $p < .05$; ** $p < .01$; *** $p < .001$

Fig. 1 Multivariate relationships with post-traumatic growth tested by Structural Equation Modeling



represented by putting into perspective, positive reappraisal and positive refocusing. The three latent constructs were considered as possible ‘predictors’ of PTG. The variables gender, age and post-MI time were included as control variables.

The obtained model was tested by Structural Equation Modeling (SEM). In the model, correlations between the error terms of the manifest variables and correlations between the three latent constructs were allowed. The structural model appeared to have a good fit (average absolute standardized residuals = 0.03; χ^2 (28) = 26.91; $p = .52$; comparative fit index (CFI) = 0.99). The results are shown in Fig. 1.

Inspection of Fig. 1 from the left to the right shows that the three *latent* constructs (Psychological health, Personality, Cognitive coping) are all indeed strong and significant reflections of their *manifest* indicators. In addition, the three latent constructs all significantly ‘predicted’ PTG. The most important ‘predictor’ of PTG—after controlling for age, gender and post-MI time—was Cognitive coping with a correlation of .49 (explaining 24.0 % of the variance of PTG) followed by Personality ($r = .42$; explaining 17.6% of the variance of PTG) and Psychological health ($r = .28$; explaining 7.8% of the variance).

Discussion

The aim of the present study was to examine the relative contributions of personality, psychological health, and cognitive coping to post-traumatic growth (PTG) after an MI. The presented model showed that all three factors importantly contributed to growth, over and above the

influence of gender, age and post-MI time. PTG partly appeared to reflect stable personality characteristics but also reflected people’s general psychological health. In addition, growth could be explained by people’s specific cognitive coping strategies.

More specifically, the results indicated that 18% of the variance of PTG could be explained by one’s personality, expressed by neuroticism, extraversion and conscientiousness. As far as extraversion is concerned, this confirmed the results of previous studies that had found this trait to be the most consistent and significant predictor of growth (Sheikh, 2004). The significant finding with regard to neuroticism contradicts some studies (Tedeschi & Calhoun, 1996; Sheikh, 2004), yet it supports the study of Evers et al., (2001). Also previous results regarding the relationship between conscientiousness and PTG have been mixed (Linley & Joseph, 2004). The results of the present study clearly suggest that the personality component in PTG reflects an interplay among the three personality characteristics, which does justice to the high intercorrelations among these personality variables. The difference in results compared to studies that had found only extraversion *or* neuroticism to predict PTG, but not both of them at the same time, might be explained by the choice of the statistical technique. In most of the previous studies, multiple regression analyses had been performed. This is a technique that has not been designed to deal with high predictor intercorrelations. In the present study, Structural Equation Modeling was used. This statistical method is designed to deal with the very high intercorrelations among predictor variables, such as neuroticism, extraversion, and conscientiousness. It might be concluded that—in contrast to what earlier studies suggested—these three personality

variables are all of importance to PTG and that future studies should account for their very high intercorrelations more than has been done before.

In addition, 8% of the variance of PTG was explained by psychological health, which was expressed by positive well-being and depressive symptoms (inversely). This confirmed the results of previous studies (e.g. Helgeson et al., 2006; Linley & Joseph, 2004). The fact that the explained variance was rather low suggests that PTG is not just another correlate of the psychological health dimension. It also provides support to Tedeschi and Calhoun (2004), who argued that PTG should probably not be considered the same as an increase in well-being or a decrease in distress.

The results further showed that the largest part of the variance of PTG was explained by the cognitive coping strategies that patients with MI used to handle this event (24%). In the presented model, cognitive coping was expressed by three specific cognitive coping strategies: putting into perspective, positive refocusing, and positive reappraisal. Positive reappraisal coping has been found to be of influence on PTG in samples other than MI (e.g., Helgeson et al., 2006), but has never been included in a sample of MI patients before. Unlike previous studies in other patient groups (e.g., Helgeson et al., 2006; Linley & Joseph, 2004) acceptance, planning, rumination, self-blame, and other-blame were not related to PTG in the MI sample. Remarkable was that in people with MI only the ‘positive’ cognitive coping strategies appeared to be significantly related to PTG. As cognitive coping strategies have been suggested to be changeable mechanisms unlike personality, this finding has potential implications for interventions.

An extensive body of research has already shown that post-MI interventions for depression are effective in increasing the quality of life and decreasing the risk of cardiac complications and mortality. The present study adds to this conclusion that it could also be promising to aim interventions at increasing perceptions of growth. A few previous studies have indeed confirmed that patients who perceived positive changes after their first MI were less likely to have another MI and had lower levels of morbidity 8 years later (Affleck et al., 1987). Some other studies have already shown that it is possible to influence levels of reported positive change and growth by a clinical intervention (Antoni et al., 2001). The present study provides a potential target for such interventions: learning positive cognitive coping strategies in response to one’s heart attack. For example, short (group) interventions could be provided to people with a recent MI to teach them to use more ‘adaptive’ strategies such as how to put events into perspective, how to refocus on more positive issues and how to re-appraise the situation. The focus should be on the content of thoughts and bringing about effective cognitive change. This approach can be linked to well-established

cognitive therapies, which focus on changing dysfunctional and irrational cognitions.

A limitation of the study design was that the detection of PTG, personality and psychological health, as well as the assessment of cognitive coping strategies was made on the basis of self-reported evaluations, which may have caused some bias. Future studies should also use other forms of data-collection, such as personal interviews. In addition, our sample comprised patients who had in common that they had experienced an MI. However, the extent to which they had elevated depression scores before the MI was unknown. Another limitation was that several aspects that could also be related to PTG, such as anxiety, social support, and goal adjustment were not included in the present study. Future studies should try to include these other aspects as well. In addition, the present study gives no information on how emotional responses develop over time. Therefore, prospective studies are needed to examine the extent to which people may undergo different stages of recovery in the months after the MI and any associated emotional fluctuations. Since cross-sectional data were used in the study, no conclusions can be drawn about directions of influence. Longitudinal studies are needed to clarify the directions of these associations. Still, whatever the directions of influence may be: this study has clearly shown that personality, psychological health, and cognitive coping on the one hand and PTG on the other are *related* issues, suggesting that both should play an important role in theoretical models and intervention strategies.

In conclusion, the present study was the first study that examined the joint influence of personality, psychological health and cognitive coping on PTG in MI patients. It showed that PTG after the experience of a (first-time) acute MI—besides reflecting stable personality traits and general psychological health—could be explained by people’s cognitive coping strategies. Further studies are necessary to confirm these relationships; these studies should use prospective designs and forms of data-collection other than self-report. Nevertheless, the results of this study carry important implications for the focus and content of intervention and prevention of mental health problems after the experience of an MI.

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