

Original Papers

Polish Psychological Bulletin
2009, vol. 40 (1), 38-45
DOI - 10.2478/s10059-009-0006-2

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Coping after myocardial infarction. The mediational effects of positive and negative emotions

The aim of the study was to examine mediational effects of positive and negative emotions (PEs and NEs) on the relationship between cognitive appraisal and coping after myocardial infarction (MI). Subjects were 163 patients assessed a few days after their first MI episode for cognitive appraisal using the Situation Appraisal Questionnaire developed by Wrześniewski and based on the Lazarus theory. The participants' current emotional state and coping strategies were evaluated with Polish versions of the PANAS and CISS-S, respectively. The data were analyzed using the bootstrapping procedure. Resultant models turned out to be similar for threat and loss appraisal, where PEs mediated task-oriented coping, while NEs were found to mediate emotion-oriented coping. A different relationship was found for challenge. Due to a significant intercorrelation among appraisals, mediational models for threat and loss were re-analyzed when controlling for challenge. Nevertheless, even if a situation is perceived as highly stressful, both positive and negative emotions can emerge, resulting in strategies that serve different functions to meet external and internal demands.

Keywords: myocardial infarction, coping, appraisal, emotions

Introduction

The situation of myocardial infarction (MI) is threatening to the individual's biopsychosocial wellbeing and imposes limitations on his/her everyday functioning and life in general. It seems justified then to consider the subject's MI-related cognitive, emotional and behavioral activities in terms of stress.

For almost five decades now the predominating approach to stress has been the cognitive-phenomenological, transactional theory of stress and coping by Richard Lazarus (1986, 1991b). In this classical approach the central concept is that of the subject's cognitive appraisal in terms of harm/loss, threat or challenge. Such appraisal determines not only the presence of stress, but also the remaining aspects of the stress transaction, i.e. emotions and coping. In accordance with the theory, the subject's activity in a difficult situation is goal-directed towards changing both the disadvantageous transaction and his/her emotional state. Thus, in keeping with Lazarus's theory, emotions are shaped, on the one

hand, by cognitive appraisal, and on the other hand – by coping. As a matter of fact, there are two types of emotions occurring at different temporal intervals. Emotions that reflect cognitive appraisal accompany the appraisal when the decision is made whether a given transaction is stressful or not, but they have no motivating function, while emotional states that result from coping may be regarded as coping efficacy indicators. Such an approach seems astonishing in the light of a general psychological theory connecting emotions with modulation and selection of the individual's behavior (cf. Ekman & Davidson, 1999).

Folkman and Lazarus (1988) argue that both problem- and emotion-oriented coping are associated with changes in the subjects' emotional state. However, the author of the theory himself and his followers have focused mostly on emotional outcomes of the coping process (cf. Folkman, Lazarus, Gruen & DeLongis, 1986). And even though Folkman and Lazarus in one of their publications (1985) referred to the two afore-mentioned ways of construing emotions, nevertheless their line of statistical inference was

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AUTHORS' NOTE: The study was supported by the Ministry of Science and Higher Education grant No. H01F 0193 as a part of a project conducted under direction of Irena Heszen.

based on the assumption that emotions were determined by coping. A global verification of the stress and coping model was not provided by the authors.

The analyses conducted so far usually dealt with selected variables of the coping process. Among other things, a relationship was found between appraisal in terms of challenge and task-oriented coping, as well as between appraisal in terms of threat and emotion-oriented coping (McGowan, Gardner & Fletcher, 2006). Instrumental coping turned out to be related most often to positive emotionality, while mood-regulating strategies –to negative affect (cf. Ben-Zur, 202; Lu, 1996; Revenson & Felton, 1989).

Valuable findings were obtained by Carver and Scheier (1994) in their follow-up study concerning the situation of examination stress. In longitudinal analyses coping strategies used at baseline turned out to be poor predictors of emotions at the end of the stressful transaction. On the other hand, a statistical reversal of causal relationships between these variables yielded interesting results. Namely, it is negative affect that was found to be a significant predictor of avoidant strategies, which has put in doubt the relations between major components of a stressful transaction as assumed by Lazarus.

Likewise, research conducted by Heszen and her co-workers concerning the situation of examination stress provided evidence for reciprocal relationships between emotions and behavior during this transaction (Heszen-Niejodek, 2002). Similar results were obtained by the same research group in a study on coping with stress after myocardial infarction (Gwozdecka, 2000). Emotions (anxiety and hope) determined the choice of specific coping strategies at both a 1-month and 6-month follow-ups after the cardiac episode. In other studies negative affect resulted in avoidant coping strategies among women with breast cancer (Carver et al., 1993), while positive emotional states were predictors of social support seeking and cognitive reframing of the situation in a study of general stress among college students (Yamasaki, Sakai & Uchida, 2006).

It is more and more often pointed out that not only negative, but also positive affect may be produced in response to a difficult situation (cf. Folkman & Moskowitz, 2000, 2006). Since the view that positive and negative emotions are mutually independent seems to predominate at present (cf. Diener, Lucas & Oishi, 2005), more distinctive coping strategies associated with either one or the other affective state are sought, as exemplified by the research by Fredrickson and Joiner (2002) based on the theory of a broadening and building role of positive emotions. The above-mentioned theory by Fredrickson (1998, 2001) refers to the classical conceptualization of the function fulfilled by emotions, i.e. evaluation of environmental conditions as either beneficial or disadvantageous, and the resulting tendencies to approach or avoid. While this model is well-fitting negative affect, positive emotions according

to Fredrickson are governed by different rules. Namely, positive emotional states signal the individual's opening to new opportunities, broaden the scope of the available knowledge and activities, at the same time building up his/her personal resources. Thus, the role of positive emotions in coping efficacy is probably reflected by their impact on the course of cognitive processes, and by stimulation of the individual's activity, directly aiding the resolution of a difficult situation.

Aims of the study

The study was aimed at testing the relationships between the main components of the coping process as distinguished by Lazarus, i.e. cognitive appraisals, emotions and coping strategies. The difficult situation was that of illness – myocardial infarction (MI). On the grounds of the general psychological theory and research findings reported in the literature the following research questions were posed:

1. Is the relationship between cognitive appraisal and coping mediated by emotions?
2. Does the function of coping differentiate between models of the appraisal-emotions-coping relationship?

Thus, the cognitive determinism characteristic of Lazarus (cf. Lazarus, 1991a) has been retained. Cognitive appraisal was assumed to be an independent variable, also due to the situational context of the study: since the variables were measured a few days after the MI episode, the event had been probably already cognitively interpreted by the subject of the transaction. Emotions reflecting the patient's cognitive appraisals were assumed to have a motivational value.

Method

Participants in the presented study were 163 patients after their first uncomplicated MI (115 men, 48 women, aged 27 to 67 ($M = 52.35$, $SD = 7.35$). The majority of the sample were married or in a steady relationship (86.5%) and had children (93.9%). Less than a half (42.4%) of the patients had either a secondary or college education, and 50.3% were in regular employment¹.

The following instruments were used:

1. Kwestionariusz Oceny Sytuacji (Situation Appraisal Questionnaire) developed by Wrześniewski, Jakubowska-Winecka & Włodarczyk (Włodarczyk, 2004) to measure situational cognitive appraisals in

¹ Among the controlled variables such as age, gender, education level, marital status, employment, beta-blocker treatment and cardiac chest pains, respondents' gender turned out to be the only variable differentiating their cognitive appraisals, emotions, and coping strategies. Namely, women as compared to men more often appraised the MI episode as a harm/loss ($t = -2.596$; $df = 161$; $p = 0.01$) and challenge ($t = -2.260$; $df = 161$; $p = 0.01$); experienced more negative emotions ($t = -2.051$; $df = 161$; $p = 0.042$), and utilized more emotion-oriented coping ($t = -3.729$; $df = 161$; $p < 0.001$).

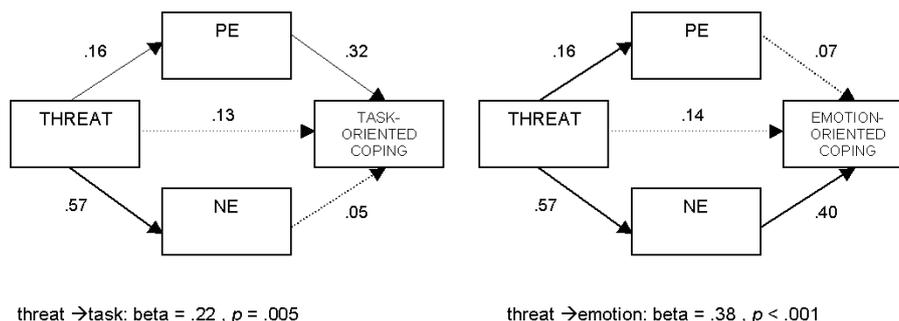


Figure 1. Mediation models for threat appraisals and task- and emotion-oriented coping strategies – standardized scores. Note. In all the diagrams dashed lines denote insignificant relationships. The relationship described directly under each diagram shows the total effect of a given independent variable on the dependent variable, and its significance level. PE - positive emotions; NE –negative emotions.

Table 1
The total indirect effect and detailed indirect effects in the relationship between threat appraisals and both task-oriented and emotion-oriented coping – non-standardized scores.

Indirect Effect	Task-oriented coping				Emotion-oriented coping			
	Estimates	Bootstrap percentile 95% CI		p	Estimates	Bootstrap percentile 95% CI		p
		Lower	Upper			Lower	Upper	
Total	.112	-.081	.282	.147	.427	.234	.642	<.001
PE	.071	.011	.143	.056	.022	-.019	.079	.341
NE	.041	-.120	.197	.549	.405	.217	.617	<.001

- terms of harm/loss ($\alpha = 0.77$); threat ($\alpha = 0.81$) or challenge ($\alpha = 0.77$);
- the PANAS questionnaire by Watson, Clark & Tellegen in the Polish adaptation by Brzozowski (1995) to measure positive ($\alpha = 0.91$) and negative ($\alpha = 0.95$) emotions;
 - the CISS–S by Endler & Parker in the Polish adaptation by Wrześniewski to measure task-oriented ($\alpha = 0.81$) and emotion-oriented ($\alpha = 0.79$) coping strategies².
- The respondents were examined individually on the ward, on the average on the fifth day following the MI episode.

Results

In the literature of the subject separate models for single mediators are most often analyzed, while in reality an answer is sought to the question: what is the simultaneous effect of several potential mediators? The introduction of a multiple mediation model gives some undeniable advantages. According to Preacher and Hayes (2007), such a model allows to estimate not only the total indirect effect (corresponding to regression analyses aimed at establishing the significance of the effect of a number of predictors), but also specific effects of particular mediators. Moreover, the mediational effect of any single variable is computed

² A series of factor analyses were performed for all the instruments to establish their construct validity. However, the obtained values differed to various degrees from those reported by the authors of respective instruments, most probably due to the sample specificity. Therefore, it was decided to develop indicators based on the authors' own data.

when controlling for the remaining potential mediators. Finally, the error of simple mediational models that results from their leaving out additional variables is eliminated, at least to a certain degree. Therefore, on the grounds of the data collected in this study six models were tested using the bootstrapping procedure (Preacher & Hayes, 2004; Shrout & Bolger, 2002). In the models both positive and negative emotions were simultaneously taken into account as mediators, as can be seen in relevant figures and accompanying tables. In accordance with the classical postulate by Baron and Kenny (1986), the values of the total effect of the independent variable on the dependent variable were also given: if this previously significant effect becomes statistically insignificant after mediational variables have been accounted for, it is an evidence for their mediational role.

Mediational models for cognitive appraisals in terms of threat

As can be seen in Fig.1, while the total effect of the independent variable for task-oriented coping is significant, the total indirect effect remains insignificant. However, when the effects of positive and negative emotions were separated, the latter turned out to exert a mediational influence at the level of statistical trend (see Table 1). Interestingly then, the appraisal of the analyzed situation in terms of threat does not seem to exclude experiencing positive emotions, which in turn stimulate task-oriented coping efforts. Even though the relationship of situational threat appraisals with positive emotions is weaker than that

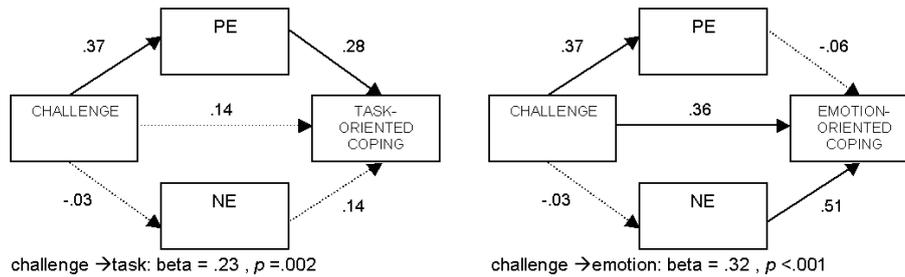


Figure 2. Mediation models for challenge appraisals and task- and emotion-oriented coping strategies – standardized scores.

Table 2
The total indirect effect and detailed indirect effects in the relationship between challenge appraisals and both task-oriented and emotion-oriented coping – non-standardized scores.

Indirect Effect	Task-oriented coping				Emotion-oriented coping			
	Estimates	Bootstrap percentile 95% CI		p	Estimates	Bootstrap percentile 95% CI		p
		Lower	Upper			Lower	Upper	
Total	.139	.032	.255	.012	-0.072	-.248	.097	.417
PE	.146	.055	.253	.004	-.040	-.132	.053	.411
NE	-.007	-.050	.030	.677	-.032	-.186	.117	.670

with negative affect, it turns out to be strong enough to reveal a relationship with coping behaviors.

As regards emotion-oriented coping, the indirect effect was found to be significant, and dependent, above all, on negative emotions as the mediator.

Mediation models for cognitive appraisals in terms of challenge

In the next category of cognitive appraisal a different pattern of relationships was found. Namely, challenge appraisal was significantly associated only with the intensity of positive emotions, while its association with negative affect intensity was approaching zero, as illustrated in Fig. 2. Therefore, any mediational effect can be produced only the former way. As a matter of fact, such an effect occurred for task-oriented coping solely (Table 2), while for emotion-oriented coping the indirect effect was insignificant, with a simultaneously significant direct effect and a clear association with negative emotions. Thus, it can be said that according to this model challenge appraisals and negative emotional states turn out to be relatively independent predictors of palliative coping.

Mediation models for cognitive appraisal in terms of harm/loss

As regards this type of cognitive appraisal, the pattern of relationships is similar to that for threat appraisals, with some slight differences. One of them consists in the fact that in the cognitive appraisal-coping relationship the total indirect effect turned out to be significant here, which results, above all, from a more salient influence of positive emotions (Table 3). The path via negative emotions remained insignificant. Therefore, it should be noted again that appraisal of a stressful situation as an irreversible

loss or serious harm does not automatically preclude the emergence of positive emotions in this context (Fig. 3). In the case of emotion-oriented coping a significant indirect effect was found for negative emotions solely, but in contradistinction to threat appraisals, these coping behaviors were also directly affected by the appraisal involving harm/loss, so mediation is only partial here.

Significant positive relationships of threat and harm/loss appraisals not only with negative, but also positive emotions may suggest that this result is due to a partial sharing of the variance with the third category of appraisal, i.e. that in terms of challenge. Table 4 shows correlations between these variables. While the strongest associations can be seen, as expected, between the two negative appraisal categories, nevertheless there is, interestingly, an evident correlation of challenge appraisals with these in terms of harm/loss, and a somewhat weaker one - with threat appraisals. To test whether the above presumption was justified, a second series of mediation analyses for both types of negative cognitive appraisal was conducted after challenge appraisals had been regressed on them. Thus, in this series only the residuals which could be interpreted as free from the potentially confounding effect of challenge appraisals were entered in the computation.

Mediation models for threat and harm/loss appraisals after controlling for the effect of challenge appraisals

The obtained results are presented in Figures 4 and 5, as well as in the accompanying Tables 5 and 6. As can be seen, the crucial difference pertains to the models where cognitive threat appraisals are used as the independent variable, since the relationship with positive affect becomes insignificant there, thus precluding any possibility of mediation via this path. The models involving cognitive appraisal in terms of

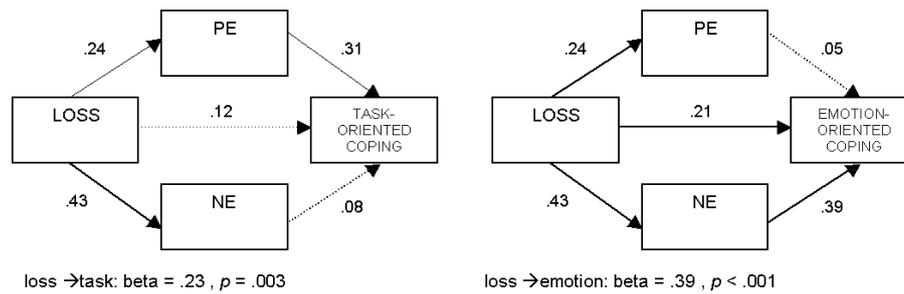


Figure 3. Mediation models for harm/loss appraisals and task- and emotion-oriented coping strategies – standardized scores.

Table 3

The total indirect effect and detailed indirect effects in the relationship between harm/loss appraisals and both task-oriented and emotion-oriented coping – non-standardized scores.

Indirect Effect	Estimates	Task-oriented coping		p	Emotion-oriented coping				
		Bootstrap percentile 95% CI			Lower	Upper	Lower	Upper	p
		Lower	Upper						
Total	.134	.029	.270	.017	Total	.293	.151	.455	<.001
PE	.092	.031	.187	.013	PE	.018	-.043	.083	.511
NE	.042	-.036	.140	.333	NE	.275	.144	.432	<.001

Table 4

Pearson's r coefficients of correlation between various categories of cognitive appraisal.

Cognitive appraisal	Threat	Harm/loss	Challenge
Threat	-	.399***	.153*
Harm/loss		-	.203**
Challenge			-

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

harm/loss remained largely unchanged, since the relationship with positive emotions, although weaker, remained still significant there. In consequence, an analogical indirect effect was found for instrumental coping, but it was weaker, on the verge of statistical significance.

Discussion

The analysis of the models tested indicates that emotions may well be a variable mediating between cognitive appraisal and coping strategies in the process of recovery from myocardial infarction. The results for threat and harm/loss appraisals turned out to be similar - in both cases positive emotions mediated task-oriented coping, while negative emotions – emotion-oriented coping. The latter effect was stronger. On the other hand, as regards challenge appraisals, in the relationship with task-oriented coping only an indirect effect of positive emotions was found.

Thus, positive and negative emotions were shown to lead to different ways of coping with a difficult situation. Positive affect systematically (irrespective of cognitive appraisal) motivated the patients to task-oriented coping, while negative affect - to coping focused on negative

emotions and their regulation. The findings are consistent with these reported in other studies (where, however, the effect of coping on affect was more often investigated). An overview of the research literature by Folkman and Moskowitz (2000) on the relationship between positive affect and coping suggests that positive emotions are associated with positive cognitive appraisals and task-oriented strategies. This association has been confirmed also by the research on stress of daily hassles (Ben-Zur, 2002; Lu, 1996), and by follow-up studies in patients with rheumatoid arthritis (Revenson & Felton, 1989).

Our findings may be regarded also as an obvious corroboration of the thesis proposed by Fredrickson (1998, 2001) about different roles of negative and positive emotions in the process of coping. The former probably limit the repertory of behaviors to clear-cut behavioral tendencies allowing to reduce distress. What's important - this does not mean that negative emotions actively inhibit task-oriented coping, since no negative correlations can be seen there, but only insignificant relationships approaching zero. On the other hand, positive emotions through increasing flexibility and creativity of behavior support instrumental coping, but at the same time have no effect on emotion-oriented coping intensity.

The regularities discussed so far pertained especially to cognitive appraisals involving threat or harm/loss, since both these types of appraisal (that according to Lazarus and Folkman lead to emotions of negative valence), were positively associated with not only negative, but also positive emotions. This surprising outcome required examining relationships within cognitive appraisals. Positive intercorrelations between positive and negative situational cognitive appraisals have confirmed our suppositions about

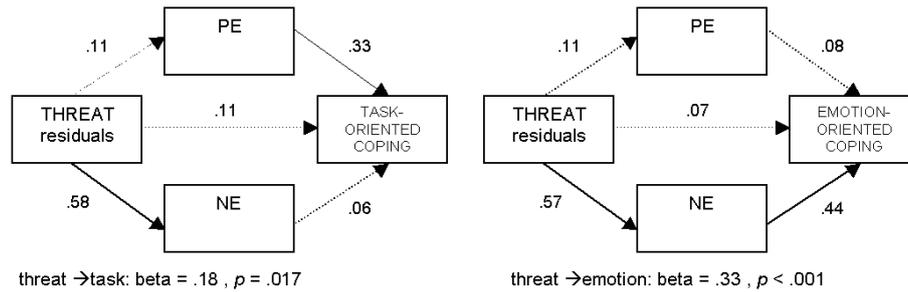


Figure 4. Mediation models for threat appraisals and task- and emotion-oriented coping strategies after controlling for the effect of challenge appraisals - standardized scores.

Table 5
The total indirect effect and detailed indirect effects in the relationship between threat appraisals and both task-oriented and emotion-oriented coping after controlling for the effect of challenge appraisals – non-standardized scores.

Indirect Effect	Estimates	Bootstrap percentile 95% CI		p
		Lower	Upper	
		Task-oriented coping		
Total	.299	-.081	.282	.210
PE	.147	-.021	.371	.182
NE	.151	-.368	.692	.480
Emotion-oriented coping				
Total	1.420	.824	2.169	<.001
PE	.049	-.012	.243	.365
NE	1.371	.787	2.118	<.001

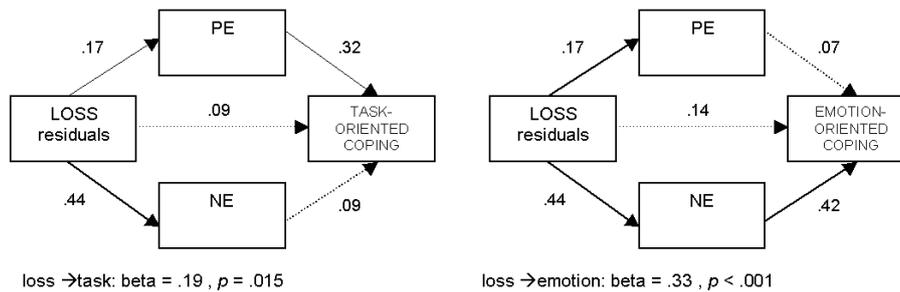


Figure 5. Mediation models for harm/loss appraisals and task- and emotion-oriented coping strategies after controlling for the effect of challenge appraisals - standardized scores.

Table 6
The total indirect effect and detailed indirect effects in the relationship between harm/loss appraisals and both task-oriented and emotion-oriented coping after controlling for the effect of challenge appraisals – non-standardized scores.

Indirect Effect	Estimates	Bootstrap percentile 95% CI		p
		Lower	Upper	
		Task-oriented coping		
Total	.380	.015	.878	.041
PE	.221	.026	.532	.053
NE	.159	-.116	.539	.292
Emotion-oriented coping				
Total	1.070	.613	1.685	<.001
PE	.064	-.039	.309	.358
NE	1.006	.575	1.587	<.001

their co-dependence: namely, both harm/loss and threat appraisals were affected by challenge appraisals.

It should be noted that the Lazarus and Folkman theory suggests considering these appraisal categories as mutually exclusive. However, it has been common practice (shared by the authors of the theory themselves) to treat these three appraisal types as separate dimensions, without any particular exploration of their mutual relationship. That way three values of the current situation appraisal can be simultaneously ascribed to every subject, which

is an overlooked fact. Assuming each of the appraisals to be associated with a different emotional response, and consequently, with a different behavior, it follows that the observable is probably a resultant of the processes in question. Therefore, by analyzing only dimensions in an abstract way nothing can be learned about individuals' real behavior in a given situation. This problem clearly requires further elaboration, both theoretical and statistical.

As far as the analyzed data are concerned, the relationship between threat appraisals and positive emotions was

completely explained by challenge appraisals, even though the association of these two types of cognitive appraisal should be considered as weaker than that of harm/loss appraisals. It should be emphasized in this context that both threat and challenge evaluations are of anticipatory nature, and their shared variance was a mere 2.3%. Thus, they may be regarded as either not quite independent from each other, or at least mutually nonexclusive appraisals, which bears an analogy to the contemporary understanding of opposite-valence emotions. Referring to the obtained data it would not be an overstatement to say that they indicate a concurrence of cognition and emotion in perceiving the future after a very distressing experience. It should be noted besides that there is a close correspondence between these two components that form psychologically meaningful cognitive-affective groupings (cf. Siemer, Mauss & Gross, 2007) together with relevant behavioral tendencies. Situational threat appraisals mediated by negative emotions lead to the choice of emotion-oriented coping strategies, while challenge appraisals associated with positive emotions support task-oriented coping.

On the other hand, evaluation of the current situation in terms of harm/loss even after controlling for challenge turned out to generate positive emotions in MI patients. Paradoxically, this type of cognitive appraisal referring to the past evoked by itself emotions commonly regarded as contradictory, since it is negative emotions that should be a natural consequence of the loss of an important object (in this case – health) and of experienced or perceived harm. The presence of negative affect was unquestionable³. On the other hand, the associated positive emotions might be due to the very fact of surviving a potentially fatal event. Since it was located in the past, the patient could feel relief or even joy. Such an affective state could be maintained also by positive illusions (cf. Taylor, 1984, 1988), or by denial which at this stage of illness may serve an adaptive function (Levine et al., 1987).

Finally, it should be emphasized that the presented reasoning is based on results of cross-sectional analyses, while as a matter of fact the models should be analyzed under the longitudinal approach. Consequently, the obtained relationships are at best of a probabilistic character. However, arguments on their behalf are firstly, the clarity of the established relationships, and secondly, confirmation by other studies that tested merely a fragment of the coping model, or utilized only correlation or regression analysis. Summarizing, even in such a life-threatening situation as myocardial infarction, the individual's threat and harm/loss appraisals of the transaction are associated with both positive and negative emotions that in turn lead to utilization of distinctive, specific ways of coping. These results are consistent with recent findings reported by

³ In the sample studied the level of negative emotions was significantly higher than that of positive affect ($t = 6.481$; $df = 162$; $p < 0.001$).

Folkman (Folkman & Moskowitz, 2006) or Fredrickson (Fredrickson, Tugade, Waugh & Larkin, 2003), concerning the role of positive emotions in the process of coping with difficult situations. This issue requires further study, with a more numerous sample, differentiated with respect to age and gender, and investigated during various transactions.

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