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Association between resiliency and posttraumatic growth in firefighters: the role of stress appraisal

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The purpose of this study was to establish the relation between resiliency and the level of positive changes, comprising posttraumatic growth in a group of firefighters experiencing job-related traumatic events and the mediating role of stress appraisal in this relation. The study was performed on a group of 100 firefighters from firefighting and rescue brigades, out of which 75 admitted to experiencing a traumatic event. Firefighters covered by the study were on average 31.51 years old ($SD = 6.34$). A Polish version of Posttraumatic Growth Inventory, the Resiliency Assessment Scale and Stress Appraisal Questionnaire were used in the study. The results have shown that 22.7% of firefighters displayed low, 58.6% average and 18.7% high intensity of positive changes resulting from a traumatic event. Resiliency poorly correlates with posttraumatic growth expressed in changes in self-perception, and strongly correlates with stress appraisal, negatively correlates with threat and harm/loss and positively correlates with challenge. Appraisal of stress as a threat and challenge appeared to be mediators of the relationship between resiliency and posttraumatic growth.

Keywords: positive changes; trauma; posttraumatic growth; resiliency; firefighters

1. Introduction

1.1. Exposure to traumatic events in firefighters

Emergency service workers, and firefighters in particular, are exposed to an elevated level of potentially traumatizing events related to the nature of their job. These events are associated with saving human life and health and confronting death. Studies conducted in major cities in Canada and the USA [1] found that during a year 90% of US and 85% of Canadian firefighters participated in a traumatic event.

In Poland the proportion of professionals among emergency service representatives who experience such events is similar. According to studies from rescue-firefighting units conducted by the Nofer Institute of Occupational Medicine in Łódź, Poland, 86% of them experienced traumatic events, and 78% experienced it more than once.[2] Similar results were noted in studies carried out by Ogińska-Bulik and Langer [3] and by Ogińska-Bulik and Kaflik-Pieróg.[4]

The experience of traumatic situations often entails negative effects on health, among which posttraumatic stress disorder (PTSD) is most common. In the case of US and Canadian firefighters, PTSD was diagnosed in 22% of patients,[1] whereas for Polish firefighters investigated by staff from the Nofer Institute of Occupational Medicine the number is less than 10%.[5] In studies of Ogińska-Bulik and Langer [3] 18% of firefighters who

had experienced traumatic events revealed symptoms of posttraumatic stress. Experiencing a traumatic event may also lead to the occurrence of positive effects of trauma, appearing in the form of posttraumatic growth.

1.2. Posttraumatic growth phenomenon

The term posttraumatic growth (PTG), which was introduced by Tedeschi and Calhoun,[6] regards the occurrence of positive changes which encompass self-perception changes, changes with respect to relations with others and appreciation of life, which can emerge as a consequence of attempting to deal with an experienced traumatic event. PTG is more than just a return to equilibrium after an experienced traumatic situation. This phenomenon indicates that as a result of an experienced situation a person underwent some kind of transformation and achieved a higher level of functioning than before the trauma.

Tedeschi and Calhoun [6,7] refer this phenomenon to the existential approach and assume that PTG results from an engagement of cognitive processes such as changes in the view of the self and the world involving their deeper understanding and making sense out of what happened. The mechanism underlying PTG is connected with cognitively restructuring information, reconstructing cognitive schemes, and seeking meaning of the event and its importance for one's future functioning. Tedeschi and Calhoun [7] assume that PTG does not result from actually

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experiencing the trauma, but rather from the undertaken coping strategies. This does not exclude the occurrence of adverse effects of experienced trauma. Posttraumatic growth does not mean that the experience of trauma is desirable or necessary to make significant changes in life. It is not equated with a sense of happiness, either. It is, however, an opportunity for a more meaningful and valuable life.

There are few studies indicating the occurrence of positive effects of experienced trauma in firefighters. A study conducted on a group of Israel firefighters examined one month after the Carmel fire disaster [8] revealed an occurrence of positive changes, measured with a short version of the Posttraumatic Growth Inventory (PTGI). Greater changes were observed in personal strength and appreciation of life. Posttraumatic growth was also noted in Australian firefighters.[9] Melerski,[10] who interviewed rescue workers (firefighters, police officers and emergency medical technicians) participating in the events of September 11, 2001 in New York, revealed that 87% of respondents indicated at least one positive outcome of the event. Polish data also indicated that emergency service workers, among them firefighters, are prone to reveal positive changes following traumatic events.[4,11,12]

Among the growth conditions subsequent to trauma, apart from factors related to the trauma itself (its intensity in particular) much emphasis is placed on the impact of personal resources, such as resiliency, self-efficacy or ability to cope. However, little is known of the role of cognitive appraisal of experienced stress in posttraumatic growth. There are only a few studies in Poland which indicate the relationship between stress appraisal and positive traumatic changes. In research conducted on a group of firefighters by Ogińska-Bulik and Juczyński [13] stress appraisal in terms of challenge was positively correlated with growth after trauma. On the other hand, studies conducted in Israel [14] suggest that stress appraisal in terms of threat may predict posttraumatic growth. These few studies indicate an unclear relationship between different stress appraisal and PTG. It seems appropriate to verify the above relationship, taking into account indirect effects in the form of mediation and suppression.

1.3. Resiliency, stress appraisal and posttraumatic growth

Resiliency, treated as a broad cluster of personal characteristics, is expressed by persistence and flexible adaptation to life demands, an ability to take remedial actions in difficult situations and a tolerance of negative emotions and failures.[15,16] The higher the resiliency, the greater the capacity to modify one's ego-control in keeping with situational opportunities. People characterized by a high level of resiliency more often experience positive emotions, are more self-confident, more effectively cope with stress and generally present better psychological adjustment.[17,18]

Due to different conceptualizations of the term existing in the literature, i.e., the process (resilience) and the personality characteristics (resiliency), the relationship between resilience/resiliency and PTG is not clear. Some authors equate resilience with PTG.[19] Others assume that PTG is a form of resilience,[20] whereas still others assume that a benefit from trauma is something more than resilience and, therefore, plays a superior role.[21]

Tedeschi and Calhoun [6] distinguish the two concepts of resilience and PTG, emphasizing that development following trauma results from transformation, which means cognitive rebuilding. Resiliency assumes an ability to move forward with life after adversity, whereas PTG involves a movement beyond pretrauma levels of adaptation. Moreover, researchers stress that resilient individuals do not necessarily have to experience PTG, as not all traumatic events are subjectively identified as challenging.

A positive relationship between resiliency (treated as a trait) and PTG, especially in changes relating to others, new possibilities and personal strength, was found among vehicle accident survivors.[22] This relationship was confirmed by studies conducted in a group of persons who lost someone close [23,24] among firefighters [4] and in a group of people who experienced various traumatic events.[25] Other researchers [26,27] found a negative relationship between resilience, defined as the ability to adapt to new conditions without having adverse consequences in one's psychosocial life, and PTG in a group of people experiencing horror in a war. Because of this ambiguity, research on the relationship between resiliency and PTG is still necessary.

Cognitive appraisal of stress is a personal interpretation of an experienced situation. Lazarus and Folkman's [28] model of stress specifies that an individual's response to a stressor is a function of two linked cognitive processes: primary and secondary appraisal. In primary appraisal people may assess a stressful situation as a harm/loss, threat or challenge. In secondary appraisal individuals decide if they have the coping resources to deal effectively with stress. The cognitive process seems to play an initial reaction to experienced traumatic situation and later effects, both negative and positive.

The findings from the studies suggest that negative appraisal (harm/loss, threat) is associated with using passive coping and in consequence negative psychological adjustment, whereas positive appraisal (challenge) is associated with active coping and positive adjustment.[29] Therefore, special attention should be paid to appraisal of stress as a challenge, which may enhance positive emotions and promote positive changes following trauma. The tendency of people to appraise stress as a challenge may be the result of their high level of resilience. The data obtained by Kaczmarek [30] indicated a positive relationship between resiliency and challenge/activity appraised. Moreover, positive stress appraisal (challenge) occurred as a mediator in the relationship between temperament and stress outcomes

in a group of diabetic patients.[31] One may assume that the cognitive appraisal of stress in terms of challenge may mediate the relationship between resiliency and posttraumatic growth. The purpose of this study was to estimate the mediation role of cognitive appraisal of stress in the relationship between resiliency and posttraumatic growth in a group of firefighters who have experienced traumatic events in the context of their work. The research presented in this article uses Tedeschi and Calhoun's model as a conceptual framework in which personal factors influence the occurrence of posttraumatic positive outcomes.

2. Material and methods

Data of 100 firefighters (all male) who have experienced a traumatic event in their worksite from central Poland were investigated. The research was conducted during the performance of duties, with the approval of superiors and the consent of the respondents. Respondents were explained the aim of research and informed of their anonymity. Before completing the questionnaires they answered (in writing) whether they had experienced traumatic events in the course of their duties in the past five years.¹ Seventy-five of the examined firefighters (75%) admitted that such an event took place. The results of this group were subject to statistical analyses. The age of participants ranged from 23 to 50 years ($M = 31.5$; $SD = 6.34$). The PTGI, the Assessment Resiliency Scale and the Stress Appraisal Questionnaire (SAQ) were used in the study.

The PTGI developed by Tedeschi and Calhoun [6] is the most frequently used and best-validated questionnaire to assess positive changes after trauma. It consists of 21 items (e.g., I changed my priorities about what is important in life) rated on a Likert-type scale from 0 = *I did not experience this change as a result of my crisis* to 5 = *I experienced this change to a very great degree as a result of my crisis*. Higher scores indicate higher levels of posttraumatic growth. The Polish adaptation of PTGI [13] comprises of the following four factors:

- factor 1. Changes in self-perception – as a result of an experienced trauma a person notices new opportunities and perceives growth in personal strength;
- factor 2. Changes in relating to others – greater sense of relating to others, increased empathy and altruism;
- factor 3. Greater appreciation of life – changes in philosophy of life, change of priorities, greater appreciation of everyday life;
- factor 4. Spiritual changes – better understanding of spiritual problems and an increase in religiosity.

Internal consistency measured by Cronbach's α for the full scale and test-retest reliability after two months are high (0.93 and 0.74, respectively).

The Resiliency Assessment Scale by Ogińska-Bulik and Juczyński [17] measures resiliency treated as a

personality characteristic which promote coping with stress. It consists of 25 items (e.g., I undertake actions to deal with problems no matter how difficult the problems are) rated from 0 = *definitively not* to 4 = *definitively yes*. Factor analyses of the scale revealed five factors: (a) Determination and persistence in actions, (b) Openness to new experiences and a sense of humour, (c) Competencies to cope and tolerance of a negative affect, (d) Tolerance of failures and treating life as a challenge, and (e) Optimistic life attitude and ability to mobilize in difficult situations. SPP-25 is a reliable tool: Cronbach's $\alpha = 0.89$; internal stability (measured after four weeks) = 0.85.

The SAQ developed by Wrześniewski, Jakubowska-Winecka and Włodarczyk [32,33] is designed to examine a type and intensity of appraisal related to a stressful situation. It consists of two forms: (a) to assess situational and (b) to assess dispositional stress appraisal. Both forms contain the same set of 35 adjectival expressions used for describing stressful situations, but they differ in instructions. The respondents use a 4-point scale and indicate their choices (from 0 = *definitely not* to 3 = *definitely yes*). Both forms allow for stress appraisal in terms of threat, harm/loss and challenge.² The internal consistency, measured by Cronbach's α coefficients, is satisfactory (0.71–0.90 for situational version and 0.74–0.87 for dispositional version). Dispositional version of the tool (e.g., Usually the situation is for me mobilizing) was used in the study.

3. Results

Analyses of the results were performed using SPSS version 21.0. In subsequent stages of the analyses means of analysed variables and correlation coefficients between variables were calculated, and then the analyses of mediation were conducted. Table 1 presents mean values of analysed variable and the relationship between them.

Average values of positive posttraumatic changes measured by the Polish version of PTGI do not differ from the results of studies standards [13] and are within the range of the average results (5 sten [standard ten]). The biggest changes in the areas of PTGI connected with traumatic events in the context of firefighters work were also examined. For this purpose received the average of each of the factors of posttraumatic growth was divided by the number of composing statements. The obtained values indicate greater changes in appreciating of life ($M = 3.38$; $SD = 1.09$) and self-perception ($M = 3.06$; $SD = 0.74$) compared to the relations with others ($M = 2.88$; $SD = 0.83$) and spiritual sphere ($M = 2.11$; $SD = 1.25$), in which the lowest level of changes was observed ($p < 0.01$). Considering the development of standards for the Polish version of PTGI [13] may indicate that in the group of firefighters 22.7% experienced low, 58.6% medium and 18.7% a high level of growth after trauma.

Table 1. Means, standard deviations of analysed variables and Pearson's correlation coefficients between resiliency, stress appraisal and posttraumatic growth.

Variable	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1 Posttraumatic growth – total	58.86	20.21														
2. Changes in self-perception	21.89	9.96														
3. Changes in relating to others	21.97	7.42														
4. Appreciation of life	9.94	3.39														
5. Spiritual changes	5.05	2.95														
6. Resiliency – total	65.61	14.67	0.11	0.25*	0.01	0.01	–0.05									
7. Determination and persistence in action	12.98	3.08	0.17	0.19	0.20	0.07	–0.08									
8. Openness on new experiences and sense of humor	14.02	2.36	0.22	0.32**	0.13	0.09	–0.03									
9. Competencies to cope and tolerance of negative affect	13.00	3.98	0.05	0.17	–0.06	0.04	–0.10									
10. Tolerance of failures and treating life as a challenge	13.36	3.20	0.08	0.18	0.05	–0.10	–0.02									
11. Optimistic life attitude and ability to mobilize in difficult situations	12.23	4.17	0.23	0.33**	0.11	0.04	0.05									
12 Threat	15.57	5.96	0.30**	0.25*	0.24*	0.16	0.21	–0.27*	–0.32**	–0.10	–0.29*	–0.26	–0.09			
13 Harm/loss	5.32	2.59	0.15	0.09	0.13	0.02	0.30**	–0.28*	–0.30**	–0.02	–0.43***	–0.28*	–0.07			
14 Challenge	8.57	3.71	0.29*	0.33**	0.21	0.14	0.04	0.33**	0.12	0.32*	0.31*	0.16	0.38***			

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Age of the respondents did not differentiate the levels of posttraumatic positive changes. Younger firefighters (below 31 years) showed a similar level of change as the older firefighters (31 years and older) ($M = 67.03$, $SD = 13.81$ and $M = 59.25$, $SD = 15.38$, $t = 0.09$, respectively). The resulting average resiliency in the group of firefighters is similar to the results of different groups of adults involved in the study of standardization [17] and corresponds to the 5 sten. The results of stress appraisal do not differ from the data obtained in the study of standardization.[33]

The data presented in Table 1 indicate a weak relationship between resiliency and posttraumatic growth. Only factor 1 PTG, which are changes in self-perception in a statistically significant way correlates with resiliency, especially with the optimistic life attitude and the ability to mobilize in difficult situations (factor 5), and openness on new experiences and sense of humour (factor 2). Stress appraisal as a threat positively correlates with the overall result of PTGI and the changes in the self-perception and relationships with others. Stress appraisal in terms of harm/loss is associated only with changes in the spiritual sphere. In turn, perception of stress as a challenge is related to the result of the overall PTGI and changes in the self-perception. Evaluation of stress as a threat and harm/loss is negatively linked to resiliency and the majority of its factors. On the other hand, the assessment of stress in terms of the challenge has a positive relation with resiliency.

In the next step indirect effects were analysed. Mediation analyses were performed based on the procedure bootstrapping proposed by Preacher and Hayes,[34] by drawing 5000 bootstrap samples. This method is more useful than the quite commonly used Sobel test. It has more explanatory power, it does not require the assumption of normal distribution of variables and allows us to conduct analyses on relatively small samples.[34,35] Generally, the analyses of mediation allow us to set a more complex model structure, in which the independent variable, functioning as a predictor variable (in this case, resiliency) is associated with the dependent variable (posttraumatic growth) through a third variable, performing the function of a mediator (stress appraisal). Mediating effect, in the form of suppression (enhancement) occurs when the mediating variable increases the predictive properties of the independent variable on the dependent variable.

A first step was to analyse the relationship between the general result of the resiliency and the general result of posttraumatic growth in the group of firefighters, and stress appraisals were fed as mediators. In the next steps analyses with the participation of the dependent variable in the form of individual factors of posttraumatic growth, leaving the general result of resiliency as an independent variable, were carried out.

As can be seen in Figure 1 there is no direct relationship between resiliency and posttraumatic growth in the group

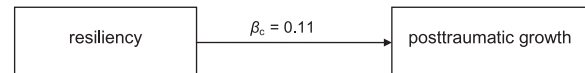


Figure 1. The direct relationship between resiliency and posttraumatic growth. Note: $\beta_c = \beta$ coefficient between dependent and independent variable (total effect).

of examined firefighters. The introduction of a third variable in the form of stress appraisal indicates its influence on the relationships between variables, but the nature of these relationships is different. In the case of threat (Figure 2), we can talk about the effect of suppression (growth β coefficient). Moreover, cooperation between the two variables (resiliency and threat) can lead to growth after trauma, but resiliency has more predictive power. A firefighter characterized by a high level of resiliency and rarely perceiving stress as a threat can experience growth after trauma. While in the case of challenge (Figure 3) we can talk about the role of the mediating variable (decrease β coefficient). A resilient person who appraises stress in terms of challenge may experience higher levels of posttraumatic growth than a person with a lower level of resiliency. It is worth noting that resiliency has a negative relationship with threat and a positive relationship with challenge. Stress appraisal in terms of harm/loss did not mediate a relationship between resiliency and posttraumatic growth. The next stage of the analyses was to introduce the factors of posttraumatic growth in place of the dependent variable.

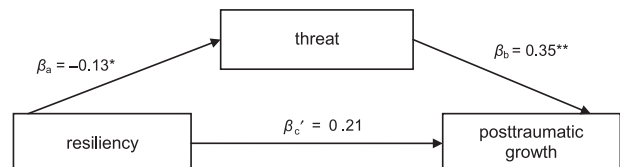


Figure 2. A model of the relation between resiliency, stress appraisal as a threat and posttraumatic growth. Note: $*p < 0.05$; $**p < 0.01$; $\beta_a = \beta$ coefficient between dependent variable and mediator (indirect effect); $\beta_b = \beta$ coefficient between mediator and independent variable (indirect effect); $\beta_c' = \beta$ coefficient between dependent and independent variable (direct effect).

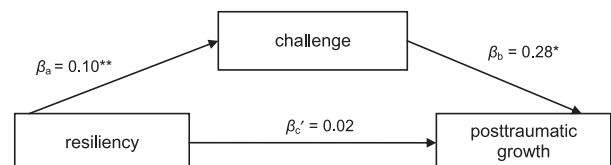


Figure 3. The model of relation between resiliency, stress appraisal as a challenge and posttraumatic growth. Note: $*p < 0.05$; $**p < 0.01$; $\beta_a = \beta$ coefficient between dependent variable and mediator (indirect effect); $\beta_b = \beta$ coefficient between mediator and independent variable (indirect effect); $\beta_c' = \beta$ coefficient between dependent and independent variable (direct effect).

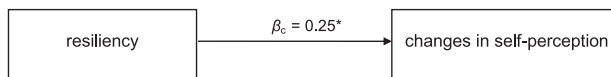


Figure 4. The direct relationship between resiliency and changes in self-perception.
 Note: * $p < 0.05$; $\beta_c = \beta$ coefficient between dependent and independent variable (total effect).

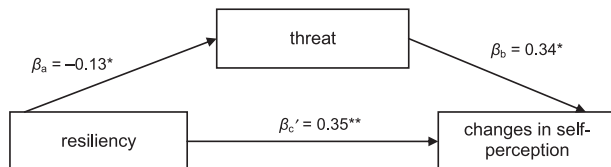


Figure 5. A model of the relation between resiliency, stress appraisal as a threat and changes in self-perception.
 Note: * $p < 0.05$; ** $p < 0.01$; $\beta_a = \beta$ coefficient between dependent variable and mediator (indirect effect); $\beta_b = \beta$ coefficient between mediator and independent variable (indirect effect); $\beta_c' = \beta$ coefficient between dependent and independent variable (direct effect).

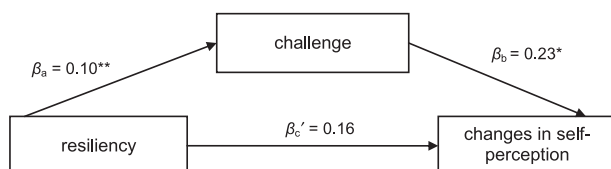


Figure 6. A model of the relation between resiliency, stress appraisal as a challenge and changes in self-perception.
 Note: * $p < 0.05$; ** $p < 0.01$; $\beta_a = \beta$ coefficient between dependent variable and mediator (indirect effect); $\beta_b = \beta$ coefficient between mediator and independent variable (indirect effect); $\beta_c' = \beta$ coefficient between dependent and independent variable (direct effect).

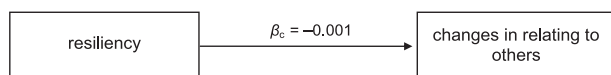


Figure 7. The direct relationship between resiliency and changes in relating to others.
 Note: $\beta_c = \beta$ coefficient between dependent and independent variable (total effect).

The results of the mediation analyses indicate that, in the case of three factors of posttraumatic growth, introduction of a third variable, in the form of stress appraisal, causes the indirect effects. As can be seen in Figure 4, there is a weak relationship between resiliency and changes in self-perception. The introduction of stress appraisal as a threat results in an indirect effect as suppressor (Figure 5), while introducing stress appraisal as a challenge results in an indirect effect as mediator (Figure 6). Thus, the first increases the predictive power of resiliency, and the other takes over part of the capacity at each other. Appraising stress as a challenge rather than as a threat will result in a higher level of change in self-perception. There is no association between resiliency and changes in relating to others (Figure 7). The introduction of stress appraisal in terms

of threat results in a suppression. It seems that the rarer appraising trauma as a threat, the greater changes in relating to others a resilient person can experience (Figure 8). Resiliency is not associated with spiritual changes (Figure 9); however, harm/loss plays suppressive role in relationship of resiliency – and this dimension of PTG (Figure 10). The rarer perception traumatic event as a harm/loss, the higher level of spiritual changes.

The results of the analyses also indicate a suppressive role of threat for factor 1 of resiliency (Determination and persistence in action; $\beta_a = -0.54^{**}$; $\beta_b = 0.68^*$; $\beta_c = -0.43$; $\beta_c' = -0.70$), factor 3 (Competencies to cope and tolerance of negative affect; $\beta_a = -0.49^*$; $\beta_b = 0.79^{**}$; $\beta_c = 0.19$; $\beta_c' = 0.58$) and factor 4 (Tolerance to failures and treating life as a challenge; $\beta_a = -0.60^*$; $\beta_b = 0.79^{**}$; $\beta_c = 0.42$; $\beta_c' = 0.89$). This may mean that threat strengthens the predictive power of these factors on posttraumatic growth and, consequently, can provide positive effects in traumatic situations. While in the case of factor 2 of resiliency (Openness to new experiences and sense of humour; $\beta_a = 0.38^{**}$; $\beta_b = 0.90^*$; $\beta_c = 0.98^*$; $\beta_c' = 0.65$) and factor 3 (Competencies to cope and tolerance of negative affect; $\beta_a = -0.49^*$;

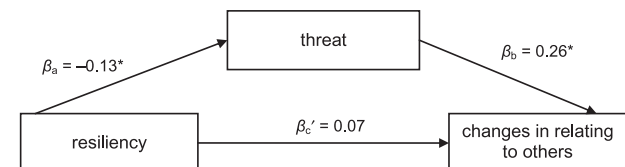


Figure 8. A model of the relation between resiliency, stress appraisal as a threat and changes in relating to others.
 Note: * $p < 0.05$; $\beta_a = \beta$ coefficient between dependent variable and mediator (indirect effect); $\beta_b = \beta$ coefficient between mediator and independent variable (indirect effect); $\beta_c' = \beta$ coefficient between dependent and independent variable (direct effect).

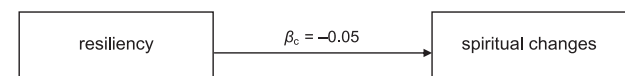


Figure 9. The direct relationship between resiliency and spiritual changes.
 Note: $\beta_c = \beta$ coefficient between dependent and independent variable (total effect).

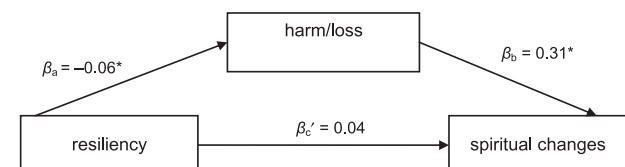


Figure 10. A model of the relation between resiliency, stress appraisal as a harm/loss and spiritual changes.
 Note: * $p < 0.05$; $\beta_a = \beta$ coefficient between dependent variable and mediator (indirect effect); $\beta_b = \beta$ coefficient between mediator and independent variable (indirect effect); $\beta_c' = \beta$ coefficient between dependent and independent variable (direct effect).

$\beta_b = 0.79^{**}$; $\beta_c = 0.19$; $\beta_c' = 0.58$) the results of the analyses indicate that challenge plays a mediating role in the analysed relationships. Therefore stress appraisal as a challenge in cooperation with the mentioned factors can predict the appearance of posttraumatic growth in the group of firefighters. Stress appraisal in terms of harm/loss did not play a mediating or suppressing role in the relation between resiliency (general result) and factors of posttraumatic growth.

Considering all of the analyses it can be assumed that both the threat and the challenge analyses indicate indirect effects. Both suppression and mediation allow researchers to predict posttraumatic growth in a group of firefighters. In the case of suppression, suppressor (threat) strengthens the predictive power of the independent variable on the dependent variable. In contrast, the mediator (challenge) in cooperation with the independent variable can lead to an increase in the value of the dependent variable. Analyses indicate that (in case of general results of resiliency and posttraumatic growth as well as factors of PTG), appraisal of stress as a threat turned out to be a suppressor, and appraisal stress as a challenge – a mediator.

4. Discussion

In the group of firefighters experiencing traumatic events in the context of their work appear positive changes that make up the posttraumatic growth – greater in appreciating of life and the self-perception in comparison with relationships with others and the spiritual sphere; 22.7% of respondents revealed low, 58.6% average and 18.7% a high level of positive changes as a result of experienced events.

It should also be noted that the level of positive changes achieved by the respondents, although located within the average, is slightly lower than in the other examined groups included in the study standardization.[13] Lower levels of positive changes may be due to the fact that firefighters, in connection with their work, experience many different traumatic situations.

Resiliency proved to be weakly associated with severity of positive changes after a traumatic experience. Only factor 1 of posttraumatic growth, i.e., changes in the self-perception in a statistically significant way, is associated with this variable, especially with such dimensions as openness to new experiences and a sense of humour and an optimistic attitude and ability to mobilize in difficult situations.

Weak relationship between resiliency and the level of positive changes after trauma can be due to the fact that resiliency is treated primarily as a protective factor against the experienced negative life events, including posttraumatic stress symptoms. This is indicated by results of research conducted on the victims of road accidents [22] or on people after cardiac surgery.[36]

In other words, the resiliency allows a return to equilibrium, and it is not synonymous with growth. In addition,

for people with a high level of resiliency, experiencing a negative event may not be a strong enough challenge, as stressed by Tedeschi and Calhoun.[6] High levels of resiliency may not be conducive to cognitive processing of trauma, and consequently the occurrence of positive changes as a result. Perhaps resiliency as indicated Ogińska-Bulik and Kaflik-Pieróg [4] should be considered as a factor favouring the occurrence of only some of the changes that make up the posttraumatic growth, particularly changes in self-perception. We can assume that they are prepared for their occurrence and largely immune. Such a situation may not be conducive to the growth process. It should be noted that to reap the benefits of a traumatic situation fosters resiliency, and therefore strengthens and shapes the resistance of an individual. This, in turn, protects primarily against incurring negative effects of experienced events, but does not necessarily lead to growth.

Resiliency turned out to be associated with stress appraisal: negatively with appraisal in terms of threat and harm/loss and positively with appraisal of the type of challenge. It indicates that resilient firefighters are less prone to assess stressful situations in terms of harm/loss and threat, and more prone to assess them as a challenge. This result is partly in line with data presented by Tugade and Fredrickson,[18] who have shown that resiliency leads to less intense appraisal of stress in terms of threat, but is unrelated to challenge appraisal. Stress appraisal in terms of harm/loss and threat may be treated as maladaptive, whereas appraisal in terms of challenge as adaptive cognitive appraisal. It is worth noting that maladaptive appraisal, expressed in negative thinking (catastrophizing) of experienced events, was a risk factor for developing posttraumatic stress symptoms in firefighters.[37]

Mediation analyses indicate that the two types of stress appraisal play an important role in the appearance of posttraumatic growth. Stress appraisal as a threat plays a suppressing role, and thus strengthens the predictive power of resiliency on posttraumatic growth and its factors. Control of this factor allows the prediction of higher growth. In contrast, stress appraisal in terms of challenge plays mediating role. This means that stress appraisal in the form of challenge is conducive to growth after trauma. This result is partly in line with data delivered by Kaczmarek [30] in a study conducted on a group of university students. Resilient individuals appraised stressful situations as a challenge. Appraisal of stress in terms of challenge/activity was a mediator in relation between resiliency and positive affect [30] and also in a study between temperament and stress outcomes.[31]

The conducted studies are related with certain restrictions. Evaluation of the positive effects of the experienced traumatic event was performed by means of self-description. The study did not include any analyses of the type of experienced traumatic event. The negative effects of the event were not measured, and the period of time

since the traumatic event was not considered. The study did not analyse traumatic personal experiences that may have occurred – at least for some workers – and affected the level of growth. Also the effect of multiple traumas experienced at work (cumulative effect) on the level of post-traumatic growth was not taken into account. Additionally, one should remember that the cross-sectional design of the study does not allow us to fully explain the cause–effect relations.

Despite the aforementioned limitations, the importance of the conducted research and the obtained results has to be emphasized. The obtained data extended our knowledge about the role of resiliency and stress appraisal in occurrences of positive effects of experienced traumatic events. However further studies on the relationship between resiliency and PTG, also including cognitive processes such as stress appraisal and rumination processes, are desired. The results can be used in practice. They indicate that development of resiliency and skills appraisal of stress, particularly in terms of challenge, may promote better psychological adjustment of emergency service workers in general and firefighters in particular. Perception of stress affects the appearance of growth after trauma, which may have practical applications in prevention programs. The methods of stress appraisal, the levels of resiliency and the levels of posttraumatic growth seem to be important because of effectivity and safety of work. Firefighters, and other representatives of the emergency services, with high levels of resiliency showing a tendency to appraise stress mainly in terms of challenge and inclined to experience growth, will be more resistant to future challenges, which can contribute to increasing the effectiveness and safety of their work.

5. Conclusions

The results of the study allow us to formulate the following conclusions:

- (1) The firefighters exposed to traumatic events related with their work are able to benefit from these experiences, expressed in posttraumatic growth.
- (2) Resiliency is weakly associated with posttraumatic growth.
- (3) Posttraumatic changes are related with stress appraisal as a threat – negatively – and with stress appraisal as a challenge – positively.
- (4) The relationship between resiliency and posttraumatic growth is mediated by stress appraisal.
- (5) The development of resiliency and stress appraisal as a challenge may increase occurrence of positive posttraumatic changes in firefighters.

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. This criterion was adopted to reduce the impact of forgetting.
2. The Stress Appraisal Questionnaire also makes it possible to distinguish two types of challenge appraisal: activity-oriented and passivity-oriented.

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