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Research Article

Patterns of Threat and Challenge Appraisals Differentially Predict Mental Health Outcomes in Municipal Firefighters

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ABSTRACT

Background: Considerable research suggests that individuals appraise potential stressors as threats or challenges, with threat appraisal reflecting the perception that situational demands exceed perceived ability to cope and challenge appraisal reflecting that situational demands are within perceived ability to cope. This research also shows that people show considerable cross-situational consistency in their stress appraisals, indicating that threat and challenge appraisal tendencies are stable aspects of persons. Recent research has challenged the traditional binary model of threat *vs.* challenge, suggesting that it overlooks significant differences in stress appraising, responding and outcomes.

Objectives: The present study had two objectives. The first was to use Latent Profile Analysis (LPA) of the appraisal of challenge or threat scale to identify multiple patterns of threat/challenge appraisal in a large sample of municipal firefighters. The second was to examine how these profiles related to several indices of psychological functioning, including Post-Traumatic Stress Disorder (PTSD) symptomology, depression and subjective well-being.

Methods: This study was conducted using secondary data collected from a group of 737 municipal firefighters. Linear profile analysis aided in identifying latent profiles. One-way Analysis of Variance (ANOVAs) were used to determine differences between each profile. Materials used in the study included R Studio and Jamovi statistical software as well as the pre-existing data set. Measures included the appraisal of challenge or threat scale, the posttraumatic stress disorder checklist, the Zung depression inventory and the satisfaction with life scale.

Results: The results of this study found four appraisal profiles indicating various degrees of threat or challenge: Three challenge groups and one threat appraisal group. These appraisal patterns were differentially associated with indicators of psychological health.

Conclusion: The findings suggest that gradations consisting of multiple profiles may exist among threat and challenge perceptions due to variations in degrees of primary appraisals of situational demands and secondary appraisals of available resources.

Key Words: Latent profile analysis; Appraisal of challenge or threat; Posttraumatic stress; Depression; Satisfaction with life; Municipal firefighters; Mental health

INTRODUCTION

Mental health issues among rescue workers

First responders, including police officers, Emergency Medical Technicians (EMTs) and firefighters, are the first to reach accident and emergencies. The first responder's primary functions are to protect lives, property and the environment during emergencies. Some of the responsibilities of these officials include responding to emergency situations, performing Cardiopulmonary Resuscitation (CPR)/other life-saving procedures, securing crime scenes and detaining suspects (these tasks differ depending on the responder's line of work and training) [1].

Due to the nature of their work and their day-to-day responsibilities, first responders commonly witness and are actively involved in

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handling various stressful events such as personal threats of injury, the death and injury of others, gruesome accidents, body handling and suicides. They are also often the bearers of tragic news to friends and trauma victims. In many urban regions, between 60.0% and 90.0% of emergency calls to firefighters involve medical emergencies; a significant stressor [1]. Experiences of such extreme traumatic events have significant psychological consequences on firefighters' emotional well-being. Such events often cause posttraumatic stress (as high as 25.5%), depression and a lower overall satisfaction with life [2,3].

A greater incidence of posttraumatic stress, depression and a lower satisfaction with life poses a significant issue because they lead to greater rates of alcohol dependence (more than 30% among firefighters), higher rates of suicidal ideations and other adverse health behaviors that result in massive medical and personal costs [3]. This paper explores whether and how cognitive stress appraisals contribute to a greater experience of adverse emotional conditions, which may lead to poorer overall health outcomes in a large sample of first responders.

Appraisal theories of challenge and threat

Appraisal theories of stress and emotion emphasize that cognitive evaluations of situations are a proximal determinant of acute emotional reactions [4]. Early on, Lazarus defined stress as the relationship between a person and their environment where the person appraises that situational demands tax or exceed the individual's ability to cope [5,6]. Lazarus and Folkman's appraisal model included two appraisal dimensions: Primary and secondary [6]. Primary appraisal reflected an assessment of a situation as having implications for well-being, whereas secondary appraisal reflected evaluation of options (i.e., resources, abilities) for coping. Finally, Lazarus and Folkman described three types of primary appraisals: Threat, challenge and harm/loss [6]. Threat and challenge were anticipatory, whereas harm/loss was post hoc.

Interestingly, Lazarus and Folkman never suggested that secondary appraisal contributes to appraisals of threat, challenge or even harm/loss. Tomaka et al., were the first to expand this conception by showing that threat and challenge were not distinct forms of primary appraisal per se but instead reflected a relationship between primary appraisal of situational demands and secondary appraisal of coping resources or abilities. In this conception, threat appraisals were defined as situations where individual perceptions of situational demands exceeded perceived resources or abilities to cope. In contrast, challenge appraisals were defined as situations that are the converse; individual perceptions of coping ability outweigh perceptions of situational demands [7].

More recently, researchers have begun investigating threat *vs.* challenge appraisal not just as situational reactions but as stable characteristics of persons. Tomaka et al., for example, discussed the development and validation of the Appraisal of Challenge or Threat Scale (ACTS) [8,9]. The scale asks respondents to cognitively appraise a series of potentially stressful daily events they might encounter (e.g., conflict situations, unexpected events, public speaking). The scale captures the relationship between demands (primary appraisal) and coping ability (secondary appraisal) by calculating difference scores between the two ratings for each event. Positive differences reflect challenge appraisal of each situation; negative differences reflect threat appraisal of each situation. The final scale score reflects the average difference score across 24 appraised situations. Three studies by Tomaka et al., provided support for the reliability and validity of the scale in assessing individual tendencies to appraise situations as either threatening or challenging across multiple domains [8]. These findings are important because they show that there may be sub-types of people who consistently appraise most stressful events either as challenging or as threatening. Such consistency would be important for appraisal tendencies to have long-term health consequences.

Applying latent profile analysis to cognitive stress appraisals

Although generating considerable research, the categorical description used in many of these studies suggests only two possible outcomes of appraisal processes, threat or challenge and ignores potential variation of gradations of appraisal processes. For example, the original Tomaka et al., study compared two groups of "challenged" *vs.* "threatened" individuals (group membership was based on the relationship between primary and secondary appraisal) [7]. One problem with this conception is that a two-category description of threat and challenge obscures the possibility that some people may appraise events with multiple shades or degrees of threat and/or challenge appraisal, ranging from absolute threat to maximum challenge. For example, some people may perceive a stressful situation as a "super challenge" (coping appraisal far exceeds demand appraisal), a simple challenge (demand appraisal is within appraised coping ability), a simple threat (demand appraisal exceeds appraised coping ability) or even as a "super threat" (appraised demands far exceed appraised ability to cope). Moreover, even with similar relationships between primary and secondary appraisal, people may differ significantly in their starting level of primary appraisal, with some individuals appraising most situations as very demanding and others as not at all demanding. Indeed, the use of continuous measures of threat and challenge appraisals, such as appraisal ratios (i.e., primary appraisal/secondary appraisal) or difference scores, rather than between-group analyses, reflects this concern [8,9].

Categorical Profile Analyses (CPA) and Linear Profile Analyses (LPA) are modeling approaches that identify groups of individuals or subpopulations based on how similarly individuals score on a set of input variables. For example, a study by Spurk et al., used LPA to examine profiles relating to work engagement [10]. Using mean scores for three variables—working compulsively, working excessively and work engagement—as input variables, they identified eight distinct profiles including, low work investors, purely engaged workers, idle workers, compulsive workers, high work investors, engaged workers, workaholic workers and excessive but disengaged workers. Low work investors showed low values in all three input variables. In contrast, workaholic workers showed low indicators of work engagement but high levels of working compulsively and working excessively.

One study suggests that this method may also help identify various types or degrees of threat and challenge appraisals [11]. Bao et al., used LPA to identify differences in employees' threat and challenge appraisals based on their demand and resource (i.e., primary and secondary) appraisals of pay dispersion practices within their workplace. In addition to appraisals, participants rated levels of burnout and work engagement. Using demand and resource appraisals as input variables in the LPA, they identified three appraisal profiles, including: (a) a high demand-low resource profile; (b) a moderate demand-moderate resource profile; (c) a high demand-high resource profile. They went on to show that individuals having these different appraisal profiles differed in work attitudes/engagement and burnout. Specifically, the high demand-low resource profile, what Tomaka et al., might call "threat," was associated with high levels of burnout and low levels of work engagement compared with the moderate demand-moderate resource profile, which was associated with moderate levels of burnout and low levels of work engagement and the high demand-high resource profile,

what Tomaka et al., might call "challenge," which was associated with low levels of burnout and high levels of work engagement [7]. While these results have implications for workplace stress-related behavioral indicators, this research also suggests that LPA can identify multiple patterns of stress-appraisal tendencies and show how different profiles relate to different psychological and behavioral outcomes.

The current study extends this work by examining stress appraisal profiles more directly and examining the association of such profiles to mental health outcomes among a large sample of US firefighters—a population shown to suffer from PTSD symptoms [3]. Accordingly, the current study had two specific aims. The first was to identify the number of distinct appraisal profiles using a measure directly related to the threat and challenge appraisal model (i.e., the Bao et al., study used appraisals of pay dispersion practices, not potentially stressful events per se). The second was to determine whether and how the identified profiles differed along various psychological dimensions, such as depression, posttraumatic stress and life satisfaction. We predicted we would find between two and seven linear profiles and these identified profiles would relate meaningfully to the selected outcomes.

MATERIALS AND METHODS

Overview

The current study was conducted using secondary data collected from a group of municipal firefighters by Tomaka et al., [3]. Linear profile analysis aided in identifying latent profiles. One-way Analysis of Variance (ANOVAs) were used to determine differences between each profile. These were the primary methods of analysis utilized in this study. Materials used in the study included R Studio and Jamovi statistical software as well as the pre-existing data set [12,13]. The New Mexico State University Institutional Review Board (IRB) approved this secondary analysis study.

Participants

The original data collection was a cross-sectional study that included a sample of 737 participants. Individual participants consisted of EMT certified municipal firefighters from the El Paso Texas Department. Of the participants, 98.1% were male firefighters in their mid to late thirties and forties. The majority of the sample was Hispanic with over 76% of participants reporting their ethnic background as Latino. Among the participants, only 73% were married.

Procedure

A sample of firefighters attending a continuing education program located within a primary training facility in El Paso Texas were invited to participate in the study; only those who voluntarily agreed to participate were included in the sample. Participation in the study occurred at various times (due to the limited classroom accommodation size) with participant samples consisting of group sizes between 20 and 50. Participants were provided with a self-reported survey to fill out during their allotted timeslot. The early questions in the survey asked demographic questions such as age, gender, marital status, years in service, etc. The remaining survey questions were used to obtain data pertaining to challenge appraisal, posttraumatic stress symptoms, depression symptoms and life satisfaction [3].

Measures

Appraisal of Challenge or Threat Scale (ACTS): The appraisal of challenge or threat scale is a 24-question scale measuring how challenging or threatening an individual appraises potentially stressful situations. The questions present a series of situations that depict potentially stressful daily events individuals may encounter. Participants rate how demanding each event is as well as their perceived ability to handle or deal with it [8]. The questions are answered on a 5-point scale, with 1 indicating not at all and 5 indicating very much [8]. There are 6 areas of demanding situations the questionnaire encompasses.

Posttraumatic Stress Disorder Checklist (PCL-C): The posttraumatic stress disorder checklist is a self-administered 17-item self-reported checklist used to diagnose and rate posttraumatic stress alongside clinical diagnosis [14]. The PCL-C asks about stressful experiences that affect the general population. Items are scored using a 5-point scale with 1 indicating not at all and 5 indicating very much [14]. Higher scores indicate greater rates of posttraumatic stress while lower scores indicate lower rates of posttraumatic stress [14].

Zung Depression Inventory (ZSDS): The Zung depression inventory is a 20-item self-reported scale of depression that aids in quantifying the symptoms present and the level of depression in cases of depression [15]. The questions within the scale rate the four common characteristics of depression: The pervasive effect, psychological equivalents, other disturbances and psychomotor activities [15]. Questions are rated from 0 to 4, with 1 indicating a little of the time and 4 indicating most of the time [15]. Higher scores indicate more depression while lower scores indicate less [15].

Satisfaction With Life Scale (SWLS): The satisfaction with life scale is a 5-item scale intended to measure cognitive perceptions/judgments about oneself on the global level in terms of life satisfaction [16]. This is not a measure of positive or negative effect but rather how satisfied an individual is [16]. In answering questions, participants indicate how strongly they agree with each item using a 7-point scale which ranges from 7 which is strongly agree to 1 which is strongly disagree [16]. Higher scores indicate a greater overall satisfaction with life while lower scores indicate a lower overall satisfaction with life [16].

Data analyses

This study used secondary data collected on U.S. firefighters that was analyzed using R statistical software to identify the number of profiles based on average primary and secondary stress appraisals [13]. We then used Jamovi statistical software to compare the resulting profiles on posttraumatic stress symptoms, depression and subjective well-being using descriptive statistics and Analysis of Variance (ANOVA) [12].

RESULTS

Descriptive analysis

The sample had a mean age of 37.7 (Standard Deviation (SD)=8.06). The majority of the sample self-identified as Hispanic (75.8%) and male (98.1%). For marital status, 71.5% reported being married or living with someone, 15.3% reported being single, 9.1% reported being divorced and the remaining 4.1% reported being widowed, separated, never married or other.

Table 1, shows the descriptive statistics, reliability estimates and intercorrelations among the appraisal and outcome variables. All of the scales showed coefficient alpha's>0.70. The correlation between total primary appraisal and total secondary appraisal was high. Posttraumatic stress symptoms were positively associated with depression and negatively associated with life satisfaction. Depression was also negatively associated with life satisfaction.

Profile analysis

We used the tidy LPA library to conduct the latent profile analysis [17]. For this analysis, 7 profiles or possible solutions were extracted. Table 2, shows the results of this analysis including multiple measures of the adequacy of the solution or "fit". Although not universal across all fit indices, we settled on the five-profile solution as having the most consistently favorable fit statistics. For example, it showed the lowest values for Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) and the second-highest entropy value. It also showed the second-highest max probability. No other classification had similarly consistent values. Therefore, a five-class solution was selected.

Figure 1 and Table 3, describe the five profiles extracted from the LPA analysis. As shown, the analyses identified three groups making challenge appraisals and one making threat appraisals. For the challenge appraisal groups, in all cases, appraisal of resources exceeded appraisals of situational demands (the general pattern that has been used to designate challenge in past research). However, these profiles differed significantly in the level of estimated demands (high, moderate and low demands). They also differed in estimated coping abilities with the moderate demand challenge group differing from the other two. I labeled the first group, low demand challenge, the second moderate demand challenge and the third high demand challenge. Another difference among these groups was that the low demand challenge group had the most pronounced difference between perceived demand (low) and perceived resource (high) appraisals. A fourth group was labeled threat because their ratings of demand exceeded their ratings of resources. Finally, the analysis identified a fifth group labeled low low. This group, which consisted of only 17 individuals, reported extremely low ratings (near the bottom of the scales) across both demand and resources. Because the low low group was comprised of less than 25 individuals and because the mean values appeared to reflect a pattern of non-responsiveness to the questions, we eliminated this group from further analyses. The specific pattern of non-responsiveness suggests that these individuals checked 0, for the first option or 1, for the second option without considering the content of the questions. The moderate demand challenge group was the largest, comprising nearly half the total sample. The low demand challenge group was the next largest, comprising roughly a quarter of the sample. The threat group was the third largest comprising almost 17% of the sample. Finally, the high demand challenge and low low groups were the smallest at 9.5% and 2.3%, respectively.

Differences between profiles

A series of one-way Analyses of Variance (ANOVA) examined demographic factors as a function of profile membership. Table 4, shows the demographic factors by profile. Only age differed significantly between groups with the low demand challenge group being significantly older than the high demand challenge group, with the other two groups falling in between. The profiles did not differ on any other demographic variable.

A similar series of ANOVAs showed that the three outcome variables differed significantly between the groups. Figure 2 and Table 5, summarize these results. As shown, the threat group had the highest reported experience of PTSD Checklist-Civilian (PCL-C) version and depression (Zung) and the lowest reported Satisfaction With Life (SWL). In contrast, the three challenge groups showed lower reported posttraumatic stress symptoms, depression and higher satisfaction with life. The low-demand challenge group had the lowest reported posttraumatic stress symptoms and depression and the highest reported satisfaction with life of all the groups. As Table 5, shows, the differences between low demand challenge and the other challenge groups were that low demand challenge was significantly lower than both for posttraumatic stress symptoms, significantly lower than moderate demand challenge for depression and significantly higher than moderate demand challenge for satisfaction with life.

Table 1: Means, Standard Deviations (SD), alpha and correlations among study variables.

S. No.		Mean	SD	α	1	2	3	4	5
1	Total appraisal	-1.16	1.20	0.94	–				
2	Total primary appraisal	2.89	0.82	0.93	.87***	–			
3	Total secondary appraisal	4.05	0.63	0.94	-.77***	-.35***	–		
4	Post-traumatic stress	27.40	10.20	0.92	.42***	.30***	-.40***	–	
5	Depression	32.5	7.85	0.81	.42***	.28***	-.44***	.60***	–
6	Satisfaction with life	23.3	4.83	0.90	-.30***	-0.20***	.31***	-.42***	-.48***

Note: ***p<.001.

Table 2: Fit indices for 1-7 profile solutions.

Profiles	AIC	BIC	Entropy	Prob_Min	Prob_Max	N_Min	N_Max	BLRT(p)
1	3434.43	3452.84	1	1	1	1	1	<0.001
2	3389.38	3421.59	0.57	0.78	0.92	0.31	0.69	<0.001
3	3250.27	3296.3	0.75	0.79	0.93	0.02	0.68	<0.001
4	3220.95	3280.78	0.64	0.76	0.93	0.02	0.48	<0.001
5	3194.29	3267.93	0.73	0.55	0.97	0.02	0.47	<0.001
6	3199.51	3286.96	0.68	0.41	0.97	0.02	0.47	0.53
7	3192.7	3293.96	0.68	0.59	0.98	0.02	0.43	0.02

Note: AIC=Akaike Information Criterion; BIC=Bayesian Information Criterion; BLRT=Bootstrap Likelihood Ratio Test.

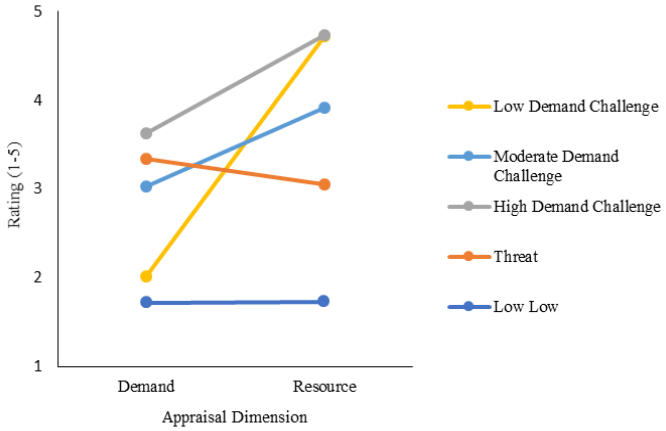

Figure 1: Means plot for 5-profile solution.

Table 3: Descriptive statistics for a 5-profile solution.

	Demand		Resource		n	Percent
	M	SD	M	SD		
Low demand challenge	2.02	0.23	4.72	0.54	179	24.29%
Moderate demand challenge	3.03	0.26	3.92	0.66	346	46.95%
High demand challenge	3.63	0.2	4.73	0.48	70	9.50%
Threat	3.34	0.28	3.05	0.69	125	16.96%
Low low	1.72	0.64	1.73	0.41	17	2.31%

Note: Values not sharing a common superscript differ significantly at p<.05

Table 4: Demographic factors by profile.

Demographics	F	Low demand challenge	Moderate demand challenge	High demand challenge	Threat
Age (Years)	5.50*	39.17	37.61	34.93	37.26
Hispanic (% Hispanic)	0.82	76%	74%	81%	78%
Gender (% Male)	NA	98%	98%	100%	98%
Marital status (% Single)	0.81	70%	65%	67%	71%
Rank (% Officer)	1.1	30%	28%	24%	22%

Note: *p<.01; Values not sharing a common superscript differ at p<.05; The F for gender could not be computed because of the lack of variance in the high demand challenge group.

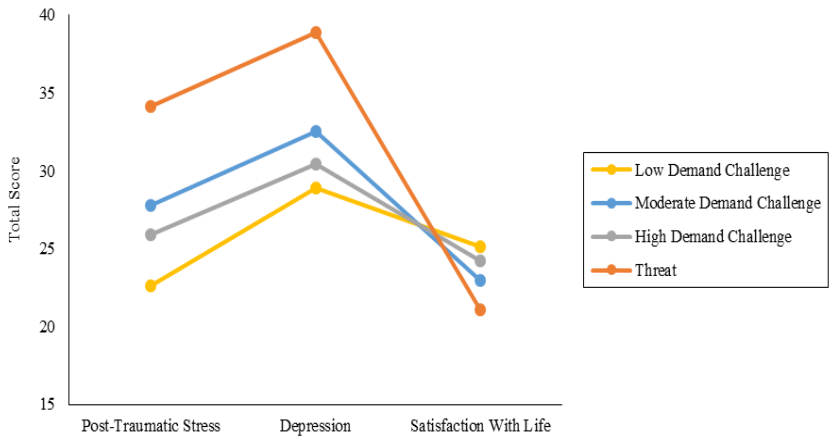

Figure 2: Emotional well-being outcomes.

Table 5: Outcome variables by profile.

Outcome	F	Low demand challenge	Moderate demand challenge	High demand challenge	Threat
Post-traumatic stress	36.92***	22.64	27.77	25.93	34.15
Depression	42.86***	28.87	32.51	30.44	38.90
Satisfaction with life	18.40***	25.15	22.98	24.20	21.06

Note: *=p<.05, ***=p<.001; Values not sharing a common superscript differ at p<.05.

DISCUSSION

Purpose

The purpose of this study was twofold. The first purpose was to identify the number of distinct appraisal profiles in a sample of American firefighters and then to compare them with the profiles found among Chinese employees. The second purpose was to determine whether and how the identified profiles differed along various psychological dimensions including posttraumatic stress, depression and life satisfaction. We anticipated finding between two and seven linear profiles and predicted that these profiles would relate differently to the selected emotional outcomes.

Primary findings

Regarding the first aim, the latent profile analysis results showed that a five-class solution had the most consistently favorable fit statistics. The 5-class solution included three challenge appraisal groups, one threat appraisal group and one small outlier group that we eliminated from the analyses. The fifth group consisted of only 17 individuals from the sample who reported very low ratings across demand and resource appraisals. This group was excluded from the final analysis because it included only 17 individuals [10]. The three challenge appraisal groups all reported that their perceived resources exceeded the perceived demand. The threat group showed a different pattern, with ratings of perceived demand exceeding ratings of resources. Ratings of perceived demands differentiated the three challenge groups with the high demand challenge group having the highest demand ratings, the low demand challenge group having the lowest demand ratings and the moderate demand challenge group falling in between. All three-challenge groups differed significantly in their appraisals of estimated demands and the moderate demand challenge group reported significantly lower resources than the high demand challenge and low demand challenge groups. The low demand challenge group had the most pronounced difference between demand and resource appraisals.

In addition, close examination of these responses suggested a form of self-report bias where individuals appeared to respond at the zero point (the left-most option) for almost every item. Because of the way the Appraisal of Challenge or Threat Scale (ACTS) was structured, this effectively meant they went straight down the left-hand side column to indicate their answers without considering the content of the questions. If these results stand up to replication, it suggests the ability of LPA to detect some forms of response biases in large samples.

As noted, the threat group had a moderate demand appraisal that exceeded the perceived resources. This group felt they were least able to cope with the stressful situations contained in the ACTS scale. The threat group differed significantly from the low demand challenge group for demand appraisals and the low, moderate and high demand challenge groups for resources appraisals.

Regarding the second aim, significant findings emerged from the well-being outcomes. Specifically, the threat group reported the highest posttraumatic stress symptoms and depression and the lowest reported satisfaction with life, compared with the other profiles. In contrast, the three challenge groups indicated lower posttraumatic symptoms, depression and a higher satisfaction with life, with the groups differing as a function of their level of demand. Indeed, the low demand challenge group had the lowest posttraumatic stress and depression as well as the highest reported satisfaction with life. These findings support this study's second hypothesis, suggesting that participants in the different profiles would differ systematically in other mental health outcomes. These data point to cognitive appraisal tendencies (i.e., stable characteristics of persons), as a proximal risk factor for these disorders.

Findings in relation to previous research

These findings have significant implications for previous research. Previous conceptions of stress appraisals dating back to Lazarus and Tomaka et al., suggested threat and challenge are categorical responses in stressful situations [5,7]. This study's use of latent profile analyses suggests that multiple distinct appraisal patterns exist along the threat and challenge continuum. This indicates that there are more than simply two categories individual stress appraisals fall into. Beyond threat appraisals that indicate situational demands that exceed resources, the data showed three types of challenge appraisals, based on levels of perceived demand (low, moderate and high).

The results were similar to a recent study by Bao et al., who also used latent profile analyses on cognitive appraisal variables [11]. Recall, that they identified three profiles related to appraisals of pay dispersions within the workplace. Their three groups were high demand-low resource, moderate demand-moderate resource and high demand-high resource. The current study on the other hand, produced four groups, a high demand challenge group, a moderate demand challenge group, a low demand challenge group and a threat group. In terms of overlapping groups, Baos's moderate demand-moderate-resource group is similar to what we labeled threat and their high demand-high resource group was similar to our high demand challenge group. Unlike Bao et al., we did not find a clearly "threatened" group, similar to their high demand-low resource group. In addition, we found two additional types of challenge appraisals (low and moderate demands) that Bao et al., did not find.

Differences between the samples may help account for these discrepancies. One difference between the samples is that Bao's study sample came from Chinese employees within a workplace as opposed to the current study's sample of southwestern U.S. firefighters. Cultural differences may have impacted the stress appraisals made by each sample group. Additionally, profession may have had an impact since firefighters are likely more adept to dealing with various stressors than individuals within the general workplace. A second difference is that Bao's sample was significantly smaller than the present sample.

The Bao study's sample consisted of 306 employees as opposed to the current study's 737. This may have had a significant impact on the size and number of profiles identified in each study. A third difference is that the Bao study included a significantly larger proportion of women than the current study (54% of the sample was female). The gender diversity of Bao's sample may have affected the size and type of profiles. One other difference is that although both study's evaluated input variables related to appraisals of demand and coping ability, the Bao study was related to pay dispersions, a factor people may not have any control over as compared to the current study's analysis of minor daily stressors where greater control may be possible.

Implications/directions for future research

This study has several implications. First, the study's findings build upon previous research on cognitive stress appraisals and latent profile analyses by suggesting there are more than two possible responses to stressful events. The study's findings also indicate that these unique profiles differ among factors relating to emotional well-being. This information can be used to predict cognitive perceptions of stressful events based on the group an individual is identified with and to predict other psychological conditions these perceptions may be accompanied by such as post-traumatic stress, depression and satisfaction with life.

There are a number of ways these findings can be used to direct future research. First, this method of profiling could be used to assess those who may be in greater need of psychotherapeutic and other related interventions. For example, the threat group found in this study is most clearly in need of counseling/therapy to address the group member's high rates of depression and posttraumatic stress. Similarly, individual changes in appraisal profiles over time might be used to gauge the efficacy of such interventions. Second, this method could be used to assess potential employees in workplace settings. Information gathered related to potential employee's stress appraisals and these other cognitive dimensions could potentially be used to determine if there are certain areas these candidates may need special training in or tasks, they may be best suited for. Another direction may involve using different methods (such as longitudinal or experimental methods) to identify the cause-and-effect relationship. It is important to note that in order to be fully comparable, future research should include the same input variables such as those contained within the ACTS scale.

CONCLUSION

This study provides new insight into latent profile analysis in the context of cognitive stress appraisals. There appears to be evidence that gradations exist among threat and challenge perceptions due to variations in degrees of primary appraisals of situational demands and secondary appraisals of available resources. Additionally, there appears to be groups of individuals along this continuum that respond similarly to stressful events. These groups show significant differences in stress appraisals as well as other various emotional cognitive outcomes. Further research should be conducted on this type of analysis in other settings in public health and psychological contexts.

LIMITATIONS

This study had several limitations. One limitation involves the sample's generalizability. Since the sample consists entirely of EMT municipal firefighters, the stress appraisals of the profiles may differ from those seen by everyday individuals (such as those in the Bao study). Another sample limitation is that the sample was predominantly male. The lack of gender diversity in this study's sample may have affected the types and ranges of the profiles. A second limitation is this study design's reliance on self-reporting. Since participant's responses were self-reported, it can be hard to determine if a portion of participants may have inaccurately represented their true appraisals (assuming outside factors drove them to do so). The low low profile removed from the final analyses in this study certainly indicates that this may be a possibility. A third limitation is the cross-sectional nature of the data. This limited our ability to establish clear cause and effect relationships. For example, appraisals may lead to depression or depression may lead to appraising things in certain ways. Future studies may attempt to follow a prospective study design.

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