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Structuring the Process of Disaster Relief Nurses' Cognitive Evaluation of Stress

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Abstract

Aim: This study aims to structure the process of cognitive evaluation of stress in disaster relief nurses, focusing on long-term adjustment or maladjustment.

Methods: A self-administered questionnaire was completed by 535 disaster relief nurses from Japanese prefectures outside the impact zone of the Great East Japan Earthquake. The study was based on Lazarus and Folkman's work on the theory of stress and divided into three stages: cognitive evaluation of stress, secondary evaluation of emotional changes, and re-evaluation of individual adjustment or maladjustment. External impact factors were established for each stage. A checklist for disaster relief workers and the Impact of Event Scale-Revised were employed. A structural equation model with observed variables was used.

Results: The endogenous variable relationships of the structural model comprised a) cognitive evaluation of stress and emotional changes and b) negative emotions and long-term inability to cope. External impact factors were as follows: for cognitive evaluation of stress, gender (female), marital status (married), timing of disaster relief activities (within 2 weeks of the disaster), nature of the activities (work at evacuation sites), and individual adjustment behaviors (focusing on the problem); for negative emotions, assessment of others' intentions and adjustment behaviors during work

(laughing and joking); for long-term maladjustment, inappropriate assessments of one's own behavior and individual adjustment behaviors (focusing on emotion). The structural model showed discrepancies due to gender.

Conclusions: The cognitive evaluation process of disaster relief nurses' stress could be structured according to stress theory. Furthermore, the study revealed differences in the structural model by gender.

Keywords: Disaster relief nurses, disaster relief activities, structuring, post-traumatic stress disorder, stress-adjustment theory

Introduction

Since the Great Hanshin Earthquake of 1995, Japanese society has increasingly focused on mental health problems, including post-traumatic stress disorder (PTSD), in disaster survivors. Natural disasters threaten not only people's lives and property, but also their mental health. This psychological impact is not limited to direct survivors; it also affects police officers, firefighters, and members of the Self-Defense Forces, in addition to doctors, nurses, and others who perform disaster relief activities (hereafter, "disaster relief workers").

In fact, disaster relief workers experience various stresses: a punishing work regime, feelings of anger and guilt, the task of dealing with corpses, the disaster's impact on them and their family members, insecure livelihoods, and difficulties in adopting stress-adjustment behaviors (Kin, 2003; Kuroda & Sakai, 2008; Yamakawa, Shimizu, & Sato, 2009). Some exhibit symptoms of acute stress disorder (ASD), including feelings of guilt for not having done everything they possibly could to help and re-experiencing shock and rekindled anguish after seeing images of the disaster scene (Nakanobu & Yamada, 2009). These reactions are legitimate responses to disaster situations that individuals should recognize and deal with appropriately (Yamakawa et al., 2009).

Research on PTSD in disaster relief workers reported that 15.6% of 880 firefighters nationwide who experienced traumatic disasters were at high risk of PTSD (Hatanaka, Matsui, & Maruyama, 2004). Furthermore, 12.4% of workers and 6.2% of police officers involved in victim rescue and reconstruction at the World Trade Center in New York exhibited symptoms of PTSD two years after the 2001 attacks (Perrin, 2007). Twelve months after the Great Hanshin Earthquake of 1995, 4.7% of disaster relief nurses were diagnosed with PTSD (Yamaga, Tsutsumi, Doi, & Shirotaka, 2002). Two years after the 2004 Chuetsu Earthquake, 7.9% of disaster relief nurses had high risk of PTSD (Yamasaki & Tanno, 2009). These findings demonstrate a need to understand the psychological impact of disaster relief activities on workers (Fullerton, Ursano, & Wang, 2004).

In 2013, the Headquarters for Earthquake Research Promotion announced a 60% to 70% likelihood of a magnitude 8–9 earthquake occurring in the Nankai Trough within 30 years. If such a disaster were to occur, nurses from all over Japan would be deployed to the scene. Moreover, support would be needed for them to perform their duties without becoming affected by PTSD.

Although studies on disaster relief workers have reported on PTSD occurrence rates and their causes, no study has analyzed the process from the perspective of

cognitive stress evaluation of disaster relief workers' adjustment or maladjustment after the event, along with factors influencing this process. Moreover, most studies on disaster relief nurses have focused on nurses from the disaster areas, with little investigation of nurses from other areas. In addition, as women are more sensitive to stress and are more cognitively aware of threats than men (Olff, 2008), an examination of stress adjustment mechanisms by gender is needed.

Therefore, this study creates a conceptual framework for research based on Lazarus and Folkman's (1984) theory of stress, appropriate because it addresses processes, including stress evaluation as cognitive evaluation, primary evaluation, and secondary evaluation and adjustment. More specifically, this theory takes as its target disaster relief nurses from outside disaster-affected areas and aims at structuring the process from cognitive evaluation of stress experienced in disaster relief activities to emotional changes experienced after the event and long-term adjustment or maladjustment. Furthermore, it aims at clarifying gender differences in this regard.

Conceptual Framework

The conceptual framework comprises three stages: cognitive evaluation of stress during disaster relief activities (stage 1); secondary evaluation and adjustment (stage 2); and re-evaluation and adjustment or maladjustment (stage 3). See Figure 1.

Stage 1: Cognitive evaluation of stress. This is a primary evaluation. Disaster relief workers evaluate events as unrelated to themselves, as harmless duty, or as stressful. Both individual factors (e.g., age, gender, experience in disaster relief activities, motives, adjustment behaviors) and circumstantial factors (e.g., timing, duration, and nature of disaster relief activities) influence cognitive evaluation of stress (Lazarus & Folkman, 1984).

Stage 2: Secondary evaluation and adjustment. Secondary evaluation is the process of determining what to do in a stressful situation. According to Lazarus and Folkman (1984), this is a vital stage in terms of subsequent steps taken by an individual. Adjustment behavior is based on 1) health and energy, 2) positive conviction, 3) problem-solving abilities, and 4) social support. It is hypothesized that individual factors influencing emotions include how individuals evaluate their participation in disaster relief activities, their motives for working in disaster relief, and their adjustment behaviors. Social factors include others' evaluations, the support system for disaster relief activities, and interpersonal relationships (within the rescue team).

Stage 3: Re-evaluation and adjustment/maladjustment. In the re-evaluation stage, one considers whether decisions made in the primary evaluation stage and adjustment strategies were appropriate. This process influences individuals' subsequent

steps (Lazarus & Folkman, 1984). Both individual and social factors influence Stage 3, and adjustment behaviors influence workers' long-term adjustment or maladjustment.

Methods

Participants

Survey participants were 535 nurses nationwide, affiliated with 167 facilities designated as Disaster Medical Assistance Team (DMAT) medical and related institutions. These nurses performed disaster relief activities within 3 months of the Great East Japan Earthquake (March 11, 2011). Nurses based in the three most affected prefectures (Iwate, Fukushima, and Miyagi) were excluded.

Survey Method/Data Collection

An anonymous, self-administered questionnaire was provided from April to July 2014. A letter was sent to supervisory staff in the nursing departments of 605 DMAT medical institutions, and 167 institutions in 44 prefectures agreed to participate. Survey forms were sent to institutions agreeing to participate, and respondents individually returned completed forms by mail.

Ethical Considerations

We provided a written explanation to the research targets and supervisory staff, detailing research objectives and methods, the voluntary nature of participation, how

personal information would be protected, and how research findings would be published. We obtained consent for return of the survey forms.

The Kyushu University Institutional Review Board for Clinical Research (License No.: 26-24) approved this research project.

Survey Contents

The survey items evaluated the following.

1) Stage 1: Cognitive evaluation of stress (20 items)

Dependent variables: Stressors (eight items)

Stressors encountered at the scene were plotted numerically by intensity. Stressors were extracted from preliminary research (Kin, 2003; Kuroda & Sakai, 2008; Yamakawa et al., 2009), and eight items were isolated through discussions between the researchers. For cognitive evaluation of stress, four answer choices were available from "0: I felt no stress" to "3: I felt stress quite strongly." Items' internal consistency was evaluated using Cronbach's α ($\alpha = 0.74$).

Independent variables

(1) Factors influencing cognitive evaluation of stress

Individual factors (nine items): basic factors (age, gender, marital status, years of experience, work rank, and area of residence), experience in disaster relief

activities, motives for performing disaster relief activities, and adjustment behaviors (Stress Self-Rating Scale, Ozeki, 1993)

Circumstantial factors (three survey items): organization dispatching the disaster relief worker and the timing and nature of disaster relief activities

2) Stage 2: Secondary evaluation and adjustment (14 items)

Dependent variables: Emotional changes (Disaster relief workers' checklist)

For clarifying the psychological impact of disaster relief activities, Kato's (2006) checklist has been used as a research measurement tool and a self-checking tool for disaster relief workers (Ohtsuka & Matsumoto, 2007; Kobayashi et al., 2011). It records emotional changes experienced immediately after time in the field (11 check items). If three or more items apply to the respondent, the psychological impact of disaster relief activities is considered severe.

Independent variables

(1) Adjustment behaviors during disaster relief activities (six items)

(2) Factors influencing emotional changes

Individual factors (four survey items): self-evaluation of one's disaster relief activities (affirmative and negative) (four answer choices), motives for performing disaster relief activities, and individual adjustment behaviors (Stress Self-Rating Scale).

Social factors (three survey items): appropriate assessment of others' intentions in conducting disaster relief activities, the support system, and interpersonal relationships within the rescue team (four answer choices)

3) Stage 3: Re-evaluation and adjustment or maladjustment (10 survey items)

Dependent variables: Adjustment or maladjustment (Impact of Event Scale-Revised (IES-R)

The IES-R (Asukai, 1999) is a linear measure for assessing intrusive symptoms that form the basis for a PTSD diagnosis (eight check items), avoidance symptoms (eight check items), and hyperarousal symptoms (six check items). The five answer choices for its 22 items range from "0: Not at all" to "4: Very much so." A score of 25 or over indicates high risk of PTSD. The credibility and appropriateness of this linear measure have been demonstrated (Iwai, Kato, & Asukai, 1998); here, it was used as an index of adjustment/maladjustment during the survey—approximately 3 years after time in the field.

Independent variables

(1) Adjustment behaviors after the event (nine items)

Measurement Tools

Stress Self-Rating Scale (Ozeki, 1993). During the survey, this linear measure

of adjustment assesses the greatest stressor the respondent felt. Positive adjustment was categorized into focusing on the problem and focusing on the emotion. Negative adjustment was categorized into avoidance and flight. Each item had four answer choices ranging from "0: Not at all" to "3: Always." The credibility and appropriateness of this linear measure have been demonstrated (Ozeki, Haraguchi, Tsuda, 1993; Masuda, 1994), and it was used here as an index for adjustment behaviors under the rubric of individual as opposed to social or circumstantial factors.

Data Analysis

Cognitive evaluation of stress, emotional changes, and long-term adjustment/maladjustment were set as standard variables for each stage. The relation between these and factors exerting influence (explanatory variables) was examined through multiple regression analysis. Male and female respondents were analyzed separately. Differing factors that exerted influence were extracted. We used JMP Pro 11 and Stata/MP 13.1 for statistical analysis and set the level of significance (critical p-value) at under 5%. Next, structural equation models (SEM) with observed variables were used to create the structural model.

Results

Of 1,011 survey forms sent, 544 (53.8%) were returned, yielding 535 (52.9%)

effective responses.

Disaster Relief Nurses' Individual Characteristics and Life Situations (Table 1)

Respondents' average age was 42.8 ± 8.3 years. There were 393 (73.5%) women and 140 (26.1%) men. Among them, 224 (41.9%) were single. The greatest number of respondents (225; 42.1%) were nursing staff. In area of residence, 458 respondents (85.4%) came from outside the Tohoku and Kanto regions, which are directly contiguous with the main impact zone of the Great East Japan Earthquake. With regard to the time period, 127 individuals (23.7%) began disaster relief activities within a week of the earthquake. The majority of respondents (330; 61.7%) worked at evacuation sites.

Factors Exerting Influence at Each Stage (Table 2)

Factors influencing cognitive evaluation of stress (stage 1), emotional changes (stage 2), and long-term adjustment/maladjustment (stage 3) were subjected to multiple regression analysis for each stage.

Cognitive Evaluation of Stress

Averages for cognitive evaluation of stress (scale of 0 to 24) were 10.4 ± 4.8. Items that received the most "I felt it strongly" responses were "Tragic scenes" (184 respondents; 34.4%), "We are at the limits of disaster relief activities" (136 respondents;

25.4%), and “Insecure livelihoods” (120 participants; 22.4%).

Individual factors that influenced cognitive evaluation of stress were gender (female), marital status (married), and individual adjustment behaviors (focusing on the problem). Neither experience in disaster relief activities, nor years of clinical experience were related.

Influential circumstantial factors were the nature of the disaster relief activities (“working at evacuation sites”) and timing (“within 2 weeks of the disaster”). The organization that dispatched the workers was not related.

Emotional Changes

The average score (scale of 0 to 11) on the checklist was 1.8 ± 1.3 points. A score of three points or above, indicating a severe psychological impact and need for intervention, was recorded for 146 (27.3%) individuals.

Among the six adjustment behaviors used during disaster relief activities, for the secondary evaluation items, over nine-tenths of the disaster relief nurses responded positively to “Taking time for breaks,” “Taking time and space for meals,” and “Taking time for sleep.” The only adjustment behavior linked with emotions after time in the field was “Telling jokes and laughing.”

Among individual factors, a link was found for sense of purpose acting as

motivation and inappropriate assessment of one's own behavior. Among social factors, a link was found only for appropriate assessment of others' intentions. Positive self-evaluation, adjustment behaviors, etc., were not influential.

Long-term Adjustment/Maladjustment

Average IES-R values (scale of 0 to 88) were 7.0 ± 10.8. Thirty-eight (7.1%) respondents scored 25 points or more. Among items representing adjustment behaviors, the one to which respondents most often answered "I often did it" was "I talked with my fellow rescue workers" (74 respondents; 13.8%). The only item linked to subsequent maladjustment was "I talked with my colleagues."

Individual factors that exhibited a link were inappropriate assessment of one's own behavior and individual adjustment behaviors (focusing on emotion). Among social factors, it was the appropriate assessment of others' intentions.

Structural Model and Goodness of Fit (Figure 2)

Based on factors that influenced each stage of disaster relief, we used SEM to create a structural model of the process from cognitive evaluation of stress to adjustment/maladjustment after time in the field (Figure 2).

Cognitive evaluation of stress, negative emotions, and long-term maladjustment were endogenous variables. For cognitive evaluation of stress, exogenous variables

exerting an influence were gender (female); marital status (married); timing of disaster relief activities (within 2 weeks of the disaster); nature of disaster relief activities (working at evacuation sites); and adjustment behaviors (focusing on the problem). For negative emotions that occurred after time in the field, variables were appropriate assessment of others' intentions and adjustment behaviors during relief activities (telling jokes and laughing). For long-term maladjustment, they were inappropriate assessment of one's own behavior and adjustment behaviors (focusing on emotion). Regarding interconnections between endogenous variables, we found strong links between cognitive evaluation of stress and negative emotions and between negative emotions and long-term maladjustment.

The structural model's goodness of fit is 0.888 on the comparative fit index (CFI), the root mean square error of approximation (RMSEA) is 0.064, and the standardized root mean square residual (SRMR) is 0.036.

Factors Influencing Each Stage by Gender (Table 3)

In Stage 1, for female respondents, influencing factors were marital status (married); individual adjustment behaviors (focusing on the problem); nature of disaster relief activities (working at evacuation sites); and timing of disaster relief activities (within 2 weeks of the disaster). For male respondents, the only factor was lifesaving operations as part of disaster relief activities.

In Stage 2, for female respondents, influencing factors were adjustment behavior (telling jokes and laughing); motives for engaging in disaster relief activities (sense of purpose); and appropriate assessment of others' intentions. For male respondents, it was inappropriate assessment of one's own behavior.

In Stage 3, for female respondents, influencing factors were not evaluation of behavior, but adjustment behaviors after time in the field such as talking with colleagues and focusing on emotion. In contrast, for male respondents, the only factor was inappropriate evaluation of their behavior. Furthermore, social factors were not an influential factor in gender.

Gender Discrepancies in the Structural Model

Figure 3 presents the structural model. For female respondents, in the cognitive evaluation of stress, influencing factors were marital status (married); timing of disaster relief activities (within 2 weeks of the disaster); nature of disaster relief activities (working at evacuation sites); and adjustment behaviors (focusing on the problem). Concerning negative emotions, factors were appropriate assessment of others' intentions and adjustment behavior during work (telling jokes and laughing). Regarding long-term maladjustment, factors were adjustment behavior after time in the field (talking with colleagues) and adjustment behaviors (focusing on the emotion).

For male respondents, in cognitive evaluation of stress, factors were the nature of disaster relief activities (lifesaving activities) and negative emotions. With regard to long-term maladjustment, the factor was inappropriate assessment of one's own behavior.

The goodness of fit was as follows: for the female model, CFI = 0.909, RMSEA = 0.064, and SRMR = 0.032; for the male model, CFI = 0.955, RMSEA = 0.077, and SRMR = 0.050.

Discussion

Structural Model for Cognitive Evaluation of Stress From Time in the Field to Adjustment/Maladjustment

Lazarus and Folkman (1984) clarified that an individual's experience greatly influences cognitive evaluation of stress, the adjustment process, emotions, and long-term adjustment or maladjustment. Rescue workers who display ASD immediately after disaster relief activities have higher risk of developing PTSD symptoms (Fullerton et al., 2004). This study has established that primary evaluation, secondary evaluation, and re-evaluation have strong impact that extends to individuals' emotions immediately after disaster relief activities and to subsequent adjustment.

Moreover, based on influence factors at each stage, it was possible to structure

disaster relief nurses' process of stress response accompanying disaster relief activities.

Furthermore, in the structural model, major gender differences were demonstrated by influencing factors. However, factors that influenced each stage of the structural model all differed, and in fact, were not the same for males and females. In addition, this study's structural model (Fig. 2) was almost the same as the females' model (Fig. 3), because 73.5% of the respondents were females.

Therefore, we examined factors influencing each stage of the structural model for males and females.

Females' structural model

In Stage 1, individual factors influencing cognitive evaluation of stress are commitment and positive conviction. Circumstantial factors are indeterminacy of events, degree of temporal urgency, and duration of events (Lazarus & Folkman, 1984). Commitment reflects what is important to the individual and includes decision making, values, and goals. Positive conviction is the degree to which individuals believe that they can control stressor circumstances and outcomes. The survey addressed four factors influencing disaster relief nurses' evaluations that the disaster scene was "dangerous" or "threatening." Individual factors were marital status (married), and adjustment behaviors (focusing on the problem). Circumstantial factors were the timing

of disaster relief activities and working at evacuation sites. Although motives and the organization that dispatched disaster relief workers were hypothesized as related to commitment, no such links were established.

Of disaster relief nurses, married women felt stress more strongly than their single counterparts, possibly explained by anxiety at relinquishing their various family life roles to spouse and children to venture into a disaster zone. Their tendency to conflate the situation of families in the disaster zone with their own family's situation is another explanation. With regard to adjustment behaviors, the stronger the tendency disaster relief nurses display toward focusing on the problem, the stronger their responses. Many stressors are intractable problems not amenable to direct identification and resolution. Thus, nurses who tend to focus on the problem evaluate their stress levels as higher in situations they cannot control.

Stressors include handling mutilated corpses, particularly the corpses of children; the limitations of what rescue operations can achieve; criticism and complaints from residents of the disaster zone; and threats to the workers' own safety and well-being (Kin, 2003). Furthermore, rescue workers dispatched during the disaster's acute phase suffered deterioration of their subjective sense of well-being and were likely to suffer worsening sleep disorders and a heightened sense of fatigue (Yokoyama et al.,

2014). Thus, this study has clarified circumstantial factors of relief workers assisting at evacuation sites within 2 weeks of the disaster. The disaster scene in its acute phase was chaotic, with constant risk of aftershocks and secondary damage. Workers at evacuation sites were exposed to the trauma of survivors or to survivors' anger and might have identified strongly with survivors' feelings. These situations functioned as circumstantial factors influencing workers' cognitive evaluation of stress.

Secondary evaluation comprises examining how one should handle stress and deal with situations. It is impacted by emotions felt immediately after working in the field.

Secondary evaluation in relation to choice of adjustment behavior alters in response to developments in the situation and influences long-term adjustment (Lazarus & Folkman, 1991). The onsite adjustment behavior of "telling jokes and laughing," along with others' appropriate evaluation of one's disaster relief activities, was related to positive emotions after disaster relief activities. In fact, "Telling jokes and laughing" was the only adjustment behavior related to positive emotions after time in the field. Saito and Sugawara (2007) stated that focusing on the problem reduces stress in situations that are highly amenable to being controlled. However, in uncontrollable situations, focusing on emotion by telling jokes and laughing may have been the most

effective means for disaster relief nurses to suppress their discomfort, find relief, and reduce stress.

Another factor linked to negative emotions was the feeling that one's efforts were not appropriately evaluated by others. Commitment and positive conviction influence cognitive evaluation of stress (Lazarus & Folkman, 1984) and tie into one's sense of mission and responsibility in disaster relief activities (Urabe & Miyazono, 2007). The feeling of failing to receive appropriate recognition for one's efforts can decrease one's self-esteem and sense of achievement, leading to negative emotions.

After disaster relief workers have gone through the process of primary and secondary evaluation and engaged in adjustment behavior, they enter stage 3, the re-evaluation stage. Stress in harsh environments leads to long-term adaptation and maladaptation by processes such as people's assessment and coping (Lazarus & Folkman, 1984). We believe that re-evaluation—if workers can reduce stress and reflect on the experience of disaster relief activities as "a personal plus"—will lead to further self-development and involvement in disaster relief activities. However, if disaster relief workers are persistently unable to adjust to stress reactions, they may fall into a state of maladjustment.

Adjustment behaviors (focusing on emotion) and the behavior "I talked with

my colleagues," after time in the field influenced maladjustment. Kin (2003) recommended that disaster relief workers refrain from suppressing their memories and accept what happened. Disaster relief nurses who tended to focus on emotion, by "ceasing to think about problems involved in the relief effort" and "rethinking the meaning of problems involved in the relief effort," tended to suppress their negative feelings, consequently becoming prone to maladjustment. Furthermore, physiologically, when anyone is confronted with stressors, the body produces oxytocin. However, because women have a greater quantity of oxytocin, their relationships with others close to them are further spurred, making women more likely than men to seek support from those around them (Taylor, Klein, Lewis, & Gruenewald, 2000). Furthermore, socially, it is regarded as desirable for women to seek support (Collins & Miller, 1994). These findings clarify that when women are engaged in disaster relief activities, they reduce stress by engaging with others.

Males' structural model

For men, lifesaving operations and inappropriate assessment of their individual behavior influenced the process toward adjustment or maladjustment. Taylor et al. (2000) stated that the "fight or flight" response is particularly notable in men. The disaster covered by this survey involved both an earthquake and a tsunami, and the

situation related to lifesaving operations was exceptionally taxing. The sole factor influencing male respondents was their own behavior in lifesaving operations and the resulting outcomes. But unlike female respondents, the influence did not extend to male respondents' adjustment behavior. These gender disparities arise from socialization, in which asking for support is considered a display of weakness in men, but encouraged for women (Collins & Miller, 1994). Thus, men may have inappropriate assessment of their individual behavior; "I could have done more" is linked to the feeling "I couldn't do anything and wish I could have done more." In other words, the individual is unable to offer any examples of achievements in the limited time span available. This is linked with feelings of not having completed the job and lacking competence in disaster relief activities. We can presume that these emotions, which oppress the individual over the long term, influence disaster relief workers.

Drawing on Lazarus and Folkman's (1984) theory of stress and the conceptual framework, this study has clarified disaster relief nurses' process of adjustment or maladjustment from cognitive evaluation of stress after time in the field. Disaster relief nurses' stress reactions are explicable in terms of stress theory. Furthermore, there are gender differences in the process of adjustment or maladjustment resulting from

cognitive evaluation of stress.

The structural model of males and females reached satisfactory values on goodness-of-fit indices. This suggested that the model may be clinically useful in cases of disaster relief nurses' maladjustment, as an examination of an effective intervention period and intervention methods. Furthermore, during times of calm, planning education and support systems that consider gender as a given is necessary to forestall any maladjustment that might occur for disaster relief activities after nurses' time in the field.

Possibility of Applying the Structural Model for Disaster Nurses and Study Limitations

Since the Great East Japan Earthquake of 2011, other major disasters have occurred, such as torrential rains in northern Kyushu in 2012, Saitama tornadoes in 2013, and torrential rains in Hiroshima Prefecture in 2014. Similar disasters will occur in the future, and disaster relief nurses will be needed for lifesaving operations and survivor support. Thus their risk for ASD and PTSD must be addressed.

Recently, the period after working in the field has become a major focus in mental health care for disaster relief workers. Since the Great Hanshin Earthquake of 1995, multiple initiatives have provided debriefing and peer counseling, along with

construction of a care system for disaster relief workers (Matsui, Inoue, & Hatanaka, 2006). However, for disaster relief workers to avoid ASD and PTSD, governments, NGOs, and other entities must develop education and support systems that cover the process from cognitive evaluation of stress in disaster relief activities to long-term adjustment/maladjustment.

The study's structural model showed that cognitive evaluation of stress at the disaster scene and immediate, subsequent negative emotions greatly influence disaster relief nurses' maladjustment. This suggests that intervention is necessary from the first stages of disaster relief activities, and a support system is needed throughout the process.

The timing and location of disasters are unpredictable, and disaster relief nurses have various motivations for their work. Of influencing factors, those amenable to control are adjustment behaviors and evaluation of disaster relief activities by respondents and others. To prevent long-term maladjustment, nurses must become aware of their adjustment behaviors and choose effective ways of managing their emotions. Furthermore, receiving appreciation helps disaster relief nurses adjust to negative emotions and can lead to feelings of self-affirmation, such as "I did everything I could" and "It was a meaningful effort." Hence, establishing an active support system

for during and after disaster relief activities is important.

Gender discrepancies in the structural model have important implications. Namely, education before nurses become involved in a disaster situation and support structures, each tailored to males and females, are necessary to address these differences.

These findings are based on a survey of a composite disaster, including the earthquake and tsunami, that constituted the Great East Japan Earthquake, and there are limits to their general application. They may, however, be of use in the international environment, where disasters strike in many forms. Application of a structural model using stress theory may be useful to governments or NGOs in developing a support system for disaster relief nurses.

Further multifaceted studies are needed to structure the complexities of human behavior and psychology behind disaster relief nurses' adjustment or maladjustment. From now on, to increase this structural model's validity, integrated, substantive, and qualitative research is needed.

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Disclosure

We have no actual or potential conflicts to disclose.

Contributions

YM, HN contributed to the conception and design of this study and drafted the manuscript; TK, YM performed the statistical analysis; NH critically reviewed the manuscript and supervised the whole study process. All authors read and approved the final manuscript.

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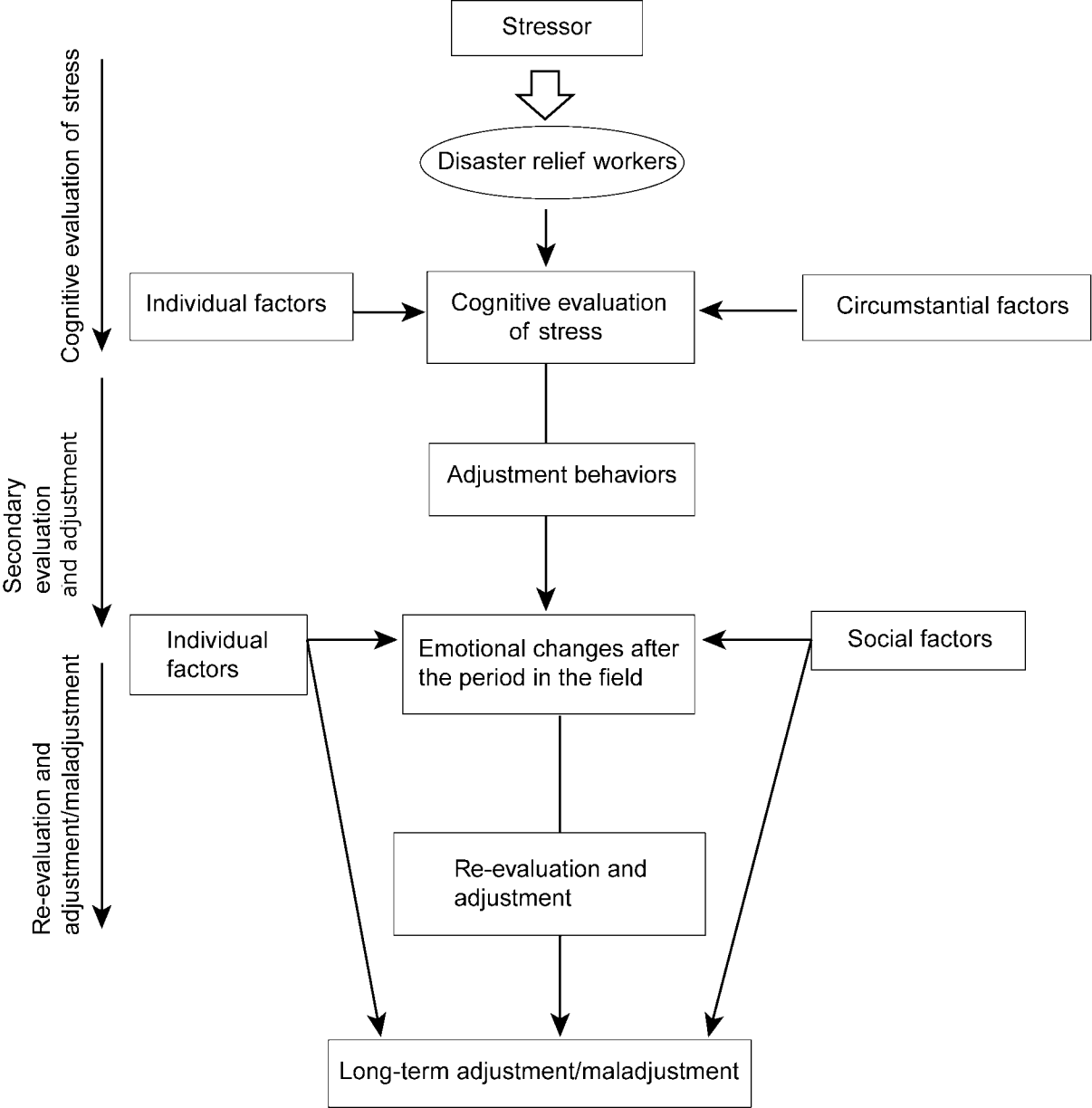
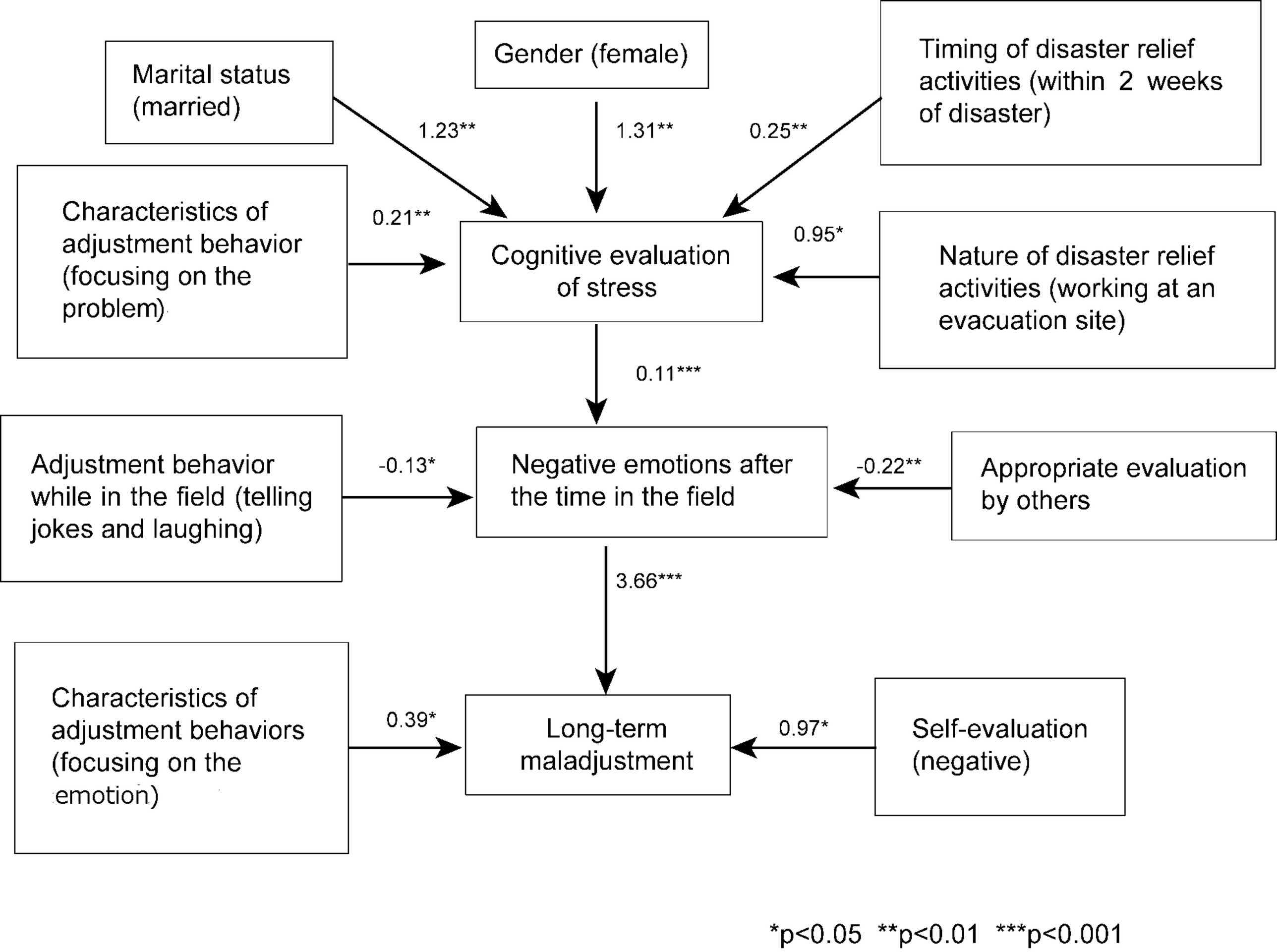

Stressor
Disaster relief workers
Cognitive evaluation of stress
Individual factors
Cognitive evaluation of stress
Circumstantial factors
Secondary evaluation and adjustment
Adjustment behaviors
Individual factors
Emotional changes after the period in the field
Social factors
Re-evaluation and adjustment/maladjustment
Re-evaluation and adjustment
Long-term adjustment/maladjustment


Marital status (married)
Gender (female)
Timing of disaster relief activities (within 2 weeks of disaster)
1.23**
1.31**
0.25**
Characteristics of adjustment behavior (focusing on the problem)
0.21**
Cognitive evaluation of stress
0.95*
Nature of disaster relief activities (working at an evacuation site)
0.11***
Adjustment behavior while in the field (telling jokes and laughing)
-0.13*
Negative emotions after the time in the field
-0.22**
Appropriate evaluation by others
3.66***
Characteristics of adjustment behaviors (focusing on the emotion)
0.39*
Long-term maladjustment
0.97*
Self-evaluation (negative)
*p<0.05 **p<0.01 ***p<0.001

Females n = 393

Marital status (married)

Timing of disaster relief activities (within 2 weeks of the disaster)

1.08*

0.27**

Characteristics of adjustment behavior (focusing on the problem)

0.20*

Cognitive evaluation of stress

1.20*

Nature of the disaster relief activities (working at an evacuation site)

0.12***

Adjustment behaviors while in the field (telling jokes and laughing)

-0.17*

Negative emotions after the period in the field

-0.32***

Appropriate evaluation by others

3.91***

Characteristic behaviors (focusing on the emotion)

0.61**

Long-term maladjustment

-1.32*

Adjustment behaviors after the time in the field (talking with colleagues)

Males n = 140

Nature of the disaster relief work (lifesaving activities)

3.04*

Cognitive evaluation of stress

0.10***

Self-evaluation (negative)

0.24*

Negative emotions after the period in the field

2.66***

2.55***

Long-term maladjustment

*p<0.05 **p<0.01 ***p<0.001

Table 1
Disaster Relief Nurses' Individual Characteristics and Life Situation (N = 535)

	N	%	Mean	SD
Age			42.8	8.3
Gender				
Female	393	73.5		
Male	140	26.1		
Unclear	2	0.4		
Marital status				
Single	224	41.9		
Married	306	57.1		
Unclear	5	1.0		
Years of experience			20.4	8.3
Work rank				
Head of nursing dept.	7	1.3		
Vice head	23	4.2		
Head nurse	116	21.7		
Senior nurse	164	30.6		
Staff nurse	225	42.1		
Area of residence				
Tohoku and Kanto	77	14.6		
Outside Tohoku and Kanto	458	85.4		
Experience in disaster relief activities				
Experienced	80	14.9		
Inexperienced	455	85.1		
Motives for performing disaster relief activities				
Sense of mission	269	50.3		
Duty	83	15.5		
Organization dispatching the disaster relief worker				
Medical institutions	217	40.6		
DMAT	113	21.1		
Japanese Nursing Association	66	12.3		
Timing of disaster relief activities				
From occurrence ≦ 7days	127	23.7		
8–14 days	47	8.8		
15–30 days	148	27.6		
31–60 days	139	26.1		
≧ 61 days	59	11.0		
Unclear	15	2.8		
Nature of disaster relief activities (multiple answers)				
Lifesaving	40	9.2		
Work at an evacuation center	330	61.7		
Work at a hospital in disaster zone	104	19.4		
Psychological care	45	8.4		
Traveling clinic	239	44.7		
Visits (health management)	146	27.3		
Other	65	12.1		

Table 2

Factors: Cognitive Evaluation (Stress), Emotional Change, Long-Term Adjustment/Maladjustment (N = 535)

	Mean(SD)	β	SE	p value
【Stage 1: cognitive evaluation of stress】				
Cognitive evaluation of stress （0–24）	10.4 (4.8)			
Individual factors				
Gender (female)		0.11	0.24	.015*
Marital status (married)		0.12	0.21	.008**
Characteristics of adjustment behaviors (focusing on the problem)		0.13	0.07	.003**
Circumstantial factors				
Nature of disaster relief work (working at evacuation center)		0.11	0.21	.015*
Timing of disaster relief work (within 2 weeks of occurrence)		0.11	0.22	.013*
【Stage 2: emotional changes after the period in the field】				
Checklist for disaster relief workers （0–11）	1.8 (1.3)	Note: over 3 pts：146 people （27.3%）		
Adjustment behaviors while in the field				
Telling jokes and laughing		-0.16	0.07	<.001***
Individual factors				
Motives for engaging in disaster relief activities (sense of purpose）		0.12	0.05	.004**
Self-evaluation (negative)		0.11	0.06	.007**
Social factors				
Appropriate evaluation by others		-0.11	0.08	.007**
【Stage 3: Long-term adjustment/maladjustment】				
IES-R (0-88)	7.0 (10.8)	Note: Over 25 pts： 38 people （7.1%）		
Adjustment behaviors after the period in the field				
Talking with colleagues		-0.11	0.52	.013*
Individual factors				
Self-evaluation (negative)		0.14	0.45	<.001***
Characteristics of adjustment behaviors (focusing on the emotion)		0.13	0.21	.001**
Social factors				
Appropriate self-evaluation		-0.13	0.54	.002*

*p <0 .05 **p <0 .01 ***p <0.001

Table 3
Factors: Cognitive Evaluation (Stress), Emotional Changes, Long-Term Adjustment/Maladjustment by Gender

	Female n = 393				Male n = 140			
	Mean (SD)	β	SE	p value	Mean (SD)	β	SE	p value
【Stage 1: Cognitive evaluation of stress】								
Cognitive evaluation of stress (0–24)	10.6(4.9)				9.6 (4.5)			
Individual factors								
Marital status (married)		0.10	0.24	.045*				
Characteristics of adjustment behaviors (focusing on the problem)		0.12	0.08	.020*				
Circumstantial factors								
Nature of disaster relief work (lifesaving activities)						0.19	0.72	.028*
Nature of disaster relief work (working at evacuation center)		0.13	0.25	.007**				
Timing of disaster relief work (within 2 weeks of occurrence)		0.11	0.28	.036**				
【Stage 2: emotional changes after the period in the field】								
Checklist for disaster relief workers (0–11)	1.9 (1.4)				1.6 (1.4)			
Adjustment behaviors while in the field								
Telling jokes and laughing		-0.21	0.07	< .001***				
Individual factors								
Motives for engaging in disaster relief activities (sense of purpose)		0.11	0.07	.030*				
Self-evaluation (negative)						0.21	0.12	.013*
Social factors								
Appropriate evaluation by others		-0.21	0.09	< .001***				
【Stage 3: Long-term adjustment/maladjustment】								
IES-R (0–88)	7.6(10.2)				5.6 (8.9)			
Adjustment behaviors after the period in the field								
Talking with colleagues		-0.14	0.64	.003**				
Individual factors								
Self-evaluation (negative)						0.37	0.76	<.001***
Characteristics of adjustment behaviors (focusing on the emotion)		0.13	0.26	.009**				

*p < 0.05 **p <0.01 ***p < 0.001