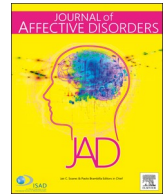




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Research paper

When a maritime disaster disrupts the community: The longitudinal course of Post-traumatic stress disorder and predicted factors after Sewol ferry disaster in South Korea



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ABSTRACT

Background: The present study assessed acute, delayed, and chronic post-traumatic stress disorder (PTSD) in community residents affected by the disaster, as well as the factors related to the manifestation of symptoms.

Methods: A total of 2,597 community residents who lived in Jindo, where the Sewol ferry disaster occurred, participated in a survey at baseline (1.5 months); 1,228 (47%) of these respondents were followed-up 15 months later. The variables included demographic characteristics, witnessing the rescue scene, being a community volunteer, and lifetime traumatic experiences. PTSD, depression, and anxiety symptoms were measured using the Impact of Events Scale-Revised (IES-R), Center for Epidemiologic Studies Depression (CESD), and Beck Anxiety Inventory (BAI), respectively. An assessment of property loss due to the Sewol ferry disaster was also included in the follow-up evaluation.

Results: The proportion of PTSD cases among community residents at baseline and follow-up were 16.1% and 15.6% (delayed PTSD, 10.1; chronic PTSD, 5.5%), respectively. Depression and anxiety symptoms at each time point were consistently associated with acute, delayed, and chronic PTSD. Logistic regression analyses showed that anxiety symptoms at baseline predicted the delayed and chronic PTSD. Chronic PTSD was independently predicted by the witness rescue and loss of property immediately after the disaster.

Conclusions: The present findings provide important evidence supporting the need for comprehensive assessment and management of mental health problems in community residents exposed to a disaster. Financial losses experienced by community residents after a trauma must also be addressed, and psychiatric comorbidities such as depression and anxiety should be identified and treated.

1. Introduction

On April 16, 2014, the Sewol ferry capsized and sank off the coast of Jindo, South Korea and more than 300 people died (The New York Times, 2017). Most of the victims were students from Incheon on a high school trip to Jeju Island. The search mission for victims of the disaster ended on November 11, 2014; the bodies of nine victims were never recovered. Recent follow-up studies have reported that survivors of the Sewol ferry disaster have suffered from PTSD symptoms as well as depression, insomnia, anxiety, and aggression even several years after the disaster (Lee et al., 2018a, 2018b). Embitterment among the bereaved families has increased along with PTSD, anxiety, and complicated grief over time (Yun et al., 2018).

The residents of Jindo, a rural town in South Korea with a population of 33,000, are mostly employed in the agriculture, fishery, and

tourism industries. In April, many tourists travel to Jindo for the Spring Festival. Paengmok Harbor in Jindo is the closest port to the site of the Sewol ferry disaster (approximately 25 kilometers away) and is normally used to transport villagers and goods to nearby islands. During the disaster, the harbor functioned as a base camp for rescue operations, and as shelter for victims and their family members. Thus, the residents of Jindo witnessed the rescue process and the overwhelming grief of bereaved families at the harbor. An initial study with 2,298 adults (respondents making use of mental health services after the disaster) assessing the immediate reactions of the Jindo residents after the Sewol ferry disaster reported that the prevalence of post-traumatic stress disorder (PTSD) was 15.8% (Lee et al., 2017). Thus, witnessing the disaster is considered to be an important contributory factor to the development of PTSD symptoms in this population.

The rescue process prolonged the exposure of Jindo residents to the

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disaster and hindered their community-based work. After the disaster, Paengmok Harbor became a pilgrimage site; family members of victims and hundreds of citizens gather at the harbor in memory of their loved ones every year following the disaster. At the same time, Jindo was stigmatized as a community of death and sadness. The somber atmosphere around Jindo has resulted in a decrease in the number of tourists visiting the island, in turn decreasing the incomes of residents. According to the Jindo Fisheries Cooperative, 511 debtors received special working funds that amounted to \$14.79 billion from fishermen who experienced economic difficulties after the Sewol ferry disaster (Yeonhap, 2019).

Several studies have reported that mental health problems among community residents affected by a disaster persist long after the actual event, especially in those that experience negative financial outcomes (Galea et al., 2008; Buttke et al., 2012). However, to date, the majority of studies investigating the psychosocial and financial compensation issues associated with the Sewol ferry disaster have focused on the family members of individuals who lost their lives; the residents and volunteers of Jindo have been relatively overlooked. Thus, the present study examined the long-term (i.e., after 15 months) consequences of the Sewol ferry disaster for the residents of Jindo. Additionally, we tried to examine the association between PTSD symptoms and disaster-related factors among the community residents according to the course of PTSD symptoms using follow-up assessment.

2. Methods

2.1. Study design and participants

Figure 1 shows flowchart of the study procedure. The present longitudinal study assessed symptoms of PTSD reported by the residents of Jindo via a self-report survey administered 1.5 and 15 months after the disaster. This investigation was performed as part of a community school-based study that examined the mental health consequences of the Sewol ferry disaster; therefore, all of the participants in this study were parents of students in Grades 1 through 12 drawn from 20 of the

21 schools on Jindo. The initial survey was conducted from May 25 to June 3, 2014, which was approximately 1.5 months after the Sewol ferry disaster. A total of 3,482 adults were approached to take part in the study, of whom 2,760 (79.3%) consented to participate. A total of 2,597 subjects (1,241 males), after excluding those with incomplete or inappropriate responses to the IES-R, were included in the baseline analyses. The follow-up assessment was conducted from July 13 to 18, 2015, which was approximately 15 months after the disaster and 1,228 (47.3%, 568 males, and 660 females) were included in the follow-up analysis. Each parent received a sealed questionnaire and information from the participating students. They completed the questionnaire at home and returned it in a sealed envelope. The students and classroom teachers received written explanations of the procedure and purpose of this study, and informed consent was obtained from all subjects. The study was approved by the Chonnam National University Hospital Institutional Review Board.

Data on sociodemographic factors, exposure to the rescue scene, and volunteerism were obtained at baseline and follow-up. Lifetime traumatic experiences were assessed at the baseline assessment. Self-report questionnaires, including the Impact of Events Scale-Revised (IES-R), the Center for Epidemiologic Studies Depression Scale (CESD), and Beck Anxiety Inventory (BAI) were administered to the subjects at baseline and follow-up. Information regarding the loss of property due to the disaster was collected at the follow-up.

2.2. Sociodemographic characteristics and disaster-related factors

Data regarding sociodemographic characteristics, including gender, age, length of residence in Jindo, education level, self-rated socioeconomic status, religion, and employment status were obtained. Participants were asked the following question regarding whether they had directly witnessed distressing scenes at the rescue site: “Did you visit Paengmok Harbor following the Sewol ferry disaster when dead bodies were present at the scene and family members of victims were waiting for them to be found?” Participants were asked whether they had participated in rescue work at Paengmok Harbor following the

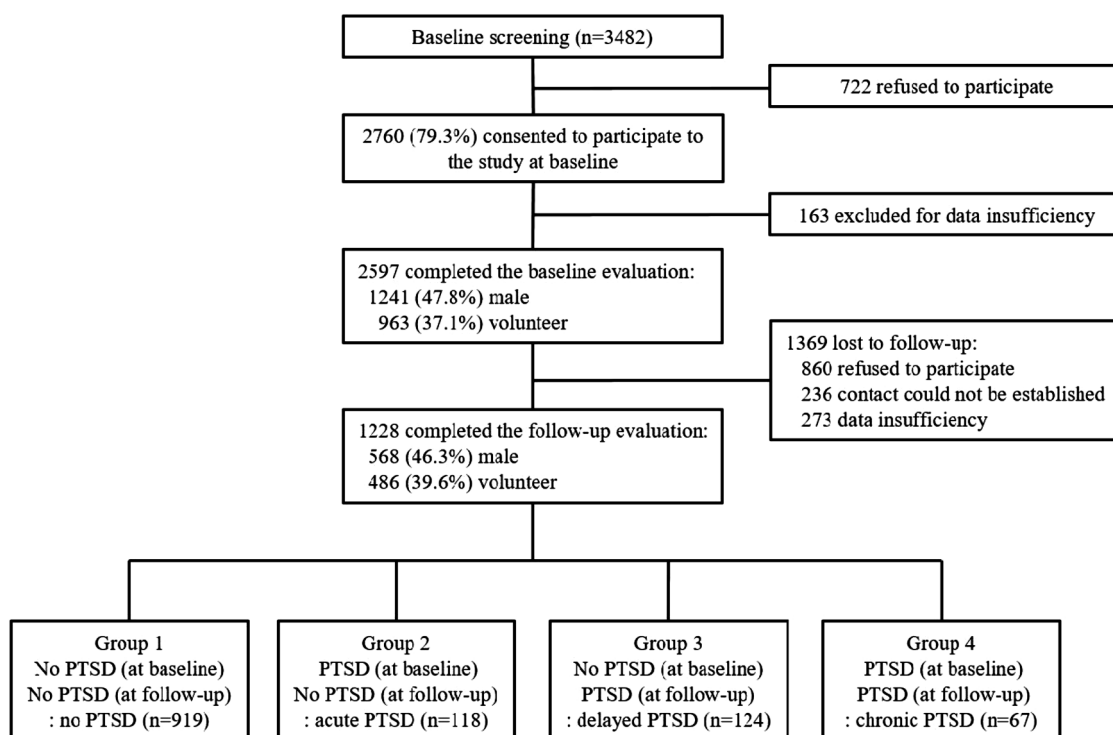


Fig. 1. Flow diagram for baseline recruitment and sample follow-up (PTSD = Post-Traumatic Stress Disorder)

Sewol ferry disaster. Regarding lifetime traumatic experiences, participants were asked whether they had previously experienced traumatic events, including bereavement (“One of my parents, a brother or sister died”), property loss or damage (“I have experienced property loss due to bankruptcy of my family member”), or a natural disaster (“I have experienced property or health damage by a natural disaster”) before the Sewol ferry disaster. Each item was scored dichotomously for the presence/absence of exposure to each type of traumatic event.

2.3. Outcome measures

2.3.1. PTSD symptoms

PTSD symptoms were assessed using the Korean version of the IES-R (Lim et al, 2009), which was administered to parents. The IES-R is a useful self-rated instrument, particularly for PTSD symptoms after a traumatic event. It evaluates the severity of symptoms experienced during the previous week. The IES-R consists of 22 items rated on a 5-point Likert scale ranging from 0 (not at all) to 4 (very much), with a total score of 22 suggestive of clinically relevant PTSD symptoms (Asukai et al., 2002). In this study, Cronbach's alpha for internal consistency was 0.955. In this study, participants with scores ≥ 22 on the IES-R were considered to have clinically relevant PTSD symptoms.

2.3.2. Depression

Depression was measured using the CESD (Orme et al., 1986). The CESD contains 20 items regarding depressive symptoms experienced in the past week, which are rated on a Likert-type scale (less than 1 day to most or all (5–7) days). Total scores range from 0 to 60. The reliability and validity of the Korean version of the CESD are well-established (Cho & Kim, 1993). In this study, Cronbach's alpha for internal consistency was 0.754. A score of ≥ 16 is generally accepted as indicative of clinically relevant symptoms of depression. In this study, participants who scored ≥ 16 on the CESD were considered to have depressive symptoms.

2.3.3. Anxiety

The Korean version of the BAI was used to measure anxiety severity (Yook and Kim, 1997). This scale consists of 21 items, and respondents are asked to indicate the degree to which they have been bothered by each symptom over the past week. Each item is scored on a scale ranging from 0 to 3; thus the total score ranges between 0 and 63, where 16 is the threshold for clinically significant anxiety (Beck and Steer, 1993). In this study, Cronbach's alpha for internal consistency was 0.949. Participants who scored ≥ 16 on the BAI were considered to have anxiety symptoms in this study.

2.3.4. Loss of property after the Sewol ferry disaster

The participants were asked to rate their property loss after the Sewol ferry disaster using a 3-point scale (0 = none, 1 = moderate, and 2 = severe); they were categorized into three groups based on the responses.

2.4. Statistical analysis

The prevalence of PTSD at baseline was determined. We have identified four groups according to the presence of PTSD symptoms: Group 1 with no PTSD symptoms at baseline and no PTSD at follow-up (‘no PTSD’ group); Group 2 with PTSD symptoms at baseline, but no PTSD at follow-up (‘acute PTSD’ group); Group 3 with no PTSD symptoms at baseline, but PTSD at follow-up (‘delayed PTSD’ group); Group 4 with consistent PTSD symptoms at baseline and at follow-up (‘chronic PTSD’ group). We used a univariate analysis to investigate the factors of each group with Group 1 as the reference group. Potentially associated factors (p<0.05) in the univariate analyses were then entered into the multivariate logistic regression analysis to investigate the differences between Group 1 versus Group 2, Group 1 versus Group 3,

and Group 1 versus Group 4. Statistical analyses were performed using SPSS software (version 21.0; SPSS Inc., Chicago, IL, USA). All statistical tests were two-tailed, and a P-value < 0.05 was considered significant.

3. Results

3.1. Subjects at follow-up and the proportion of PTSD cases

Table 1 presents characteristics of the subjects (n = 1,228) at follow-up. About half of the respondents had high school or below education level (56%) and participants were predominantly employed (80.4%). A total of 736 (59.9%) reported that they witnessed the rescue operation and 486 (39.6%) respondents participated in the rescue work as volunteers.

Regarding the follow-up assessment, the participants (n = 1,228) and non-participants (n = 1,369) significantly differed in terms of age (mean [SD] age: 44.6 [5.5] and 45.6 [6.5] years, respectively; P < 0.001), but not gender (51% male and 49% female; P = 0.146), depression (P = 0.104), and anxiety (P = 0.252). At baseline, 417 (16.1%) of the 2597 participants reported the presence of PTSD (data not shown). Of the 1,228 subjects at follow-up, 191 of whom (15.6%) reported the presence of PTSD. The distribution of the four groups according to the presence of PTSD symptoms was as follows: no-PTSD

Table 1 Demographic and clinical characteristics of subjects at follow-up (n=1228)

Characteristics	N(%) or Mean (standard deviation)
Gender	
Male	568 (46.3)
female	660 (53.7)
Age [years, Mean (SD)]	44.6 (5.5)
Length of resident [years, Mean (SD)]	26.4 (19.5)
Education	
High school or below	688 (56.0)
College or upward	518 (42.2)
Socioeconomic status	
Low	210 (17.2)
Middle	748 (61.2)
High	264 (21.6)
Religion	
No	615 (50.1)
Yes	613 (49.9)
Employment	
Unemployed	241 (19.6)
Employed	987 (80.4)
Witness rescue	
No	469 (38.2)
Yes	736 (59.9)
Volunteer	
No	694 (56.5)
Yes	486 (39.6)
Lifetime traumatic experiences	
Bereavement	341 (27.8)
Property damage	42 (3.4)
Natural disaster	59 (4.8)
Loss of property after Sewol ferry disaster	
None	594 (48.4)
Moderate	417 (34.0)
Severe	217 (17.7)
PTSD	
IESR ≥ 22 at baseline	185 (15.1)
IESR ≥ 22 at follow-up	191 (15.6)
Depression	
CESD ≥ 16 at baseline	123 (10.0)
CESD ≥ 16 at follow-up	116 (9.4)
Anxiety	
BAI ≥ 16 at baseline	70 (5.7)
BAI ≥ 16 at follow-up	104 (8.5)

Abbreviations: PTSD = Post-traumatic stress disorder, IES-R = Impact of Events Scale-Revised, CESD = Center for Epidemiological Studies Depression Scale, BAI = Beck Anxiety Inventory.

Note: Due to missing values, the sum total of participants may not equal 1228 for each variable

Table 2
Univariate associations of sociodemographic and disaster-related variables according to each group relative to no PTSD group.

	Acute	Delayed	Chronic
Predictor	OR (95% CI)	OR (95% CI)	OR (95% CI)
Gender, female	1.35 (0.92-2.00)	1.12 (0.77-1.64)	0.98 (0.60-1.61)
Education, College or upward	1.22 (0.83-1.80)	0.81 (0.55-1.20)	1.48 (0.90-2.44)
Socioeconomic status			
Low (reference)	-	-	-
Middle	0.73 (0.43-1.22)	1.22 (0.70-2.13)	0.60 (0.31-1.15)
High	1.51 (0.85-2.67)	1.58 (0.84-2.98)	1.41 (0.70-2.85)
Religion, yes	1.47 (0.98-2.11)	1.09 (0.75-1.59)	2.24 (1.32-3.76)**
Employment, yes	0.49 (0.32-0.76)**	0.57 (0.37-0.88)*	0.72 (0.40-1.31)
Witness rescue, yes	1.41 (0.938-2.12)	1.58 (1.05-2.37)*	2.10 (1.19-3.70)*
Volunteer, yes	1.41 (0.58-3.44)	2.06 (1.39-3.04)**	1.62 (0.97-2.69)
Bereavement, yes	1.51 (1.00-2.26)*	1.07 (0.70-1.63)	1.79 (1.07-3.00)*
History of property damage, yes	3.36 (1.517.48)**	0.67 (0.16-2.87)	6.31 (2.78-14.33)**
Natural disaster, yes	3.61 (1.87-7.00)**	2.10 (0.98-4.50)	1.277 (0.38-4.28)
Loss of property after Sewol ferry disaster			
None (reference)	-	-	-
Moderate	1.14 (0.75-1.73)	1.33 (0.86-2.07)	3.48 (1.78-6.80)**
Severe	0.91 (0.51-1.63)	2.45 (1.53-3.94)**	6.47 (3.22-12.97)**
Depression at baseline	15.78 (9.63-25.87)**	2.79 (1.44-5.41)**	15.12 (8.37-27.31)**
Anxiety at baseline	88.81 (30.73-256.65)**	11.63 (3.24-41.82)**	154 (51.56-462.36)**
Depression at follow-up	2.89 (1.41-5.90)**	14.85 (8.90-24.78)**	24.80 (13.51-45.53)**
Anxiety at follow-up	3.29 (1.25-8.67)*	42.79 (22.90-79.95)**	62.65 (30.71-127.83)**

*P < 0.05, ** P < 0.01, *** P < 0.001

(n = 919, 75.7%), acute PTSD (n = 118, 9.6%), delayed PTSD (n = 124, 10.1%), and chronic PTSD (n = 67, 5.5%)

3.2. Factors associated with the symptom groups by univariate analysis

The results of univariate analyses of the participants' socio-demographic and clinical characteristics in each group compared to the no-PTSD group are shown in Table 2. Employment had a negative association with the acute and delayed PTSD groups. Lifetime traumatic experiences including bereavement, property damage, and natural disaster had significant positive effect in the acute PTSD. Volunteer had a significant positive effect in the delayed PTSD. Witness rescue had a significant positive effect in the delayed and chronic PTSD. Depression and anxiety symptoms at baseline and follow-up had a positive effect in all the PTSD groups.

3.3. Predictors of acute, delayed, and chronic PTSD by Multivariate logistic analysis

The results of multivariate logistic regression analyses compared to the no-PTSD group are shown in the Table 3. Baseline anxiety

Table 3
Multivariate associations of sociodemographic and disaster-related variables according to each group relative to no PTSD group

	Acute	Delayed	Chronic
Predictor	OR (95% CI)	OR (95% CI)	OR (95% CI)
Religion, yes	-	-	1.68 (0.69-4.09)
Employment, yes	0.53 (0.31-0.90)*	0.69 (0.38-1.25)	-
Witness rescue, yes	-	1.52 (0.78-2.94)	2.87 (1.04-7.92)*
Volunteer, yes	-	1.39 (0.76-2.56)	-
Bereavement, yes	1.16 (0.68-1.96)	-	1.42 (0.58-3.48)
History of property damage, yes	2.86 (1.03-7.91)*	-	4.05 (0.98-16.82)
Natural disaster, yes	2.85 (1.29-6.31)*	-	-
Loss of property after Sewol ferry disaster			
None	-	-	-
Moderate	-	1.62 (0.92-2.85)	8.74 (2.64-28.99)**
Severe	-	1.61 (0.84-3.09)	6.83 (1.91-24.40)**
Depression at baseline	7.14 (3.78-13.52)**	0.96 (0.33-2.76)	1.87 (0.48-7.22)
Anxiety at baseline	29.04 (9.14-92.32)**	11.72 (1.67-82.48)*	81.71 (12.24-545.60)**
Depression at follow-up	1.10 (0.39-3.09)	6.58 (3.20-13.52)**	4.31 (1.33-14.01)*
Anxiety at follow-up	1.56 (0.42-5.80)	27.20 (13.27-55.78)**	59.78 (19.89-179.69)**

*P < 0.05, ** P < 0.01, *** P < 0.001

symptoms predicted the acute, delayed, and chronic PTSD group relative to the no-PTSD group. Employment was negatively associated with the acute PTSD. The history of property damage and natural disaster was associated with acute PTSD group. The depression and anxiety symptom at follow-up predicted the delayed PTSD group relative to the no PTSD group. The chronic PTSD group was independently predicted (relative to the no PTSD group) by witnessing the rescue scene, loss of property due to the Sewol ferry disaster, depression and anxiety symptoms at follow-up.

4. Discussion

The present longitudinal study found that the proportions of acute, delayed, and chronic PTSD cases in community residents following the Sewol ferry disaster were 9.6%, 10.1%, and 5.5%, respectively. The proportion of PTSD cases at follow-up was 15.6% (delayed PTSD 10.1% plus chronic PTSD 5.5%). The prevalence of PTSD following human-made disasters ranges from 15–75% (Neria et al., 2008), and the prevalence of PTSD within the first year of a human-made disaster ranges from 1–11% in the general population (Palinkas et al., 1993; Havenaar et al., 1997; Smith et al, 1999). Over a long-term period, most

individuals who exhibit early PTSD symptoms are expected to recover if a secure environment is re-established (Silove and Steel, 2006). However, despite a downward trend, the prevalence of PTSD at the follow-up assessment was largely similar to that at baseline in this study. However, few studies have investigated the longitudinal impact of a disaster on community residents who may have engaged in long periods of rescue work. Moreover, although the government officially terminated rescue work approximately 7 months after the Sewol ferry disaster, the commercial fishing and tourism industries have not been as active as before because salvaging of the Sewol ferry was delayed due to technical problems and political wrangling; it was finally recovered in 2017. The present findings suggest that uncertainty surrounding the salvaging process following a human-made disaster and a long-term worsening of socioeconomic status are associated with prolonged post-traumatic responses (Arnberg et al., 2011; Maeda and Oe, 2017). Furthermore, the residents of Jindo had to struggle with specific social issues associated with the Sewol ferry tragedy, such as “the devil’s sea” stigma. Similarly, the delay to the salvage operation, and the negative attitude among the wider public regarding the delay, might have reduced community resilience, which could in turn have contributed to the development and maintenance of post-traumatic responses.

One challenge associated with the present study was accounting for the risk factors associated with PTSD symptoms at the different study timepoints. Acute PTSD was associated with lifetime traumatic experiences such as property damage and natural disaster. Studies investigating general populations have found that past traumatic events themselves are associated with PTSD symptoms (Breslau et al., 1991). Because the Sewol ferry disaster resulted in economic damage to the local community, as well as numerous deaths, residents’ responses may have been influenced by previous experiences of property damage and natural disaster.

Depression and anxiety symptoms were the strongest and most consistent factors associated with acute, delayed, and chronic PTSD in the present longitudinal study. Cross-sectional studies have found that PTSD is highly comorbid with depression and anxiety (Chou et al., 2005; Fan et al., 2011; Ginzburg et al., 2010). In particular, the present study found that the level of baseline anxiety predicted delayed and chronic PTSD symptoms at the follow-up assessment. Severe anxiety could influence affective and cognitive processing of traumatic events via more intense stress responses (Laposa and Alden, 2008; Logan and O’Kearney, 2012). An impaired capacity to regulate and cope with highly intense emotions leads to the maintenance of strong emotions and may have functioned as an important peri-traumatic risk factor for PTSD at follow-up. The follow-up investigation in the present study was conducted shortly after many mourners visited Jindo for the first anniversary of the Sewol ferry disaster. The somber atmosphere around Jindo, and the extensive Korean media coverage in the first year after the disaster, may have triggered anniversary reactions. “Anniversary reactions” involve several days, or even weeks, of anxiety, flashbacks, depression, and/or fear (Pollock, 1972). Indeed, the anniversary date itself may trigger memories of the traumatic event (Cohen et al., 2006). It is possible that individuals with anxiety symptoms at the time of the disaster are more vulnerable to reminders of the anniversary period of the traumatic event, and long-term PTSD symptom recovery.

The present study also found that witnessing the rescue scene was significantly associated with chronic PTSD. Several community studies have reported a significant association between witnessing a rescue scene and PTSD symptoms (Lee et al., 2017; Neria et al., 2008) and personally witnessing horrific events characterized by traumatic scenes, or hearing wailing (e.g., by workers and/or bereaved family members), may lead to highly intense emotional responses. Taken together, the results suggest that the emotional reactions of the Jindo residents who were directly exposed to the disaster scene during rescue work could be considered symptoms of secondary trauma. The term “secondary trauma” was defined by human services professionals acting as first responders at disaster sites (Boscarino et al., 2004). The Diagnostic and

Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) excludes media exposure to a traumatic event from its definition of trauma. Although the residents exposed to the rescue scene in this study were not directly involved in the actual rescue process, the intensity of the threat-related responses evoked was higher than that of individuals who were exposed to the disaster only via media sources. This suggests that specialized interventions are needed for residents who are directly exposed to a rescue scene, to help them cope with their emotions and prevent post-traumatic stress symptoms in the long-term.

The loss of property after the Sewol ferry disaster was a significant independent risk factor of chronic PTSD in the regression analysis. These findings support those of previous studies showing that financial loss is associated with a high burden of PTSD (Galea et al., 2008; Nilni et al., 2013). Unresolved financial concerns that are directly or indirectly related to a disaster may also act as a source of PTSD symptoms (Roorda et al., 2004). The conservation of resources theory by Hobfoll posits that the loss or gain of resources is the major factor in predicting psychological impact during the stress process (Hobfoll, 1988). The present results suggest that the disaster-related financial adversity experienced by Jindo residents might have reduced their mental resilience for a significant period of time. Although the present study only assessed property loss after the disaster based on self-reported decreases in income following the disaster, it is known that concerns about finances and/or perceived changes in income adversely affect mental health (Buttke et al., 2012; Bisgaier and Rhodes, 2011). Even though the residents of Jindo experienced community trauma and financial strain following the Sewol ferry disaster, they may have suppressed their concerns regarding economic difficulties by participating in the ongoing rescue process and joining in with the grieving taking place at the national level. To address these issues, data concerning health status, and changes therein over time, among residents affected by a community disaster would be needed (Roorda et al., 2004). Moreover, appropriate financial support may be required to reduce stress-related symptoms and/or aid recovery from PTSD.

5. Study limitations

The present study had several limitations that should be acknowledged. First, the findings were based on self-report data, which could have been affected by any interim adjustments to the disaster of the respondents. Second, it may be inappropriate to generalize the results of this study to community residents in large urban areas. Additionally, the study population primarily included parents of Jindo students, and may not have been representative of the general population of the affected area. Third, the length of exposure to rescue and relief work of community volunteers, and the intensity thereof, were not assessed; these may act as predisposing factors for mental health problems. Fourth, pre-existing psychiatric disorders that could have influenced PTSD symptoms were not identified. Finally, although we explained the purpose of this study to the subjects as a mental health assessment associated with the ferry trauma, ferry trauma was not specified for the IES-R and so non-ferry related PTSD symptoms could not be clearly excluded. Furthermore, as additional critical life events that occurred during the follow-up period were not assessed; controlling for these potentially confounding variables will be necessary in future studies.

Despite these limitations, this remains the first longitudinal follow-up study to examine the consequences of a human-made disaster associated with a long-lasting socioeconomic burden on the mental health status of community residents. The present results address gaps in previous studies and may have important clinical implications regarding the development of strategies to prevent PTSD, and for mental health interventions, particularly in a community facing socioeconomic collapse (c.f. the drastic societal changes associated with COVID-19) (Kim and Su, 2020).

6. Conclusion

The present results suggest that both evaluation of mental health status and interventions are necessary for communities affected by a social disaster. Additionally, individuals experiencing negative financial consequences following a disaster will likely require psychiatric interventions, as well as economic support, which could aid recovery from chronic PTSD symptoms. The present study provides evidence that long-term, targeted aftercare is required for residents affected by a community disaster.

Contributors

JYL and SWK were involved in the conception and design of the study. JYL and SWK were involved in the analysis and interpretation of data. JYL drafted the manuscript and all authors commented on the manuscript and provided input on the final manuscript.

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Declaration of Competing Interest

The authors declare no conflicts of interest.

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