# Prevalence and Determinants of Provisional Post-Traumatic Stress Disorder Among Medical Help-Seekers After the Chi-Chi Earthquake

Kuo-Che Wang, Shih-Wei Lai, Ming-May Lai, Chiu-Shung Liu, Wen-Pin Liu, Shing-Chaur Liu, Cheng-Chieh Lin, Kuo-Min Hsu

Department of Community Medicine, China Medical College Hospital, Taichung, Taiwan, R.O.C.

***Backgrounds.*** A major earthquake with the magnitude of 7.3 struck Taiwan at 1:47 a.m. on September 21, 1999. We investigated the prevalence of possible post-traumatic stress disorder (PTSD) within one month after earthquake, as well as risk factors for PTSD among medical-help seekers.

***Methods.*** A total of 157 subjects were recruited. Among them, 137 sought help at a mobile health station and filled out a questionnaire which was designed based on PTSD diagnostic criteria. The other 20 patients were admitted to our hospital due to earthquake-induced injury and also filled out the questionnaire.

***Results.*** The prevalence of provisional PTSD within one month of the earthquake among medical help-seekers was 35.7%. Older people were more likely to develop provisional PTSD than younger people. Women with low levels of education, with severe damage to their homes, and history of medical diseases had influence on their prevalence of provisional PTSD. In addition, those who were married and not hospitalized were at higher risk of developing provisional PTSD.

***Conclusions.*** Cronbach's $\alpha$ reliabilities were 0.7. The factory validity of parts B and D were consistent with the theory. Only the factory validity of part C was not consistent with the theory. The results of multivariate logistic regression analyses showed significant correlation of the prevalence of provisional PTSD within one month of the earthquake were past history of medical disease ($p < 0.05$), severely damaged home ($p < 0.01$), and no hospitalization ($p < 0.001$).

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**Key words**

determinant, earthquake, post-traumatic stress disorder

## INTRODUCTION

On September 21, 1999, at 1:47 a.m., an earthquake measuring 7.3 on the Richter scale, with the epicenter at Chi-Chi, caused widespread destruction in central Taiwan. More than 2300 deaths and more than 10000 serious injuries were reported. Thirty thousand buildings, including homes, businesses and schools, were severely damaged. Some cities in central Taiwan were almost completely destroyed.

After the Chi-Chi earthquake, China Medical College Hospital was assigned to Hsin-Sher Hsiang to provide primary medical care. The team included physicians, nurses, social workers and mental health staff. The aim of this study was to evaluate the prevalence of provisional post-traumatic stress disorder (PTSD) within one month of the earthquake among medical help-seekers, as well as to establish the determinant factors of PTSD.

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Address reprint requests to : Cheng-Chieh Lin, Department of Community Medicine, China Medical College Hospital, No 2, Yuh-Der Road, Taichung 404, Taiwan, R.O.C.

The diagnosis of PTSD first appeared in 1980 in the third edition of Diagnostic and Statistical Manual of Mental Disorder (DSM-III) [1]. The DSM-III underwent some revision in 1987 in the revised third edition (DSM-III-R) [1].

The fourth edition of Diagnostic and Statistical Manual of Mental Disorder (DSM-IV) defined PTSD as: 1) The person must have experienced, witnessed, or been confronted with an event involving death, serious injury, or a threat to the physical integrity of the self or others. 2) The traumatic event must have been persistently re-experienced in the form of distressing images, thoughts, perceptions, dreams, or reliving; intense psychological or physiological reactivity may also be present on being reminded of the event. 3) Persistent avoidance of stimuli associated with the trauma and the numbing of responsiveness must have been present since the trauma. 4) Persistent symptoms of increased arousal should have been present since the trauma. 5) The duration of symptoms should have been at least 4 weeks. 6) The disturbance should have caused clinically significant signs of distress in social, occupational, or other important areas of functioning [1].

## MATERIALS AND METHODS

We designed a structured questionnaire which included several determinant factors that might have influenced the prevalence of provisional PTSD using the diagnostic criteria of PTSD in DSM-IV. In this way, we hoped to find out if the differences between acute stress disorder (ASD) and PTSD were only time variations; we also wanted to discuss the relationship between the two disorders.

After the Chi-Chi earthquake, we recruited 137 people who lived in Hsin-Sher Hsiang who had experienced the disaster and 20 people who were admitted to our hospital due to earthquake-related injuries from September 23, 1999 through October 21, 1999. Since we set a medical service station at Hsin-Sher Hsiang, the questionnaire was provided to those who came to our station for help (total 137 people). The same questionnaire was given to the patients (20 people) admitted to our hospital due to injuries during the Chi-Chi earthquake.

The questions on the guestionnaie included marital status, age, date of birth, gender, family history of psychosis, medical history including medications and diseases, heart rate, blood pressure, amount of damage to the home and education. The blood pressure and heart rate of the subjects were measured by physicians and nurses. Level of damage to the home was classified as totally destroyed, semi-destroyed, mildly damaged, or not damaged. The education level was divided into elementary school, junior high school, senior high school, college and none. Marital status was divided into married, unmarried, and divorced. Symptoms of PTSD were grouped into several categories as follows: (A) The person had been exposed to a traumatic event in which both of the following were present: 1) The person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others, and 2) the person's response involved intense fear, helplessness, or horror. (B) The traumatic event is persistently re-experienced in one (or more) of the following ways: 1) recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions, 2) recurrent distressing dreams of the event, 3) acting or feeling as if the traumatic event were recurring, 4) intense psychological distress at exposure to internal or external cues that symbolize or resemble and aspect of the traumatic event, and 5) physiologic reactivity on exposure to internal or external cues that symbolize or resemble and aspect of the traumatic event. (C) Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), as indicated three (or more) of the following: 1) efforts to avoid thoughts, feelings, or conversations associated with the trauma, 2) efforts to avoid activities, places, or people that arouses recollections of the trauma, 3) inability to recall an important aspect of the trauma, 4) markedly diminished

Table 1. The occurrence rate of each item in the questionnaire

| Criteria | Yes n (%) | No n (%) |
|---|---|---|
| A. Met at least one of criteria A. | 120 (76.4) | 37 (23.6) |
| 1.Was any member of your family injured or killed during the Chi-Chi earthquake? | 47 (29.9) | 110 (70.1) |
| 2.Did you feel intense fear, helplessness, or horror after the Chi-Chi earthquake? | 108 (68.8) | 49 (31.2) |
| B. Met at least one of criteria B. | 135 (86.0) | 22 (14.0) |
| 1.Did you have recurrent and intensive distressing recollections of the event, including images, thoughts or perceptions after the Chi-Chi earthquake? | 77 (49.0) | 80 (51.0) |
| 2.Did you have recurrent distressing dreams of the events after the Chi-Chi earthquake? | 49 (31.2) | 108 (68.8) |
| 3.Did you act or feel as if the earthquake was recurring? | 100 (63.7) | 57 (36.3) |
| 4.Did you have intense psychological distress during exposure to damaged home, the deaths or the injuries of family members caused by Chi-Chi earthquake? | 90 (67.0) | 67 (42.7) |
| 5.Did you have any physiological reactions on exposure to injured family members, damaged home or the deaths caused by Chi-Chi earthquake? | 49 (31.2) | 108 (68.8) |
| C. Met at least three of criteria C. | 62 (39.5) | 95 (60.5) |
| 1.Did you make any effort to avoid thoughts, feelings, or conversations associated with the Chi-Chi earthquake? | 52 (33.1) | 105 (66.9) |
| 2.Did you make any effort to avoid activities, places, or people that aroused recollections of the Chi-Chi earthquake? | 55 (35.0) | 102 (65.0) |
| 3.Were you unable to recall an important aspect of the Chi-Chi earthquake? | 39 (24.8) | 118 (75.2) |
| 4.Did you have markedly diminished interest or participated less in significant activities after the Chi-Chi earthquake? | 66 (42.0) | 91 (58.0) |
| 5.Did you have a feeling of detachment or estrangement from others after the Chi-Chi earthquake? | 23 (14.6) | 124 (85.4) |
| 6.Did you have restricted range of affect (e.g., unable to feel love) after the Chi-Chi earthquake? | 27 (17.2) | 130 (82.8) |
| 7.Did you have a sense of a foreshortened future after the Chi-Chi earthquake? | 71 (45.2) | 86 (54.8) |
| D. Met at least two of criteria D. | 77 (49.0) | 80 (51.0) |
| 1.Did you have difficulty falling or staying asleep after the Chi-Chi earthquake? | 97 (61.8) | 60 (38.2) |
| 2.Did you have irritability or outbursts of anger after the Chi-Chi earthquake? | 51 (32.5) | 106 (67.5) |
| 3.Did you have difficulty concentrating after the Chi-Chi earthquake? | 72 (46.0) | 85 (54.0) |
| 4.Were you hypervigilant after the Chi-Chi earthquake? | 92 (58.6) | 65 (41.4) |
| 5.Did you have exaggerated startle responses to aftershocks ? | 53 (33.8) | 104 (66.2) |

interest or participation in significant activities, 5) feeling of detachment or estrangement from others, 6) restricted range of affect, and 7) sense of a foreshortened future. (D) Persistent symptoms of increased arousal (not present before the trauma), as indicated by two (or more) of the following: 1) difficulty falling or staying asleep, 2) irritability or outbursts of anger, 3) difficulty concentrating, 4) hypervigilance, and 5) exaggerated startle response. In our study, provisional post-traumatic stress disorder was defined as the presence of at least both of the A criteria (exposed to a traumatic event), at least one of the B criteria, at least three of the C criteria and at least two of the D criteria (Table 1). Because we performed the study within one month of the earthquake, all subjects who met the criteria in our questionnaire met the time requirement of persistence of symptoms (2 days to 4 weeks). Chi-squared test, *t*-test analysis and logistic regression analyses were used.

Table 2. The demographic data and some characteristics of subjects

| Total (157) | | n (%) |
|---|---|---|
| Gender | Female | 76 (48.7) |
| | Male | 81 (51.6) |
| Marital status | Married | 97 (61.8) |
| | Not married | 59 (31.7) |
| | Divorced | 1 (0.6) |
| Post-traumatic stress disorder | Yes | 56 (35.7) |
| | No | 101 (64.3) |
| Hospitalized | Yes | 20 (12.7) |
| | No | 137 (87.3) |
| Family history of psychosis | Yes | 3 (1.9) |
| | No | 154 (98.1) |
| Medical history | Yes | 31 (19.7) |
| | No | 126 (80.3) |
| Mean Age (years) | | 38.94 ± 17.57* |
| Mean Systolic pressure (mm Hg) | | 123.69 ± 15.76* |
| Mean Diastolic pressure (mm Hg) | | 77.38 ± 8.28* |
| Mean Heart rate (beats/min) | | 79.69 ± 10.84* |

* Mean ± SD.

## RESULTS

### Basic Data

A total of 157 subjects were recruited. Among them, 137 (87.3%) were not hospitalized, and 20 (12.7%) were hospitalized. The mean age was 38.94 ± 17.57 years. Eighty-one men (51.6%) were enrolled in this study. A total of 59 people (37.6%) were not married, 91 (61.8%) were married, and one person (0.6%) was divorced. Most of the subjects (98.1%) had no family history of psychosis. Thirty-one subjects (19.7%) had history of disease such as hypertension or diabetes mellitus (Table 2).

Thirty-eight subjects (24.3%) had elementary school education or lower, 41 (26.1%) finished junior high school, 57 (36.3%) finished senior high school, and 11 subjects (7.0%) had college education or above. After the earthquake the homes of the 157 subjects sustained the following damage: 48 (30.6%) were totally destroyed, 20 (12.7%) were semi-destroyed, 50 (31.8%) were only mildly damaged, and 39 (24.8%) were not damaged. In our study, 56 subjects (35.7%) met the criteria for provisional PTSD.

### The Difference in Prevalence of Provisional PTSD Between Hospitalized and Non-Hospitalized Populations

Among the non-hospitalized group of subjects, 52 (38.0%) met the criteria for PTSD. In the hospitalized group of subjects, only four (20%) met the criteria for PTSD (Table 3). The hospitalized group had lower prevalence of provisional PTSD.

### The Relationship Between Provisional PTSD and Severity of Damage to the Home

Among the 56 subjects who met the criteria for PTSD, six (10.7%) did not have their homes damaged. The houses of 24 subjects (42.9%) with PTSD were totally destroyed (Table 4). We divided the people who met the criteria for PTSD into two groups: severe damage to the home, including totally and semi destroyed, and mild damage to the home, including mild damage or no damage. There were 38 subjects (67.9%) in the severe damage group and 18 subjects (32.1%) in the mild damage group (Table 3). Two thirds of the people who met the criteria for PTSD had their home severely damaged.

Among the 89 subjects with minor damage to their homes (Table 3), 18 (20.2%) met the criteria for PTSD. Among the 68 subjects with severe damage to their homes, 38 (55.9%) met the criteria for PTSD ($p<0.001$). The data showed that the more severe the damage to the home, the higher the prevalence of provisional PTSD.

### The Relationship Between Level of Education and Provisional PTSD

We classified those with PTSD into high

Table 3. The determinants that influenced the prevalence of provisional post traumatic stress disorder

| Determinant factors | (n) | Non-PTSD n (%) | PTSD n (%) |
|---|---|---|---|
| Hospitalized | Yes (20) | 16 (80.0) | 4 (20.0)* |
| | No (137) | 85 (62.0) | 52 (38.0) |
| Education | High (68) | 53 (77.9) | 15 (22.1)† |
| | Low (89) | 48 (53.9) | 41 (46.1) |
| Marital status | Married (97) | 53 (56.6) | 44 (45.4)† |
| | Unmarried (59) | 47 (79.7) | 12 (20.3) |
| Level of damage to the home | Mildly (89) | 71 (79.8) | 18 (20.2)† |
| | Severely (68) | 30 (44.1) | 38 (55.9) |
| Gender | Female (76) | 41 (54.0) | 35 (46.0)† |
| | Male (81) | 60 (74.1) | 21 (25.9) |
| Medical history | Yes (31) | 12 (38.7) | 19 (61.3) |
| | No (126) | 89 (70.6) | 37 (29.4) |

* $p < 0.01$, †$p < 0.05$. PTSD = post-traumatic stress disorder.

Table 4. The prevalence of each determinant factor in the 56 patients with post traumatic stress disorder

| Determinant | n (%) |
|---|---|
| Marital status | |
| Married | 12 (21.4) |
| Not married | 44 (78.6) |
| Education | |
| Illiterate | 3 (5.4) |
| Elementary school | 21 (37.5) |
| Junior high school | 17 (30.4) |
| Senior high school | 13 (23.2) |
| College | 2 (3.5) |
| Level of damage to the home | |
| No damage | 6 (10.7) |
| Mild damage | 12 (21.4) |
| Semi-destroyed | 14 (25.0) |
| Totally destroyed | 24 (42.9) |

education (senior high school, college) and low education (no education, elementary school and junior high school) groups. There were 41 subjects (73.2%) in the low education and 15 (26.7%) in the high education group (Table 4). Among the total of 157 subjects, 68 were in the high education group, and only 15 (22.1%) met the criteria for PTSD ($p<0.001$) (Table 3). Thus the lower the education level, the higher the prevalence of provisional PTSD.

## The Relationships Between Marital Status, Gender, Medical History and Provisional PTSD

Twelve subjects (21.3%) with PTSD were married, and 44 (78.6%) with PTSD were not married (Table 4). Among the 97 subjects who were married, 44 (45.3%) had PTSD. Among the 59 unmarried subjects, only 12 (20.3%) had PTSD ($p<0.005$) (Table 3). Married people appeared more likely to develop PTSD than unmarried people.

Among the people who met the criteria for PTSD, 35 (51.6%) were women and 21 (48.4%) were men (Table 4). Among the total 76 women, 35 (46.0%) met the criteria for PTSD. Among the 81 men, only 21 (25.9%) met the criteria for PTSD ($p<0.01$) (Table 3). Women were more likely to develop provisional PTSD than men.

Thirty- seven subjects (66.1%) who met the criteria for PTSD did not have any remarkable medical history, and 19 (33.9%) had history of medical disease (Table 4). Among the total of 31 subjects with history of medical diseases, 19 (61.3%) met the criteria for PTSD. Among the 126 subjects without remarkable history of medical diseases, 37 (29.4%) met the criteria for PTSD ($p<0.001$) (Table 3). Those with history of medical diseases were more likely to develop provisional PTSD than those without remarkable history of medical disease.

## Logistic Regression Analysis of the Factors that Affected the Prevalence of Provisional PTSD

From logistic regression analysis, we found that the factors that influenced the prevalence of provision PTSD were history of medical diseases ($p<0.05$), severe damage to the home ($p<0.01$) and no admittance to a hospital ($p<0.001$) (Table 5).

Table 5. Factors that influenced the prevalence of post traumatic stress disorder

| Variables | ß | Standard error | Odds ratio | 95% CI | *p* value |
|---|---|---|---|---|---|
| Medical history (Yes=1, No=0) | 1.07 | 0.53 | 2.91 | 1.04, 8.19 | < 0.05 |
| Damage to the home (Severe=1, Mild=0) | 1.88 | 0.42 | 6.57 | 2.86, 15.07 | < 0.001 |
| Hospitalized (Yes=1, No=0) | −2.02 | 0.72 | 0.13 | 0.03, 0.54 | < 0.01 |

CI = confidence interval.

## DISCUSSION

Acute stress disorder was found to be an excellent predictor of post-traumatic stress disorder 7–10 months after a traumatic event. The study of mass shooting events in the workplace by Classen et al, used the Stanford Acute Stress Reaction Questionnaire which showed that 33% of employees who experienced this kind of event met the criteria for the diagnosis of acute stress disorder [2]. The study by Eriksson and Lundin showed a statistically significant relationship between the occurrence of peritraumatic dissociative symptoms and early post-traumatic symptoms [3]. In our study, the prevalence of provisional PTSD among medical help-seekers was 35.7%. The prevalence of PTSD was higher in the non-hospitalized group of subjects than in the hospitalized group (38.0% *vs* 20%). The reason for this difference may be that the hospitalized subjects did not live in an environment that would make them recall the earthquake. Also, they did not really experience the aftermath of the disaster due to being hospitalized. In the hospital, good health services were provided which might have made them feel less detached or estranged from others.

Another factor influencing the prevalence of PTSD among medical help-seekers was the level of damage to their homes. Following an earthquake, the level of damage to the home might indicate the degree of exposure to traumatic events. The degree of exposure to a traumatic event has been found to be associated with the level of symptoms following a traumatic event [4-14]. Little is known about the relationships between damage to the home and the prevalence of PTSD after an earthquake. In our study, we found that among those whose home were severely damaged, there was high prevalence of provisional PTSD, most likely due to the psychological impact.

A third factor influencing the prevalence of the provisional PTSD was the subject's medical history. Those with history of medical diseases such as hypertension, DM or other medical condition seemed more likely to develop PTSD. We did not inquire about each subjects medical history in detail, so further evaluation of medical history in relation to PTSD is needed.

Previous studies have shown a close relationship between ASD and PTSD. Harvey and Bryant evaluated the relationship between ASD and PTSD in motor vehicle accident survivors. Seventy eight percent of ASD participants and 60% of subclinical ASD participants met the criteria for PTSD [15]. Classen also found that ASD was an excellent predictor of PTSD 7–10 months after a traumatic event [1]. The criteria of PTSD include persistence of symptoms for over one month after the event, and those of ASD include persistence of symptoms for a minimum of 2 days to a maximum of 4 weeks. In our study, we used the ASD and PTSD criteria to design a questionnaire and to determine if the differences between ASD and PTSD were only in time and duration of symptoms. Since the study ended just 1 month after the earthquake, there was not enough time to elucidate the differences between ASD and PTSD.

Results of previous studies have shown six strong predictors for risk of PTSD: female gender, neuroticism, early separation from parents, prior anxiety or depression, family

anxiety, and familial antisocial personality [1]. In our study, the prevalence of provisional PTSD was influenced by level of education, marital status, gender, level of damage to the home and medical history. The subjects in the PTSD group had low levels of education, were married women with severe damage to their homes, and had history of medical diseases. There were three people with family history of psychosis in our study, and two of them (66.7%) had PTSD. This might indicate a relationship between PTSD and family history of psychosis. However, a larger sample size is needed to confirm this finding.

Blood pressure might be influenced by psychological stress such as PTSD. According to the results of the study by Saito et al., during the 4 weeks after the Hanshin-Awaji earthquake the mean blood pressure increased significantly in hypertensive patients exposed to the earthquake [16]. In our study, the subjects in the provisional PTSD group were older (43.84 ± 16.54 years *vs* 36.21 ± 17.61 years) and had higher systolic pressure than those in the non-PTSD group.

In conclusion, the results of this study provide information about the prevalence of provisional PTSD among the medical help-seekers during the month following the Chi-Chi earthquake. It also indicates the determinant factors of PTSD, such as old age, not hospitalized, severely damaged home, female gender, married, low education level, family history of psychosis and history of medical disease. This study provides us with an opportunities for early identification of possible PTSD cases and early prevention of PTSD.

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# 集集大地震後尋求醫療協助者符合災後壓力症診斷準則的盛行率及決定因素

王國哲 賴世偉 賴明美 劉秋松 劉文斌 劉興潮 林正介 許國敏

中國醫藥學院附設醫院 社區醫學部

**背景** 1999年9月21日清晨1點47分臺灣發生了芮氏地震儀上7.3級的大地震。作者在地震後，從1999年9月23日至1999年10月21日，研究地震後一個月內，尋求醫療協助者，符合災後壓力症診斷準則的盛行率及決定因素。

**方法** 總共有137人至中國醫藥學院附設醫院的新社鄉醫療救護站就醫並填寫問卷，另外20人則因地震受傷住院並在中國醫藥學院附設醫院填寫問卷。

**結果** 研究發現地震後一個月內，尋求醫療協助者，符合災後壓力症診斷準則的盛行率爲35.7%。另外，在此研究中，作者發現年紀大的人，符合災後壓力症診斷準則的盛行率較高。而此研究也發現，是否符合災後壓力症診斷準則與此人的教育程度、婚姻狀態、房屋受損程度、性別、有無內科過去病史、家族有無精神病史及住院與否有關。也就是說，低教育程度，已婚，房屋嚴重受損，女性，有內科過去病史或沒住院的人，於地震後一個月內，符合災後壓力症診斷準則的盛行率較高。

**結論** 此問卷的內部信度(Cronbach's $\alpha$) 接近0.7。問卷效度經分析後，診斷準則B與D維持於相同因素內，只有診斷準則C被區分於不同的因素外。經過多變項邏輯迴歸分析，眞正影響是否符合災後壓力症診斷準則的盛行率之因素爲：1)此人是否有內科過去病史($p<0.05$)；2)房屋受損程度($p<0.01$)； 3)住院與否($p<0.001$)。（中台灣醫誌 2000;5:173-80）

**關鍵詞**

決定因素，地震，災後壓力症

聯絡作者：林正介

地 址：404台中市北區育德路2號

中國醫藥學院附設醫院 社區醫學部

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