# WHAT IS THE ASSOCIATION BETWEEN POST-TRAUMATIC STRESS DISORDER AND UNEMPLOYMENT AFTER A DISASTER?

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## Abstract

**Objectives:** The problem is to determine whether, after a disaster, unemployment is a possible cause of post-traumatic stress disorder (PTSD) – the classic model, or whether PTSD is a possible cause of unemployment – the alternative model. **Material and Methods:** The study was conducted on a probabilistic sample of 26 213 adults who provided responses using the *Davidson Trauma Scale* and lived in regions near or far from the epicenter (Cobquecura, the coast of Chile) of the earthquake and tsunami of February 27, 2010. **Results:** Independent of the proximity to the epicenter, there is an association between PTSD, unemployment, female sex and the poverty line. For regions close to the epicenter, the alternative model has better adjustment indicators than the classic model. **Conclusions:** Given the adjustment of the alternative model, the occurrence of PTSD cases is more likely to explain the unemployment condition. Int J Occup Med Environ Health. 2021;34(6):755–66

**Key words:**
resiliency, psychosocial risk factors, odds ratio, unemployment, sex difference, post-traumatic stress disorder

## INTRODUCTION

In 2004 Nandi et al. [1] found an empirical relationship between job loss, unemployment, work stress, job satisfaction and post-traumatic stress disorder (PTSD) following the terrorist attacks of September 11, 2001 in the USA. In their study published in the *Journal of Occupational and Environmental Medicine,* they concluded that those who are unemployed or working in adverse conditions are more likely to develop and stay with PTSD for a period of 6–12 months after the disaster [1]. With this work, they began a line of research regarding the relationship between the psychosocial impact of disasters and unemployment. Further studies identified that poorer people would present more PTSD after a disaster [2]; this would not happen among people with more resources [3], or among the poorest in different developed cultural contexts or countries [4].

Recently and continuing with the discussion started in 2004, Lowe et al. [4] discovered that New York commu-

nities with high unemployment would not present more cases of PTSD in the period of 13–16 months after a disaster (Hurricane Sandy), but they would present more cases 25–28 months later. Moreover, this relationship would be stronger in communities most affected by storms, erosion and coastal flooding (the south of Brooklyn and Queens, the northeast of Staten Island).

All of these investigations assume that unemployment causes PTSD after a disaster. Logically, it is expected that the unemployed would have fewer resources and be more exposed to the impact of a disaster, which would make disruptive responses more likely [5,6]. However, it is also logical to think that presenting disruptive responses (e.g., PTSD) could cause loss of work. Although there is evidence pointing to the impact of unemployment on stress and health, there is no clarity when the stress-unemployment cycle could begin [7]. Furthermore, once this cycle begins, the relationship between stressors, unemployment and mental health tends to be interdependent [7–9]. This is the first hypothesis that the present study supports.

To explore this relationship, the *Davidson Trauma Scale* (DTS) [10,11] was analyzed. This scale was applied complementing the *Chilean National Socioeconomic Characterization Survey* (Encuesta de Caracterización Socioeconómica Nacional – CASEN) 4 months after the Chilean earthquake of February 27, 2010 (F-27), the most destructive in one of the most seismic countries on the planet [12–14]. Therefore, this study used a probabilistic sample of 26 737 participants from a 4329-km-long territory affected by the same potentially traumatic event [15]. Studies like this are more the exception than the rule to investigate the nature of the relationship between PTSD and post-disaster unemployment.

Based on the existing association between PTSD, unemployment, and risk factors common to both (sex and poverty) [16–20], 2 models were evaluated: one that explains PTSD based on factors and unemployment (the classic model) and another that explains unemployment from the factors and PTSD (the alternative model). In order to control the degree of exposure to the disaster, the regions near the epicenter (O'Higgins, Maule and Biobío) were compared with the others. It is known to be more probable to find cases of PTSD in places near the epicenter [21]. This also allows controlling the estimation error of PTSD. For example, 25–75% of those who are exposed (near the epicenter) would have PTSD compared with a 1–11% incidence of PTSD among those who are protected (far from the epicenter) [22]. Therefore, the second hypothesis of this study is that the association between unemployment, PTSD and the exposure factors occurs only in regions close to the epicenter.

## MATERIAL AND METHODS
### Participants

In May 13–June 28, 2010 (approx. 4 months after F-27), DTS was applied together with CASEN. Using a 2-stage probabilistic sample (random blocks and houses), the occupants of each house were interviewed, and they could report the physical, economic and psychosocial conditions at home. A total of 26 737 adults were surveyed but only 26 213 were eventually included in the study. This sample was divided into 2 groups:

– inhabitants of regions near the epicenter (O'Higgins, Maule and Biobío N = 9602, age: M±SD 50.5± 16.7 years, 68.7% female);
– inhabitants of regions far from the epicenter (N = 16 611, age: M±SD 49.5±17.0 years, 67.4% female).

Regarding ethical guidelines, CASEN is a survey that has been applied in Chile since 1990 by the Ministry of Social Development [23]. Each application is supervised by a panel of experts who evaluate the questions, the sampling framework and procedures. In addition, the survey is conducted by the National Institute of Statistics, an agency that recruits and trains interviewers.

## Instruments

The symptoms of PTSD were evaluated using DTS [11,24]. The 17 items that make up DTS measure the frequency and intensity of PTSD symptoms by means of 2 scales (from 0 – "nothing/never" to 4 – "daily/extreme"). The total score ranges 0–136 pts. A score of >40 pts indicates that the probability of presenting PTSD is high, which would indicate a case (no case – 0, case –1) [25].

Unemployment was measured by applying the concept of the International Labor Organization (ILO), which considers someone as unemployed if during the last week he/she did not work, did not do any business, or did not seek work [26]. It is a broad criterion that includes as unemployed people also those who do unpaid activities (e.g., students, housewives). Based on this standard, the variable "employment condition" was constructed to divide the sample between employed and unemployed people (employed – 0, unemployed – 1) from the "Occupation" module of CASEN.

As relevant sociodemographic variables related to both PTSD and unemployment, the poverty status and phenotypic sex were evaluated [17–19,27–29]. Someone is considered poor (0 – not poor, 1 – poor) if they have less than the minimum monthly income to meet basic needs. The limit of the poverty line used in CASEN is *per capita* monthly income of USD 99 for the urban area and USD 67 for the rural area [30]. Finally, the phenotypic sex was evaluated (0 – male, 1 – female).

## Statistical analysis

The association between PTSD, unemployment, poverty and sex in regions near or far from the epicenter was evaluated using contingency tables. Significance, meaning and risks were evaluated using the contingency coefficient ($CC_{max} = 0.71$, $p < 0.05$), adjusted standardized residuals (ASR <2 or ASR >2) and the odds ratio (OR >1.96), respectively. Using the samples from regions near and far from the epicenter, the classic (PTSD is explained from other variables) and alternative (unemployment is explained from other variables) models were compared. To this end, 2 binomial logistic regression models (the maximum likelihood method) were used. The variables were incorporated into the model as long as they had significant parameters (B, $p < 0.05$). The effect size ($R^2_{Nagelkerke}$) and the percentage of correct classification (>60%) were considered as indicators of fit. All data analyses were performed with SPSS 14.

## RESULTS

The proximity to the epicenter increases the probability of having PTSD but not being unemployed (Table 1). For the group of regions near the epicenter, the prevalence of PTSD was 9.2%, while in the distant ones it was 2.1%. This association is significant, although not of great magnitude (contingency coefficient (95% CC = 0.158, p = 0.000). However, there is twice the risk of presenting PTSD when it is close to the epicenter (OR = 2.268, 95% CI: 2.076–2.477). On the other hand, although the unemployment rate in regions close to the epicenter (63.8%) was higher than in the distant ones (57.2%), the association is weak (95% CC = 0.065, p = 0.000), and there would be no more or less risk of unemployment when close to the epicenter (OR = 1.195, 95% CI: 1.156–1.236). Given this finding, the regions near and far from the epicenter had to be analyzed separately.

The second finding indicates that the association between PTSD and unemployment is similar regardless of the proximity to the epicenter (Table 1). Although there would be more cases of unemployment (adjusted standardized residuals [ASR] = 4.8, ASR = 3.1), this association was weak and did not imply a greater or lower risk in the nearby regions (95% CC = 0.049, p = 0.001, OR = 0.69, 95% CI: 0.59–0.81) than in those far away from the epicenter (95% CC = 0.024, p = 0.002, OR = 0.70, 95% CI: 0.56–0.89). The same happened when being below the poverty line with PTSD, both close (95% CC = 0.036, p = 0.000, OR = 1.34, 95% CI: 1.14–1.58) and far from the epicenter

**Table 1.** Association between post-traumatic stress disorder (PTSD), unemployment, sex and poverty in regions near (O'Higgins, Maule and Biobío) or far from the epicenter (Valparaíso, Metropolitana, Araucanía and the rest of the country) of the earthquake and tsunami of February 27, 2010, Chile, measured 4 months later

| Variable | Participants (N = 26 213) | | | | | | |
|---|---|---|---|---|---|---|---|
| | total | employment status | | sex | | poverty line | |
| | | employee | unemployed | men | women | above | under |
| **Regions near the epicenter** | | | | | | | |
| PTSD | | | | | | | |
| cases [n] | 882 | 254 | 628 | 165 | 717 | 669 | 213 |
| resilience [%] | 90.8 | 33.5 | 57.3 | 29.6 | 61.2 | 73.4 | 17.4 |
| prevalence [%] | 9.2 | 2.6 | 6.5 | 1.7 | 7.5 | 7.0 | 2.2 |
| resilience by group [%] | – | 92.7 | 89.8 | 94.5 | 89.1 | 91.3 | 88.7 |
| prevalence by group [%] | – | 7.3 | 10.2 | 5.5 | 10.9 | 8.7 | 11.3 |
| ASR | – | –4.8 | 4.8 | –8.5 | 8.5 | –3.5 | 3.5 |
| CC | – | 0.49** | | 0.09** | | 0.04** | |
| OR (95% CI) | – | 0.69 (0.59–0.81) | | 2.10 (1.77–2.50) | | 1.34 (1.14–1.58) | |
| **Regions far from the epicenter** | | | | | | | |
| PTSD | | | | | | | |
| cases [n] | 355 | 123 | 232 | 49 | 306 | 268 | 87 |
| resilience [%] | 97.9 | 42.1 | 55.8 | 32.3 | 65.6 | 82.7 | 15.1 |
| prevalence [%] | 2.1 | 0.7 | 1.4 | 0.3 | 1.8 | 1.6 | 0.5 |
| resilience by group [%] | – | 98.3 | 97.6 | 99.1 | 97.3 | 98.1 | 96.7 |
| prevalence by group [%] | – | 1.7 | 2.4 | 0.9 | 2.7 | 1.9 | 3.3 |
| ASR | – | –3.1 | 3.1 | –7.6 | 7.6 | –4.6 | 4.6 |
| CC | – | 0.02** | | 0.06** | | 0.04** | |
| OR (95% CI) | – | 0.70 (0.56–0.89) | | 3.07 (2.267–4.158) | | 1.77 (1.39–2.27) | |

ASR – adjusted standardized residuals; CC – contingency coefficient.
** p < 0.01.

(95% CC = 0.036, p = 0.000, OR = 1.77, 95% CI: 1.39–2.27). Also, the female phenotypic sex was associated with a higher incidence of PTSD, both close (95% CC = 0.086, p = 0.000) and far (95% CC = 0.059, p = 0.000), although the risk was twice as high among women who were close (OR = 2.10, 95% CI: 1.77–2.50) and 3 times greater among those who were far (OR = 3.07, 95% CI: 2.27–4.16).

The same pattern of independent associations of proximity to the epicenter was found between unemployment, female phenotypic sex or being below the poverty line (Table 2). The only difference was that these relationships had greater magnitude. For example, in regions near the epicenter, being a woman (95% CC = 0.301, p = 0.000, OR = 0.25, CI: 0.23–0.27) or being below the poverty line (95% CC = 0.107, p = 0.000, OR = 0.55, 95% CI: 0.49–0.62) was associated with increased unemployment. The same pattern was observed in distant regions, i.e., being a woman (95% CC = 0.315, p = 0.000,

**Table 2.** Association between unemployment, sex and poverty in regions near or far from the epicenter of the earthquake and tsunami of February 27, 2010, Chile, measured 4 months later

| Variable | Participants (N = 26 213) | | | | |
|---|---|---|---|---|---|
| | total | sex | | poverty line | |
| | | men | women | above | under |
| Regions near the epicenter | | | | | |
| unemployment cases [n] | 6129 | 1244 | 4885 | 4728 | 1401 |
| employment rate [%] | 36.2 | 18.4 | 17.8 | 31.1 | 5.1 |
| unemployment rate [%] | 68.3 | 13.0 | 50.9 | 49.2 | 14.6 |
| employment rate by group [%] | – | 58.6 | 25.9 | 38.7 | 25.8 |
| unemployment rate by group [%] | – | 41.4 | 74.1 | 61.3 | 74.2 |
| ASR | – | –31.0 | 31.0 | –10.5 | 10.5 |
| CC | – | 0.30** | | 0.11** | |
| OR | – | 0.25 (0.23–0.27) | | 0.55 (0.49–0.62) | |
| Regions far from the epicenter | | | | | |
| unemployment cases [%] | 9500 | 1815 | 7685 | 7675 | 1825 |
| employment rate [%] | 42.8 | 21.6 | 21.2 | 38.1 | 4.7 |
| unemployment rate [%] | 57.2 | 10.9 | 46.3 | 46.2 | 11.0 |
| employment rate by group [%] | – | 66.4 | 31.4 | 45.2 | 29.9 |
| unemployment rate by group [%] | – | 33.6 | 68.6 | 54.8 | 70.1 |
| ASR | – | –42.7 | 42.7 | –14.5 | 14.5 |
| CC | – | 0.32** | | 0.11** | |
| OR | – | 0.23 (0.22–0.25) | | 0.52 (0.47–0.57) | |

Abbreviations as in Table 1.
** p < 0.01.

OR = 0.23, CI: 0.22–0.25) or being below the poverty line (95% CC = 0.112, p = 0.000, OR = 0.52, CI: 0.47–0.57) had medium and medium-low magnitudes, respectively.

The third finding arises from the comparison of the model in which PTSD is predicted from unemployment and its associated variables (the classic model – Table 3) with the model in which unemployment is predicted and its associated variables (the alternative model – Table 3). Both for the classic model (B = 0.165, p = 0.042) and for the alternative model (B = –0.165, p = 0.042), the PTSD and unemployment variables presented a significant and statistically causal relationship only in regions close to the epicenter. Furthermore, within this group of regions, compared to the classic model ($R^2_{Nagelkerke}$ = 0.020), the alternative model obtained better adjustment indicators ($R^2_{Nagelkerke}$ = 0.140, 69.4%).

Regarding the parameters estimated for the alternative model in regions close to the epicenter (Table 3), PTSD had a negative coefficient (B = –0.165, p = 0.042), which indicates that having PTSD increases the probability of being unemployed. The negative sign of the male group coefficient (B = –1.37, p < 0.01) indicates that the probability of being unemployed for that group was lower. Finally, those

**Table 3.** Parameters to estimate cases (prevalence) of post-traumatic stress disorder (PTSD) and unemployment in regions near or far from the epicenter of the earthquake and tsunami of February 27, 2010, Chile, measured 4 months later

| Variable | B | Error | Wald | df | Sig | Odds of p | Probability | $R^2_{Nagelkerke}$ | % of hits |
|---|---|---|---|---|---|---|---|---|---|
| PTSD[a] | | | | | | | | | |
|   regions near the epicenter | | | | | | | | 0.020 | 90.8 |
|     intersect | −2.063 | 0.100 | 421.469 | 1 | 0.000 | | | | |
|     on the poverty line | −0.217 | 0.084 | 6.660 | 1 | 0.010 | 0.805 | 0.446 | | |
|     below the poverty line | 0 | 0 | – | 0 | – | – | | | |
|     man | −0.673 | 0.093 | 52.419 | 1 | 0.000 | 0.510 | 0.338 | | |
|     woman | 0 | 0 | – | 0 | – | – | | | |
|     unemployment | 0.0165 | 0.081 | 4.137 | 1 | 0.042 | 1.180 | 0.999 | | |
|     employment | 0 | 0 | – | 0 | – | – | | | |
|   regions far from the epicenter | | | | | | | | 0.026 | 97.9 |
|     intersect | −3.230 | 0.143 | 507.664 | 1 | 0.000 | | | | |
|     on the poverty line | −0.471 | 0.126 | 13.882 | 1 | 0.000 | 0.624 | 0.384 | | |
|     below the poverty line | 0 | 0 | – | 0 | – | – | | | |
|     man | −1.069 | 0.160 | 44.489 | 1 | 0.000 | 0.343 | 0.255 | | |
|     woman | 0 | 0 | – | 0 | – | – | | | |
|     unemployment | 0.038 | 0.117 | 0.105 | 1 | 0.746 | 1.039 | 0.999 | | |
|     employment | 0 | 0 | – | 0 | – | – | | | |
| Unemployment[b] | | | | | | | | | |
|   regions near the epicenter | | | | | | | | | |
|     intersect | 1.598 | 0.092 | 302.344 | 1 | 0.000 | | | 0.140 | 69.4 |
|     on the poverty line | −0.498 | 0.060 | 68.514 | 1 | 0.000 | 0.608 | 0.378 | | |
|     below the poverty line | 0 | 0 | – | 0 | – | – | | | |
|     man | −1.367 | 0.047 | 852.627 | 1 | 0.000 | 0.255 | 0.203 | | |
|     woman | 0 | 0 | – | 0 | – | – | | | |
|     no PTSD | −0.165 | 0.081 | 4.139 | 1 | 0.042 | 0.848 | 0.459 | | |
|     with PTSD | 0 | 0 | – | 0 | – | – | | | |
|   regions far from the epicenter | | | | | | | | | |
|     intersect | 1.269 | 0.122 | 107.833 | 1 | 0.000 | | | 0.150 | 67.9 |
|     on the poverty line | −0.540 | 0.048 | 124.478 | 1 | 0.000 | 0.583 | 0.368 | | |
|     below the poverty line | 0 | 0 | – | 0 | – | – | | | |
|     man | −1.436 | 0.035 | 1639.608 | 1 | 0.000 | 0.238 | 0.192 | | |
|     woman | 0 | 0 | – | 0 | – | – | | | |
|     no PTSD | −0.038 | 0.117 | 0.104 | 1 | 0.747 | 0.963 | 0.491 | | |
|     with PTSD | 0 | 0 | – | 0 | – | – | | | |

[a] The category of reference is resilience (not a case) to PTSD.
[b] The category of reference is employment.

who were above the poverty line had a lower probability of being unemployed (B = – 0.50, p < 0.01). The variables that predict the change from unemployment to employment are resilience to PTSD (45%), being above the poverty line (38%) and male sex (20%).

## DISCUSSION

The results do not reject the first hypothesis. There is an association between PTSD and post-disaster unemployment. Moreover, given the fit of the alternative model, it is more probable that the appearance of PTSD cases explains the unemployment condition. This finding is novel in the literature reviewed and supports ideas such as the lack of clarity when the stress-unemployment cycle could begin [7,31], and the relationship between stressors, unemployment and mental health tends to be interdependent once it starts [7,9,32], in refugees [33,34], immigrants [35], men [36] and women veterans [37], and social workers, to name a few cases. For example, studies conducted on Iraqi refugees show that exposure before and after the event predicts unemployment by 91% [7]. Therefore, if it is necessary to choose when this cycle begins, it would be better to do it from PTSD towards unemployment. In other words, first people have disruptive symptoms and then they could lose their job.

Specifically, after a disaster those who have intrusive memories are more anxious, avoid thinking about the event, are depressed or dissociated [38], and would have a greater chance of losing their job. In fact, there is a concept of post-disaster stress that includes PTSD and other disruptive social responses such as alcohol and drug abuse or family and work problems [39,40]. To test this new hypothesis, it is proposed to measure the same participants in 2 different moments. This would identify if the previous disruptive responses (e.g., PTSD) may be affecting the actual unemployment or vice versa.

Considering the results, the second hypothesis is rejected. Although the prevalence of PTSD is higher in places close to the epicenter, its association with unemployment would

be independent of proximity while other exposure factors such as phenotypic sex and poverty would not.

This finding provides evidence to clarify the relationship between PTSD and unemployment in an area where the literature is incipient [41–44]. In regards to proximity, both near and far from the epicenter, PTSD cases would be explaining the occurrence of unemployment cases. Of course, the PTSD cases and unemployment in regions close to the epicenter could be explained by the exposure to the disaster, the gender roles linked to the female sex and the condition of poverty, while in remote regions PTSD (less prevalent) and unemployment would be explained by gender roles and poverty [18,27–29,45,46]. For example, studies indicate that 20% of the population that receives less income has a higher probability of experiencing PTSD after a disaster [2].

There are 4 theories that explain this finding. First, the biological dose-response: the more serious an event is, the greater its dose or impact [47,48]. The second theory is the conservation of resource model: a potentially traumatic event (i.e., a disaster) creates an ecological demand that diminishes the personal and community resources to face it. In addition, those who have fewer resources are more vulnerable to losing or not using them. In this sense, Hobfoll indicated that a decrease in the resources of the personal, social and material caravan prior to the disaster (e.g., precarious jobs) increases the possibility that after the event these resources are lower or non-existent (e.g., unemployment).

It should be considered, as indicated by cross-cultural studies, that PTSD is one of the possible responses to trauma, but not necessarily universal if non-western studies are considered, so there would be an inability of PTSD to cover all cultural differences after the disaster (e.g., nerve attacks, sleep paralysis, shame, loss of honor). In that context, the fact that there are first disruptive responses related to unemployment could be another example of expected responses in each culture [5,49]. The third theory concerns

the prototypical patterns of the disruption model: after a potentially traumatic event and across time (0–2 years), most people (55–90%) recover or respond in a healthy way, or do not present disruptive responses; the fluctuation of disaster responses depends on a combination of risk and resilience factors [50,51]. Finally, the fourth is the psychosocial impact of potentially traumatic events model.

There are 2 independent continuums (exposure-protection to the event vs. healthy-disruptive responses) that organize types of psychosocial impact. Those who are exposed and respond disruptively belong to the prevalent group (e.g., PTSD, unemployment), while those who respond healthily belong to the resilient group [52,53]. For example, a study that relates PTSD and unemployment indicates that its prevalence and impact are higher in central areas of the city exposed to an earthquake [54]. In the case of this study, the prevalence of PTSD and unemployment is higher in regions close to the epicenter, and even more in exposed populations such as being a woman and under the poverty line (Tables 1 and 2). Historically in Chile, women have a lower labor participation than men [55]. The cause could be the division of labor according to gender roles in which the woman takes care of the family and the man is the provider [56,57]. The role of social protection at the level of public policies is evident for these groups [12,58].

## CONCLUSIONS

Considering that PTSD would be the cause of unemployment after a disaster has implications in public policies. Post-disaster employment and reconstruction plans should start with mental health diagnoses and psychoeducation regarding the psychosocial impact of the disaster on people. This allows communities to recover, take disaster as a development opportunity and increase their resilience. This principle underlies the "kokoronokea" or "care of the heart" (e.g., doing affective closeness and active listening, teaching stress coping strategies, applying traditional

knowledge) present in public policies to face disasters in Japan, and which has also been adapted to Chile [59,60]. Likewise, it is possible to mitigate the impact of traumatic events and unemployment at the same time, considering the effectiveness of cognitive behavioral therapy for post-disaster distress to generate strategies that allow activating behaviors which facilitate job search and, in parallel, perform a cognitive restructuring that allows one to elaborate the trauma [61].

Despite the advantages of massively applying a probabilistic survey (e.g., CASEN), because DTS was applied only once, it is not possible to determine the causality of the relationship found. For future applications, it is suggested that DTS or other screening scales (e.g., SPRINT-E [39]) be applied within the framework of representative and longitudinal surveys, for the purpose of measuring temporal changes and making interpretations of causality.

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