The impact of Earthquakes on Mental Health in Mexico

Juan Enrique Huerta-Wong [*]   Julieth Santamaria [†]

Adan Silverio-Murillo [‡]   Isidro Soloaga [§]

September 26, 2018

Abstract

This paper analyzes the effects of earthquakes that impacted Mexico on women's mental health and substance abuse in 2017. Using a difference-in-differences approach we find: i. the earthquakes have negative consequences on women's mental health; ii. we do not find evidence that the earthquakes increased the consumption of alcohol or cigarettes; iii. we find evidence of factors that worsen women's mental health (such as perception of insecurity), and others that help women to be more resilient (such as family size); and iv. women who received psychological support improved some measures of mental health, yet we do not observe this result for all the measures analyzed. It is estimated that 27% of the population in Mexico is exposed to earthquakes. To face this situation, the Mexican government has implemented the Fund for Natural Disasters (FONDEN). This fund is used to distribute food and money for reconstruction. Yet, it is necessary to analyze the possibility of extending its support to the attention of mental health.

Keywords: natural disasters; mental health

JEL: I14, I24, Q546.

[*]UPAEP, Centro de Investigación e Inteligencia Económica. E-mail: `juan.huerta@upaep.mx`

[†]University of Minnesota, Department of Applied Economics, PhD Student. E-mail: `santa098@umn.edu`

[‡]Department of Public Administration and Policy, American University. E-mail: `asmurillo@american.edu`

[§]Department of Economics, Universidad Iberoamericana. E-mail: `isidro.soloaga@ibero.mx`

1 Introduction

The effects of natural disasters on increasing the prevalence of mental health are estimated in the range of 5% to 40% (Galea et al., 2008). Despite the efforts to document the effects of natural disasters on mental health, Goldmann and Galea (2014) point out three important limitations in this literature: i. baseline information is often lacking in studies analyzing effects of natural disasters on mental health. In addition, it is observed that many studies lack of a comparison group. This lack of information limits the ability to draw causal inferences; 2. it is necessary to improve our knowledge about the variables (pre-disaster and post-disaster) that worse the effects of natural disasters on mental health; and 3. additional studies are needed to understand what kind of interventions works to reduce the mental health problems among disaster victims.

To understand the effects of natural disasters on mental health, we use the Survey of Social Mobility in Disaster Zones in Mexico (SSMDZ) that contains information of localities that were affected by earthquakes that hit Mexico during September 2017. The data contain information regarding consumption, prices, assets, and women's mental health. In particular, the survey contains information of two affected municipalities (treatment) and two municipalities that were not affected by the earthquakes (control). The municipalities not affected (control) were selected using the following criteria: i. having a Human Development Index similar to the municipalities affected by the natural disaster; and ii. having a similar trajectory in terms of economic growth in the last 5 years with respect to the affected municipalities. Regarding the collection of data, in each municipality the streets were randomly selected, and in the selected streets, five households

were interviewed until the sample size was completed. The survey was collected in October 2017, and asks to recall information for August 2017 (one month before the occurrence of the earthquake). In addition, the survey collects information regarding variables that can worse the effects of natural disasters (pre-disaster and post-disaster), and information regarding women that received psychological support after the earthquake.

Using a difference-in-differences estimation, we analyze the effect of earthquakes on eight items regarding mental health (having nightmares, sleeping problems, being irritated, being tired, concentration problems, being sad, feeling fear, having oppression, and suffering a trembling body), and two items regarding substance abuse (alcohol and tobacco consumption). We find: i. the earthquakes have negative consequences on women's mental health; and ii. there is no evidence that the earthquakes increased the consumption of alcohol or tobacco. In addition we explore how variables during the childhood (father's death, mother's death, automobile accident, suffering a natural disaster, and sexual assault), pre-disaster (self-esteem, self-control, attended school, and age), and post-disaster (assets, savings, lost of partner's job, family size, and neighbor's insecurity) worse the impact of the natural disaster on women's mental health. We find evidence that the post-disaster variables can explain some heterogeneous effects. Particularly, the effects of earthquakes on mental health were worst among women whose partner stopped contributed with income to the home, women living in a small family, and women who feel more insecure in their neighborhoods. Finally, we analyze the effects of receiving psychological support. We find that women who received psychological support improved some measures of mental health, yet we do not observe this

result for all the measures analyzed.

Our work relates to a literature studying the effects of natural disasters on mental health. Rhodes et al. (2010), using a sample of 392 low-income parents exposed to hurricane Katrina that affected the United States in 2005, find that the effects on mental illness persisted one year after the hurricane and nearly half of the respondents presented post-traumatic disorder. Tracy et al. (2011), using a sample of 658 adults exposed to hurricane Ike that affected the United States in 2008, find that after the hurricane, the prevalence of post-traumatic stress disorder and depression was 6% and 5%, respectively. Heid et al. (2017), using a sample of 2205 older individual aged 54-80 affected by Hurricane Sandy in 2012, find that greater storm exposure was linked to higher levels of post-traumatic stress disorder (PTSD). More interesting, they find that the impact of the hurricane on PTSD symptoms was less for individuals with higher levels of neighborhood social capital.

The main contributions of this paper are threefold. First, this paper contributes to the literature on the effects of natural disasters on mental health attending some of the limitations to obtain causal effects. In particular, our data contains information for both periods (pre and post the occurrence of the natural disaster), and we use a comparison group to approximate causal effects. Second, this paper provides evidence regarding factors (pre-disaster and post-disaster) that can worse the impacts of natural disasters on mental health. Galea et al. (2008) present evidence of pre-disaster variables such as shocks during childhood, age, personality, or socioeconomic status that worse the mental health among disaster victims. We do not find evidence that these pre-disaster factors worse the effects of the earth-

quakes on mental health. Yet, we find evidence that variables post-disaster such as perception of insecurity can worse the mental health of the women affected. Finally, the results provide some lights about the role of receiving psychological support after the natural disaster. Our results show that women who received psychological support reduce their mental health problems in some items, but not in all. This can be a consequence of the short period of receiving this support, and it will be necessary to evaluate the results in the medium term.

The rest of the paper is organized as follows: in Section II, we describe the background, data, and empirical methods; in Section III, we present the results; and, Section IV is the conclusion.

2   Background, Data and Empirical Methods

2.1   Background

According to the World Bank (2012), 27% of the population in Mexico is exposed to earthquakes. During September 2017, more than 5,000 earthquakes hit Mexico. Yet, those occurred on September 7 and 19 had serious consequences. On September 7, an earthquake of 8.1 degrees caused the death of at least 102 people in Oaxaca, Chiapas, and Tabasco. The most serious damage occurred in Juchitán, Oaxaca where 70 people died, and 15,000 homes were affected. On September 19 there was an earthquake (7.1 degrees) that caused more than 369 deaths in Mexico City, Morelos, and Puebla. The Government estimates that as a consequence of

these earthquake, 369 people died and 12 million were affected (injuries, property losses, interruptions in the educational cycle, among others). One of the most affected localities was Jojutla in the state of Morelos.

2.2 Description of Data

To estimate the impact of earthquakes on women's mental health, we use the Survey of Social Mobility in Disaster Zones (SSMDZ). The SSMDZ data contain information on two selected municipalities affected by the earthquakes: Juchitan, Oaxaca, and Jojutla, Morelos. Data were also collected from two municipalities that are used as a comparison group: Martínez de la Torre, Veracruz and Rincón de Romos, Aguascalientes. The criteria for selecting these two control were: i. having a Human Development Index similar to the municipalities affected by the natural disaster; and ii. having a similar trajectory in terms of economic growth in the last 5 years with respect to the treatment municipalities. Regarding the collection of data, in each municipality the streets were randomly selected, and in the selected streets, five households were interviewed until the sample size was completed. We get 402 women interviewed in the treatment and 395 in the control municipalities.

SSMDZ collects data regarding eight questions about mental health and two questions regarding substance abuse. The questions regarding mental health refer to having nightmares, sleeping problems, being irritated, being tired, concentration problems, being sad, feeling fear, having oppression, and suffering a trembling body. The questions regarding substance abuse refer to consumption of alcohol

and tobacco. This information was collected for the months of August (recall) and October. Table 1 Panel A compares the measures of mental health previous (period 1) and after (period 2) the earthquake for the treatment and control municipalities. For the eight items, we observe important increases in the probability of having mental problems in the localities affected by the natural disaster. For example, the number of women in the treatment localities that reported having nightmares increased from 13% to 50%. While in the comparison municipalities, we observe that mental health outcomes remains relatively constant. The only exception is the variable of sadness that observes a considerable decrease (from 38% to 28%). Regarding the variables of substance abuse (alcohol and tobacco), we do not observe important changes between the periods of analysis for both the treatment and control group (see Table 1).

Table 1 Panel B includes information for variables that will be used in the regression analysis as controls such as age, school attendance, being head of the household, relocated as a consequence of the natural disaster and family size. In addition, receiving transfers from PROGRESA, Temporary Employment Program, 70 and more years Program, remittances, money for reconstruction, and money to buy durable goods. In addition, Table 1 Panel C includes information for variables regarding shocks during childhood, pre-disaster, and post-disaster that will be used to analyze heterogeneous effects. The variables regarding shocks during childhood (when 15 years old or younger) are: father's death, mother's death, automobile accident, natural disaster, and sexual assault. The variables regarding pre-disaster are: self-esteem, self-control. In addition, we will use age and education (attending school). The variables regarding post-disaster are: assets, savings, partner's con-

7

tribution to family income, insecurity during the day, and family size. Finally, the data also contains information for women reporting having psychological support after the natural disaster. It is observed that 29% of the women in the localities affected by the earthquake reported this kind of support.

2.3 Empirical Strategy

We use a difference-in-differences (DID) approach to examine the effect of the earthquakes on women's mental health:

$$Y_{it} = \beta_0 + \beta_1 After_t + \beta_2 Earthquake_i + \beta_3 \left(After_t * Earthquake_i\right) + X_{1i}\theta_i + e_{it}$$

where Y_{it} is the outcome of interest for women i at time t; $After_t$ takes the value of 1 in the period after the shock; $Earthquake_i$ takes the value of 1 in the municipalities affected by the natural disaster and zero otherwise; X_{1i} is a set of control variables. Standard errors are clustered at the street level. Notice that the coefficient of interest is β_3. It estimates the effect that the earthquake has on mental health in the treated municipalities compared to the control group. To identify the causal effect, the above difference-in-differences (DID) estimator must satisfy the following:

1. The additive structure imposed is correct.

2. $cov(e_{it}, After_t * Earthquake_i) = 0$.

The last assumption is known as the *parallel-trend* assumption, and it means

8

that the outcome variables of the treatment and comparison groups followed the same trend over time before the hurricane took place. In other words, the unobserved characteristics that create a gap between measured treatment and control outcomes are assumed to be time invariant and as a consequence there is not a problem regarding omitted variable bias.

While the survey collected information for localities that follow a similar trajectory in terms of economic growth in the last 5 years, we only have two data points for the mental health variables and as a consequence we can not test the assumption of parallel-trends. To sort this problem of potential omitted variables, we use a bounding approach proposed by Altonji et al. (2005) and refined by Oster (2017). Altonji et al. (2005) observed that a common approach to evaluate robustness to omitted variable bias is to include additional control variables on the right hand side of the regression. If such additions do not affect the coefficient of interest, then this coefficient can be considered to be unlikely biased. This strategy implicitly assumes that selection on observables is informative about selection on unobservables. Oster formalizes this idea, and provides conditions for bounds and identification. In addition, Oster points out that it is not only necessary to add controls, but to observe the movements in the R-squared.

Oster shows that a consistent estimator of the parameter of interest can be obtained; yet, it is a function of two parameters unknown by the econometrician: (1) the R-squared for a hypothetical model that contains both the observable and unobservable variables; and, (2) the proportion of selection of unobservables on observables. In particular, Oster defines R_{max} as the overall R-squared of the model,

that is the R-squared that would be obtained from a regression of the dependent variable (Y) on the variable of interest $(After_t * Earthquake_i)$, observables (X_1), and unobservables (X_2). Also, Oster defines δ to be a parameter that ensures the equality $\frac{Cov(After_t*Earthquake_i, X_2)}{Var(X_2)} = \delta \frac{Cov(After_t*Earthquake_i, X_1)}{Var(X_1)}$, i.e. this relationship formalizes the idea that the magnitude and sign of the relationship between $After_t * Earthquake_i$ and X_1 provides some information about the magnitude and sign of the relationship between $After_t * Earthquake_i$ and X_2. Oster argued that selection on unobservables should not be greater than selection on observables. Thus, the lower bound of δ is zero and the upper bound is one. To determine R_{max}, Oster tested the robustness of treatment parameters from randomized control studies published in top economic journals between 2008 and 2013 by using $R_{max} = min\{\pi \tilde{R}, 1\}$ with various values of π and $\tilde{R}$ being the R-squared of regressing Y on the variable of interest and observables. Oster found that only 20% of results were robust when $R_{max} = 1$ while using $R_{max} = 1.3\tilde{R}$ (or $\pi = 1.3$) reproduced 90% of randomized results. Thus, Oster suggests that β^* (the parameter of interest) be calculated for the following ranges of δ: $0 \leq \delta \leq 1$. This allows one to construct the set $[\beta^*(\delta = 0), \beta^*(\delta = 1)]$ assuming $R_{max} = 1.3\tilde{R}$. If this set excludes zero, the results from the controlled regressions can be considered to be robust to omitted variable bias. In other words, the results indicate that $\beta^* \neq 0$.

Finally, we estimate the heterogeneous effects with respect to variables regarding shocks during childhood, pre-disaster, and post-disaster. The equation that we estimate is as follows:

$$Y_{it} = \beta_0 + \beta_1 After_t + \beta_2 Earthquake_i + \beta_3 Z_i + \beta_4 After_t Earthquake_i +$$
$$\beta_5 After_t Z_i + \beta_5 Earthquake_i Z_i + \beta_7 After_t Z_i Earthquake_i Z_i + X_{1i}\theta_i + e_{it}$$

where z_i is a variable of interest regarding heterogeneous effects. In this specification β_7 is our coefficient of interest.

3 Results

3.1 Main results and bounding methodology

Table 2 presents estimates of the impact of earthquakes on women's mental health. All the regressions control for age, education, family size, and being head of the household. In addition, we control for participation in the following social programs: PROGRESA, Temporary Employment, and 70 years old and more. Finally, we include being relocated as a consequence of the natural disaster, receiving psychological support, receiving money for reconstruction, receiving money to buy durable goods, remittances, and municipality fixed effects. The estimates show a positive and significant effect of earthquakes on all the measures regarding mental health: nightmares (0.379), sleeping (0.571), irritated (.351), concentration (0.437), tired (0.452), sad (0.790), fear (0.755), oppression (0.405), and trembling body (0.417). Table 3 presents estimates of the impact of earthquakes on substance abuse. Using the same controls as in Table 2, we do not find evidence that the earthquakes increased the consumption of alcohol or tobacco.

A crucial assumption for our results is that: $cov(e_{it}, After_t * Earthquake_i) = 0$. In other words, that we do not have an omitted variable bias problem. Thus, we estimate the range of estimated parameters using a bounding methodology pro-

posed by Oster (2017). Table 4 presents the results of the bounding methodology for the variables regarding mental health. We find that the bounds for all the outcomes analyzed do not include the zero, suggesting that the results are robust.

3.2 Heterogeneous Effects

The literature on earthquakes has found some factors that can worse the impact of natural disasters on the people affected. In particular, we explore how variables during the childhood, pre-disaster, and post-disaster worse the impact of the natural disaster on women's mental health.

Table 5 presents heterogeneous effects regarding shocks that affected the women when were 15 years old or less (father's death, mother's death, automobile accident, suffering a natural disaster, and sexual assault). Our hypothesis is that women who received these kind of shocks during childhood are more likely to be affected by the earthquakes. We found no evidence that these shocks have worsened the mental health conditions of women affected more by earthquakes.

Table 6 presents heterogeneous effects of earthquakes on women's mental health depending on pre-disaster variables: self-esteem, self-control, attending school, and age. Our hypothesis is that people who have higher levels of self-esteem and self-control (our measure is lack of self-control) are more resilient to external shocks. Regarding self-esteem and self-control, we only have measures of these variables for period 2. Thus, we assume that these variables are stable between period 1 and period 2. In addition, the literature has found that people with more education

and older are more resilient to natural disasters (Galea et al., 2008). In general, we observe that people with more self-esteem and self-control are more resilient to the natural disaster, yet we do not find that these coefficients are statistically significant. Regarding education, we use a dummy variable that takes the value of 1 if women attend school and 0 otherwise. In general, we observe a positive relation, yet it is only statistically significant for two variables: irritated and tired. A potential explanation of these results is that women who are more educated are more able to recognize that they are suffering a potential problem of mental health. Finally, we observe that older women were more resilient to the natural disaster, yet the coefficients were not statistically significant.

Table 7 presents heterogeneous effects of earthquakes on women's mental health depending on variables post-disaster: assets, savings, having a partner who continue contributing to household's income after the earthquake, family size, and neighbor's insecurity. Regarding assets and savings, our hypothesis is that women living in households who lost more assets and reduce their savings are more affected in their mental health. In the case of having a partner who continues contributing to household's income after the earthquake, we expect reduce the negative effect on women's mental health. Regarding the perception of living in an insecurity area we expect that this variable worse the mental health of women. Finally, regarding family size, one hypothesis is that women who live with more people increase their probability of having psychological support and as a consequence observe lower levels of mental health problems after suffering a shock like the earthquake. On the other hand, it is possible that the earthquake has affected the family size trough the death of a relative and as a consequence the earthquake can impact

more negatively the mental health of women. We do not find evidence of heterogeneous effects regarding assets and savings (see Panel A and B). In the case of having a partner who continues contributing to household's income after the earthquake, we find that this factor can mitigate the shock of the earthquake on the mental health of women. In particular, we find that the coefficients are statistical significant for concentration, fear, oppression, and trembling body (see Panel C). Regarding family size, we observe that women who live in a bigger family suffer less mental health (see Panel D). Finally , we observe that perception of living in an insecurity area can worse the effect of the earthquake on women's mental health (Panel E).

Finally, we analyze the heterogeneous effects of having psychological support. According to the Survey of Social Mobility in Disaster Zones (SSMDZ), 29% of women living in areas affected by the earthquake receiving some kind of psychological support. One hypothesis is that women who receiving psychological support were able to handle better their mental health after receiving the shock. Yet, another hypothesis is that women who have psychological support are more aware about the situation, and as a consequence we should observe that they report a higher level of mental health problems. Table 8 presents mixed results. We observe that women who receive psychological support were less irritated, suffering less problems of concentration, less tired, and reduce their fear. Yet, we observe that women who have psychological support were suffering more nightmares, problems of sleeping, sad, oppression, and a trembling body.

14

4   Conclusion

This paper analyzes the effects of the earthquakes that affected Mexico in September 2017 on women's mental health and substance abuse. We use the following measures of mental health: having nightmares, sleeping problems, being irritated, being tired, concentration problems, being sad, feeling fear, having oppression, and suffering trembling body. In the case of substance abuse we analyze the consumption of alcohol and tobacco. In addition, we analyze the role of variables pre-disaster and post-disaster that can worse or make more resilient the women affected by an earthquake. Finally, we evaluate the effect of having psychological support after the earthquake.

Using a difference-in-differences estimator we find: i. the earthquakes impacted negatively women's mental health; ii. there is no evidence that the earthquakes increase the consumption of alcohol or tobacco; iii. we find that variables post-disaster affected more the effects of women's mental health than variables pre-disaster. For example, living in an insecurity area worse the effect of the earthquakes on mental health, but family size can help women to be more resilient when facing a natural disaster; and iv. having psychological support help to face mental health problems for some items, but not for all.

There are two important limitations of this paper: i. we only have two points of time, and we are not able to check for the whether the parallel trend assumptions holds (i.e. that the results are not driven by omitted variable bias); and ii. we potentially face a problem of recall. Regarding the first point, we agree that it is possible that unobserved characteristics potentially affect our result. Thus,

to check that the results are not biased as a consequence of omitted variables, we use a bounding approach proposed by Altonji et al. (2005) and refined by Oster (2017).The results suggest that the estimates are robust to omitted variable bias. Regarding the second point, while we do not discard a recall bias problem, we consider that if this problem exists is minimum. In particular, the survey was collected in October and we ask the recall questions for the August month (one month before the occurrence of the earthquakes).

In terms of public policy, Mexico implemented the Natural Disasters Fund (FONDEN) to face risks from natural disasters. This fund provides short-term assistance (such as food) and long-term assistance (hospital infrastructure, roads, and schools) for affected communities. Yet, the fund does not provide psychological support. The literature has documented that the individual's mental health is affected after a natural disaster, and that this negative effect can remain for a long period of time. In this sense, it would be necessary to review the design of FONDEN and to analyze the possibility of incorporating psychological support for individuals affected by natural disasters. In addition, it is necessary to document what kind of psychological interventions are more effective to improve the mental health of individuals affected by a natural disaster.

References

ALTONJI, J. G., T. E. ELDER, AND C. R. TABER (2005): "Selection on Observed and Unobserved Variables: Assessing the Effectiveness of Catholic Schools," *Journal of Political Economy*, 113, 151–184.

GALEA, S., C. R BREWIN, M. GRUBER, R. JONES, D. KING, L. A KING, R. MCNALLY, R. URSANO, M. PETUKHOVA, AND R. KESSLER (2008): "Exposure to Hurricane-Related Stressors and Mental Illness After Hurricane Katrina," 64, 1427–34.

GOLDMANN, E. AND S. GALEA (2014): "Mental Health Consequences of Disasters," *Annual Review of Public Health*, 35, 169–183, pMID: 24159920.

HEID, A. R., R. PRUCHNO, F. P. CARTWRIGHT, AND M. WILSON-GENDERSON (2017): "Exposure to Hurricane Sandy, neighborhood collective efficacy, and post-traumatic stress symptoms in older adults," *Aging & Mental Health*, 21, 742–750, pMID: 26911314.

OSTER, E. (2017): "Unobservable Selection and Coefficient Stability: Theory and Evidence," *Journal of Business & Economic Statistics*, 0, 1–18.

RHODES, J., C. CHAN, C. PAXSON, C. E. ROUSE, M. WATERS, AND E. FUSSELL (2010): "The Impact of Hurricane Katrina on the Mental and Physical Health of Low-Income Parents in New Orleans," *The American Journal of Orthopsychiatry*, 80, 237–247.

TRACY, M., F. H. NORRIS, AND S. GALEA (2011): "Differences in the determinants of posttraumatic stress disorder and depression after a mass traumatic event," *Depression and Anxiety*, 28, 666–675.

WORLD BANK (2012): "FONDEN: El Fondo de Desastres Naturales- una reseña," Washington, D.C.

5 Appendix

Table 1: Descriptive Statistics

	Period 1		Period 2	
	Treatment	Control	Treatment	Control
Panel A. Mental Health and Substance Abuse				
Nightmares	0.13	0.12	0.50	0.11
Trouble sleeping	0.14	0.25	0.75	0.22
Irritated	0.18	0.22	0.50	0.23
Tired	0.24	0.41	0.71	0.43
Concentration problems	0.12	0.25	0.58	0.28
Sad	0.16	0.38	0.87	0.28
Fear	0.14	0.25	0.83	0.19
Oppression	0.12	0.21	0.52	0.18
Trembling	0.08	0.20	0.45	0.15
Tobacco	0.06	0.07	0.05	0.07
Alcohol	0.11	0.07	0.13	0.08
Panel B. Control Variables				
Age	46.67	44.51	46.67	44.51
Attended school: 1 Yes 0 No	0.88	0.91	0.88	0.91
Head of household : 1 Yes 0 No	0.38	0.29	0.38	0.29
Family size	5.37	4.45	5.37	4.45
PROGRESA program	0.14	0.29	0.11	0.27
Temporary Employment program	0.02	0.02	0.33	0.00
70 and more program	0.09	0.04	0.09	0.03
Remittances	0.03	0.01	0.05	0.01
Relocate	0.00	0.00	0.76	0.00
Money for reconstruction	0.00	0.00	0.32	0.00
Money to buy durable goods	0.00	0.00	0.13	0.00
Panel C. Other variables				
Father's death (when 15 years old or younger)	0.10	0.04	0.10	0.04
Mother's death (when 15 years old or younger)	0.06	0.04	0.06	0.04
Automobile accident (when 15 years old or younger)	0.03	0.02	0.03	0.02
Natural disaster (when 15 years old or younger)	0.23	0.04	0.23	0.04
Sexual assault (when 15 years old or younger)	0.03	0.01	0.03	0.01
Self-esteem	-0.03	0.03	-0.03	0.03
Self-control	-0.01	0.02	-0.01	0.02
Assets	7.81	7.27	3.92	7.28
Savings	0.26	0.16	0.06	0.10
Contribution to family income (partner)	0.68	0.84	0.54	0.84
Insecurity in the day	2.68	2.57	3.19	2.64
Insecurity at night	2.99	3.16	3.62	3.22
Psychological Support	0.00	0.00	0.29	0.00
Observations	402	395	402	395

Source: Mexico's Survey of Social Mobility in Disaster Zones (SSMDZ)

Table 2: Difference-in-Difference Estimates of the Impact of Earthquakes on Mental Health

	Nightmares (a)	Sleeping (b)	Irritated (c)	Concentration (d)	Tired (e)	Sad (f)	Fear (g)	Oppresion (h)	Trembling (i)
After*Treatment	0.379***	0.571***	0.351***	0.437***	0.452***	0.790***	0.755***	0.405***	0.417***
	(0.064)	(0.056)	(0.057)	(0.057)	(0.062)	(0.049)	(0.052)	(0.059)	(0.061)
After	-0.010	-0.026	0.012	0.031	0.026	-0.092***	-0.055***	-0.021	-0.045**
	(0.015)	(0.022)	(0.019)	(0.020)	(0.025)	(0.024)	(0.020)	(0.020)	(0.020)
Treatment	0.007	-0.107***	0.012	-0.091**	-0.201***	-0.214***	-0.094***	-0.073**	-0.114***
	(0.033)	(0.041)	(0.041)	(0.038)	(0.052)	(0.045)	(0.034)	(0.037)	(0.032)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.17	0.27	0.12	0.16	0.13	0.32	0.36	0.16	0.13
Observations	1564	1564	1563	1562	1563	1563	1563	1562	1559

Note: Other controls include: age, education, family size, and being head of the household. Participation in the following social programs: PROGRESA, Temporary Employment, an 70 and more. Finally, I include being relocated as a consequence of the natural disaster, receiving psychological support, receiving money for reconstruction, receiving money to buy durable goods, and remittances. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Difference-in-Difference Estimates of the Impact of Earthquakes on Substance Abuse

	Alcohol (a)	Tobacco (b)
After*Treatment	0.006	-0.000
	(0.042)	(0.027)
After	0.002	-0.000
	(0.011)	(0.005)
Treatment	0.001	-0.005
	(0.030)	(0.031)
Other controls	Yes	Yes
Locality FE	Yes	Yes
R^2	0.03	0.03
Observations	1564	1564

Note: Other controls include: age, education, family size, and being head of the household. Participation in the following social programs: PROGRESA, Temporary Employment, an 70 and more. Finally, I include being relocated as a consequence of the natural disaster, receiving psychological support, receiving money for reconstruction, receiving money to buy durable goods, and remittances. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Bounding Methodology: Effects of Earthquakes on Psychological Variables

	Nightmares (a)	Sleeping (b)	Irritated (c)	Concentration (d)	Tired (e)	Sad (f)	Fear (g)	Oppresion (h)	Trembling (i)
After*Treatment	[0.368,0.389]	[0.464,0.678]	[0.295,0.406]	[0.350,0.525]	[0.341,0.563]	[0.359,1.222]	[0.206,1.305]	[0.332,0.478]	[0.251,0.583]
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1564	1564	1563	1562	1563	1563	1563	1562	1559

Note: Other controls include: age, education, family size, and being head of the household. Participation in the following social programs: PROGRESA, Temporary Employment, an 70 and more. Finally, I include being relocated as a consequence of the natural disaster, receiving psychological support, receiving money for reconstruction, receiving money to buy durable goods, and remittances.

Table 5: Heterogeneous Effects of of the Impact of Earthquakes on Mental Health by Shocks during Childhood

	Nightmares (a)	Sleeping (b)	Irritated (c)	Concentration (d)	Tired (e)	Sad (f)	Fear (g)	Oppresion (h)	Trembling (i)
				Panel A					
After*Treatment	0.399***	0.585***	0.357***	0.448***	0.454***	0.809***	0.753***	0.405***	0.416***
	(0.065)	(0.058)	(0.059)	(0.060)	(0.065)	(0.051)	(0.054)	(0.062)	(0.062)
After*Treatment*Father's death	-0.140	-0.058	-0.002	-0.016	0.041	-0.269	0.194	0.091	-0.037
	(0.111)	(0.148)	(0.185)	(0.168)	(0.149)	(0.173)	(0.146)	(0.145)	(0.128)
R^2	0.18	0.28	0.12	0.16	0.14	0.32	0.37	0.17	0.13
Observations	1557	1557	1556	1556	1556	1556	1556	1555	1553
				Panel B					
After*Treatment	0.389***	0.575***	0.355***	0.438***	0.459***	0.789***	0.764***	0.395***	0.406***
	(0.065)	(0.059)	(0.059)	(0.061)	(0.063)	(0.051)	(0.053)	(0.059)	(0.064)
After*Treatment*Mother's death	-0.204	-0.077	-0.081	-0.021	-0.174	-0.201	-0.216	0.055	0.056
	(0.166)	(0.160)	(0.150)	(0.174)	(0.157)	(0.189)	(0.161)	(0.084)	(0.140)
R^2	0.18	0.28	0.13	0.17	0.14	0.33	0.37	0.16	0.14
Observations	1561	1561	1560	1560	1560	1560	1560	1559	1557
				Panel C					
After*Treatment	0.388***	0.566***	0.360***	0.427***	0.456***	0.787***	0.748***	0.409***	0.413***
	(0.065)	(0.056)	(0.058)	(0.058)	(0.063)	(0.050)	(0.052)	(0.060)	(0.063)
After*Treatment *Automobile accident	-0.091	0.326*	-0.245*	0.234	-0.094	0.037	0.205	-0.090	0.106
	(0.218)	(0.196)	(0.145)	(0.167)	(0.243)	(0.247)	(0.242)	(0.152)	(0.205)
R^2	0.18	0.27	0.12	0.16	0.14	0.32	0.36	0.16	0.13
Observations	1561	1561	1560	1560	1560	1560	1560	1559	1557
				Panel D					
After*Treatment	0.375***	0.561***	0.352***	0.429***	0.458***	0.785***	0.746***	0.404***	0.395***
	(0.066)	(0.059)	(0.060)	(0.058)	(0.062)	(0.053)	(0.054)	(0.061)	(0.061)
After*Treatment*Natural disaster	0.102	0.044	0.038	0.095	-0.005	-0.041	-0.036	0.050	0.100
	(0.079)	(0.105)	(0.073)	(0.108)	(0.125)	(0.164)	(0.094)	(0.102)	(0.135)
R^2	0.18	0.27	0.12	0.17	0.14	0.32	0.36	0.17	0.14
Observations	1551	1551	1550	1550	1550	1550	1550	1549	1547
				Panel E					
After*Treatment	0.385***	0.581***	0.349***	0.438***	0.454***	0.792***	0.756***	0.407***	0.413***
	(0.065)	(0.056)	(0.060)	(0.058)	(0.063)	(0.049)	(0.052)	(0.059)	(0.061)
After*Treatment *Sexual assault	-0.119	-0.473	0.235	-0.218	-0.096	-0.100	-0.209	0.007	-0.222
	(0.202)	(0.307)	(0.173)	(0.282)	(0.270)	(0.167)	(0.271)	(0.183)	(0.282)
R^2	0.18	0.27	0.13	0.17	0.13	0.33	0.37	0.16	0.13
Observations	1561	1561	1560	1560	1560	1560	1560	1559	1557
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Other controls include: age, education, family size, and being head of the household. Participation in the following social programs: PROGRESA, Temporary Employment, an 70 and more. Finally, I include being relocated as a consequence of the natural disaster, receiving money for reconstruction, receiving money to buy durable goods, and remittances. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Heterogeneous Effects of the Impact of Earthquakes on Mental Health by Pre-disaster Variables

	Nightmares (a)	Sleeping (b)	Irritated (c)	Concentration (d)	Tired (e)	Sad (f)	Fear (g)	Oppresion (h)	Trembling (i)
				Panel A					
After*Treatment	0.371***	0.560***	0.334***	0.425***	0.434***	0.782***	0.744***	0.406***	0.398***
	(0.064)	(0.057)	(0.054)	(0.055)	(0.062)	(0.050)	(0.053)	(0.060)	(0.059)
After*Treatment*Self-esteem	0.050	-0.016	-0.034	-0.033	-0.015	0.025	-0.013	-0.008	-0.044
	(0.037)	(0.037)	(0.042)	(0.035)	(0.036)	(0.041)	(0.032)	(0.030)	(0.033)
R^2	0.18	0.29	0.14	0.17	0.15	0.33	0.37	0.17	0.13
Observations	1557	1557	1556	1556	1556	1556	1556	1555	1553
				Panel B					
After*Treatment	0.364***	0.555***	0.327***	0.423***	0.441***	0.780***	0.746***	0.401***	0.397***
	(0.064)	(0.057)	(0.054)	(0.054)	(0.062)	(0.050)	(0.052)	(0.060)	(0.060)
After*Treatment*Self-control	0.024	-0.003	0.010	0.030	-0.016	0.027	-0.035	0.041	0.049
	(0.033)	(0.039)	(0.044)	(0.039)	(0.044)	(0.043)	(0.041)	(0.031)	(0.038)
R^2	0.18	0.28	0.17	0.19	0.15	0.34	0.37	0.18	0.14
Observations	1556	1556	1555	1554	1555	1555	1555	1554	1551
				Panel C					
After*Treatment*	0.400***	0.437***	0.173*	0.327***	0.216*	0.698***	0.749***	0.434***	0.313***
	(0.103)	(0.135)	(0.093)	(0.125)	(0.121)	(0.112)	(0.123)	(0.125)	(0.098)
After*Treatment*Attended school	-0.023	0.150	0.198**	0.123	0.261**	0.103	0.008	-0.031	0.115
	(0.085)	(0.133)	(0.079)	(0.121)	(0.115)	(0.115)	(0.115)	(0.121)	(0.099)
R^2	0.17	0.27	0.12	0.16	0.13	0.32	0.36	0.16	0.13
Observations	1564	1564	1563	1562	1563	1563	1563	1562	1559
				Panel D					
After*Treatment	0.407***	0.873***	0.414**	0.651***	0.600***	0.819***	0.762***	0.430**	0.539***
	(0.146)	(0.154)	(0.164)	(0.164)	(0.166)	(0.165)	(0.175)	(0.184)	(0.165)
After*Treatment*Age	-0.000	-0.006**	-0.001	-0.004	-0.003	-0.000	0.000	-0.000	-0.002
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
R^2	0.18	0.27	0.12	0.16	0.13	0.32	0.36	0.16	0.13
Observations	1564	1564	1563	1562	1563	1563	1563	1562	1559
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Other controls include: age, education, family size, and being head of the household. Participation in the following social programs: PROGRESA, Temporary Employment, 70 and more. Finally, I include being relocated as a consequence of the natural disaster, receiving money for reconstruction, receiving money to buy durable goods, and remittanc
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Heterogeneous Effects of the Impact of Earthquakes on Mental Health by Post-disaster Variables

	Nightmares (a)	Sleeping (b)	Irritated (c)	Concentration (d)	Tired (e)	Sad (f)	Fear (g)	Oppresion (h)	Trembling (i)
				Panel A					
After*Treatment	0.403***	0.597***	0.367***	0.389***	0.411***	0.819***	0.770***	0.380***	0.402***
	(0.072)	(0.062)	(0.066)	(0.065)	(0.070)	(0.054)	(0.051)	(0.067)	(0.067)
After*Treatment* Assets	0.022	0.033	-0.004	0.013	0.084*	0.030	-0.025	-0.048	-0.036
	(0.039)	(0.042)	(0.038)	(0.040)	(0.045)	(0.043)	(0.042)	(0.041)	(0.039)
R^2	0.18	0.27	0.12	0.16	0.14	0.32	0.37	0.16	0.13
Observations	1537	1537	1536	1535	1536	1536	1536	1535	1532
				Panel B					
After*Treatment	0.389***	0.562***	0.368***	0.449***	0.457***	0.778***	0.737***	0.394***	0.407***
	(0.065)	(0.060)	(0.059)	(0.061)	(0.064)	(0.053)	(0.053)	(0.059)	(0.060)
After*Treatment*Savings	-0.018	0.124	-0.057	-0.133	-0.110	0.082	0.129	0.113	0.144
	(0.124)	(0.097)	(0.129)	(0.114)	(0.113)	(0.118)	(0.109)	(0.129)	(0.116)
R^2	0.18	0.27	0.12	0.16	0.13	0.32	0.37	0.16	0.13
Observations	1558	1558	1557	1556	1557	1557	1557	1556	1553
				Panel C					
After*Treatment	0.417***	0.601***	0.369***	0.546***	0.474***	0.790***	0.864***	0.497***	0.505***
	(0.086)	(0.092)	(0.084)	(0.088)	(0.088)	(0.085)	(0.075)	(0.100)	(0.097)
After*Treatment*Income (partner)	-0.052	0.026	-0.046	-0.171*	-0.055	-0.007	-0.137*	-0.198**	-0.170**
	(0.072)	(0.091)	(0.079)	(0.089)	(0.092)	(0.086)	(0.073)	(0.092)	(0.083)
R^2	0.19	0.29	0.12	0.19	0.15	0.34	0.39	0.19	0.15
Observations	1379	1379	1378	1377	1378	1378	1378	1377	1374
				Panel D					
After*Treatment	0.379***	0.778***	0.386***	0.563***	0.611***	0.991***	0.853***	0.580***	0.594***
	(0.092)	(0.101)	(0.086)	(0.081)	(0.087)	(0.091)	(0.082)	(0.085)	(0.090)
After*Treatment*Family size	0.000	-0.045**	-0.009	-0.027*	-0.035**	-0.045***	-0.021	-0.039***	-0.039***
	(0.012)	(0.019)	(0.014)	(0.014)	(0.015)	(0.015)	(0.014)	(0.012)	(0.014)
R^2	0.18	0.27	0.12	0.16	0.13	0.32	0.36	0.16	0.13
Observations	1564	1564	1563	1562	1563	1563	1563	1562	1559
				Panel E					
After*Treatment	0.369***	0.572***	0.317***	0.416***	0.422***	0.783***	0.727***	0.382***	0.412***
	(0.069)	(0.058)	(0.057)	(0.058)	(0.063)	(0.054)	(0.055)	(0.061)	(0.064)
After*Treatment*Insecurity (day)	0.129***	0.144***	0.052	0.072**	0.019	0.103***	0.079**	0.074*	0.112***
	(0.033)	(0.033)	(0.038)	(0.033)	(0.043)	(0.039)	(0.033)	(0.039)	(0.036)
R^2	0.19	0.28	0.13	0.17	0.14	0.33	0.38	0.16	0.13
Observations	1559	1559	1558	1558	1558	1558	1558	1557	1555
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: Other controls include: age, education, family size, and being head of the household. Participation in the following social programs: PROGRESA, Temporary Employment, an 70 and more. Finally, I include being relocated as a consequence of the natural disaster, receiving money for reconstruction, receiving money to buy durable goods, and remittances. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Difference-in-Difference Estimates of the Impact of Earthquakes on Mental Health by Psychological Support

	Nightmares (a)	Sleeping (b)	Irritated (c)	Concentration (d)	Tired (e)	Sad (f)	Fear (g)	Oppresion (h)	Trembling (i)
After*Treatment	0.377***	0.569***	0.355***	0.441***	0.455***	0.788***	0.761***	0.403***	0.416***
	(0.064)	(0.056)	(0.057)	(0.057)	(0.062)	(0.049)	(0.051)	(0.059)	(0.061)
After*Treatment*Psychological Support	0.182**	0.320***	-0.640***	-0.560***	-0.460***	0.257***	-0.845***	0.324***	0.207**
	(0.074)	(0.072)	(0.083)	(0.084)	(0.086)	(0.066)	(0.068)	(0.084)	(0.090)
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.17	0.27	0.12	0.16	0.13	0.32	0.36	0.16	0.13
Observations	1564	1564	1563	1562	1563	1563	1563	1562	1559

Note: Other controls include: age, education, family size, and being head of the household. Participation in the following social programs: PROGRESA, Temporary Employment, an 70 and more. Finally, I include being relocated as a consequence of the natural disaster, receiving psychological support, receiving money for reconstruction, receiving money to buy durable goods, and remittances. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$