UC Irvine
UC Irvine Previously Published Works

Title
Earthquake exposure, adverse childhood experiences, and psychosocial functioning in Chilean children: A longitudinal study

Permalink
https://escholarship.org/uc/item/9ns2n803

Journal
Journal of Traumatic Stress, 35(4)

ISSN
0894-9867

Authors
Dutta, Anamika
Peña, Felipe
Holcomb, Juliana M
et al.

Publication Date
2022-08-01

DOI
10.1002/jts.22826

Peer reviewed

Earthquake exposure, adverse childhood experiences, and psychosocial functioning in Chilean children: A longitudinal study

Anamika Dutta[1], **Felipe Peña**[2], **Juliana M. Holcomb**[1,3], **Loreto Leiva**[4], **Ana María Squicciarini**[5], **Katia M. Canenguez**[1,6], **Paul Bergmann**[7], **Alexa Riobueno-Naylor**[8], **Alyssa M. Farley**[9], **Ariela Simonsohn**[5], **Dana Rose Garfin**[10], **Roxane Cohen Silver**[11], **Talia S. Benheim**[1], **Javier Guzmán**[5], **Michael S. Jellinek**[1,6,12], **J. Michael Murphy**[1,6]

[1]Department of Psychiatry, Massachusetts General Hospital, Boston, Massachusetts, USA

[2]Independent researcher, Santiago, Chile

[3]Department of Psychology, Suffolk University, Boston, MA

[4]Department of Psychology, University of Chile, Santiago, Chile

[5]Department of School Health, Junta Nacional de Auxilio Escolar y Becas, Santiago, Chile

[6]Department of Psychiatry, Harvard Medical School, Boston, Massachusetts, USA

[7]Foresight Logic, Inc., Saint Paul, Minnesota, USA

[8]Department of Counseling, Developmental, and Educational Psychology, Boston College, Chestnut Hill, Massachusetts, USA

[9]Center for Anxiety and Related Disorders, Boston University, Boston, Massachusetts, USA

[10]Sue & Bill Gross School of Nursing and Program in Public Health, University of California, Irvine, Irvine, California, USA

[11]Department of Psychological Science, Department of Medicine, Program in Public Health, University of California, Irvine, Irvine, California, USA

[12]Department of Pediatrics, Harvard Medical School, Boston, Massachusetts, USA

Abstract

The impact of an 8.8 magnitude Chilean earthquake on elementary school students' psychosocial functioning was assessed along with exposure to adverse childhood experiences (ACEs). *Skills for Life*, a national school-based mental health program in Chile, routinely assesses first- and third-grade students' psychosocial functioning and classroom adaptation. Students ($N = 19,627$) were screened before (2009) and after (2011) the 2010 earthquake with parent-and teacher-report measures and with a parent-report of four ACEs (family psychopathology, child chronic illness, family social isolation, father absence). Earthquake exposure was categorized as mild, moderate, or severe for Chile's 15 regions. Multilevel models analyzed the unadjusted and adjusted impacts

Correspondence: J. Michael Murphy, Massachusetts General Hospital, Department of Psychiatry and Harvard Medical School, Department of Psychiatry, 32 Fruit St. Boston, MA 02114. mmurphy6@mgh.harvard.edu.

of earthquake exposure and ACEs on functioning while clustering for school-and district-level effects. In covariate-adjusted models, earthquake exposure and three ACEs were significantly associated with worsened psychosocial functioning; earthquake exposure and all four ACEs were significantly associated with worsened classroom adaptation. New family psychopathology, $B =$ 1.90, $p < .001$; chronic illness, $B = 2.25$, $p < .001$; and severe earthquake impact, $B = 1.29$, $p < .001$, held the strongest negative effects on psychosocial well-being. Moderate, $B = 3.04$, $p = .011$, and severe earthquake exposure, $B = 2.53$, $p = .047$, and new family psychopathology, $B = 1.99$, $p < .001$, were associated with the worst classroom functioning 1-year postdisaster. Findings suggest that both exogenous and home-based stressors can have significant consequences for children's psychosocial functioning and classroom adaptation, and routine screening helps quantify how individual students are affected by chronic versus acute stressors.

On February 27, 2010, the sixth-strongest recorded earthquake in history occurred in Chile, causing more than 500 deaths; the destruction of hundreds of buildings, including schools; and a blackout that affected most of the country's population (Earthquake Engineering Research Institute, 2010; National Institute of Standards and Technology, 2016). With a magnitude of 8.8 on the Richter scale (8.8 M_w) and an epicenter off the coast of Biobío, the earthquake was felt by approximately 75% of the country's population (United States Geological Survey, 2011). An accompanying tsunami reached heights of more than 95 ft and caused large-scale destruction and death in several coastal cities (SMS Tsunami Warning, 2018). Media outlets in Chile extensively covered this destruction in addition to the fires, looting, and widespread evacuations that occurred in some areas of the country (Garfin et al., 2014). The earthquake struck the night immediately before the start of a new school year, and, consequently, all schools in the country were closed for weeks.

Exposure to earthquakes has consistently demonstrated negative associations with child mental health outcomes. In a sample of 62 Nepali children and adolescents exposed to a 2015 earthquake (7.8 M_w) in Nepal, earthquake-related exposures were positively associated with posttraumatic stress disorder (PTSD) symptoms (Schwind et al., 2018). Similarly, 188 Chinese children and adolescents from areas affected by high levels of exposure to the 2008 Sichuan earthquake (7.9 M_w) reported more mental health problems than their 235 peers in less-exposed areas (Zhang et al., 2010). Following the 2013 Ya'an earthquake in China (M_w 6.6), negative life events were found to mediate the association between PTSD and depressive symptoms in a sample of 4,137 adolescents near the earthquake's epicenter (Jin et al., 2018). The strong evidence base supporting an association between proximity to a disaster and poorer mental health outcomes in children suggests that developmentally, children are able to process disaster-related fear and stress and are, therefore, an important age group to study following disasters.

Studies assessing the impact of the Chilean earthquake have also demonstrated associations between more severe earthquake exposure and poorer outcomes. Children who experienced the earthquake in Santiago immediately before starting preschool ($n = 698$) were found to have significantly worse developmental problems compared to their peers who started preschool the year prior ($n = 720$; Gomez & Yoshikawa, 2017). Garfin and colleagues (2014) found that students in Biobío ($n = 117$) who had been directly exposed to earthquake-

related violence, injuries, or death were more likely to experience posttraumatic stress compared to their peers with fewer disaster-related exposures. Although the findings from cross-sectional studies have supported the negative impact of earthquakes, few studies with both pre- and postdisaster data exist, thereby limiting the understanding of how children's psychosocial functioning changes following disaster exposure. Small sample sizes in prior studies on earthquakes have also restricted inferences from a population-level, public health perspective.

Similar to the effects of natural disasters, the harmful psychological effects of adverse childhood experiences (ACEs) are well established (Centers for Disease Control, 2020). Over the past two decades, researchers have explored the association between ACEs and problems with interpersonal relationships, memory, sleep, depression, anxiety, suicidal behavior, substance use, and chronic medical illnesses in adulthood (Anda et al., 2006; Bellis et al., 2014; Felitti et al., 1998; Giovanelli et al., 2016; Herzog & Schmahl, 2018; Leung et al., 2016; Merrick et al., 2017). Most research on ACEs focuses on outcomes in adults rather than pediatric populations (Struck et al., 2021), and without an understanding of the near-term effects of childhood adversity, it is difficult to develop interventions that provide affected children with adequate resources (Hunt et al., 2017).

The smaller number of studies that have explored the impact of ACEs on children and/or adolescents have shown that recent ACEs (e.g., household instability) are associated with poorer health in young children and adolescents at the time of assessment (Flaherty et al., 2013; Kerker et al., 2015). In a sample of young adults, Karatekin (2018) found an association between retrospectively reported childhood maltreatment or household instability and current mental health among college students. Additional studies have found a significant positive association between recent family food insecurity, considered an ACE, and increased problems with psychosocial functioning in children (Kleinman et al., 1998; Miller et al., 2008; Murphy et al., 1998).

Understanding the psychological effect of adversity on elementary school–aged children is particularly important given their growing developmental ability to conceptualize and cope with stressful events (Gonzalez et al., 2016; Lowe et al., 2020). Similar to the literature gap on preand postdisaster outcomes, few studies on ACEs have analyzed how psychosocial functioning changes following a new exposure to adversity (Sweeting et al., 2020). Moreover, no studies to date have simultaneously explored the impacts of a large-scale natural disaster along with those related to daily home-based ACEs. Adversity typically does not occur in isolation from other events. A child exposed to illness or discord within the home may also be exposed to environmental disasters, and being able to differentiate the impacts of a range of adverse experiences may help in developing targeted interventions for affected youth.

To address the small sample sizes and absence of comparisons between exogenous and individual-level stressors in prior research, the current study longitudinally assessed exposure to both the 2010 Chilean earthquake and a variety of home-based ACEs in a sample of 19,627 elementary school students. With a large sample size allowing for more robust quantitative analyses, our research team sought to address four research questions:

(a) Did the 2010 earthquake predict deteriorations in student psychosocial and classroom functioning? If so, did the earthquake equally affect students in all regions of Chile, or were there significant regional differences based on proximity to the epicenter?; (b) Did exposure to individual ACEs predict worsened psychosocial and classroom functioning?; (c) Did the earthquake and exposure to ACEs uniquely predict worsened psychosocial and classroom functioning in a covariate-adjusted model?; and (d) What were the psychosocial and behavioral effects of compounded adversity? Based on prior literature (Garfin et al., 2014; Goldmann & Galea, 2014), we hypothesized that students living in the regions most severely affected by the earthquake (i.e., closer to the epicenter) would experience the highest degree of worsened psychosocial functioning 1-year postdisaster. As no studies of which we are aware have specifically compared the impact of an exogenous disaster with those related to individual-level stressors, we had no directional hypotheses as to which stressor or stressors would have the largest impact.

METHOD

Participants and procedure

Skills for Life (SFL; called *Habilidades para la vida* in Spanish) in Chile is one of the largest school-based mental health programs in the world (Murphy et al., 2017). Administered by the National Board of Student Aid and Scholarships (*Junta Nacional de Auxilio Escolar y Becas*; JUNAEB), a division of the national Ministry of Education, SFL was serving more than 250,000 Chilean public-school students in more than 1,200 schools in the country's most economically disadvantaged communities at the time of the earthquake in 2010 (JUNAEB, 2019). The current study focused on students enrolled in SFL-participating schools when they were in first grade (2009) and third grade (2011).

Through SFL's routine programming, elementary school students were screened for psychosocial problems with one teacher-report measure of classroom behavior (i.e., the Teacher Observation of Classroom Adaptation Re-Revised for Chile [TOCA-RR]; De la Barra et al., 2002, 2005; Kellam et al., 1975) and one parent-report measure of overall psychosocial functioning (Pediatric Symptom Checklist–Chilean Version [PSC-CL]; George et al., 1995) before (i.e., 2009) and after (i.e., 2011) the 2010 earthquake. Students were simultaneously screened for selected ACEs, as reported by a parent or caregiver. Parent and teacher forms are administered in the middle of each academic year, which in Chile begins around March 1 and ends in mid-December. Program officials in Chile deidentified the data before sending it to the United States–based team for analysis. The study was approved by the Institutional Review Board through Mass General Brigham as secondary use, nonhuman subjects research.

A total of 56,776 students attended an SFL-participating school in 2009. Of these students, 40,174 provided complete data on key baseline measures: 15,006 students were excluded because they were missing data from 2009 parent-reports of psychosocial functioning (PSC-CL) and teacher-reports of classroom adaptation (TOCA-RR), and 1,596 students did not provide data on one or more baseline demographic covariates. Of this first-year sample, 20,420 students did not have a longitudinally matched PSC-CL or TOCA-RR in third grade (2011). An additional 127 students were excluded for missing third-grade data on covariates.

After exclusions, the resulting and final analytic sample consisted of 19,627 students, which represents 48.9% of students with valid and complete first-grade data. TOCA-RR and PSC-CL CLA forms were completed on paper by parents or caregivers and input, along with information on ACE exposure, into an online database by SFL's mental health professionals in each school.

One prior publication (Murphy et al. (2014)) used a *Skills for Life* dataset from 2009 to 2011 that overlapped with the current study but had a distinctly different focus. The current paper explores the association between earthquake exposure and adverse childhood experiences with posttest PSC-CL and TOCA-RR scores. Murphy et al. (2014) focused on the association between PSC-CL and TOCA-RR risk, demographic characteristics, grade point average, and school attendance.

Measures

Psychosocial indicators

Teacher-reported psychosocial functioning: SFL-participating schools annually administer two validated measures to assess behavioral and psychosocial risk in their students. The behavioral measure is the TOCA-RR (De la Barra et al., 2002, 2005 De la Barra et al., 2005), a Spanish translation of the original version of TOCA-R (Kellam et al., 1975) that was adapted and validated by the SFL team for use in Chile (Cronbach's as = .74–.95; George et al., 1995; Leiva et al., 2019). Through an interview, a member of the SFL local mental health team administers the TOCA-RR to each student's teacher regarding the student's behavior and functioning within the classroom. There are 31 items grouped in six dimensions that assess the student's social contact, authority acceptance, emotional maturity, cognitive achievement, attention and concentration, and activity level. TOCA-RR items are scored on a Likert scale ranging from 1 (*almost never*) to 6 (*almost always*). Higher scores on the TOCA-RR indicate more difficulty with classroom and behavioral functioning. Overall TOCA-RR risk is determined by a combination of the six subscales, each of which has its specific cutoff score indicating substantial functional difficulty (Guzmán et al., 2015).

Parent- or caregiver-reported psychosocial functioning: The SFL program also includes the PSC-CL (Murphy et al., 2014), an adapted version of the widely-used parent-report PSC, which has been translated into more than three dozen languages and studied in diverse populations in the United States and internationally (Massachusetts General Hospital, 2020). The PSC was adapted for use in Chile (i.e., PSC-CL) and has been one of the SFL's two screening measures since the program started more than 20 years ago (George et al., 1995). The PSC-CL consists of 33 questions used to assess a broad range of psychosocial and behavioral problems. Reliability testing in Chilean youth yielded a Cronbach alpha value of .85 (De la Barra et al., 2002, 2005). Items are scored on a Likert scale with three response options: 1 (*never/nunca*), 2 (*sometimes/a veces*), and 3 (*very often/muy seguido*). Possible overall weighted scores range from 33 to 99, with higher scores indicating a higher degree of psychosocial difficulty. A score of 65 or higher on the PSC-CL indicates psychosocial risk (Guzmán et al., 2015).

ACEs—The 10 ACEs utilized in the original ACE Study (Felitti et al., 1998) can be organized into themes of abuse, neglect, and household instability and comprise the most standardized and traditional measure of ACEs. Recent literature, however, has identified many additional types of childhood adversity in pediatric populations, such as bullying, severe illness, or discrimination (Bethell et al., 2017; Oh et al., 2018). After reviewing measures of ACEs available at the time the program was created, SFL created a concise measure of childhood adversity in the form of a five-item assessment of background risk factors (George et al., 1995).

The risk factor questionnaire, called Chilean-ACEs (CLA), was added as a second scale to the 33-item PSC-CL form to provide additional context for clinical referrals (Guzman et al., 2011). Four of the items on the CLA are subject to change over time: psychopathology in a family member, child chronic illness, family social isolation, and father absence (due to divorce, separation, death, or other circumstances). The population of interest in the current study was children whose parents or caregivers did not report a given ACE in 2009 (first grade) but did report that ACE in 2011 (third grade), therefore focusing on children with a newly occurring ACE, also referred to as "exposure" to ACEs, from 2009 to 2011. This group of children was contrasted with children whose parents or caregivers never reported a given ACE, no longer reported a previously reported ACE, or reported a given ACE at both time points. Previous studies of SFL have documented an association between individual CLA items and standardized academic test scores, grade-point average, school maladjustment, and overall psychosocial functioning (Guzman et al., 2011; Leiva et al., 2019; Murphy et al., 2014). PSC-CL and CLA forms were completed on paper by parents or caregivers and, along with TOCA-RR scores, inputted into an online database by SFL's mental health professionals in each school.

Earthquake severity—The severity of the 2010 earthquake's physical impact was classified using information published by the Pan American Health Organization (PAHO; 2010). Earthquake severity was categorized as "mild/unaffected," "moderate," or "severe," based on the level of destruction each region experienced, including loss of lives and damage to infrastructure (see Figure 1 and Tables 1, 2). Destruction was most severe in the areas closest to the epicenter and lessened as the distance from the epicenter increased. In the analyses, severe or moderate exposure levels were contrasted with mild exposure. Many prior studies have used the proximity to a disaster's epicenter as a proxy for earthquake exposure, correlating closer proximity with increased severity of PTSD (Armenian et al., 2000; Chan et al., 2011; Dell'Osso et al., 2013) and worsened overall mental health (Cao et al., 2003). To align with this prior evidence base, children's residential region was recoded into one of these exposure categories as a proxy for earthquake exposure severity.

Sociodemographic variables—The current study also included variables from individual student records, including student gender and family participation in Chile's *Solidario* program (i.e., welfare) and/or *Sename* (i.e., Child Protective Services; CPS). Welfare and CPS were used as proxies for low socioeconomic status in the current study as well as in prior studies (Guzmán et al., 2015; Murphy et al., 2014).

Compounded exposure to adversity—To explore the compounded effect of microlevel stressors, we created a variable that summed the number of newly reported ACEs. The resulting variable ranged from zero to three or four new adverse experiences; we combined three or four new adverse experiences into one category, as the latter category included very few students and was not robust on its own.

Data analysis

Preliminary data cleaning and all statistical analyses were conducted using SPSS (Version 24.0). Given that we aimed to assess the impact of new ACEs and earthquake exposure longitudinally, only students with complete data in both years were included in the analytic sample. Chi-square analyses and *t* tests were conducted to assess baseline differences between students who did and did not have follow-up data in third grade, and chi-square analyses were conducted to assess associations between earthquake exposure and newly reported ACEs. We performed bivariate linear regressions to assess the associations between baseline covariates and third-grade PSC-CL or TOCA-RR scores to determine which factors to control for in adjusted models.

Given that our sample comprised 19,627 students clustered within varying districts and schools in Chile at two assessment points, we conducted multilevel modeling analyses that controlled for random effects at the district and school level (Peugh, 2010). Unadjusted models assessed the individual impact of each fixed effect predictor (i.e., earthquake severity, child illness, family psychopathology, father absence, and social isolation) by third-grade PSC-CL and TOCA-RR scores while clustering for random district and school effects. Adjusted models assessed the effects of all significant fixed-effect predictors with significant predictors of third-grade screening scores in one model. A separate adjusted model also assessed the effect of compounded adversity on third-grade screening scores.

RESULTS

Participant characteristics

Students in the final sample came from 1,114 schools, 125 school districts, and all 15 regions of Chile. About half (49.2%) of the sample was male, 13.0% had families that were receiving welfare, and 4.1% had families involved with CPS. In the analytic sample, 3,577 students (18.2%) lived in a region that was mildly affected or unaffected by the earthquake, 10,344 (52.7%) lived in a moderately affected region, and 5,706 (29.1%) lived in a severely affected region. TOCA-RR scores did not significantly change from 2009 to 2011, whereas mean scores on the PSC-CL increased (i.e., psychosocial functioning worsened) slightly but significantly, $p < .001$, from first to third grade, with a small effect size (i.e., an increase of 0.41 points on PSC-CL), $d = 0.05$.

Students who were lost to follow-up screening in third grade (2011) had significantly higher baseline PSC-CL and TOCA-RR scores, indicating a higher degree of psychosocial difficulty relative to their peers. Additionally, they were significantly more likely to be enrolled in welfare and CPS and had significantly higher proportions of chronic illness, family psychopathology, and father absence compared with students with follow-up data.

Associations between earthquake and ACE exposure

There were no consistent significant associations between earthquake severity and newly reported ACEs. Of students with new chronic illness from first to third grade, 6.7% lived in mildly affected regions, 7.6% in moderately affected regions, and 8.0% in severely affected regions, $\chi^2(2, 19{,}627) = 5.84$, $p = .054$. The highest proportion of new family psychopathology was found among students with moderate earthquake exposure (6.8%) relative to mild (5.6%) and severe (6.0%) exposure, $\chi^2(2, 19{,}627) = 7.78$, $p = .020$, whereas mild earthquake exposure was associated with the highest proportion of (a) newly reported father absence relative to moderate and severe exposure (9.4% vs. 8.6% vs. 7.2%), $\chi^2(2, 19{,}627) = 15.56$, $p < .001$, and (b) newly reported family social isolation relative to moderate and severe exposure (14.7% vs. 13.4% vs. 13.9%), $\chi^2(2, 19{,}627) = 3.41$, $p = .181$.

Baseline predictors of third-grade PSC-CL and TOCA-RR scores

First grade PSC-CL score $B = 0.58$, $p < .001$; gender, $B = 2.15$, $p < .001$; welfare program participation, $B = 1.77$, $p < .001$; and CPS involvement, $B = 2.36$, $p < .001$, significantly predicted third-grade PSC-CL scores and were, therefore, included as additional predictors in the adjusted models. Similarly, first grade TOCA-RR score, $B = 0.54$, $p < .001$; gender, $B = 9.38$, $p < .001$; welfare program participation, $B = 4.65$, $p < .001$; and CPS involvement, $B = 12.67$, $p < .001$, significantly predicted third-grade TOCA-RR scores and were included in adjusted models.

Assessing ACE and earthquake exposure

As shown in Table 3, children with newly reported chronic illness, family psychopathology, father absence, moderate earthquake exposure, and severe earthquake exposure all had average third-grade PSC-CL scores that were significantly higher (i.e., worse psychosocial functioning) than their peers by 1.36–3.02 points in unadjusted models. The same adverse experiences, with the addition of new family social isolation, were significantly associated with higher TOCA-RR scores (i.e., 2.30–4.14 points higher).

In the adjusted model predicting third-grade PSC-CL scores, students with new chronic illness in third grade showed the poorest psychosocial functioning in 2011 relative to their peers. After controlling for first-grade PSC-CL scores and baseline demographic variables, students with new reports of chronic illness scored an average of 2.25 points higher on the PSC-CL in 2011, $p < .001$, than their peers without this exposure. New family psychopathology was associated with an average 1.90-point increase in third-grade PSC-CL scores compared to children without this new ACE. Severe and moderate earthquake exposure were, respectively, associated with average PSC-CL score increases of 1.29-points, $p < .001$, and 0.82-points, $p = .017$, higher than students with mild earthquake exposure. Children who no longer lived with their fathers also had significantly poorer psychosocial functioning in 2011, with PSC-CL scores an average of 1.28 points higher in third grade compared to their peers.

When predicting third-grade TOCA-RR scores, moderate and severe earthquake exposure, relative to mild exposure, were significantly associated with the poorest classroom adaptation. Students from moderately or severely affected areas scored 3.04, $p = .011$, and

2.53, p = .047, points higher, respectively, on the TOCA-RR in third grade compared to their peers in mildly affected areas. Comparatively, new reports of family psychopathology, father absence, child chronic illness, and family social isolation were significantly associated with average third-grade score increases of 1.99 points, p = .001; 1.87 points, p = .001; 1.72 points, p = .002; and 1.42 points, p = .001, respectively.

Compounded exposure to adversity

Among students who were exposed to multiple ACEs from 2009 to 2011, posttest PSC-CL and TOCA-RR scores were significantly higher relative to their peers with no adverse experiences, above and beyond the effects of baseline sociodemographic characteristics and earthquake exposure. Experiencing three or four new home-based stressors (n = 99) was significantly associated with an average posttest PSC-CL score 4.14 points higher, p < .001, than students who did not report new adverse experiences. Similarly, experiencing one or two new home-based stressors was significantly associated with average posttest scores 1.14 points, p <.001, and 2.60 points higher, p < .001, respectively, than scores among children who did not report any new adversity. Comparatively, moderate and severe earthquake exposure were, respectively, associated with mean posttest PSC-CL scores that were 0.83 points, p = .016, and 1.30 points, p < .001, higher than reported scores of students in mildly affected regions. Similar patterns with third-grade TOCA-RR scores existed for students who experienced two, B = 3.89, p < .001, or three or four, B = 4.52, p = .031, new adverse experiences compared to no new adverse experiences. In comparison, children with moderate and severe earthquake exposure had average TOCA-RR scores that were 3.04 points, p = .011, and 2.53 points, p = .048, higher than their peers.

DISCUSSION

The current study explored the impact of one exogenous natural disaster and four individual-level ACEs on standardized measures of psychosocial functioning and classroom adaptation assessed prospectively in a large, longitudinal sample of elementary school students from all 15 regions of Chile. The severity of earthquake exposure and exposure to three of the four examined ACEs (child illness, family psychopathology, and father absence) were consistently associated with significantly worse functioning as measured on posttest PSC-CL and TOCA-RR scores, both as individual stressors and after adjusting for the relative contribution of each. These findings suggest that both micro- and macro-level stressors are relevant to psychosocial and classroom adaptation.

The current paper expands upon the results of an earlier study of the impact of the 2010 earthquake on school children in Chile (Garfin et al., 2014) in several ways. First, the large sample size in the present investigation provides more confidence in estimating the magnitude of the earthquake's psychological effects. Despite the disaster's major social, physical, psychological, and financial effects throughout Chile, living in a region severely affected by the earthquake significantly predicted posttest scores only 1.29 points and 2.53 points higher on the PSC-CL and TOCA-RR, respectively, relative to mildly affected areas. As hypothesized, students who lived in the most severely affected regions showed significantly greater impairment in their psychosocial functioning with regard to their

posttest PSC-CL scores as compared with students who lived in mildly affected regions, aligning with prior studies (Schwind et al., 2018; Zhang et al., 2010). The small effect sizes suggest that the earthquake's impact on students' psychosocial functioning and classroom adaptation, as observed by their teachers and parents or caregivers, over a 2-year period was significant but relatively minor. Although these associations may suggest limited clinical utility on a case-by-case basis, they provide further value from a public health standpoint with regard to assessing pediatric resilience in the face of adversity. The findings are congruent with prior research in a sample of children exposed to Hurricane Andrew in 1992, who largely displayed resilient functioning despite experiencing a large-scale disaster (La Greca et al., 2013).

New child chronic illness and family psychopathology were also significantly and strongly associated with poorer psychosocial functioning in third grade, suggesting that chronic stressors can have similar and, possibly, even larger negative effects to acute stressors. With posttest PSC-CL scores ranging from 1.90 to 2.25 points higher among children with these ACEs in 2011 compared with those without these stressors, chronic home-based stressors appear to be especially pertinent to children's psychosocial well-being. Although our study investigated the impact of nonspecific family psychopathology, previous research has similarly identified a significant association between poor parental mental health and psychosocial distress among school-aged children following major earthquakes (Endo et al., 2007; Juth et al., 2015; Proctor et al., 2007). Given the integral role of parents in demonstrating effective coping and emotion regulation skills following a disaster, the current results suggest that any interventions, such as school-based mental health programs, might be improved by incorporating resilience-based interventions to support both the family member, such as a parent, as well as the child.

Compounded exposure to home-based stressors was associated with even worse psychosocial and behavioral functioning above and beyond the effects of earthquake exposure. Students exposed to three or four ACEs had posttest PSC-CL and TOCA-RR screening scores that were more than three times higher and nearly twice as high, respectively, than scores associated with severe earthquake exposure. The substantial negative effects of these ACEs align with prior research (Turney, 2020) and suggest that the multiplicity of stressors in a child's life can be quite detrimental to both psychosocial and classroom functioning.

This study had several limitations. First, we used students' proximity to the earthquake's epicenter at the regional level as a proxy for earthquake severity. Although this method is supported by findings from previous studies (Armenian et al., 2000; Chan et al., 2011; Dell'Osso et al., 2013), it does not account for more specific variations in geographic location, as earthquake impact may vary even street by street. Additionally, we did not have access to data on other variables, such as perceived threat and direct exposure to violence, that may have improved the coding of earthquake severity.

Nearly half of the initial first-year sample did not have follow-up data in 2011, and at-risk students on both measures in 2009 were more likely to be missing follow-up data compared to their non–at-risk peers. These students with preexisting ACEs and/or psychosocial

difficulty may have shown more susceptibility to the impacts of the earthquake but were not included in the final sample, potentially leading to an underestimate of the earthquake's true effect.

Third, the current study was limited in that pretest data were collected 6–9 months before the earthquake (i.e., mid-2009), and posttest data were not collected until 15–18 months after the earthquake (i.e., mid-2011). Although a smaller interval pre- and postdisaster may have permitted a more precise indication of the earthquake's immediate impact, the significant longer-term effects reported herein could instead be viewed as evidence for the strength of these findings. Also, we did not have access to data on these students' psychosocial functioning over a longer postdisaster period. As such, no observations could be made about the persistent, longer-term effects of the earthquake or regarding whether findings would align with the recency model of ACEs, which suggests that adversity is more closely associated with poor mental health outcomes shortly after a traumatic event than after a longer period (Dunn et al., 2018).

Finally, the ACEs described in this study were not measured using a standard assessment of childhood adversity. However, the SFL program has collected data on current social risk factors in nearly 1,000,000 students over the past two decades, and the CLA has demonstrated its validity in a number of studies by showing associations between the ACEs it is designed to assess and poor academic and psychosocial outcomes (Guzman et al., 2011; Leiva et al., 2019; Vargas et al., 2019). Given these prior findings and the strength of the findings on ACEs exposure in the current study, it seems likely that the results would hold if another measure of ACEs was used in place of the CLA.

Despite these limitations, this longitudinal study of nearly 20,000 students in a national sample from Chile explored heretofore unexamined issues following a major natural disaster. Although most previous research on ACEs has focused on the long-term consequences of childhood adversity, the present study demonstrates their more near-term effects, whether from a time-limited situation, such as an earthquake, or a chronic situation, such as managing an ongoing illness. Resilience-based skills that address both internal and external stressors, particularly those that involve children's family members, may be especially relevant given the increasing awareness of how often traumatic events simultaneously occur in children's lives. Routine screening in schools can identify how individual children are affected by chronic versus acute stressors and serve as a guide for how to individualize treatment plans.

Funding information

REFERENCES

Anda RF, Felitti VJ, Bremner JD, Walker JD, Whitfield C, Perry BD, Dube SR, & Giles WH (2006). The enduring effects of abuse and related adverse experiences in childhood. European Archives of Psychiatry and Clinical Neuroscience, 256(3), 174–186. 10.1007/s00406-005-0624-4 [PubMed: 16311898]

Armenian HK, Morikawa M, Melkonian AK, Hovanesian AP, Haroutunian N, Saigh PA, Akiskal K, & Akiskal HS (2000). Loss as a determinant of PTSD in a cohort of adult survivors of the 1988 earthquake in Armenia: Implications for policy. Acta Psychiatrica Scandinavica, 102(1), 58–64. 10.1034/j.1600447.2000.102001058 [PubMed: 10892611]

Bellis MA, Lowey H, Leckenby N, Hughes K, & Harrison D (2014). Adverse childhood experiences: Retrospective study to determine their impact on adult health behaviours and health outcomes in a U.K. population. Journal of Public Health, 36(1), 81–91. 10.1093/pubmed/fdt038 [PubMed: 23587573]

Bethell CD, Carle A, Hudziak J, Gombojav N, Powers K, Wade R, & Braveman P (2017). Methods to assess adverse childhood experiences of children and families: Toward approaches to promote child well-being in policy and practice. Academic Pediatrics, 17(7), S51–S69. 10.1016/j.acap.2017.04.161. [PubMed: 28865661]

Cao H, McFarlane AC, & Klimidis S (2003). Prevalence of psychiatric disorder following the 1988 Yun Nan (China) earthquake – the first 5-month period. Social Psychiatry and Epidemiology, 38(4), 204–212. 10.1007/s00127-003-0619-2

Centers for Disease Control and Prevention. (2020). Adverse childhood experiences. https://www.cdc.gov/violenceprevention/aces/index.html

Chan CL, Wang CW, Qu Z, Lu BQ, Ran MS, Ho AH, Yuan Y, Zhang BQ, Wang X, & Zhang X (2011). Posttraumatic stress disorder symptoms among adult survivors of the 2008 Sichuan earthquake in China. Journal of Traumatic Stress, 24(3), 295–302. 10.1002/jts.20645. [PubMed: 21608035]

De la Barra F, Toledo V, & Rodríguez J (2002). Mental health study in two cohorts of schoolchildren from West Santiago. I: Prevalence and follow up of behavioral and cognitive problems. Revista Chilena de Neuro-Psiquiatría, 40(1). 10.4067/S0717-92272002000100002

De la Barra F, Toledo V, & Rodríguez J (2005). Prediction of behavioral problems in Chilean schoolchildren. Child Psychiatry & Human Development, 35(3), 227–243. 10.1007/s10578-004-6459-9 [PubMed: 15731888]

Dell'Osso L, Carmassi C, Massimetti G, Stratta P, Riccardi I, Capanna C, Akiskal KK, Akiskal HS, & Rossi A (2013). Age, gender and epicenter proximity effects on post- traumatic stress symptoms in L'Aquila 2009 earthquake survivors. Journal of Affective Disorders, 146(2), 174–180. 10.1016/j.jad.2012.08.048 [PubMed: 23098626]

Dunn EC, Soare TW, Raffeld MR, Busso DS, Crawford KM, Davis KA, Fisher VA, Slopen N, Smith AD, & Tiemeier H (2018). What life course theoretical models best explain the relationship between exposure to childhood adversity and psychopathology symptoms: Recency, accumulation, or sensitive periods? Psychological Medicine, 48(15), 2562–2572. 10.1017/S0033291718000181 [PubMed: 29478418]

Earthquake Engineering Research Institute. (2010). The Mw 8.8 Chile earthquake of February 27, 2010. EERI special earthquake report. https://www.eeri.org/site/images/eeri_newsletter/2010_pdf/Chile10_insert.pdf

Endo T, Shioiri T, Someya T, Toyabe S, & Akazawa K (2007). Parental mental health affects behavioral changes in children following a devastating disaster: A community survey after the 2004 Niigata-Chuetsu earthquake. General Hospital Psychiatry, 29(2), 175–176. 10.1016/j.genhosppsych.2006.09.006 [PubMed: 17336669]

Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, & Marks JS (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) Study. American Journal of Preventive Medicine, 14(4), 245–258. 10.1016/s0749-3797(98)00017-8 [PubMed: 9635069]

Flaherty EG, Thompson R, Dubowitz H, Harvey EM, English DJ, Proctor LJ, & Runyan DK (2013). Adverse childhood experiences and child health in early adolescence. JAMA Pediatrics, 167(7), 622–629. 10.1001/jamapediatrics.2013.22 [PubMed: 23645114]

Garfin DR, Silver RC, Gil-Rivas V, Guzmán J, Murphy JM, Cova F, Rincón PP, Squicciarini AM, George M, & Guzmán MP (2014). Children's reactions to the 2010 Chilean earthquake: The role of trauma exposure, family context, and school-based mental health programming. Psychological Trauma: Theory, Research, Practice, and Policy, 6(5), 563–573. 10.1037/a0036584

George M, Siraqyan X, Mores R, de la Barra F, Rodríguez J, López C, & Toledo V (1995). Adaptation and validation of two screening instruments of mental health of first grade schoolchildren of Santiago. Revista de Psicologia, 5, 17–26. 10.5354/0719-0581.1994.18486

Giovanelli A, Reynolds AJ, Mondi CF, & Ou S-R. (2016). Adverse childhood experiences and adult well-being in a low-income, urban cohort. Pediatrics, 137(4), e20154016. 10.1542/peds.2015-4016 [PubMed: 26966132]

Goldmann E, & Galea S (2014). Mental health consequences of disasters. Annual Review of Public Health, 35(1), 169–183. 10.1146/annurev-publhealth-032013-182435

Gomez CJ, & Yoshikawa H (2017). Earthquake effects: Estimating the relationship between exposure to the 2010 Chilean earthquake and preschool children's early cognitive and executive function skills. Early Childhood Research Quarterly, 38, 127–136. 10.1016/j.ecresq.2016.08.004

Gonzalez A, Monzon N, Solis D, Jaycox L, & Langley AK (2016). Trauma exposure in elementary school children: Description of screening procedures, level of exposure, and posttraumatic stress symptoms. School Mental Health, 8(1), 77–88. 10.1007/s12310-015-9167-7 [PubMed: 27721907]

Guzman MP, Jellinek M, George M, Hartley M, Squicciarini AM, Canenguez KM, Kuhlthau KA, Yucel R, White GW, & Guzmán J (2011). Mental health matters in elementary school: First-grade screening predicts fourth-grade achievement test scores. European Child&Adolescent Psychiatry, 20(8), 401–411. 10.1007/s00787-011-0191-3 [PubMed: 21647553]

Guzmán J, Kessler RC, Squicciarini AM, George M, Baer L, Canenguez KM, Abel MA, McCarthy A, Jellinek MS, Murphy JM (2015). Evidence for the effectiveness of a national school-based mental health program in Chile. Journal of the American Academy of Child & Adolescent Psychiatry, 54(10), 799–807. [PubMed: 26407489]

Herzog JI, & Schmahl C (2018). Adverse childhood experiences and the consequences on neurobiological, psychosocial, and somatic conditions across the lifespan. Frontiers in Psychiatry, 9, 420. 10.3389/fpsyt.2018.00420 [PubMed: 30233435]

Hunt TKA, Slack KS, & Berger LM (2017). Adverse childhood experiences and behavioral problems in middle childhood. Child Abuse & Neglect, 67, 391–402. 10.1016/j.chiabu.2016.11.005 [PubMed: 27884508]

Jin Y, Sun C, Wang F, An J, & Xu J (2018). The relationship between PTSD, depression and negative life events: Ya'an earthquake three years later. Psychiatry Research, 259, 358–363. 10.1016/j.psychres.2017.09.017 [PubMed: 29120843]

Junta Nacional de Auxilio Escolar y Becas. (2019). Balance de Gestión Integral. [Comprehensive management balance]. Ministerio de Educación, Gobierno de Chile. https://www.gestion.gob.cl/bgi_pdf/bgi_2020_0909.pdf

Juth V, Silver RC, Seyle DC, Widyatmoko CS, & Tan ET (2015). Postdisaster mental health among parent-child dyads after a major earthquake in Indonesia. Journal of Abnormal Child Psychology, 43(7), 1309–1318. 10.1007/s10802-015-0009-8 [PubMed: 25851238]

Karatekin C (2018). Adverse childhood experiences (ACEs), stress, and mental health in college students. Stress & Health, 34(1), 36–45. 10.1002/smi.2761 [PubMed: 28509376]

Kellam SG, Branch JD, A. KC, & Ensminger ME (1975). Mental health and going to school: The Woodlawn Program of Assessment, Early Intervention, and Evaluation. University of Chicago Press.

Kerker BD, Zhang J, Nadeem E, Stein RE, Hurlburt MS, Heneghan A, Landsverk J, & Horwitz SM (2015). Adverse childhood experiences and mental health, chronic medical conditions, and development in young children. Academic Pediatrics, 15(5), 510–517. 10.1016/j.acap.2015.05.005 [PubMed: 26183001]

Kleinman RE, Murphy JM, Little M, Pagano M, Wehler CA, Regal K, & Jellinek MS (1998). Hunger in children in the United States: Potential behavioral and emotional correlates. Pediatrics, 101(1), E3. 10.1542/peds.101.1.e3

La Greca A, Lai B, Llabre M, Silverman W, Vernberg E, & Prinstein M (2013). Children's postdisaster trajectories of PTS symptoms: Predicting chronic distress. Child & Youth Care Forum, 42(4), 351–369. 10.1007/s10566-013-9206-1 [PubMed: 24683300]

Leiva L, Rojas R, Peña F, Vargas B, & Scquicciarini AM (2019). Detectando las dificultades emocionales y conductuales en la escuela: Validación de PSC-17. [Detecting emotional and

behavioral difficulties at school: Validation of PSC-17.] Revista Iberoamericana de Diagnóstico y Evaluación-e Avaliação Psicológica, 1(50), 95–105. 10.21865/RIDEP50.1.08

Leung JPK, Britton A, & Bell S (2016). Adverse childhood experiences and alcohol consumption in midlife and early old-age. Alcohol and Alcoholism, 51(3), 331–338. 10.1093/alcalc/agv125 [PubMed: 26553290]

Lowe S, Raker E, & Zacher M (2020). Extremes in context: A life-course approach to disaster mental health. One Earth, 2, 497–499. 10.1016/j.oneear.2020.05.022 [PubMed: 34173518]

Merrick, Ports KA, Ford DC, Afifi TO, Gershoff ET, & Grogan-Kaylor A (2017). Unpacking the impact of adverse childhood experiences on adult mental health. Child Abuse & Neglect, 69, 10–19. 10.1016/j.chiabu.2017.03.016 [PubMed: 28419887]

MGH. (2020). Pediatric Symptom Checklist. https://www.massgeneral.org/pediatric-symptom-checklist/

Miller E, Wieneke KM, Murphy JM, Desmond S, Schiff A, Canenguez KM, & Kleinman RE (2008). Child and parental poor health among families at risk for hunger attending a community health center. Journal of Health Care for the Poor & Under-served, 19(2), 550–561. 10.1353/hpu.0.0008

Murphy JM, Abel MR, Hoover S, Jellinek M, & Fazel M (2017). Scope, scale, and dose of the world's largest school-based mental health programs. Harvard Review of Psychiatry, 25(5), 218–228. 10.1097/hrp.0000000000000149 [PubMed: 28787304]

Murphy JM, Guzmán J, McCarthy AE, Squicciarini AM, George M, Canenguez KM, Dunn EC, Baer L, Simonsohn A, Smoller JW, & Jellinek MS (2014). Mental health predicts better academic outcomes: A longitudinal study of elementary school students in Chile. Child Psychiatry & Human Development, 46(2), 245–256. 10.1007/s10578-014-0464-4

Murphy JM, Wehler CA, Pagano ME, Little M, Kleinman RE, & Jellinek MS (1998). Relationship between hunger and psychosocial functioning in low-income American children. Journal of the American Academy of Child & Adolescent Psychiatry, 37(2), 163–170. 10.1097/00004583-199802000-00008 [PubMed: 9473912]

National Institute of Standards and Technology. (2016). Chile quake at the epicenter of expanding disaster and failure data repository. National Institute of Standards and Technology. https://www.nist.gov/news-events/news/2016/04/chile-quake-epicenter-expanding-disaster-and-failure-data-repository

Oh DL, Jerman P, Boparai SKP, Koita K, Briner S, Bucci M, & Harris NB (2018). Review of tools for measuring exposure to adversity in children and adolescents. Journal of Pediatric Health Care, 32(6), 564–583. 10.1016/j.pedhc.2018.04.021 [PubMed: 30369409]

Pan American Health Organization. (2010). El terremoto y tsunami del 27 de febrero en Chile. Crónica y lecciones aprendidas en el sector salud. [The February 27th earthquake and tsunami in Chile. Chronicles and lessons learned in the health sector]. Pan American Health Organization.

Peugh JL (2010). A practical guide to multilevel modeling. Journal of School Psychology, 48(1), 85–112. 10.1016/j.jsp.2009.09.002 [PubMed: 20006989]

Proctor LJ, Fauchier A, Oliver PH, Ramos MC, Rios MA, & Margolin G (2007). Family context and young children's responses to earthquake. Journal of Child Psychology and Psychiatry, 48(9), 941–949. 10.1111/j.1469-7610.2007.01771.x [PubMed: 17714379]

Schwind JS, Formby CB, Santangelo SL, Norman SA, Brown R, Hoffman Frances R, Koss E, & Karmacharya D (2018). Earthquake exposures and mental health outcomes in children and adolescents from Phulpingdanda village, Nepal: A cross-sectional study. Child and Adolescent Psychiatry and Mental Health, 12(1), 54. 10.1186/s13034-018-0257-9 [PubMed: 30598695]

SMS Tsunami Warning. (2018). Maule, 2010 Chile earthquake and tsunami. https://www.sms-tsunami-warning.com/pages/tsunami-chile-2010#.YJVevrVKg2w

Struck S, Steward-Tufescu A, Asmundson AJN, Asmundson GGJ, & Affifi TO (2021). Adverse childhood experiences (ACEs) research: A bibliometric analysis of publication trends over the first 20 years. Child Abuse & Neglect, 112, 104895. 10.1016/j.chiabu.2020.104895 [PubMed: 33388607]

Sweeting JA, Garfin DR, Holman EA, & Silver RC (2020). Associations between exposure to childhood bullying and abuse and adulthood outcomes in a representative national U.S. sample. Child Abuse & Neglect, 101, 104048. 10.1016/j.chiabu.2019.104048 [PubMed: 31945515]

Turney K (2020). Cumulative adverse childhood experiences and children's health. Children and Youth Services Review, 119, 105538. 10.1016/j.childyouth.2020.105538

Vargas B, Leiva L, Rojas-Andrade R, & Scquicciarini AM (2019). Effects of psychosocial adversity on school maladjustment: A follow-up of primary school students. Psicología Educativa: Revista de los Psicólogos de la Educación, 25(2), 101–108. 10.5093/psed2019a10

Zhang Y, Kong F, Wang L, Chen H, Gao X, Tan X, Chen H, Lv J, & Liu Y (2010). Mental health and coping styles of children and adolescent survivors one year after the 2008 Chinese earthquake. Children and Youth Services Review, 32(10), 1403–1409. 10.1016/j.childyouth.2010.06.009

OPEN PRACTICES STATEMENT

The current study was not formally preregistered. Neither the data nor the materials have been made available, and cannot be made available, on a permanent third-party archive.

FIGURE 1.
Earthquake severity coding. Note. $N = 19,627$. This figure depicts a map of Chile labeled with its 15 regions. There are concentric circles around Biobío, located in the middle of the country, indicating the epicenter of the earthquake. The map is adapted from https://commons.wikimedia.org/wiki/File:Chile_municipalities.png, which is in the public domain

TABLE 1

Earthquake severity coding of Chile's 15 regions as mild, moderate, or severe

Mild/unaffected ($n = 3,577$)	n	Moderate ($n = 10,344$)	n	Severe ($n = 5,706$)	n
Location	**n**	**Location**	**n**	**Location**	**n**
Tarapacá	323	Valparaíso	2,977	O'Higgins	2,055
Antofagasta	195	Araucanía	752	Maule	1,283
Atacama	172	Santiago Metropolitan	6,615	Biobío	2,368
Coquimbo	277				
Los Lagos	787				
Aysén	136				
Magallanes	976				
Los Ríos	461				
Arica and Parinacota	250				

Note: $N = 19,627$.

TABLE 2

Characteristics of the longitudinal sample

Variable	*n*	%	*M*	*SD*	Between-group difference (%)	Effect size
Demographic characteristics						
Gender					—	—
Male	9,650	49.2				
Female	9,977	50.8				
Grade level						
1st-grade Chile *Solidario* [a]	2,551	13.0			0.7	Φ = .314
3rd-grade Chile *Solidario* [a]	2681	13.7				
1st-grade *Sename* [b] services recipient	796	4.1			2.3	Φ = .780
3rd-grade *Sename* [b] services recipient	1,264	6.4				
ACEs						
Child illness						
1st grade	2,793	14.2			0.5	Φ = .409
3rd grade	2,876	14.7				
Family mental illness						
1st grade	2,011	10.2			0.0	Φ = .308
3rd grade	2,007	10.2				
Father absence						
1st grade	6,218	31.7			1.8	Φ = .662
3rd grade	6,574	33.5				
Family isolation						
1st grade	8,813	44.9			8.0	
3rd grade	10,381	52.9				
PSC-CL score						
1st grade			53.78	8.45	0.41	*d = 0.05*
3rd grade			54.18	8.78		
TOCA-RR Score						

Variable	n	%	M	SD	(%)	Effect size
					Between-group difference	
1st grade			77.40	26.02	0.18	d = 0.01
3rd grade			77.58	26.18		

Note. N = 19,627. PSC-CL = Pediatric Symptom Checklist–Chilean; TOCA-RR = Teacher Observation of Classroom Adaptation–Rerevised.

[a] Welfare program.

[b] Child protective services.

TABLE 3

Predictors of 2011 psychosocial scores in unadjusted and adjusted[a] multilevel models

Predictors	Unadjusted[c]					Adjusted[d]				
	B	95% CI	t	df	p	B	95% CI	t	df	p
PSC-CL Score										
Moderate earthquake impact[b]	1.48	[0.64, 2.32]	3.50	95.64	.001	0.82	[0.15, 1.49]	2.32	89.89	.017
Severe earthquake impact	2.08	[1.20, 2.97]	4.66	104.13	< .001	1.29	[0.58, 2.00]	3.61	97.26	< .001
New child illness	3.21	[2.75, 3.66]	13.81	19,507.36	< .001	2.25	[1.87, 2.63]	11.56	19,531.13	< .001
New family psychopathology	2.93	[2.44, 3.43]	11.66	19,524.10	< .001	1.90	[1.49, 2.31]	9.03	19,543.34	< .001
New father absence	1.36	[0.92, 1.80]	6.09	19,567.05	< .001	1.28	[0.91, 1.64]	6.87	19,597.18	< .001
New family social isolation	0.29	[−0.06, 0.64]	1.61	19,478.72	.107					
TOCA-RR Score										
Moderate earthquake impact[b]	3.77	[0.82, 6.71]	2.54	99.81	.013	3.04	[0.72, 5.36]	2.60	87.40	.011
Severe earthquake impact	3.34	[0.21, 6.47]	2.12	111.69	.037	2.53	[0.03, 5.03]	2.01	103.63	.047
New child illness	3.77	[2.44, 5.10]	5.55	19,253.82	< .001	1.72	[0.61, 2.82]	3.05	19,125.33	.002
New family psychopathology	4.14	[2.70, 5.58]	5.64	19,269.69	< .001	1.99	[0.79, 3.18]	3.26	19,128.76	.001
New father absence	3.23	[1.95, 4.51]	4.96	19,326.03	< .001	1.87	[0.82, 2.93]	3.48	19,189.58	.001
New family social isolation	2.30	[1.28, 3.32]	4.43	19,196.21	< .001	1.42	[0.58, 2.26]	3.31	19,066.64	.001

Note. PSC-CL = Pediatric Symptom Checklist–Chilean Version; TOCA-RR = Teacher Observation of Classroom Adaptation–Re-Revised.

[a] All adjusted models additionally controlled for first-grade screening scores, gender, welfare, and child protective services involvement.

[b] Moderate and severe earthquake impact were contrasted with mild earthquake impact.

[c] Random effect variance estimates for school and district ranged from 1.50 to 2.53, *p* < .001.

[d] Random effect variance estimates for school and district were 1.23 and 0.97, respectively, *p* < .001.

[e] Random effect variance estimates for school and district ranged from 17.75 to 70.77, *p* < .001.

[f] Random effect variance estimates for school and district were 74.31 and 8.93, respectively, *p*s < .001.