

This is the peer reviewed version of the following article:

Post-traumatic stress disorder, emotional and behavioral difficulties in children and adolescents 2 years after the 2012 earthquake in Italy: an epidemiological cross-sectional study / Forresi, B.; Soncini, F.; Botosso, E.; Di Pietro, E.; Scarpini, G.; Scaini, S.; Aggazzotti, G.; Caffo, E.; E. Righi., . - In: EUROPEAN CHILD & ADOLESCENT PSYCHIATRY. - ISSN 1018-8827. - 29:2(2020), pp. 227-238. [10.1007/s00787-019-01370-0]

Terms of use:

The terms and conditions for the reuse of this version of the manuscript are specified in the publishing policy. For all terms of use and more information see the publisher's website.

13/07/2024 12:33

(Article begins on next page)

European Child & Adolescent Psychiatry

Post-Traumatic Stress Disorder, emotional and behavioral difficulties in children and adolescents two years after the 2012 earthquake in Italy: an epidemiological cross-sectional study.

--Manuscript Draft--

Manuscript Number:	ECAP-D-18-00404
Full Title:	Post-Traumatic Stress Disorder, emotional and behavioral difficulties in children and adolescents two years after the 2012 earthquake in Italy: an epidemiological cross-sectional study.
Article Type:	Original Contribution
Keywords:	children, adolescents, PTSD, trauma, earthquake, parental psychopathology
Corresponding Author:	Barbara Forresi, Ph.D Sigmund Freud Privat Universitat Wien GmbH ITALY
Corresponding Author's Institution:	Sigmund Freud Privat Universitat Wien GmbH
First Author:	Barbara Forresi, Ph.D
Order of Authors:	Barbara Forresi, Ph.D Francesco Soncini Emanuele Bottosso Elena Di Pietro Gaia Scarpini Simona Scaini Gabriella Aggazzotti Ernesto Caffo Elena Righi
Funding Information:	
Abstract:	<p>Earthquakes have been associated with a range of psychopathologies in children and adolescents. While many studies focused on Post-Traumatic Stress Disorder (PTSD), only a few studies focused on both PTSD and emotional/behavioral difficulties. This cross sectional study aimed at exploring the prevalence of PTSD, internalizing and externalizing symptoms, as well as their predictors among children and adolescents survivors 2 years after the earthquake that hit Northern Italy in 2012. A total of 682 children and adolescents (9-14 years) from two districts with different degree of impact were recruited and administered an exposure questionnaire, the UCLA PTSD Index for DSM-IV, and the Strengths and Difficulties Questionnaire (SDQ). 1129 parents were assessed through the Symptom Checklist-90 (SCL-90). The estimated prevalence of "likely PTSD" in the earthquake zone was 1.9% (4.4% near the epicenter) and the total PTSD score was significantly higher than in the control zone. 14.9% of children and adolescents had a borderline/abnormal SDQ total difficulties score. In the affected area, 87.5% of children and adolescents with a probable PTSD also had a SDQ total score in the borderline/abnormal range. Earthquake exposure variables, lifetime events such as illness/death of a relative, and parental psychopathology were significant predictors of child/adolescent psychological difficulties.</p> <p>Despite some limitations, this study highlights that children and adolescents in the most affected areas may exhibit PTSD symptoms two years after disasters, often in comorbidity with other behavioral/emotional difficulties. As family psychopathology and lifetime stressful events are the most significant predictors, interventions with a whole-family approach after earthquakes are needed.</p>
Suggested Reviewers:	Anthony Mannarino amannari@wpahs.org

	Expert in the impact of traumatic events on children and adolescents
	Lucy Berliner lucyb@u.washington.edu Expert in the impact of traumatic events on children and adolescents
	David Kolko kolkodj@upmc.edu
	Rita Roncone rita.roncone@univaq.it
	Concetta Pastorelli concetta.pastorelli@uniroma1.it
Opposed Reviewers:	

Original contribution

Post-Traumatic Stress Disorder, emotional and behavioral difficulties in children and adolescents two years after the 2012 earthquake in Italy: an epidemiological cross-sectional study.

Forresi B. *, Soncini F.**, Botosso E.**, Di Pietro E.**, Scarpini G.**, Scaini S. *, Aggazzotti G.**, Caffo E.**, Righi E.**.

Acknowledgments

E. Carluccio, E. Famiglietti; O. Daolio; D. Guerardi; L. Giamboni; I. Maini; S. Leonardi; R. la Torre

Affiliations

*Sigmund Freud University

**Department of Biomedical, Metabolic and Neural Sciences, University of Modena and Reggio Emilia

Corresponding author

Barbara Forresi - b.foresi@milano-sfu.it

ABSTRACT

Earthquakes have been associated with a range of psychopathologies in children and adolescents. While many studies focused on Post-Traumatic Stress Disorder (PTSD), only a few studies focused on both PTSD and emotional/behavioral difficulties. This cross sectional study aimed at exploring the prevalence of PTSD, internalizing and externalizing symptoms, as well as their predictors among children and adolescents survivors 2 years after the earthquake that hit Northern Italy in 2012. A total of 682 children and adolescents (9-14 years) from two districts with different degree of impact were recruited and administered an exposure questionnaire, the UCLA PTSD Index for DSM-IV, and the Strengths and Difficulties Questionnaire (SDQ). 1129 parents were assessed through the Symptom Checklist-90 (SCL-90). The estimated prevalence of “likely PTSD” in the earthquake zone was 1.9% (4.4% near the epicenter) and the total PTSD score was significantly higher than in the control zone. 14.9% of children and adolescents had a borderline/abnormal SDQ total difficulties score. In the affected area, 87.5% of children and adolescents with a probable PTSD also had a SDQ total score in the borderline/abnormal range. Earthquake exposure variables, lifetime events such as illness/death of a relative, and parental psychopathology were significant predictors of child/adolescent psychological difficulties. Despite some limitations, this study highlights that children and adolescents in the most affected areas may exhibit PTSD symptoms two years after disasters, often in comorbidity with other behavioral/emotional difficulties. As family psychopathology and lifetime stressful events are the most significant predictors, interventions with a whole-family approach after earthquakes are needed.

Keywords: children, adolescents, PTSD, trauma, earthquake, parental psychopathology

1
2
3
4
5
6 Italy is one of the most seismically active countries in Europe. In the last 20 years, many severe
7 earthquakes struck different areas of Italy, including regions such as Marche, Umbria, Abruzzo and
8 Emilia-Romagna. On May 20 and 29, 2012, two earthquakes measuring 5.9 and 5.8 on the Richter scale
9 hit the province of Modena (Emilia-Romagna), killing 27 people and causing severe damages to
10 buildings. Several hundred citizens were injured and 15.000 local resident displaced. Many families lived
11 in tent cities from May until October-November 2012, with the earthquake swarm continuing for several
12 months.

13
14
15
16 It is well established that exposure to earthquakes leads to an increased prevalence of emotional and
17 psychological disorders [1-5] also in children and adolescents. Post-Traumatic Stress Disorder (PTSD) is
18 one the most common sequelae in youths exposed to earthquakes [6-8], although the actual prevalence is
19 still unclear. Previous cross-sectional studies [9-13] showed that 4.5% to 95% of children and adolescents
20 may have symptoms of PTSD after earthquakes.

21
22
23
24 Great individual differences have been found in trajectories of posttraumatic responses in adults and
25 youths [14-16], evidencing that while most individuals experience a natural recovery process, a
26 substantial percentage of people may have persistent posttraumatic reactions, due to chronic or delayed
27 onset symptoms [17-22]. After the Wenchuan earthquake, Zhang and colleagues [8] found that the
28 prevalence rates of PTSD in children were 1.3%, and 1.6% at 12 and 18-month follow-up times,
29 respectively. Jia and colleagues [20] did not find any significant change in the prevalence of PTSD
30 (decreasing from 12.4% to 10.7%) in child survivors at 15 and 36 months after the same earthquake.
31 Goenjian and colleagues [23] studied PTSD symptoms among children 18 months after the 1988
32 earthquake in Armenia: PTSD rates were respectively 95%, 71% and 26% in the three cities at increasing
33 distances from the epicenter. 20 months after the 1999 Turkey earthquake, the prevalence of PTSD was
34 39% [24]. Dell'Osso and colleagues [21] found a PTSD diagnosis in 30.7% of the adolescents 21 months
35 after a major earthquake in Italy.

36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000

1
2
3
4
5
6 Potential predictors of PTSD after disasters have been extensively investigated [19]. Consequences may
7 vary depending on demographic factors such as gender and age [7, 27-30], peritraumatic and disaster-
8 related (e.g., severity of disaster exposure, proximity to the epicenter, personal injuries, loss of loved
9 ones, severe injury of family members, destruction of property/home, and displacement), and post-
10 disaster psychosocial variables (e.g., social support)[6,27,31]. Recent studies also highlight the
11 interdependence between parental psychopathology and posttraumatic symptoms in children and
12 adolescents after a disaster [32-34]. While there is agreement on many risk factors for PTSD, conflicting
13 results have been reported for others (e.g., age) [35] and little is known about factors that may make
14 children and adolescents more vulnerable to disorders after years from the disaster.

15
16 In addition to PTSD, emotional and behavioral difficulties (e.g., fears, depressed mood, conduct
17 problems) having an impact on everyday functioning (e.g., peer relationships, capacity to perform
18 academically), are important outcome domains for children and adolescents, regardless of diagnosis of
19 PTSD, being predictive of an increased risk for future internalizing and externalizing disorders. Recent
20 studies show that earthquakes might have a delayed impact on the psychosocial functioning of children
21 and adolescents [20]. *However, only a few studies focused on these variables [36] and comorbidities with*
22 *PTSD remain poorly understood.* Given the impact on children's development [37], and the relevant
23 personal and social costs, it is of primary importance the recognition and the treatment of these long term
24 psychological difficulties. A better understanding of these symptoms and their predictors will ensure that
25 the most appropriate resources are provided to children [38].

26
27 The primary purpose of this cross-sectional study was therefore to investigate the prevalence of PTSD,
28 PTSD symptoms and other behavioral, emotional, conduct problems among children and adolescents two
29 years after the exposure to the 2012 earthquake in Italy. The secondary aim was to examine potential
30 predictors of these long term symptoms in order to improve interventions to reduce vulnerability and
31 psychological difficulties in youth after natural disasters.

32 33 34 35 **Methods**

36 *Participants*

37 To select the sample, the Province of Modena was divided in three different areas: an "earthquake area"
38 (EA), including the plain zones of the Province most affected by the earthquake (N = 14.278 subjects
39 aged 9-14 years); a "control area" (CA) including plain zones and the hills towns/communities less
40 directly affected by the earthquake, with no damages to buildings or individuals due to the disaster (N =
41 19.825); a "mountain area" (N= 3.358). The last one was excluded from this study because of different
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

1
2
3
4
5
6 environmental/socio-demographic characteristics and because it was exposed to other earthquakes in the
7 same time period.

8
9 Sampling was performed in order to include about 2% of the population and to respect a priori fixed ratio
10 of 1.5 students living in EA every 1 student living in CA. Subjects were recruited in primary and
11 secondary schools, with schools randomly selected from the comprehensive School Regional Office
12 register, published by the Italian Ministry of Education.

13
14 Overall, 682 children and adolescents attending ten different schools were included in the study. Subjects
15 had a mean age of 11 ± 1.4 y (range: 9-14 y); 349 (51.2%) were males and 333 (48.8%) females. 638
16 (94.7%) had an Italian nationality and 36 (5.3%) had a different nationality. 431 (63%) subjects were
17 living in EA and 251 (37%) in CA.

18
19 Parents of 639 students (93,7%) agreed to provide information on their psychological status. 1162 parents
20 were interviewed, 721 of which living in the EA area. Females were 52.9%, with a mean age of 43y
21 (± 5.7).

22 23 24 25 26 27 *Procedure*

28 The present study was approved by the Ethical Committee of the Province of Modena (Protocol N.
29 268/12). In this cross-sectional study, data collection was conducted two years after the earthquake. The
30 interviewers included trained child psychiatrists and psychologists. Prior to the assessment, the School
31 Principal and the School Board were asked to give their authorization. Moreover, every parent received a
32 detailed description of the study and gave a written informed consent. The procedure of the study was
33 explained to students; only who gave his/her personal consent was enrolled. Subjects who met the criteria
34 for a probable PTSD were referred to the Child Neuropsychiatric Services of the province of Modena for
35 further assessment and treatment.

36 37 38 39 40 41 42 *Measures*

43 Children and adolescents were administered an assessment protocol including:

44 - *an exposure questionnaire* created ad hoc to collect, besides demographic data, information on the
45 degree of exposure to the earthquake and exposure to lifetime traumatic events not related to the
46 earthquake (occurring before or after the earthquake) through simple questions requiring dichotomous
47 answers;

48 - *the UCLA Posttraumatic Stress Disorder Reaction Index (PTSD-RI)* for DSM-IV [39]. A short
49 instrument to screen for trauma exposure and DSM-IV PTSD symptoms, appropriate for children and
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

1
2
3
4
5
6 adolescents age 7-17 who have experienced any type of trauma. It is one of the most widely used and
7 extensively studied assessment instruments for childhood PTSD [40]. It can be administered orally or
8 completed as a self-report. This version had 20 items scored on a 5 points Likert Scale. It allows for
9 calculation of the severity of symptoms on each cluster (B, C, and D) and a total severity score [39].
10 Chronbach's alphas fall in the range of .90 for internal consistency across versions and with test-retest
11 reliability at .84 [41]. The PTSD-RI Scoring Sheet is used to tabulate a total score, and a cut-off >38 is
12 valid to have a probable PTSD. The cut-off of 38 has a sensitivity of 0.93 and specificity of 0.87 in
13 detecting PTSD [42]. Total scores in the range of 20's and 30's indicate sub-clinical PTSD. A cutoff score
14 of ≥ 3 was used to estimate the rate of clinically significant PTSD symptom clusters. As this questionnaire
15 was not validated in the Italian version; translation into Italian followed published guidelines, including
16 the use of independent back translation [23].
17

18 - the *Strengths and Difficulties Questionnaire* (SDQ) [43] Italian version [44]. The instrument is suitable
19 to screen psychological conditions in children and adolescents. The 25 items of the SDQ are divided into
20 5 subscales of 5 items each, which measure emotional symptoms, conduct problems,
21 hyperactivity/inattention, peer relationship problems and prosocial behavior. Taken together (with the
22 exception of prosocial behavior), these symptoms provide a total score for mental health difficulties.
23 Items are rated using a 3 point Likert. Normative data for the Italian population are available [44-46] and
24 the Italian version has good psychometric properties [44].
25

26 In addition to the SDQ for their children, parents were administered the *Symptom Checklist-90-R* [47-48],
27 Italian version [49]. It is a relatively brief (90 items) self-report psychometric designed to assess a broad
28 range of psychological problems and symptoms of psychopathology (according to the DSM-IV-TR).
29 Primary symptom dimensions include: Somatization, Obsessive Compulsive Disorder, Interpersonal
30 Sensitivity, Depression, Anxiety, Hostility, Phobic Anxiety, Paranoid Ideation, and Psychoticism. Each
31 item is rated on a 5 points Likert Scale. The cutoff for the Global Severity Index is 63.
32

33 For children attending primary schools, questionnaires followed an interviewer-administered procedure;
34 for secondary school children/adolescents and for parents, questionnaires were self-completed.
35
36
37
38
39
40
41
42
43
44
45
46

47 *Statistical analysis*

48 Kolmogorov-Smirnov tests were used to test the hypothesis that the distribution of the Child PTSD and
49 SDQ scores were normal. Means, standard deviations, frequencies and percentages were used for
50 descriptive data analysis. To evaluate differences in groups at bivariate level, t-tests were used for
51 continuous variables, and Chi-square tests for categorical variables. Pearson's correlation coefficients
52
53
54
55
56
57
58
59
60
61
62
63
64
65

were used to examine the relationship between PTSD scores, SDQ scores and demographic variables, earthquake related factors, lifetime stressful events, parental psychopathology and psychological symptoms. Finally, multiple linear regression models including variables most significantly associated to the outcomes at the bivariate level were run for total PTSD score and SDQ-total difficulties score. Statistical analyses were performed using IBM SPSS Statistics package ver. 25. For all statistical tests, a $p < 0.05$ was considered to be statistically significant.

Results

As reported in Table 1, there was no significant difference between the two districts with respect to age, gender or nationality. Students living in the EA reported significantly higher rates of earthquake-related stressful experiences ($p < 0.001$). 73.7% of children had to **leave their house** due to serious damages, about 20% had the **house destroyed**, more than 30% experienced **serious injuries or the death of relatives/close friends**, and 4.2% was **personally injured**. Earthquake related stressful events tend to cluster, with about half of the students in the affected area experiencing **two or more earthquake-related stressful events**.

Table 1 – Sample characteristics (N=682)

	CONTROL AREA N=251 (36.8%)	EARTHQUAKE AREA N=431 (63.2%)	P
Sex, N (%)			
Male	128 (51.0%)	221 (51.3%)	
Female	123 (49.0)	210 (48.7%)	0.94
Age, y			
mean± SD	11±1.30	11±1.50	
range	9-14	9-14	0.99
School level, N (%):			
Primary	68 (27.1%)	160 (37.1%)	

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

secondary (I level)	183 (72.9%)	271 (62.9%)	0.007
Nationality, N (%):			
Italian	238 (95.2%)	400 (94.3%)	0.361
Other	12 (4.8%)	24 (5.7%)	
Stressful Events related to earthquake			
No	202 (80.2%)	50 (11.6%)	<0.001
Yes	49 (19.5%)	380 (88.4%)	
Displacement			
Displacement	5 (2.0%)	317 (73.7%)	<0.001
Family involved in the earthquake			
Family involved in the earthquake	34 (13.6%)	338 (79.3%)	<0.001
Damaged house			
Damaged house	0	82 (19.1%)	<0.001
Personally injured			
Personally injured	4 (1.60)	18 (4.2%)	0.063
Relatives' injured			
Relatives' injured	5 (2.0%)	60 (14.0%)	<0.001
Friends injured			
Friends injured	18 (7.2%)	133 (30.9%)	<0.001
Death of family members or friends			
Death of family members or friends	0	49 (11.4%)	<0.001
Lifetime stressful events			
No	156 (62.2%)	285 (66.3%)	0.16
Yes	95 (37.8%)	145 (33.7%)	
Moved from another area			
Moved from another area	2 (0.8%)	14 (3.3%)	0.041
Serious disease of a family member			
Serious disease of a family member	48 (19.1%)	52 (12.1%)	0.012
Divorce of parents			
Divorce of parents	9 (3.6%)	15 (3.5%)	0.952

Death of a family member	58 (23.1%)	69 (16.0%)	0.022
Family member seriously injured	15 (6.0%)	27 (6.3%)	0.874
Hospital admission	17 (6.8%)	40 (9.3%)	0.256
Personally seriously injured	4 (1.6%)	7 (1.6%)	0.970

Post-traumatic stress disorder

Two years after the earthquake, **1,9% of children and adolescents living in the EA met the criteria for a probable PTSD diagnosis**, while in CA the observed prevalence was 0.4% ($p=0.099$). The prevalence rate increased with the decreasing distance to the epicentre: in Finale Emilia – a town very close to the epicentre of the first earthquake - 4.4% of children and adolescents had a likely PTSD diagnosis, a prevalence which is significantly higher than those observed in the other EA municipalities ($p=0.051$).

The mean total PTSD score observed in the EA sample was 15.62 (SD: 9.52), higher than in the CA ($p<0.001$). Students living in the exposed area also showed significantly higher scores of hyper-arousal, avoidance and re-experiencing symptoms, all above the symptom cutoff (see table 2).

Table 2 – UCLA PTSD scores in CA and EA (N= 682)

UCLA PTSD score	CONTROL AREA (N=251)	EARTHQUAKE AREA (N=431)	P
Total score	11.08±7.50	15.62±9.52	<0.001
Reexperiencing score	1.97±2.57	4.02±3.83	<0.001
Avoidance score	3.94±3.51	5.78±4.27	<0.001
Hyperarousal score	5.16±2.92	5.87±3.43	<0.010

1
2
3
4
5
6 *PTSD and risk factors*
7

8 Although higher rates of probable PTSD were observed in females (2.3% vs 1.4% in boys, $p=0.431$) and
9 adolescents (2.2% vs 1.3% in children; $p=0.474$) living in EA, they were not statistically significant.
10 Instead, a likely PTSD diagnosis was significantly associated to earthquake-related stressful experiences,
11 especially to the **death of a loved one** ($p=0.001$) and, with regard to lifetime stressful events, to **personal**
12 **severe accidents** ($p=0.014$).
13

14 No significant differences were found in the total PTSD score with regard to gender and age. However,
15 girls in the EA had significantly higher scores in **re-experiencing cluster symptoms** (4.47 ± 3.93 vs
16 3.59 ± 3.69 in boys; $p=0.018$).
17

18 Predictors of higher PTSD total scores in EA were experiencing earthquake related stressors ($p<0.001$)
19 and lifetime **stressful events** ($p<0.001$). The PTSD total score significantly increased **with the number**
20 **of stressful events** ($p<0.001$): in fact, students in the affected area experiencing 4 or more stressful events
21 (related and not-related to the earthquake), showed a PTSD total score of 21.45 ± 9.51 , indicating a
22 probable sub-clinical PTSD.
23

24 As reported in table 3, among the earthquake related events, the most significant predictors of higher
25 PTSD scores were **personal injuries** ($p=0.001$), the **death of relatives/close friend** ($p=0.003$), having
26 seen **people severely injured** ($p=0.026$). Among lifetime stressful events, the illness ($p=0.001$) or the
27 death of a family member ($p=0.003$) and **moving from another country** ($p=0.004$).
28
29
30
31
32
33
34
35
36

37 Table 3 UCLA PTSD total score according to exposure and lifetime stressful events in children and
38 adolescents living in the EA (N=431)
39

40

	PTSD score (mean±SD)		P
	In EA subjects		
Events related to earthquake	No	Yes	
Any	10.56±8.13	16.30±9.51	<0.001
Displacement	13.65±9.20	15.34±8.67	0.135
Family involved in the earthquake	13.55±9.92	16.25±9.35	0.017
Damaged house	15.35±9.65	16.83±8.94	0.206
Personally injured	15.27±9.34	22.90±10.19	0.001
Relatives injured	15.22±9.27	18.17±8.89	0.026

41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

Death of family member or friends	15.14±9.10	19.45±11.80	0.003
Lifetime stressful events	No	Yes	
Any	14.31±8.95	18.23±10.12	<0.001
Moved from another area	15.39±9.44	22.89±9.48	0.004
Serious disease of a family member	15.07±9.21	19.67±10.79	0.001
Divorce of parents	15.59±9.56	16.47±9.18	0.727
Death of a family member	15.04±9.11	18.70±11.02	0.003
Family member injured	15.44±9.61	18.41±7.79	0.118
Hospital admission	15.28±9.53	19.08±8.89	0.016
Personally serious injured	15.59±9.53	19.29±9.46	0.309

Behavioural strengths and difficulties (SDQ)

14.9% of children and adolescents in the EA reported psychological difficulties with a **total difficulties score in the borderline/abnormal range** (see table 4). This percentage was significantly higher than in the control zone ($p=0.045$). 20.5% of students in EA referred **conduct problems** in the borderline/abnormal range ($p=0.044$), and 15.2% had **peer problems** in the borderline/abnormal range ($p=0.001$).

The mean SDQ **total difficulties score in the EA** was 9.74 (± 5.34), higher than in the control zone (8.50 ± 5.23 ; $p=0.003$), as were subscale scores considering externalising difficulties (e.g. emotional and peer problems) (4.15 ± 3.21 vs 3.53 ± 3.02 ; $p=0.014$) and internalizing problems and referring to hyperactivity and conduct difficulties (5.59 ± 3.08 vs 4.96 ± 3.12 ; $p=0.011$). Higher total difficulties scores were associated to: experiencing **lifetime stressful events** (11.17 ± 5.71 ; $p<0.001$) or **stressful events related to the earthquake: being injured** (13.72 ± 5.66 ; $p<0.001$) or **living the loss of a loved one** (11.42 ± 6.05 ; $p=0.021$). Total difficulties scores were significantly higher in males ($p=0.014$) and in secondary school students ($p=0.003$). With regard to subscales, **girls reported higher emotional problems** (2.85 ± 2.34 ; $p<0.001$) while males higher **hyperactivity** (3.55 ± 2.04 ; $p=0.05$), **conduct problems** (2.50 ± 1.68 ; $p=0.011$), and **peer problems** (1.85 ± 1.84 ; $p=0.016$).

Table 4: SDQ scores in CA and EA (N= 680)

SDQ (self –report)	CONTROL AREA (N= 251)	EARTHQUAKE AREA (N= 429)	P
Total difficulties			
mean±SD	8.50±5.23	9.74±5.34	0.003
Normal score, n (%)	227 (90.4%)	365 (85.1%)	
border/abnormal score, n (%)	24 (9.6%)	64 (14.9%)	0.045
Emotional symptoms			
mean±SD	2.28±2.18	2.50±2.19	0.214
Normal score, n (%)	227 (90.4%)	386 (90.0%)	
border/abnormal score, n (%)	24 (9.6%)	43 (10.0%)	0.845
Conduct problems			
mean±SD	2.04±1.55	2.31±1.59	0.030
Normal score, n (%)	215 (85.7%)	341 (79.5%)	
border/abnormal score, n (%)	36 (14.3%)	88 (20.5%)	0.044
Hyperactivity			
mean± SD	2.92±2.02	3.28±2.04	0.028
Normal score, n (%)	223 (88.8%)	367 (85.5%)	
border/abnormal score, n (%)	28 (11.2%)	62 (14.5%)	0.221
Peer problems			
mean± SD	1.25±1.48	1.65±1.71	0.002
Normal score, n (%)	234 (93.2%)	364 (84.8%)	
border/abnormal score, n (%)	17 (6.8%)	65 (15.2%)	0.001
Prosocial			
mean± SD	7.20±1.77	7.03±2.02	0.27
Normal score, n (%)	206 (82.1%)	331 (77.2%)	
border/abnormal score, n (%)	45 (17.90%)	98 (22.80%)	0.129

In EA PTSD score was significantly correlated to the SDQ total score ($r=.629$, $p=0.000$). Most children who met the criteria for a probable PTSD diagnosis (7 over 8 subjects – 87,5%) also had severe SDQ total difficulties score (borderline/abnormal range). Children and adolescents who met the criteria for likely PTSD have severer total difficulties score (19.25 ± 6.30 ; $p<0.001$), emotional problems ($p<0.001$) and hyperactivity ($p<0.001$), falling all scores in the borderline/abnormal range (see table 5).

Table 5: SDQ score according to PTSD score in children and adolescents living in the EA (N=429)

SDQ In EA students	PTSD ≤ 37 (N=421)	PTSD > 37 (N=8)	P
Total difficulties score	9.56 \pm 5.16	19.25 \pm 6.30	<0.001
Emotional symptoms	2.43 \pm 2.14	6.13 \pm 1.80	<0.001
Behavioural problems	2.29 \pm 1.58	3.50 \pm 1.85	0.033
Hyperactivity	3.23 \pm 2.02	5.88 \pm 1.55	<0.001
Peer problems	1.61 \pm 1.68	3.75 \pm 2.25	<0.001
Prosocial	7.03 \pm 2.01	7.00 \pm 2.73	0.965

Comparing the results of self-report SDQ questionnaires to those completed by parents in the EA, we found that all the measures were/are highly correlated ($p< 0.001$ in all cases). However parents appear to overestimate emotional symptoms in their children (2.86 ± 2.21 vs 2.50 ± 2.19 ; $p=0.029$), while underestimating behavioral problems (1.91 ± 1.61 vs 2.31 ± 1.59 ; $p= 0.001$) and hyperactivity (3.09 ± 2.40 vs 3.28 ± 2.04 ; $p= 0.034$).

Parental psychopathology

Parents in the EA were seen to have a high frequency of psychopathological difficulties as recorded by SCL-90-R. 28% (208 over 721) had a global score over the cutoff, showing a level of psychopathology and mental distress significantly higher than parents living in the CA (reported by 77 over 441 subjects- 17.5%; $p<0.001$). Parents in EA had significantly higher scores than subjects living in CA for most subscales investigating different symptom dimensions. Sleep disturbances was the subscale with the maximum prevalence (45.3% in EA vs 35.0% in CA; $p<0.001$), followed by obsessive-compulsive disorders (23.1% vs 16.7%; $p=0.007$), depression (22.2% vs 11.0%; $p<0.001$), somatization (20% vs

1
2
3
4
5
6 16.2%; $p=0.049$), and anxiety (18.2% vs 7.7%; $p<0.001$). Compared to fathers, mothers in EA (but not in
7 CA) had significantly higher scores in all subscales of symptoms, with the only exception of
8 anger/hostility and psychoticism.
9

10 11 12 *Predictors of PTSD and SDQ scores*

13 With a multiple linear regression we examined the contribution of the independent variables to the total
14 score on PTSD and SDQ in separate analyses. The independent variables included living in the affected
15 zone, number of stressful events earthquake-related, number of lifetime traumatic events, parental
16 psychopathology (with a clinical score over the cutoff). We did not include SDQ total difficulties score in
17 the model analysing PTSD score and vice-versa due to the significant overlap between severer PTSD
18 symptoms and total difficulties SDQ scores (models would have ended up explaining higher PTSD scores
19 with abnormal SDQ and vice-versa).
20

21 The first model with PTSD score as an outcome, explained 16.7% of the variance ($R^2=0.167$, $F=17.596$,
22 $p<0.001$). Most powerful predictors were number of lifetime trauma ($\beta=0.324$, $p<0.001$), degree of
23 earthquake exposure ($\beta=0.163$, $p<0.001$), and parental psychopathology ($\beta=0.147$, $p<0.001$).
24

25 Linear regression results using SDQ total difficulties score as the outcome variable, revealed increased
26 risk of mental health problems for students with lifetime traumatic events not related to the earthquake
27 ($\beta=0.219$, $p=0.000$), with a higher degree of exposure to earthquake ($\beta=0.140$, $p=0.000$), and parental
28 psychopathology ($\beta=0.137$, $p=0.000$). This model explain 10% of the variance ($R^2=0.100$, $F=9.765$,
29 $p<0.001$).
30
31
32
33
34
35
36
37

38 **Discussion**

39 This study is one of the few on mental health of Italian children and adolescents in complex emergencies
40 [13,21, 50-51] and extends the literature examining PTSD and its comorbidities.
41

42 Our results demonstrate that even after earthquakes not involving a great number of deaths, children and
43 adolescents in affected areas may have a probable PTSD diagnosis years after the traumatic event: in our
44 sample the prevalence of likely PTSD two years after the earthquake was 1.9% in students living in the
45 earthquake zone and reached 4.4% in Finale Emilia, near the epicenter.
46

47 Our results give support to the hypothesis of long-lasting PTSD in children and adolescents after
48 earthquakes [8, 21], with prevalence rates varying widely.
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

1
2
3
4
5
6 Extending the existing literature, our results evidence that 87.5% of children with a probable PTSD have
7 a SDQ total score in the borderline/abnormal range, confirming that earthquakes may have a significant
8 impact on the psychosocial functioning of children and adolescents [20].
9

10 Contrary to what hypothesized on the base of previous studies [30, 52], we did not find a higher risk of
11 PTSD among girls and we found significantly higher SDQ total difficulties scores in boys. Similarly, no
12 signs of increased symptomatology were found in primary school children or adolescents (as evidenced
13 by Cenat and Derivois [28]).
14

15 Consistently with the literature [6,31,35,53], proximity to the epicenter, personal injuries, loss of loved
16 ones, are confirmed as important risk factors for PTSD, as well as for conduct, emotional, and relational
17 difficulties. However, although the degree of exposure resulted to be an important risk factor, prior
18 traumatic events [54] and parental psychopathology [34] are the stronger predictors of long term
19 symptoms after earthquakes (as resulted from SDQ and UCLA PTSD RI).
20

21 Data of this study must be interpreted with caution and several limitations in mind. Given the cross
22 sectional nature of the study and the lack of pre-earthquake prevalence rates, no inferences can be made
23 regarding causes and effects. Moreover, as we do not have data collected in the aftermath of the
24 earthquake, we cannot distinguish between chronic PTSD and delayed onset PTSD. Similarly, we cannot
25 exclude that PTSD symptoms and SDQ difficulties are related to lifetime stressful events that occurred
26 before or after the earthquake. In addition to this, the use of self-report instruments, some of which not
27 validated in Italian, might have affected the assessment, leading to over or underestimated prevalence
28 rates.
29

30 Nevertheless our results stress the need for better clinical interventions for children and adolescents
31 exposed to earthquakes, *not limited to the first few months after the traumatic event, focused on at-risk*
32 *populations* of children and adolescents, and *having a whole family approach*, given the strong
33 association between parental and youth psychopathology. As recommended by disaster management
34 experts, a stepped care approach to intervention should be adopted, with children and adolescents at
35 highest risk of chronic distress after earthquakes receiving the most intensive treatments. This study also
36 highlight the need for *long follow-up that allow a long-term evaluation of the effectiveness of*
37 *interventions*, even in case of earthquakes with a limited number of deaths.
38

39 It is now evident that PTSD symptoms, like other psychological difficulties emerging after potentially
40 traumatic events, follow multiple, distinct trajectories [22]. Further research is needed to understand
41 psychopathological trajectories in children and adolescents after earthquakes and to clarify which factors
42 differentiate those who still have symptoms after years from the disaster from those who recover.
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

1
2
3
4
5
6 Investigations with a longitudinal approach will expand our knowledge on these topics, ensuring that the
7 most appropriate interventions are provided to children and adolescents.
8
9

10 **Conflict of interest**

11 No conflict of interest was declared by the authors. All persons gave their informed consent prior to their
12 inclusion in the study. Details that might disclose the identity of the subjects under study have been
13 omitted.
14
15
16
17

18 **References**

- 19 1. Davidson JR, McFarlane AC (2006) The extent and impact of mental health problems after disaster. *J*
20 *Clin Psychiatry* 67(2):9-14
- 21 2. Norris FH, Friedman MJ, Watson PJ (2002) 60,000 disaster victims speak: Part II. Summary and
22 implications of the disaster mental health research. *Psychiatry* 65(3):240-260
- 23 3. Caffo, E, Forresi B, Strik Lievers L (2005) Impact, psychological sequelae and management of trauma
24 affecting children and adolescents. *Current Opinion in Psychiatry* 18(4):422-428
25 <https://doi.org/10.1097/01.yco.0000172062.01520.ac>
- 26 4. Yule W, Bolton D, Udwin O, Boyle S, O’Ryan D, Nurrish J (2000) The long-term psychological effects
27 of a disaster experienced in adolescence: I: the incidence and course of PTSD. *J Child Psychol Psychiatry*
28 41:503-511
- 29 5. Laor N, Wolmer L, Kora M, Yucel D, Spirman S, Yazgan Y (2002) Posttraumatic, dissociative and grief
30 symptoms in Turkish children exposed to the 1999 earthquakes. *J Nerv Ment Dis.* 190:824–832.
31 <https://doi.org/10.1097/01.NMD.0000041959.54021.A7>
- 32 6. Hong C, Efferth T (2016) Systematic review on post-traumatic stress disorder among survivors of the
33 Wenchuan earthquake. *Trauma Violence Abuse* 17(5):542-561
34 <https://doi.org/10.1177/1524838015585313>
- 35 7. Ying LH, Wu XC, Lin CD, Chen C (2013) Prevalence and predictors of posttraumatic stress disorder and
36 depressive symptoms among child survivors 1 year following the Wenchuan earthquake in China. *Eur*
37 *Child Adolesc Psychiatry* 22(9):567-575 <https://doi.org/10.1007/s00787-013-0400-3>
- 38 8. Zhang Z, Ran MS, Li YH, Ou GJ, Gong RR, Li RH, Fan M, Jiang Z, Fang DZ (2012) Prevalence of post-
39 traumatic stress disorder among adolescents after the Wenchuan earthquake in China. *Psychol Med*
40 42(8):1687-1693 <https://doi.org/10.1017/S0033291711002844>
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

- 1
2
3
4
5
6 **9.** Ayub M, Poongan I, Masood K, Gul H, Ali M, Farrukh A, Shaheen A, Chaudhry HR, Naeem F (2012)
7 Psychological morbidity in children 18 months after Kashmir Earthquake of 2005. *Child Psychiatry Hum*
8 *Dev* 43(3):323-336. <https://doi.org/10.1007/s10578-011-0267-9>
9
- 10 **10.** Feder A, Ahmad S, Lee EJ, Morgan JE, Singh R, Smith BW, Southwick SM, Charney DS (2013) Coping
11 and PTSD symptoms in Pakistani earthquake survivors: purpose in life, religious coping and social
12 support. *J Affect Disord* 147:156-163 <https://doi.org/10.1016/j.jad.2012.10.027>
13
- 14 **11.** Ma X, Liu X, Hu X, Qiu C, Wang Y, Huang Y, Wang Q, Zhang W, Li T (2011) Risk indicators for post-
15 traumatic stress disorder in adolescents exposed to the 5.12 Wenchuan earthquake in China. *Psychiatry*
16 *Res* 189(3):385-391 <https://doi.org/10.1016/j.psychres.2011.02.016>
17
- 18 **12.** Blanc J, Bui E, Mouchenik Y, Derivois D, Birmes P (2015) Prevalence of post-traumatic stress disorder
19 and depression in two groups of children one year after the January 2010 earthquake in Haiti. *J Affect*
20 *Disord* 172:121-126 <https://doi.org/10.1016/j.jad.2014.09.055>
21
- 22 **13.** Feo P, Di Gioia S, Carloni E, Vitiello B, Tozzi AE, Vicari S (2014) Prevalence of psychiatric symptoms
23 in children and adolescents one year after the 2009 L'Aquila earthquake. *BMC Psychiatry* 14:270
24 <https://doi.org/10.1186/s12888-014-0270-3>
25
- 26 **14.** Galatzer-Levy IR, Huang SH, Bonanno GA (2018) Trajectories of resilience and dysfunction following
27 potential trauma: A review and statistical evaluation. *Clin Psychol Rev* 63:41-55.
28 <https://doi.org/10.1016/j.cpr.2018.05.008>
29
- 30 **15.** Bonanno GA, Mancini A (2008) The human capacity to thrive in the face of potential trauma. *Pediatrics*
31 121:369-375 <https://doi.org/10.1542/peds.2007-1648>
32
- 33 **16.** Osofsky JD, Osofsky HJ, Weems CF, King LS, Hansel TC (2015) Trajectories of post-traumatic stress
34 disorder symptoms among youth exposed to both natural and technological disasters. *J Child Psychol*
35 *Psychiatry* 56(12):1347-1355 <https://doi.org/10.1111/jcpp.12420>
36
- 37 **17.** Goenjian AK, Roussos A, Steinberg AM, Sotiropoulou C, Walling D, Kakaki M, Karagianni S (2011)
38 Longitudinal study of PTSD, depression, and quality of life among adolescents after the Parnitha
39 earthquake. *J Affect Disord* 133(3):509-515 <https://doi.org/10.1016/j.jad.2011.04.053>
40
- 41 **18.** McFarlane AC, Hooff M (2009) Impact of childhood exposure to a natural disaster on adult mental
42 health: 20-year longitudinal follow-up study. *Br J Psychiatry* 195(2):142-148
43 <https://doi.org/10.1192/bjp.bp.108.054270>
44
- 45 **19.** Trickey D, Siddaway AP, Meiser-Stedman R, Serpell L, Field AP (2012) A meta-analysis of risk factors
46 for post-traumatic stress disorder in children and adolescents. *Clin Psychol Rev* 32(2):122-138
47 <https://doi.org/10.1016/j.cpr.2011.12.001>
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
20. Jia Z, Shi L, Duan G, Liu W, Pan X, Chen Y, Tian W (2013) Traumatic experiences and mental health consequences among child survivors of the 2008 Sichuan earthquake: A community-based follow-up study. *BMC Public Health* 13:104 <https://doi.org/10.1186/1471-2458-13-104>
 21. Dell’Osso L, Carmassi C, Massimetti G, Conversano C, Daneluzzo E, Riccardi I, Stratta P, Rossi A (2011) Impact of traumatic loss on post-traumatic spectrum symptoms in high school students after the L’Aquila 2009 earthquake in Italy. *J Affect Disord* 134:59-64 <http://dx.doi.org/10.1016/j.jad.2011.06.025>
 22. Bonanno GA, Westphal M, Mancini AD (2011) Resilience to loss and potential trauma. *Annu Rev Clin Psychol* 7:511-535. <https://doi.org/10.1146/annurev-clinpsy-032210-104526>
 23. Goenjian AK, Pynoos RS, Steinberg AM, Najarian LM, Asarnow JR, Karayan I, Ghurabi M, Fairbanks LA (1995) Psychiatric comorbidity in children after the 1988 earthquake in Armenia. *J Am Acad Child Adolesc Psychiatry* 34(9):1174-1184 <https://doi.org/10.1097/00004583-199509000-00015>
 24. Salcioglu E, Basoglu M, Livanou M (2003) Long-term psychological outcome for non-treatment seeking earthquake survivors in Turkey. *J Nerv Ment Dis* 191(3):154-160 <https://doi.org/10.1097/01.NMD.0000054931.12291.50>
 25. Terasaka A, Tachibana Y, Okuyama M, Igarashi T (2015) Post-traumatic stress disorder in children following natural disasters: a systematic review of the long-term follow-up studies. *Int J Child Youth Family Stud* 6(1):111–133 <https://doi.org/10.18357/ijcyfs.61201513481>
 26. Galea S, Nandi A, Vlahov D (2005) The epidemiology of post-traumatic stress disorder after disasters. *Epidemiol Rev* 27:78-91 <https://doi.org/10.1093/epirev/mxi003>
 27. Sharma A, Kar N (2018) Posttraumatic Stress, Depression, and Coping Following the 2015 Nepal Earthquake: A Study on Adolescents. *Disaster Med Public Health Prep* 24:1-7 <https://doi.org/10.1017/dmp.2018.37>
 28. Cénat JM, Derivois D (2015) Long-term outcomes among child and adolescent survivors of the 2010 Haitian earthquake. *Depress Anxiety* 32(1):57-63 <https://doi.org/10.1002/da.22275>
 29. Kun P, Han S, Chen X, Yao L (2009) Prevalence and risk factors for posttraumatic stress disorder: a cross-sectional study among survivors of the Wenchuan 2008 earthquake in China. *Depress Anxiety* 26(12):1134-1140 <https://doi.org/10.1002/da.20612>
 30. Silwal S, Dybdahl R, Chudal R, Sourander A, Lien L (2018) Psychiatric symptoms experienced by adolescents in Nepal following the 2015 earthquakes. *J Affect Disord* 234, 239-246 <https://doi.org/10.1016/j.jad.2018.03.002>
 31. Furr JM, Comer JS, Edmunds JM, Kendall PC (2010) Disasters and youth: A meta-analytic examination of posttraumatic stress. *J Consult Clin Psychol* 78(6):765-780 <https://doi.org/10.1037/a0021482>

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
32. Shi X, Zhou Y, Geng F, Li Y, Zhou J, Lei B, Chen S, Chen X, Fan F (2018) Posttraumatic stress disorder symptoms in parents and adolescents after the Wenchuan earthquake: a longitudinal actor-partner interdependence model. *J Affect Disord* 226:301-306 <https://doi.org/10.1016/j.jad.2017.10.011>
 33. Juth V, Silver RC, Seyle DC, Widyatmoko CS, Tan ET (2015) Post-disaster mental health among parent-child dyads after a major earthquake in Indonesia. *J Abnorm Child Psychol* 43(7):1309-1318 <https://doi.org/10.1007/s10802-015-0009-8>
 34. Kiliç C, Kiliç EZ, Aydin IO (2011) Effect of relocation and parental psychopathology on earthquake survivor-children's mental health. *J Nerv Ment Dis* 199(5):335-41 <https://doi.org/10.1097/NMD.0b013e3182174ffa>
 35. 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. *J Affect Disord* 146 (2):174-180 <https://doi.org/10.1016/j.jad.2012.08.048>
 36. Wardenaar KJ, Wigman JT, Lin A, Killackey E, Collip D, Wood SJ, Ryan J, Baksheev G, Cosgrave E, Nelson B, Yung AR (2013) Development and validation of a new measure of everyday adolescent functioning: the multidimensional adolescent functioning scale. *The Journal of Adolescent Health* 52(2):195–200 <https://doi.org/10.1016/j.jadohealth.2012.06.021>
 37. Bianchini V, Roncone R, Tomassinia A, Necozone S, Cifone MG, Casacchia M, Pollice R (2013) Cognitive Behavioral Therapy for Young People after L'Aquila Earthquake. *Clin Pract Epidemiol Ment Health* 9:238-242. <https://doi.org/10.2174/1745017901309010238>
 38. Cohen JA, Bukstein O, Walter H, Benson SR, Chrisman A, Farchione TR, Hamilton J, Keable H, Kinlan J, Schoettle U, Siegel M, Stock S, Medicus J, AACAP Work Group On Quality Issues (2010) Practice parameter for the assessment and treatment of children and adolescents with posttraumatic stress disorder. *J Am Acad Child Adolesc Psychiatry* 49(4):414-30
 39. Pynoos R, Rodriguez N, Steinberg A, Stuber M, Frederick C (1998) UCLA PTSD Index for DSM-IV. UCLA Trauma Psychiatry Program, Los Angeles
 40. Stover CS, Hahn H, Im JJ, Berkowitz S (2010) Agreement of Parent and Child Reports of Trauma Exposure and Symptoms in the Peritraumatic Period. *Psychol Trauma* 2(3):159-168 <https://doi.org/10.1037/a0019156>
 41. Steinberg AM, Brymer MJ, Decker KB, Pynoos RS (2004) The University of California at Los Angeles Post-traumatic Stress Disorder Reaction Index. *Curr Psychiatry Rep* 6:96-100.

- 1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
42. Rodriguez N, Steinberg AS, Saltzman WS, Pynoos RS (2001) PTSD Index: preliminary psychometric analyses of child and parent versions. Symposium conducted at the Annual Meeting of the International Society for Traumatic Stress Studies, New Orleans, Los Angeles.
 43. Goodman R (1997) The Strengths and Difficulties Questionnaire: A Research Note. *J Child Psychol Psychiatry* 38:581-586 <https://doi.org/10.1111/j.1469-7610.1997.tb01545.x>
 44. Marzocchi GM, Di Pietro M, Vio C, Bassi E, Filoramo G, Salmaso A (2002) Il questionario SDQ per insegnanti (Strength and Difficulties Questionnaire): uno strumento di screening per difficoltà comportamentali ed emotive in età evolutiva. *Difficoltà di Apprendimento* 8: 75-84 <https://doi.org/10.1177/0734282912473456>
 45. Tobia V, Marzocchi GM (2018) The Strengths and Difficulties Questionnaire-Parents for Italian School-Aged Children: Psychometric Properties and Norms. *Child Psychiatry Hum Dev* 49(1):1-8 <https://doi.org/10.1007/s10578-017-0723-2>
 46. Tobia V, Gabriele MA, Marzocchi GM (2013) The Italian version of the Strengths and Difficulties Questionnaire (SDQ)-Teacher: psychometric properties. *J Psychoeduc Assess* 31:493–505 <https://doi.org/10.1177/0734282912473456>
 47. Derogatis LR, Lipman RS, Covi L (1973) The SCL–90: an outpatient psychiatric rating scale - preliminary report. *Psychopharmacol Bull* 9:13-28
 48. Derogatis LR (1994) Symptom Checklist 90–R: Administration, scoring, and procedures manual. 3rd ed. National Computer Systems, Minneapolis
 49. Sarno I, Preti E, Prunas A, Madeddu F (2011) SCL-90-R Symptom Checklist-90-R Adattamento italiano. Giunti, Organizzazioni Speciali, Firenze
 50. Pollice R, Bianchini V, Roncone R, Casacchia M (2012) Distress psicologico e disturbo post-traumatico da stress (DPTS) in una popolazione di giovani sopravvissuti al terremoto dell’Aquila. *Rivista di psichiatria* 47(1):59-64
 51. Piccardi L, Marano A, Geraci MA, Legge E, D’Amico S (2016) Differences in coping strategies of preadolescents with and without exposure to the L’Aquila (Central Italy) 2009 earthquake. *Epidemiol Prev* 40(2,1):53-58 <https://doi.org/10.19191/EP16.2S1.P053.049>
 52. 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 Psychiatr Scand* 102:58-64

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

53. Tian Y, Wong TK, Li J, Jiang X (2014) Posttraumatic stress disorder and its risk factors among adolescent survivors three years after an 8.0 magnitude earthquake in China. BMC Public Health 14:1073 <https://doi.org/10.1186/1471-2458-14-1073>

54. Tang B, Deng Q, Glik D, Dong J, Zhang L (2017) A Meta-Analysis of Risk Factors for Post-Traumatic Stress Disorder (PTSD) in Adults and Children after Earthquakes. Int J Environ Res Public Health 14 (12):E1537 <https://doi.org/10.3390/ijerph14121537>