



### Deliverable 3.3: Guideline on Types of Families

**MULTIDIMENSIONAL SEISMIC RISK ASSESSMENT COMBINING STRUCTURAL DAMAGES AND PSYCHOLOGICAL CONSEQUENCES USING EXPLAINABLE ARTIFICIAL INTELLIGENCE**



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<b>Abstract</b>	<p>This document is the Guidelines on types of families (D3.3) of the project “<i>Multidimensional Seismic Risk Assessment Combining structural damages and psychological consequences using explainable artificial intelligence (MEDEA)</i>”. It describes the procedures and criteria used to: a) preliminarily classify the representative families with different levels of risk (high/low/No Risk) for the insurgence of PTSD based on socio-demographic and psychological indicators; b) draft a preliminary version of an inventory titled: “Peri-traumatic and post-traumatic factors inventory” which, in the immediate aftermath of an earthquake, could be used by rescuers to identify individuals and families exposed to the most serious and threatening situations strictly associated with the insurgence of PTSD disorder; c) set up the research protocol for the empirical study that will be performed in the pilot areas (WP6).</p>
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## ABBREVIATIONS

<b>MEDEA</b>	<b>Multidimensional Seismic Risk Assessment Combining Structural Damages And Psychological Consequences Using Explainable Artificial Intelligence</b>
<b>eCampus</b>	eCampus University
<b>UniPI</b>	Università di Pisa
<b>MED</b>	Medjimurje County
<b>GZS</b>	Gasilska Zveza Slovenije
<b>ANCI</b>	Associazione Nazionale Comuni Italiani (National association of Italian municipalities)
<b>SISST</b>	Società Italiana per lo studio dello Stress Traumatico (Italian Society for the Study of Traumatic Stress)
<b>XAI</b>	eXplainable Artificial Intelligence
<b>PTSD</b>	Post-Traumatic stress disorder



## INTRODUCTION: MEDEA PROJECT

The general objective of the MEDEA project is cross-border disaster risk management through prevention and preparedness in Europe and EU Neighbour Countries. The proposal focuses on reducing the impact of seismic events and improving resilience, i.e., the ability to resist, absorb, accommodate, and recover from the effects of earthquakes in a timely and efficient way. The project pursues this general objective by proposing an intelligent system for multidimensional seismic risk assessment in cross-border areas. The system uses artificial intelligence to estimate the losses caused by an earthquake based on the predicted damage to structures (e.g., buildings), also forecasting the psychological consequences for the individuals involved. Regarding psychological consequences, the project will focus on families and the individual, relational, and contextual factors that could amplify the psychological maladjustment of family members in case of seismic events. The project will consider the possible medium and long-term psychological consequences for the individuals involved in seismic events to help identify the families at risk of psychological maladjustment, thus predicting/preventing the onset of PTSD. Within the MEDEA project, the specific tasks of WP3 were: identifying benchmark structures and selecting and calculating the best EDPs to quantify the effect of seismic actions on structures. Moreover, regarding psychological aspects, the WP3 aims to identify representative families based on socio-demographic/psychological indicators and set up the experimental protocol. The present deliverable describes the procedures and criteria used to detect the representative families based on their socio-demographic and psychological indicators.

## BACKGROUND

Natural disasters are the consequences of events triggered by natural hazards that overwhelm local response capacity and generate a severe impact on socioeconomic development and affected population, causing significant loss of life, injured, and infrastructure damage (Hidalgo & Baez, 2019; Inter-Agency Standing Committee [IASC], 2006). Table 1 shows the classification of the natural disaster clusters alongside main types and sub-types (Below, Wirtz, & Guha-Sapir, 2009).

Earthquakes are one of the most destructive and frequent natural disaster – related emergency issues affecting each year millions of people worldwide. From 2000 to 2019, the Emergency Events Database (EM-DAT) recorded 552 earthquakes - ranked at the third place after floods (3254 events) and storms (2043 events) - caused 721,318 deaths, 118 million people affected and \$636 billion in economic losses (Yaghmaei, 2020). From the report of 2022 (Centre for Research on the Epidemiology of Disasters [CRED], 2023), 31 earthquakes recorded worldwide claimed 1626 lives and affected 3,6 million people, with economic losses of \$12.5 billion. The 2022 southeastern Afghanistan earthquake and the 2022 Indonesia earthquake, with 1,036 and 334 fatalities, respectively, stood out, ranking among the top ten deadliest disaster events in 2022. In addition, the 2022 Fukushima earthquake ranked fourth among the top ten economic losses disaster



events, with damages of \$8.8 billion (CRED, 2023).

**Table 1** - Natural disaster clusters, primary type and sub-types (Modified from Below et al., 2009, pages 5 to 8).

NATURAL DISASTER CLUSTERS					
-1- Biological	-2- Geophysical	-3- Meteorological	-4- Hydrological	-5- Climatological	-6- Extra-Terrestrial
<p><b>Epidemic</b> (Viral, Bacterial, Parasitic, Fungal, Prion Infectious Diseases)</p> <p><b>Insect infestation</b> (Grasshopper, Locust, Worms)</p> <p><b>Animal stampede</b></p>	<p><b>Earthquake</b> (Ground shaking, Tsunami)</p> <p><b>Volcano</b> (volcanic eruption)</p> <p><b>Mass movement (dry)</b> (Rockfall, Avalanche, Landslide, Subsidence)</p>	<p><b>Storm</b> (Tropical storm, Extra-tropical cyclone/Winter storm, Local/Convective storm)</p>	<p><b>Flood</b> (General river flood, Flash flood, Storm surge/coastal flood)</p> <p><b>Mass movement (wet)</b> (Rockfall, Avalanche, Landslide, Subsidence)</p>	<p><b>Extreme temperature</b> (Heatwave, Cold wave, Extreme winter conditions)</p> <p><b>Drought</b></p> <p><b>Wildfire</b> (Forest fire, Land fires)</p>	<p><b>Meteorit</b></p> <p><b>Asteroid</b></p>

### PSYCHOLOGICAL CONSEQUENCES OF SEISMIC EVENTS

Many studies highlighted how the uncontrollable effects and disastrous aftermath of the earthquakes impact on survivors' mental health (see reviews of Beaglehole, Mulder, Boden & Bell, 2019; Cénat, McIntee & Blais-Rochette, 2020; Dai et al., 2016; Kušević, Krstanović & Kroflin, 2021). In particular, these studies showed a wide range of adverse psychological consequences after exposure to a seismic event, including sleep difficulties, distress, depression, suicidal ideations, anxiety, PTSD, and increased alcohol consumption. PTSD is one of the most prevalent psychological consequences in people exposed to disasters (Hong & Efferth, 2016; Tang, Deng, Glik, Dong & Zhang, 2017). Post-traumatic stress disorder (PTSD) is one of the trauma-related disorders involving specific negative symptoms in the aftermath of an exposure to traumatic events. According to the DSM-5 and to the DSM-5-TR, PTSD is organized around four different clusters of symptoms: 1) intrusive symptoms, 2) avoidance, 3) negative cognition and mood; 4) alterations of arousal states. Symptoms must last at least a month for the diagnosis, which is a possible consequence of actual or perceived threatened death, serious injury, or sexual violence (Criterion A) that can be experienced directly, through directly experiencing the event (s) or by witnessing the event (s) occurred to others; or indirectly, by learning that the event (s) happened to a close family member or close friend; or by experiencing repeated or extreme exposure to adverse details of the event (s) (APA, 2013, 2022). On the other hand, according to the ICD-11 (WHO, 2018) the diagnosis includes only three core elements: 1) re-experiencing the traumatic event, as evidenced by intrusive memories, flashbacks, and/or nightmares; 2) avoidance of traumatic reminders, as evidenced by the avoidance of internal and/or external stimuli; and 3) a persistent sense of threat, evidenced by hypervigilance and increased startle. Regarding post-disaster PTSD prevalence across age groups, available findings provide data on children/adolescents or/and adults/elderly separately. Studies



(Liang, Zeng, Liu, Xu, & Liu, 2021; Rezeyat et al., 2020; Tang et al., 2017) showed a significant variability in the prevalence rates of post-disaster PTSD in affected populations. Prevalence rates of PTSD in children and adolescents were approximately of 19.2%, 30.0%, 24.4%, and 20.4%, respectively at the first, the second, the third, and the fourth six-month intervals after the earthquake (Rezeyat et al., 2020). Concerning adults and the elderly, the authors (Tang and colleagues, 2017) indicated prevalence rates from 4% to 67%.

Considering the remarkable variability in the range of post-disaster PTSD rates among earthquake survivors, many studies focused on the understanding of the risk factors of PTSD onset. Some authors (Tortella-Feliu et al., 2019; Trickey, Siddaway, Meiser-Stedman, Serpell, Field, 2012) classified PTSD risk variables into four descriptive categories: 1) socio-demographic factors (e.g., gender); 2) pre-trauma factors (prior to the traumatic experience; e.g., mental health problems); 3) peritraumatic factors (during or in the immediate aftermath of the traumatic experience; e.g., trauma severity); and 4) post-trauma factors (e.g., social support and coping strategies). In the literature, the availability of secondary studies (reviews, systematic reviews, and meta-analyses) is noteworthy to summarize the empirical results about the role of some risk factors in predicting PTSD onset. However, some of these significant secondary studies showed some limitations because they mainly focus on specific age groups (only adults or only elderly, or only children/adolescents) without considering the complexity of compounding effects within family systems (Gordon-Hollingsworth, Yao, Chen, Qian, & Chen, 2015). MEDEA project aims to advance the identification of risk factors by considering the complexity of effects within families and, therefore, by setting up a model of risk with preventive indicators to intervene with families according to their specific level of risk based on demographic and psychological indicators.

### AIM AND STRUCTURE OF THE PRESENT DELIVERABLE (D.8)

The general aim of the present deliverable is to indicate procedures and criteria for: 1) the development of a preliminary *classification* of different target families according to their levels of risk (high/low/No Risk) in relation to a potential PTSD onset. Different levels of risk were based on the families' socio-demographic and psychological indicators; b) the development of a **preliminary version of an Inventory** entitled: "*Peritraumatic and post-traumatic factors Inventory*" to be potentially used by frontline professionals to identify individuals and families exposed to the most serious and threatening situations - strictly associated with PTSD onset – in the immediate aftermath of an earthquake, ; c) the set up of the research protocol for research to be conducted in the pilot area (see WP6).

Specifically, the **deliverable is composed of four sections**.

**The first Section (1)** describes the procedure and the results of a systematic literature review about PTSD risk factors in seismic cases. The systematic review allowed the identification of the most significant risk factors



socio-demographic, pre-traumatic, peri-traumatic, and post-traumatic factors) that may make individuals (of different ages) more or less vulnerable to the onset of PTSD in case of seismic events.

**The second Section (2)** describes the criteria used to classify target family typologies according to a “high/low/no-risk” model of PTSD onset. This classification was based on: a) the review results; b) the descriptions of the families of: the Italian National Institute of Statistics (ISTAT); of the Statistical Office of the Republic of Slovenia, and also of the Croatian Bureau of Statistics; c) the indications of further literature about the classification of *distal, proximal risk factors and protective factors* (Baldwin et al., 1990; Di Blasio, 2005; Milani et al., 2020).

**The third Section (3)** describes the preliminary Inventory titled “*Peri-traumatic and post-traumatic factors Inventory*,” which lists the most significant peri-traumatic and post-traumatic experiences and conditions for the insurgence of PTSD. This Inventory could help the rescuers to identify, monitor and support the most at-risk individuals and families during the immediate aftermath of a seismic event, design preventive interventions, and provide the most effective interventions.

**The fourth Section (4)** describes the setup of the Research Protocol for the empirical study that will be conducted in the pilot areas of the Medea project (see WP6). The present Research Protocol was approved by the Ethical Commission of e-Campus University (nr. 05/2023), July 2023.

## SECTION ONE: THE SYSTEMATIC REVIEW OF PTSD RISK FACTORS

We conducted a systematic review to identify the individual, relational, and contextual factors that could promote the insurgence of PTSD symptoms in case of seismic events across the lifespan. This preliminary analysis of the scientific literature allowed the identification of the most significant risk factors, which, according to the literature, were categorized in terms of socio-demographic, pre-traumatic, peri-traumatic, and post-traumatic factors. The consideration of these identified factors represented a sort of baseline to: a) detect the representative families considered as high/low/no-risk risk of the insurgence of PTSD symptoms; b) to create the preliminary version of the Inventory about the peri and post-traumatic risk factors; c) to set up the research protocol of the empirical study in the pilot areas (WP6).

## METHOD

### Search Strategy

This systematic review was conducted in March 2023 under the guidance of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA; Page et al., 2021) to identify secondary studies (systematic reviews and meta-analyses) published from 2003 to 2023 that examine or report risk factors for PTSD in children, adolescents, youth, adults and elderly affected by the earthquakes. The electronic databases of

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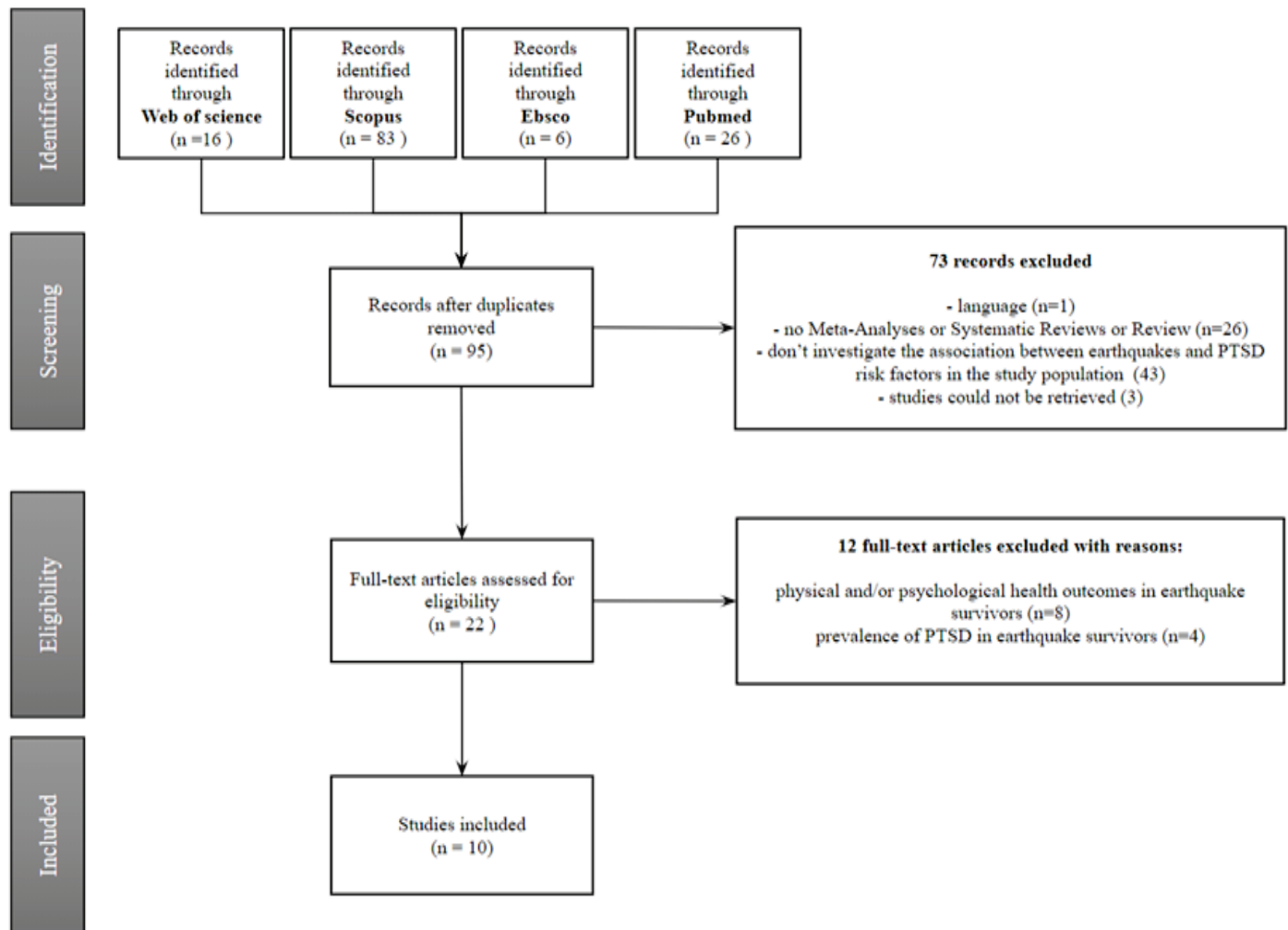
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Web of Science, Scopus, Pubmed, and EBSCO (to locate studies in APA PsycArticles and APA PsycInfo) were used for an advanced search using the keywords (“Meta-analysis” or “Systematic review”) AND (“PTSD” or “Post-traumatic stress disorder”) AND (“Earthquake” or “Seismic events”). The flow diagram (Figure 1), which was created according to the PRISMA 2020 statement (Page et al., 2021), describes the steps for the selection process of studies and related exclusion criteria, better explained in Table 2.

**Figure 1 - Flow Diagram of the Selection Process**



### Eligibility Criteria

Studies eligible for this review had to fulfill specific inclusion criteria described in Table 2. Specifically, studies were to be meta-analyses, systematic reviews, or reviews published from 2003 to 2023. They examined or reported PTSD risk factors in children, adolescents, youth or adults, or the elderly affected by earthquakes. In addition, studies could come from any Country, but they had to be written in English.



**Table 2 – Inclusion and Exclusion Criteria**

<b>Inclusion Criteria</b>	<b>Exclusion Criteria</b>
<ol style="list-style-type: none"> <li>1. Secondary studies (meta-analyses, systematic reviews, or reviews)</li> <li>2. Study population:               <ol style="list-style-type: none"> <li>2.1: Children, adolescents, and youth</li> <li>2.2: Adults</li> <li>2.3: Elderly</li> </ol> </li> <li>3. Publication criteria:               <ol style="list-style-type: none"> <li>3.1: Written in English</li> <li>3.2: Any country</li> <li>3.3: Published from 2003 to 2023</li> </ol> </li> <li>4. Articles examine or report PTSD risk factors in the study population affected by the earthquake.</li> </ol>	<ol style="list-style-type: none"> <li>1. Primary studies and studies could not be retrieved</li> <li>2. Outside of the study population:               <ol style="list-style-type: none"> <li>2.1: Medical workers</li> <li>2.2: Pregnant or post-partum women</li> </ol> </li> <li>3. Publication criteria:               <ol style="list-style-type: none"> <li>3.1: Written in Spanish</li> </ol> </li> <li>4. Articles don't strictly investigate the association between earthquakes and PTSD risk factors in the study population.</li> </ol>

### **Definition and categorization of PTSD risk factors**

Risk factors are those characteristics, variables, or hazards that precede or increase the likelihood of developing a disorder (Tortella-Feliu et al., 2019). Following the classification used in the analyzed literature (Sayed, Iacoviello, & Charney, 2015; Tang et al., 2017; Tortella-Feliu et al., 2019; Trickey et al., 2012), in the present review, we classified the wide range of different PTSD risk factors into four categories:

- 1) socio-demographic PTSD risk factors (e.g., gender, age, marital status);
- 2) pre-trauma PTSD risk factors (e.g., personal and loved ones' history of mental ill-health, previous trauma);
- 3) peri-trauma PTSD risk factors that occurred during or in the immediate aftermath of the earthquake and include: 3.1: The subjective factors event-related: cognition, emotions, personal responses, and perception related to the earthquake (e.g., having felt fear/scared, peritraumatic distress); 3.2: and the objective factors event-related: direct exposure (e.g., being injured or buried, witnessing someone buried, wounded, dying); indirect exposure (e.g., loved ones injured or dead);
- 4) post-trauma PTSD risk factors, which include the consequences and the long-term responses to earthquakes and include: 4.1: Post-earthquake subjective factors: symptomatology or perception or personal responses after the earthquake (e.g., depression, somatic symptoms, social support, post-traumatic cognition); 4.2: and post-earthquake objective factors (e.g., house damage, job loss after the earthquake).

## **RESULTS**

### **Study Selection**

This search produced 131 articles. Of these identified articles, 95 records were eliminated as duplicates, 73 records were excluded after their abstract evaluation, and 22 full-text articles were assessed for eligibility. Regarding these 22 papers, 12 were excluded based on the appraisal of the full text, and ten were included



for the analysis in this review. We excluded 12 full-text articles because these did not specifically investigate the association between earthquakes and PTSD risk factors in the study population. Their focus was about: physical and/or psychological health outcomes in earthquake survivors (Beaglehole, Mulder, Boden & Bell, 2019; Blanc, J., et al., 2020; Dube, Moffatt, Davison & Bartels, 2018; Kokai, Fujii, Shinfuku & Edwards, 2004; Kušević, Krstanović, & Kroflin, 2021; Lo, Su, & Chou, 2012; Matsumoto, Sakuma, Ueda, Nagao & Takahashi, 2016; Shigemura et al., 2021) prevalence of PTSD in earthquake survivors (Hosseinnejad et al., 2022; Liang, Zeng, Liu, Xu & Liu, 2021; Sepahvand, Hashtjini, Salesi, Sahraei & Jahromi, 2019; Rezayat et al., 2020).

### Main Characteristics of the Included Studies

The considered ten secondary studies examined PTSD risk factors in children, adolescents, youth, adults, and elderly victims of earthquakes. These secondary studies were three reviews (Aker, 2006; Farooqui et al., 2017; Kalantar Motamedi et al., 2012), three systematic reviews (Alipour & Ahmadi, 2020; Hong & Efferth, 2016; Liang, et al., 2019), two systematic reviews and meta-analyses (Cénat et al., 2020; Dai et al., 2016), and two meta-analyses (Gordon-Hollingsworth et al., 2015; Tang et al., 2017). These studies came from Europe, America, and Asia and considered different earthquakes, including Wenchuan, Marmara, and Haiti. Considering these ten secondary studies, we examined the cited primary studies that analyzed the PTSD risk factors in earthquake survivors. In addition, primary studies that could not be retrieved were not included in the present study. A total of 109 primary studies were extracted from the 10 included secondary studies, of which 46 primary studies were about children, adolescents, and youth (the age ranged from 2 years to university students), 59 were about adults (community-based studies without a specific age range), and finally, three specifically were about elderly (the age ranged from 60 to > 81 years). Tables 3, 4, and 5 summarize references from secondary and primary studies and the PTSD risk factors identified for the study population. The analysis of each PTSD risk factor is shown in Tables 3.1, 4.1, and 5.5. In the tables, the word earthquake has been abbreviated as EQ.

### Results of PTSD Risk Factors in Children, and Youth

The analysis of the 46 primary studies cited in the eight secondary studies allowed the identification of 58 risk factors for PTSD in children, adolescents, and youths. A summary overview of these data is provided in Table 3 and elaborated specifically in Table 3.1.



**Table 3-** Summary overview of PTSD Risk Factors in Children, and Youth.

<b>58 PTSD RISK FACTORS IN CHILDREN, AND YOUTH</b>			
<p><b>10 Socio-demographic PTSD risk factors</b></p> <ol style="list-style-type: none"> <li>1. Female gender</li> <li>2. Younger age</li> <li>3. Older age</li> <li>4. Ethnic minority</li> <li>5. Living in rural areas</li> <li>6. Having siblings</li> <li>7. Nuclear family</li> <li>8. Low socioeconomic status</li> <li>9. Living apart from family</li> <li>10. Parents without occupation</li> </ol>	<p><b>18 Peri-trauma PTSD risk factors</b></p> <p><u><b>Objective event-related factors</b></u></p> <p><i>a) Direct exposure</i></p> <ol style="list-style-type: none"> <li>20. Being injured during the EQ</li> <li>21. Being buried/trapped during the EQ</li> <li>22. Witnessing someone buried, wounded, dying, or traumatic scenes during the EQ</li> <li>23. Confronted with dead bodies</li> <li>24. Exposure to threat</li> <li>25. Unable to escape from the disaster</li> <li>26. Proximity to the epicenter</li> <li>27. School location (proximity to the epicenter)</li> </ol> <p><i>b) Indirect exposure</i></p> <ol style="list-style-type: none"> <li>28. Bereavement (loss of family members, classmates, teachers, friends)</li> <li>29. Family members, classmates, teachers, or friends injured</li> </ol> <p><u><b>Subjective event-related factors</b></u></p> <ol style="list-style-type: none"> <li>30. Having felt fear/scared</li> <li>31. Fear for the safety of close ones</li> <li>32. Having felt despair or danger</li> <li>33. Had felt guilt about someone's death or injury</li> <li>34. Worry about others during the earthquake</li> <li>35. Peritraumatic distress</li> <li>36. Extreme parental reaction (wailing, fainting, or panicking)</li> <li>37. Negative coping strategies</li> </ol>	<p><b>21 Post-trauma PTSD risk factors</b></p> <p><u><b>Post-earthquake objective factors</b></u></p> <ol style="list-style-type: none"> <li>38. Material losses (loss of property, money or destruction of expensive appliances, lost important belongings)</li> <li>39. House damaged or destroyed</li> <li>40. Geographic living conditions</li> <li>41. Living location (shelters)</li> <li>42. Males with lower levels of attending church-sponsored social events</li> <li>43. Family member amputated</li> </ol> <p><u><b>Post-earthquake individual factors</b></u></p> <ol style="list-style-type: none"> <li>44. Several somatic symptoms (trouble sleeping, headache, and shortness of breath)</li> <li>45. Deliberation rumination subtype</li> <li>46. Depression symptoms</li> <li>47. Sad levels</li> <li>48. Worry about aftershocks</li> <li>49. Wept more than three times while watching earthquake news</li> <li>50. Post-traumatic cognition</li> <li>51. No utilization of mental health services</li> <li>52. Who were frequently exposed to news content that was scary</li> <li>53. Post-earthquake life adversity /adverse life events</li> <li>54. Absent from school while the school was not closed</li> <li>55. Visited some affected sites</li> <li>56. Left city temporarily</li> <li>57. Time duration (rate of PTSD at time point)</li> <li>58. Low social support</li> </ol>	
<b>8 REFERENCES OF SECONDARY STUDIES</b>			
<p>Cénat, McIntee &amp; Blais-Rochette, 2020; Dai et al., 2016; Farooqui et al., 2017; Gordon-Hollingsworth, Yao, Chen, Qian &amp; Chen, 2015; Hong &amp; Efferth, 2016;</p>		<p>Liang, Cheng, Ruzek, &amp; Liu, 2019; Kalantar Motamedi, Sagafinia, Ebrahimi, Shams, &amp; Kalantar Motamedi 2012 Liang, Cheng, Ruzek, &amp; Liu, 2019 Tang, Deng, Glik, Dong, &amp; Zhang, 2017</p>	
<b>45 REFERENCES OF PRIMARY STUDIES</b>			
<p>Burnett et al., (2013); Cadichon et al., (2017); Cénat et al., (2015); Chen et al., (2017); Derivois et al., (2014); Ekşi et al., (2007); Fan et al., (2010); Fan et al., (2015); Fan et al., (2011); Fu et al., (2013); Gökçen et al., (2013); Groome et al., (2004);</p>	<p>He et al., (2011); Hou et al., (2011); Hsu et al., (2002); Jia et al., (2015); Jia et al., (2013); Jia et al., (2010). Jin &amp; Li (2015); Jin &amp; Wang (2014); Kadak et al., (2013); Lau et al., (2010); Liu et al., (2010); Liu et al., (2011);</p>	<p>Liu et al., (2010); Liu et al., (2009); Liu et al., (2010); Ma et al., (2011); Pan et al., (2009); Parvaresh et al., (2009) Silvestre (2014); Tian et al., (2014); Wang et al., (2012); Xiang et al., (2010); Ye et al., (2011); Ying, et al., (2012);</p>	<p>Ying et al., (2013); Ying et al., (2014); Yu et al., (2010); Zhang et al., (2015); Zhang et al., (2011); Zhang et al., (2012); Zhao et al., (2001); Zheng et al., (2012); Zhu et al., (2011).</p>



### Socio-demographic PTSD risk factors

The most documented socio-demographic PTSD risk factors were: female gender, older age or younger age; ethnic minority, living in rural areas, and living away from the family (see Tables 3.1). A few studies also reported: younger age, low socioeconomic status, having unemployed parents, and absence of religious faith (see Table 3.1).

### Pre-trauma PTSD risk factors

The most documented pre-trauma PTSD risk factors were: the presence of mental ill, previous trauma, family history of mental ill, external locus of control, and the negative coping strategies (see Tables 3.1). A few studies also reported dysfunctional family functioning, low intelligence, and neuroticism (Table 3.1).

### Peri-trauma PTSD risk factors

The most documented peri-trauma PTSD risk factors were: being injured or buried or trapped; witnessing someone buried, wounded, dying or traumatic scenes; bereavement of loved ones (family members, classmates, teachers, friends), injured loved ones (family members, classmates, teachers, friends), and having felt fear/scar, despair or danger (see Tables 3.1).

A few studies also reported event-related subjective factors such as fear for the safety of loved ones, guilt concerning someone's death or injury, worry about others during the earthquake, peritraumatic distress, and extremely negative parents' reactions. Moreover, further event-related objective factors were: exposure to threats to physical integrity, being unable to escape from the disaster, and personal and school proximity to the epicenter (see Table 3.1).

### Post-trauma PTSD risk factors

Finally, the most documented post-trauma PTSD risk factors were: material losses (property, money), damaged or destroyed houses, low social support, and post-earthquake adversity or negative life events (see Table 3.1). Few studies also reported additional post-earthquake subjective and objective factors such as: somatic symptoms, depressive symptoms, rumination, post-traumatic cognition, worry about aftershocks, non-use of mental health services, absence from school while the school was not closed, left the city temporarily, visited some affected sites, frequent exposure to scary news contents, geographic living condition, and living in shelters (see Table 3.1).



**Table 3.1 - Analysis of PTSD Risk Factor in Children, and Youth**

REFERENCES ABOUT THE PTSD RISK FACTORS IN CHILDREN, AND YOUTH				
<u>SOCIO-DEMOGRAPHIC PTSD RISK FACTORS</u>	References of Secondary Studies	Nr primary studies	Total number of cases	PTSD Measurement
<b>1. Female gender</b>	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	22	47563	PCL-C, IES-R, PTSD-SS, CPTSD-RI, KSADS-PL, CRIES, YULE PTSD, Watson interview, PSS-I, PCL-C, CPSS, DSM-IV
<b>2. Younger age</b>	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	5	26933	IES-R, TSCC-A, YULE PTSD, Watson interview, CRIES
<b>3. Older age</b>	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	11	21135	PTSD-SS, CRIES, CPTSD-RI, PCL-C, PTSD-SS, CPSS
<b>4. Ethnic minority</b>	Dai, W., et al., 2016; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	3	5111	PCL-C
<b>5. Living in rural areas</b>	Gordon-Hollingsworth, A. T., et al., 2015	3	5922	PTSD-SS, PCL-C
<b>6. Having siblings</b>	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	2	2121	PTSD-SS, PCL-C
<b>7. Nuclear family</b>	Tang, B., et al., 2017	1	850	PCL-C
<b>8. Low socio-economic status</b>	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020	1	723	IES-R
<b>9. Not living with parents/living apart from family</b>	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Tang, B., et al., 2017	2	1305	IES-R, YULE PTSD, Watson interview, YULE PTSD, Watson interview
<b>10. Parents without occupation</b>	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Tang, B., et al., 2017	1	872	IES-R
<u>PRE-TRAUMA PTSD RISK FACTORS</u>	References of Secondary Studies	Nr primary studies	Total number of cases	PTSD measurement
<b>11. History of mental ill-health</b>	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	5	4958	CPTS-RI, PSS-I, CPSS, CRIES
<b>12. Previous trauma</b>	Dai, W., et al., 2016; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019	2	3502	CPTS-RI, CPSS
<b>13. Low intelligence</b>	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020	1	723	IES-R



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14. Neuroticism	Liang, Y., et al., 2019	1	20749	UCLA PTSD
15. Locus of control (power others locus of control, chance locus of control)	Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015	2	6018	PCL-C
16. Negative coping strategies	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015; Liang, Y., et al., 2019; Tang, B., et al., 2017	4	9869	PCL-C, PTSD-SS
17. No religion	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Tang, B., et al., 2017	1	872	IES-R
18. Poor family functioning	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020	1	723	IES-R
19. Family history of mental ill-health	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016	2	1173	IES-R, CPTS-RI
<b>PERI-TRAUMA PTSD RISK FACTORS</b>	<b>References of Secondary studies</b>	<b>Nr primary studies</b>	<b>Total number of cases</b>	<b>PTSD measurement</b>
20. Being injured during the EQ	Dai, W., et al., 2016; Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	12	24019	PCL-C, ChIPS, KSADS-PL, CRIES, YULE PTSD, Watson interview, SCID, DSM-IV, CPSS
21. Being buried/trapped during the EQ	Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	7	33565	CRIES, PCL-C, KSADS-PL, UCLA, CPSS
22. Witnessing someone buried, wounded, dying or traumatic scenes during the EQ	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	13	44455	CAPS, PTSD-SS, CRIES, CPTSD-RI, PCL-C, TSCC-A, KSADS-PL, IES-R, SCID
23. Confronting with dead bodies	Dai, W., et al., 2016; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016	1	2987	PCL-C
24. Exposure to threat	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020	1	178	IES
25. Unable to escape from the disaster	Liang, Y., et al., 2019	1	20749	Ucla PTSD
26. Proximity to epicenter	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020	1	178	IES
27. School location (proximity to the epicenter)	Dai, W., et al., 2016; Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	1	1474	PCL-C
28. Bereavement (loss family member, classmates, teachers, friends)	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Kalantar Motamed, M. H., et al., 2012; Liang, Y., et al., 2019; Tang, B., et al., 2017	20	52784	PTSD-SS, ChIPS, CPTSD-RI, PCL-C, TSCC-A, KSADS-PL, CRIES, IES-R, YULE PTSD, Watson interview, SCID, PSSI, CPSS
29. Family members, classmates, teachers, or friends injured	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	8	33858	CRIES, KSADS-PL, IES-R, PCL-C, PTSD-SS, CPSS



30. Having felt fear/scared	Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	4	21657	UCLA PTSD, TSCC-A, IES-R, DSM-IV
31. Fear for the safety of close ones	Dai, W., et al., 2016; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019	1	3052	CPSS
32. Having felt despair or danger	Dai, W., et al., 2016; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	2	23964	CRIES
33. Had felt guilt concerning someone's death or injury	Dai, W., et al., 2016	1	596	CPTSD-RI
34. Worry about other during the EQ	Dai, W., et al., 2016	1	788	CPSS
35. Peritraumatic distress	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Tang, B., et al., 2017	1	872	IES-R
36. Extreme parental reaction (wailing, fainting, or panicking)	Tang, B., et al., 2017	1	160	CAPS
37. Negative coping strategies	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015; Liang, Y., et al., 2019; Tang, B., et al., 2017	4	9869	PCL-C, PTSD-SS
<b>POST-TRAUMA PTSD RISK FACTORS</b>	<b>References of Secondary studies</b>	<b>Nr primary studies</b>	<b>Total number of cases</b>	<b>PTSD measurement</b>
38. Material losses (property, money, destruction of expensive appliances, important belongings)	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	8	16902	PCL-C, SCID, PTSD-SS, CPTSD-RI, PSS-I
39. House damage or destroyed	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	10	19723	PCL-C, PTSD-SS, KSADS-PL, CRIES, SCID, CPSS
40. Geographic living condition	Dai, W., et al., 2016	1	433	YULE PTSD, Watson interview
41. Living location (shelters)	Dai, W., et al., 2016; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019	1	3052	CPSS
42. Males with lower levels of attending church-sponsored social events	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C. (2020)	1	140	PCL-C
43. Family member amputated	Farooqui, M., et al., 2017	1	4042	PCL-C
44. Several somatic symptoms (trouble sleeping, headache, and shortness of breath)	Dai, W., et al., 2016; Tang, B., et al., 2017	1	2299	CRIES





<b>45. Deliberation rumination subtype</b>	Tang, B., et al., 2017	1	850	PCL-C
<b>46. Depression symptoms</b>	Dai, W., et al., 2016; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019	1	548	PCL-C
<b>47. Sad levels</b>	Gordon-Hollingsworth, A. T., et al., 2015	1	205	DSM-IV
<b>48. Worry about aftershocks</b>	Dai, W., et al., 2016; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	1	3324	CRIES
<b>49. Wept for more than three times while watching eq news</b>	Dai, W., et al., 2016; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	1	3324	CRIES
<b>50. Post-traumatic cognition</b>	Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	1	3208	KSADS-PL, CRIES
<b>51. No utilization of mental health services</b>	Gordon-Hollingsworth, A. T., et al., 2015; Kalantar Motamedi, M. H., et al., 2012; Tang, B., et al., 2017	1	596	CPTSD-RI
<b>52. Frequently exposure to scary news contents</b>	Dai, W., et al., 2016; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	1	3324	CRIES
<b>53. Post earthquake negative life events</b>	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Gordon-Hollingsworth, A. T., et al., 2015; Liang, Y., et al., 2019; Tang, B., et al., 2017	3	5827	PTSD-SS
<b>54. Absent from school while the school was not closed</b>	Dai, W., et al., 2016; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	1	3324	CRIES
<b>55. Visited some affected sites</b>	Dai, W., et al., 2016; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	1	3324	CRIES
<b>56. Left city temporarily</b>	Dai, W., et al., 2016; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	1	3324	CRIES
<b>57. Time duration</b>	Dai, W., et al., 2016; Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	1	1474	PCL-C
<b>58. Low social support</b>	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Farooqui, M., et al., 2017; Gordon-Hollingsworth, A. T., et al., 2015; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	5	8108	IES-R, PCL-C, PTSD-SS, CPSS, PCL-C, KSADS-PL, CRIES



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### **Results of PTSD Risk Factors in Adults**

The analysis of the 60 primary studies cited in the nine secondary studies allowed the identification of 80 risk factors for PTSD in adults. A summary of these data is provided in Table 4 and specifically elaborated in Table 4.1.

#### *Socio-demographic PTSD risk factors*

The most documented socio-demographic PTSD risk factors were: female gender, older age, low income, unemployed, low education level, marital status (unmarried or living alone, unhappily married, divorced, widowed), minority ethnics (see Table 4.1). A few studies also reported younger age, middle age, no household income, head of the family, farmers, living in rented accommodation, living in the countryside, and the nuclear family (see table 4.1).

#### *Pre-trauma PTSD risk factors*

The most documented pre-trauma PTSD risk factors were: the history of mental ill, the presence of previous trauma, maladaptive coping strategies (see Table 4.1). A few studies also reported chronic disease, psychological distress induced by stressful life events in the last month before the earthquake; family/friend/relative history of mental ill, two-week disease prevalence (ill in the previous two weeks) (see table 4.1).

#### *Peri-trauma PTSD risk factors*

The most documented peri-trauma PTSD risk factors were: being injured, buried, or trapped; witnessing someone buried, injured, or dying; bereavement (loss of child, family members, friends, neighbors); fear during the earthquake, a higher degree of earthquake exposure, and maladaptive coping strategies (see Table 4.1). Only some studies also reported additional event-related objective factors, such as witnessing horrendous scenes (e.g., touched dead bodies), injured family members or friends, proximity to the epicenter, and damage to the building where the subject was at the time of the earthquake. Again, studies reported other event-related subjective factors, such as peritraumatic distress, guilt concerning someone's death or injury, perceived life threat, symptoms of dissociation, hyper-arousal, and helplessness.

#### *Post-trauma PTSD risk factors*

The most documented post-trauma PTSD risk factors were material losses (e.g., livelihood, property, money), damages or destruction of house, temporary or prefabricated houses or shelters, low social support, and participation in rescue work (see Table 4.1). Only some studies also report post-earthquake objective factors



such as physical injuries and surgery, economic issues, displacement, etc. Again, studies reported post-earthquake subjective factors such as poor self-perceived health status, grief due to family loss, lack of sense of control over life, persistent fear of future earthquakes, acute stress disorder in the first four weeks after the earthquake, psychological stress, depression, sleep disturbance, traumatic experiences after the earthquake, and so on (see table 4.1).



Table 4 – Overview of PTSD Risk Factors in Adults

80 PTSD RISK FACTORS FOR ADULT		
<p><b>19 Socio-demographic PTSD risk factors</b></p> <ol style="list-style-type: none"> <li>1. Female gender</li> <li>2. Younger age</li> <li>3. Middle age</li> <li>4. Older age</li> <li>5. Ethnic minority</li> <li>6. Ethnic majority</li> <li>7. Living in rented accommodation</li> <li>8. Living in the countryside</li> <li>9. Married</li> <li>10. Unmarried or living alone</li> <li>11. Divorced</li> <li>12. Widowed</li> <li>13. No household income</li> <li>14. Low income</li> <li>15. Unemployed</li> <li>16. Low education level</li> <li>17. Farmers</li> <li>18. Head of the family</li> <li>19. Nuclear family</li> </ol>	<p><b>19 Peri-trauma PTSD risk factors</b></p> <p><u><b>Objective event-related factors</b></u></p> <p><u><b>a) Direct exposure</b></u></p> <ol style="list-style-type: none"> <li>28. Being injured during the EQ</li> <li>29. Being buried/trapped during the EQ</li> <li>30. Witnessing someone buried, wounded or dying during the EQ</li> <li>31. Witnessing horrendous scenes (e.g. touched dead bodies) during the EQ</li> <li>32. Damage to the building where the subject was at the time of the EQ</li> <li>33. Higher degree of EQ exposure</li> <li>34. Exposure to a high extent of EQ shaking</li> <li>35. Having been in serious danger</li> <li>36. Proximity to epicenter</li> </ol> <p><u><b>Indirect earthquake exposure</b></u></p> <ol style="list-style-type: none"> <li>37. Bereavement (loss child, family members, friends, neighbors)</li> <li>38. Family members or friends injured</li> </ol> <p><u><b>Subjective event-related factors</b></u></p> <ol style="list-style-type: none"> <li>39. Having felt guilt concerning someone's death or injury</li> <li>40. Fear during the EQ</li> <li>41. Perceived life threat</li> <li>42. Peritraumatic distress</li> <li>43. Unusual smelling/other perception during the EQ</li> <li>44. Dissociation, hyper-arousal and helplessness experienced immediately after the EQ</li> <li>45. Negative coping/maladaptive coping strategies</li> </ol>	<p><b>34 Post-trauma PTSD risk factors</b></p> <p><u><b>Post-earthquake objective factors</b></u></p> <ol style="list-style-type: none"> <li>46. Surgery interventions after the EQ</li> <li>47. Amputation of an organ due to the earthquake</li> <li>48. No regular income after the EQ</li> <li>49. Serious economic difficulties (not related to EQ and/or as consequence of EQ)</li> <li>50. Job loss after the EQ</li> <li>51. Receipt of government financial support</li> <li>52. Material losses (e.g. possessions, livelihood, property, money)</li> <li>53. House damage or destroyed</li> <li>54. Loss of Church</li> <li>55. Areas with the worst destruction</li> <li>56. Living in temporary/prefabricated house or shelters</li> <li>57. Displaced after the EQ</li> <li>58. Relocation within the EQ region</li> <li>59. Food and water shortages</li> <li>60. Traumatic experiences after the EQ</li> <li>61. Receiving mental health support</li> <li>62. Receiving mental health support one time</li> <li>63. Having sought medical service</li> <li>64. Social network change</li> <li>65. Family members missing</li> <li>66. Participation in rescue work</li> </ol> <p><u><b>Post-earthquake subjective factors</b></u></p> <ol style="list-style-type: none"> <li>67. Poor self-perceived health status</li> <li>68. Grief due to family loss</li> <li>69. Lack of sense of control over life</li> <li>70. Negative subjective feeling of economic status</li> <li>71. Hopelessness</li> <li>72. Persistent fear of aftershocks</li> <li>73. Anticipatory fear of future earthquakes</li> <li>74. Impairment of working memory backward</li> <li>75. Acute stress disorder 4 week after EQ</li> <li>76. Psychological stress after the EQ</li> <li>77. Depression</li> <li>78. Sleep disturbance</li> <li>79. Non drinking</li> <li>80. Low social support</li> </ol>
<p><b>8 Pre- trauma PTSD risk factors</b></p> <ol style="list-style-type: none"> <li>20. History of mental ill-health</li> <li>21. Chronic disease</li> <li>22. Previous trauma</li> <li>23. Psychological distress induced by stressful life events in the last month prior to EQ</li> <li>24. Negative affect in personality disorder</li> <li>25. Two-week disease prevalence (ill in the previous two weeks)</li> <li>26. Negative coping/maladaptive coping strategies</li> <li>27. Family/ friend/relative history of mental ill-health</li> </ol>		



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**Table 4.1 - Analysis of PTSD Risk Factor in Adults**

REFERENCES ABOUT THE PTSD RISK FACTORS FOR ADULTS				
SOCIO-DEMOGRAPHIC PTSD RISK FACTORS	References of secondary studies	Nr primary studies	Total number of cases	PTSD measurement
1. Female gender	Aker, A. T., 2006; Alipour, F., & Ahmadi, S., 2020; Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Kalantar Motamedi, M. H., et al., 2012; Liang, Y., et al., 2019; Tang, B., et al., 2017	38	74331	DTS, TSSC, PCL-C, IES-R, MINI, TALS-SR, PCL-C, HTQ, DSM-IV, Breslao scale, PTSD-SS, LASC, SCID-I/P
2. Younger age	Alipour, F., & Ahmadi, S., 2020; Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	5	7707	IES-R, TALS-SR, PCL-C
3. Middle age	Alipour, F., & Ahmadi, S., 2020; Dai, W., et al., 2016; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	3	4637	IES-R, PCL-C
4. Older age	Aker, A. T., 2006; Alipour, F., & Ahmadi, S., 2020; Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	13	38890	DTS, IES-R, SCID-I/NP, HTQ, DSM-IV, Braslao scale, TSSC, PCL-C, SCID I/P
5. Ethnic minority	Dai, W., et al., 2016; Farooqui, M., et al., 2017; Kalantar Motamedi, M. H., et al., 2012; Liang, Y., et al., 2019; Tang, B., et al., 2017	3	3899	HTQ, DSM-IV, LASC
6. Ethnic majority	Alipour, F., & Ahmadi, S., 2020; Dai, W., et al., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	4	3284	PCL-C
7. Living in rented accomodation	Aker, A. T., 2006	1	430	TSSC
8. Living in the countryside	Alipour, F., & Ahmadi, S., 2020.	2	500	PCL-C
9. Married	Aker, A. T., 2006; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Kalantar Motamedi, M. H., et al., 2012; Liang, Y., et al., 2019; Tang, B., et al., 2017	3	7415	IES-R, DSM-IV, PTSD-SS
10. Unmarried or living alone	Dai, W., et al., 2016; Farooqui, M., et al., 2017; Tang, B., et al., 2017; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	3	16397	DTS, HTQ, DSM-IV, SCID-I/P
11. Divorced	Dai, W., et al., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	2	11446	HTQ, DSM-IV, PCL-C
12. Widowed	Aker, A. T., 2006; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Liang, Y., et al., 2019; Tang, B., et al., 2017	3	12356	HTQ, DSM-IV, PCL-C



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13. No household income	Dai, W., et al., 2016; Farooqui, M., et al., 2017; Liang, Y., et al., 2019; Tang, B., et al., 2017	2	2892	HTQ, DSM-IV
14. Low income	Alipour, F., & Ahmadi, S., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Kalantar Motamedi, M. H., et al., 2012; Liang, Y., et al., 2019; Tang, B., et al., 2017	9	9187	DTS, DSM-IV, MINI, HTQ, PCL-C,
15. Unemployed	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Tang, B., et al., 2017	3	1936	DTS, IES-R
16. Low education level	Aker, A. T., 2006; Alipour, F., & Ahmadi, S., 2020; Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Kalantar Motamedi, M. H., et al., 2012; Liang, Y., et al., 2019; Tang, B., et al., 2017	16	39506	TSSC, DTS, IES-R, PCL-C, PTSD-SS, LASC, SCID-I/P, DSM-IV
17. Farmers	Dai, W., et al., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	1	684	PCL-C
18. Head of the family	Dai, W., et al., 2016; Tang, B., et al., 2017	1	300	DTS
19. Nuclear family	Alipour, F., & Ahmadi, S., 2020; Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017	1	1291	TSSC
<b>PRE-TRAUMA PTSD RISK FACTORS</b>	<b>References of secondary studies</b>	<b>Nr primary studies</b>	<b>Total number of cases</b>	<b>PTSD measurement</b>
20. History of mental ill-health	Aker, A. T., 2006; Alipour, F., & Ahmadi, S., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Tang, B., et al., 2017	5	3273	TSSC, DSM-IV
21. Chronic disease	Dai, W., et al., 2016; Tang, B., et al., 2017	1	957	MINI
22. Previous trauma	Aker, A. T., 2006; Alipour, F., & Ahmadi, S., 2020; Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Tang, B., et al., 2017	3	2634	TSSC, DSM-IV, PCL
23. Psychological distress induced by stressful live events in the last month prior to EQ	Aker, A. T., 2006; Farooqui, M., et al., 2017; Tang, B., et al., 2017	1	910	DSM-IV
24. Negative affect in personality disorder	Alipour, F., & Ahmadi, S., 2020; Dai, W., et al., 2016; Liang, Y., et al., 2019	1	956	IES-R
25. Two-week disease prevalence (ill in the previous two weeks)	Dai, W., et al., 2016; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	2	3090	PCL-C
26. Negative religious coping or maladaptive coping strategies	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Farooqui, M., et al., 2017; Tang, B., et al., 2017	3	737	DTS, TSSC, SPRINT
27. Family/ friend/relative history of mental ill-health	Aker, A. T., 2006; Alipour, F., & Ahmadi, S., 2020; Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Farooqui, M., et al., 2017; Tang, B., et al., 2017	2	2233	DSM-IV
<b>PERI-TRAUMA PTSD RISK FACTORS</b>	<b>References of secondary studies</b>	<b>Nr primary studies</b>	<b>Total number of cases</b>	<b>PTSD measurement</b>



28. Being injured during the EQ	Alipour, F., & Ahmadi, S., 2020; Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Kalantar Motamedi, M. H., et al., 2012; Liang, Y., et al., 2019; Tang, B., et al., 2017	8	30578	CAPS, DSM-IV, PCL-C, SCID-I/P, IES-R, PCL-C
29. Being buried or trapped during the EQ	Aker, A. T., 2006; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	6	27503	PCL-C, SCID-I/P, TSSC, IES-R
30. Witnessing someone buried, wounded or dying during the EQ	Dai, W., et al., 2016; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	8	43910	PCL-C, PDS, IES-R, SCID-I/P
31. Witnessing horrendous scenes (e.g. touched dead bodies) during the EQ	Dai, W., et al., 2016	1	1253	PDS
32. Damage to the building where the subject was at the time of the EQ	Alipour, F., & Ahmadi, S., 2020; Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017	1	1291	TSSC
33. Higher degree of EQ exposure	Alipour, F., & Ahmadi, S., 2020; Dai, W., et al., 2016; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	3	3232	IES-R, DSM-IV, PCL-C
34. Exposure to a high exten of EQ shaking	Tang, B., et al., 2017	1	196	DSM-IV
35. Having been in serious danger	Farooqui, M., et al., 2017; Tang, B., et al., 2017	1	327	CPL-C
36. Proximity to epicenter	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Hong, C., & Efferth, T., 2016	2	3213	IES-R, TALS-SR
37. Bereavement (loss child, family members, friends, neighbors)	Aker, A. T., 2006; Alipour, F., & Ahmadi, S., 2020; Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Kalantar Motamedi, M. H., et al., 2012; Liang, Y., et al., 2019; Tang, B., et al., 2017	23	27844	TSSC, IES-R, SCID I/NP, MINI, HTQ, DSM-IV, PDS, PCL-C, PTSD-SS
38. Family members or friends injured	Alipour, F., & Ahmadi, S., 2020; Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Hong, C., & Efferth, T., 2016; Kalantar Motamedi, M. H., et al., 2012; Liang, Y., et al., 2019; Tang, B., et al., 2017	2	1753	DSM-IV, PTSD-SS
39. Having felt guilt concerning someone's death or injury	Farooqui, M., et al., 2017; Liang, Y., et al., 2019; Tang, B., et al., 2017	2	687	PCL-C
40. Fear during the EQ	Aker, A. T., 2006; Alipour, F., & Ahmadi, S., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	9	7991	TSSC, PCL-C
41. Perceived life threat	Aker, A. T., 2006; Farooqui, M., et al., 2017; Tang, B., et al., 2017	1	910	DSM-IV
42. Peritraumatic distress	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Tang, B., et al., 2017	2	1522	PCL-S, IES-R



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43. Unusual smelling/other perception during the EQ	Aker, A. T., 2006; Farooqui, M., et al., 2017; Tang, B., et al., 2017	1	910	DSM-IV
44. Dissociation, hyper-arousal and helplessness experienced immediately after the EQ	Tang, B., et al., 2017	1	1680	Braslaio scale
45. Negative religious coping or maladaptive coping strategies	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Farooqui, M., et al., 2017; Tang, B., et al., 2017	3	737	DTS, TSSC, SPRINT
<b>POST-TRAUMA PTSD RISK FACTORS</b>	<b>References of secondary studies</b>	<b>Nr primary studies</b>	<b>Total number of cases</b>	<b>PTSD measurement</b>
46. Operated on after the EQ	Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	1	14207	SCID I/P
47. Amputation	Tang, B., et al., 2017	1	9556	PCL-C
48. No regular income after the EQ	Dai, W., et al., 2016; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	2	3090	PCL-C
49. Serious economic difficulties (not necessarily related to eq and/or as consequence of EQ)	Dai, W., et al., 2016; Tang, B., et al., 2017	1	957	MINI
50. Job loss after the EQ	Alipour, F., & Ahmadi, S., 2020; Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Tang, B., et al., 2017	1	1323	DSM-IV TR
51. Receipt of government financial support	Liang, Y., et al., 2019; Tang, B., et al., 2017	1	182	SCID I/NP
52. Material losses (e.g. possessions, livelihood, property, money)	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Hong, C., & Efferth, T., 2016; Kalantar Motamedi, M. H., et al., 2012; Liang, Y., et al., 2019; Tang, B., et al., 2017	5	13171	DSM-III-R, PTSD-SS, PCL-C, PDS
53. House damaged or destroyed	Aker, A. T., 2006; Alipour, F., & Ahmadi, S., 2020; Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Kalantar Motamedi, M. H., et al., 2012; Liang, Y., et al., 2019; Tang, B., et al., 2017	7	13716	TSSC, IES-R, DTS, HTQ, DSM-IV
54. Loss of Church	Kalantar Motamedi, M. H., et al., 2012; Tang, B., et al., 2017	1	298	PCL-C
55. Person from areas with the worst destruction	Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Tang, B., et al., 2017	1	737	DSM-III R
56. Living in temporary or prefabricated house or shelters	Alipour, F., & Ahmadi, S., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Kalantar Motamedi, M. H., et al., 2012; Liang, Y., et al., 2019; Tang, B., et al., 2017	6	10521	DTS, HTQ, PCL-C
57. Displaced after the EQ	Dai, W., et al., 2016; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017	1	2525	PLC-C
58. Relocation within the EQ region	Alipour, F., & Ahmadi, S., 2020	1	541	TSSC
59. Food and water shortages	Kalantar Motamedi, M. H., et al., 2012; Tang, B., et al., 2017	1	298	PCL-C



<b>60. Traumatic experiences after the earthquake</b>		Liang, Y., et al., 2019	1	1369	IES-R
<b>61. Receiving mental health support</b>	Dai, W., et al., 2016; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017		1	2525	PCL-C
<b>62. Receiving mental health support only one time</b>		Farooqui, M., et al., 2017; Tang, B., et al., 2017	1	565	PCL-C
<b>63. Having sought medical service</b>		Dai, W., et al., 2016; Tang, B., et al., 2017	1	442	MINI
<b>64. Social network change (Respondents or most of their neighbors or relatives move away from their houses)</b>		Tang, B., et al., 2017	1	216	DSM-IV
<b>65. Family members missing</b>	Dai, W., et al., 2016; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017		1	2525	PCL-C
<b>66. Participation in rescue work</b>	Aker, A. T., 2006; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Tang, B., et al., 2017		4	12092	TSSC, PCL-C
<b>67. Poor self-perceived health status</b>	Dai, W., et al., 2016; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017		2	7444	IES-R
<b>68. Grief due to family loss</b>		Tang, B., et al., 2017	1	216	DSM-IV
<b>69. Lack of sense of control over life</b>		Alipour, F., & Ahmadi, S., 2020.	1	541	TSSC
<b>70. Bad subjective feeling of economic status</b>		Alipour, F., & Ahmadi, S., 2020; Farooqui, M., et al., 2017	1	624	SCID-I/P
<b>71. Hopelessness</b>		Tang, B., et al., 2017	1	361	PCL
<b>72. Persistent fear</b>		Tang, B., et al., 2017	1	91	IES-R
<b>73. Anticipatory fear of future EQ</b>		Alipour, F., & Ahmadi, S., 2020	1	541	TSSC
<b>74. Impairment of working memory backward</b>		Tang, B., et al., 2017	1	91	IES-R
<b>75. Acute stress disorder in the first 4 week after the EQ</b>		Tang, B., et al., 2017	1	91	IES-R
<b>76. Psychological stress after the EQ</b>		Alipour, F., & Ahmadi, S., 2020; Farooqui, M., et al., 2017	1	624	SCID-I/P
<b>77. Depression</b>	Dai, W., et al., 2016; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017		1	6075	IES-R
<b>78. Sleep disturbance</b>		Tang, B., et al., 2017	1	216	DSM-IV
<b>79. Alcohol use disorder</b>	Dai, W., et al., 2016; Hong, C., & Efferth, T., 2016; Liang, Y., et al., 2019; Tang, B., et al., 2017		1	6075	IES-R
<b>80. Low social support</b>	Alipour, F., & Ahmadi, S., 2020; Cénat, J. M., McIntee, S. E., & Blais-Rochette, C., 2020; Dai, W., et al., 2016; Farooqui, M., et al., 2017; Hong, C., & Efferth, T., 2016; Kalantar Motamedi, M. H., et al., 2012; Liang, Y., et al., 2019; Tang, B., et al., 2017		18	25421	CAPS, PCL-C, IES-R, DSM-IV TR, SPRINT, DSM-IV, LASC



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### Results of the PTSD Risk Factors in the *Elderly*

The analysis of the three primary studies cited in the two secondary studies allowed the identification of 12 risk factors for PTSD in elderly people. A summary overview of these data is provided in Table 5 and elaborated specifically in Table 5.1.

#### *Socio-demographic PTSD risk factors*

The reported socio-demographic PTSD risk factors were: female gender, older age, low education level, low monthly income, and being widowed (see Table 5.1)

#### *Peri-trauma PTSD risk factors*

The reported peri-trauma PTSD risk factors were: being injured, bereavement (spouse, family members, relatives, friends), and having felt fear (see Table 5.1)

#### *Post-trauma PTSD risk factors*

The reported post-trauma PTSD risk factors were: low social support, damages of house, loss of livelihood, and interruptions of access to health and psychiatry services (see Table 5.1).

**Table 5 - Summary overview of PTSD Risk Factors in Elderly People**

12 PTSD RISK FACTORS FOR ELDERLY		
<p><b>5 Socio-demographic PTSD risk factors</b></p> <ol style="list-style-type: none"> <li>1. Female gender</li> <li>2. Older age</li> <li>3. Low education level</li> <li>4. Low monthly income</li> <li>5. Being widowed</li> </ol> <p><b>Pre-trauma PTSD risk factors not found</b></p>	<p><b>3 Peri-trauma PTSD risk factors</b></p> <p><u>Objective event-related factors</u></p> <p>a) <u>Direct exposure</u></p> <ol style="list-style-type: none"> <li>6. Being injured</li> </ol> <p>b) <u>Indirect exposure</u></p> <ol style="list-style-type: none"> <li>7. Bereavement (loss of a spouse, family members, relatives or friends)</li> </ol> <p><u>Subjective event-related factors</u></p> <ol style="list-style-type: none"> <li>8. Having felt fear</li> </ol>	<p><b>4 Post-trauma PTSD risk factors</b></p> <p><u>Post-earthquake objective factors</u></p> <ol style="list-style-type: none"> <li>9. House damage</li> <li>10. Loss of livelihood</li> <li>11. Interruptions of access to health and psychiatry services</li> </ol> <p><u>Post-earthquake objective factors</u></p> <ol style="list-style-type: none"> <li>12. Low social support</li> </ol>
<p><b><u>2 REFERENCES OF SECONDARY STUDIES</u></b></p> <p>Hong, C., &amp; Efferth, T. (2016) Tang, B., Deng, Q., Glik, D., Dong, J., &amp; Zhang, L. (2017)</p>		
<p><b><u>3 REFERENCES OF PRIMARY STUDIES</u></b></p> <p>Chen, G., et al., (2012) Hikichi, H., et al., (2016) Zhang, Z., et al., (2012)</p>		



**Table 5.1 - Analysis of PTSD risk factor in the Elderly**

12 PTSD RISK FACTORS FOR THE ELDERLY				
SOCIO-DEMOGRAPHIC PTSD RISK FACTORS	References of secondary studies	Nr primary studies	Total number of cases	PTSD measurement
1. Female gender	Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	1	287	CAPS
2. Older age >80 years	Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	1	287	CAPS
3. Low education level	Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	1	287	CAPS
4. Low monthly income	Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	1	287	CAPS
5. Being widowed	Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	1	287	CAPS
PRE-TRAUMA PTSD RISK FACTORS	References of secondary studies	Nr primary studies	Total number of cases	PTSD measurement
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PERI-TRAUMA PTSD RISK FACTORS	References of secondary studies	Nr primary studies	Total number of cases	PTSD measurement
6. Being injured	Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	2	571	CAPS, CPL-C
7. Bereavement (spouse, family members, relatives, friends)	Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	2	3854	CAPS, SQD
8. Having felt fear	Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	1	284	CPL-C
POST-TRAUMA PTSD RISK FACTORS	References of secondary studies	Nr primary studies	Total number of cases	PTSD measurement
9. House damage	Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	1	3567	SQD
10. Loss of livelihood	Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	1	284	CPL-C
11. Interruptions of access to internal medicine and psychiatry services	Tang, B., et al., 2017	1	3567	SQD
12. Low social support	Hong, C., & Efferth, T., 2016; Tang, B., et al., 2017	1	287	CAPS

## DISCUSSION

The results of the present review showed several individual, relational, and contextual risk factors that may make individuals and their families vulnerable to the onset of PTSD following an earthquake. These were classified as socio-demographic, pre, peri, and post-traumatic risk factors. A brief summary of the most significant risk factors is indicated below.

### *Socio-demographic risk factors for PTSD*

Many studies showed some socio-demographic risk factors for PTSD. *Female gender* is one of the most



frequent risk factors for PTSD in the three considered age groups (e.g., Jia et al., 2013; Ali et al., 2012; Chen, Shen & Chen, 2012). According to Olff (2017), women are two to three times more likely than men to develop PTSD due to some biological and psychosocial factors. Specifically (Olff, 2017; Tang et al., 2017; Zhou et al., 2013), women appear more sensitive to stress hormones and perceived threats and have a greater propensity to interpret disasters more negatively. Moreover, their traditional role in society exposes them to higher stress. Conversely, the socialization to the gender role promoted a sort of repression of psychological symptoms in boys, while increasing girls' emotional expression (Korol, Green, & Gleser, 1999; Tang, 2017). Regarding *age*, the literature indicated controversial results. Some studies reported both young and older ages as potential risk factors in children, adolescents, youth, and adults, even though more studies reported that older age is a significant risk factor in all three age groups (e.g., Fan et al., 2011; Ali et al., 2012; Chen, G., Shen, H., & Chen, G., 2012). The "older age" during adolescence and the first years of adulthood could be related to greater academic pressure and stress (Liu et al., 2010, Tang et al., 2017). Conversely, during more advanced life stages, the increased vulnerability could be explained by some health problems, inadequate financial resources, absence of personal transportation, and limited social networks (Chen, G., Shen, H., & Chen, G., 2012). In adults, the vulnerability may be due to the increased stress that they may feel in association with their career, the family burden, and elderly relatives (Guo, J., Wang, X., Yuan, J., Zhang, W., Tian, & Qu, Z., 2015).

Further inconsistent results were about marital status, with studies reporting both being unmarried (Ali, M., Farooq, N., Bhatti, M. A., & Kuroiwa, C., 2012), married (Guo et al., 2014), as well as divorced or widowed (Chen, Shen, H., & Chen, 2012; Kun et al., 2013), as risk conditions. In addition, *economic issues* (e.g., no household income, low income, unemployed, low socioeconomic status) also appear to be a significant risk condition for all three age groups (Cénat, J. M., & Derivois, D., 2015; Ali, M., Farooq, N., Bhatti & Kuroiwa, 2012; Chen, G., Shen, H., & Chen, G., 2012). Finally, *the low educational level* has also been documented as a risk factor in adults and older people (Wang et al., 2009; Chen, Shen & Chen, 2012).

#### *Pre-trauma risk factors for PTSD*

In all the considered age groups, the most documented pre-trauma PTSD risk factors were: personal and loved ones' history of mental health problems (Cadichon et al., 2017; Gökçen, Sahingöz & Annagür, 2013; Başoğlu et al., 2004; Tural et al., 2004), and the presence of previous traumas (Gökçen, Sahingöz, & Annagür, 2013; Cerdá et al., 2013). Indeed, throughout life, traumatic events could increase the risk of mental disorders (Tang, 2017). Different studies also report negative coping as a common pre-earthquake PTSD risk factor in children, adolescents, youth, and adults (Zheng et al., 2012; Liu, Fu, Jing & Chen, 2016). Conversely, positive coping increases the likelihood of resilience, a knowledge that highlights the importance of integrating coping



training into post-earthquake psychological interventions (Fan et al., 2015).

### *Peri-trauma PTSD risk factors*

The literature also highlights multiple peri-trauma PTSD risk factors. In particular, studies showed that direct exposure to the earthquake is a crucial peri-earthquake PTSD risk factor. For instance, being buried/trapped (Jin & Li, 2015; Zhao et al., 2009) and witnessing someone buried, wounded, or dying during the earthquake (Ma et al., 2011; Zhou et al., 2013a) were significant PTSD risk factors for children, adolescents, youths and adults. Further significant risk factors (in all three age groups) were: being injured during the earthquake (Tian et al., 2014; Cerdá et al., 2013; Zhang et al., 2012) and having *experienced high levels of fear* (Liu et al., 2011; Zhang et al., 2011; Zhang et al., 2012). *Injured persons* are at high risk because of their high exposure to mortal danger and the additional stress and rehabilitation connected to an ongoing injury. In addition, the severity of the injuries could bring amputations of organs and disability, which can reduce the quality of life (Tang et al., 2017). Other studies showed that *having injured loved ones* (e.g., family members, classmates, teachers, or friends) could be another PTSD risk factor (Ma, et al., 2011; Cerdá et al., 2013). Moreover, *bereavement of loved ones* is reported as a significant PTSD risk factor in all three age groups (Liu et al., 2011; Cheng et al., 2015; Chen, Shen, & Chen, 2012).

### *Post-trauma PTSD risk factors*

Finally, several studies identified some PTSD risk factors during the post-earthquake period. Adequate *social support* plays an essential role in protecting the mental health of the survivors (Alipour & Ahmadi, 2020; He, Xu, & Wu, 2013). *Low social support* was therefore identified as a risk factor for PTSD (Fan et al., 2015; Zhao et al., 2009; Chen, Shen & Chen, 2012), as well as damages to the *house damages* and material losses (e.g., possessions, livelihood, property, money) (Wang et al., 2012; Liu et al., 2016; Kun et al., 2009; Zhang et al., 2011; Hikichi et al., 2016; Zhang et al., 2012). In addition, economic difficulties were also identified as PTSD risk factors for adults, such as the absence of a regular income and job loss after the earthquake and severe economic difficulties not necessarily related to the earthquake (Kun et al., 2009; Kun et al., 2013; Cerdá et al., 2013; Gigantesco et al., 2013). *Unemployment and damage to the houses* could alter survivors' ability to care for their families. Therefore, the implementation of social interventions, such as income-generating activities to facilitate a return to work is crucial (Tang et al., 2017). Other studies also showed that participation in rescue work was a further important PTSD risk factor (Salcioglu, Basoglu & Livanou, 2003; Başoğlu et al., 2000). Rescues could have additional exposure to stressful, intense situations, and could feel intense anxiety, feelings of helplessness, desperation, self-blame, and guilt resulting from the impossibility of saving people or loved ones. Again, they may feel frustration and anger toward the local and national



government authorities for their potential delayed response in rescue efforts (Salcioglu, Basoglu & Livanou, 2003).

## Conclusion

The systematic review allowed the identification of some significant individual, relational, and contextual risk factors that may make individuals and families vulnerable to the onset of PTSD following an earthquake. The above-cited results were used as an essential *baseline* in order to

1. Realize a preliminary *classification* of the representative families with different levels of risk (high-low-no-risk) - for the insurgence of PTSD. The distinct levels of risk were based on their socio-demographic and psychological indicators;
2. Realize a *preliminary version of an Inventory* titled: "*Peri-traumatic and post-traumatic factors Inventory*," which, in the immediate aftermath of an earthquake, could help rescuers to effectively identify individuals and families at risk of the insurgence of PTSD disorder;
3. Set up the research protocol for the empirical study that will be realized in the pilot areas (WP6).



## SECTION 2: THE IDENTIFICATION OF TARGET FAMILIES BASED ON DIFFERENT LEVELS OF RISK

In the present section, we reported the procedures used for preliminary identification of the representative families of the Medea research project.

Precisely, we followed the subsequent criteria and procedures for the identification and description of the typology of the representative families in terms of *distinct levels of risk* (high/low/no-risk) of PTSD:

1. *First*, we considered the results of the systematic review of PTSD risk factors (see Section 1). This review constituted a significant *baseline* for the preliminary identification of the risk factors of the representative families.
2. *Second*, we considered the descriptions of the families and the data of the following: *the Italian National Institute of Statistics (ISTAT); the Republic of Slovenia Statistical Office, and The Croatian Bureau of Statistics*. This description also allowed us to detect a typology of families that could be found in all three Nationalities of the Medea project.
3. *Third*, we took into consideration further indications of the literature, specifically those of the "*Process-Oriented Model*" (Cummings, Davies, & Campbell, 2000, Di Blasio, 2005) and the *Distinction between the Distal and Proximal Factors* (Baldwin, Baldwin, & Cole, 1990).
4. *Fourth*, consistent with these further indications of the literature, we classified the most significant PTSD risk factors (identified by the systematic review, Section 1) as *distal and proximal factors*.
5. *Fifth*, thanks to the joint consideration of the identified family typologies and of the classification of distal and proximal PTSD risk factors, we detected the representative families with *distinct levels of risk* (high/low/no-risk) of PTSD in case of seismic events.

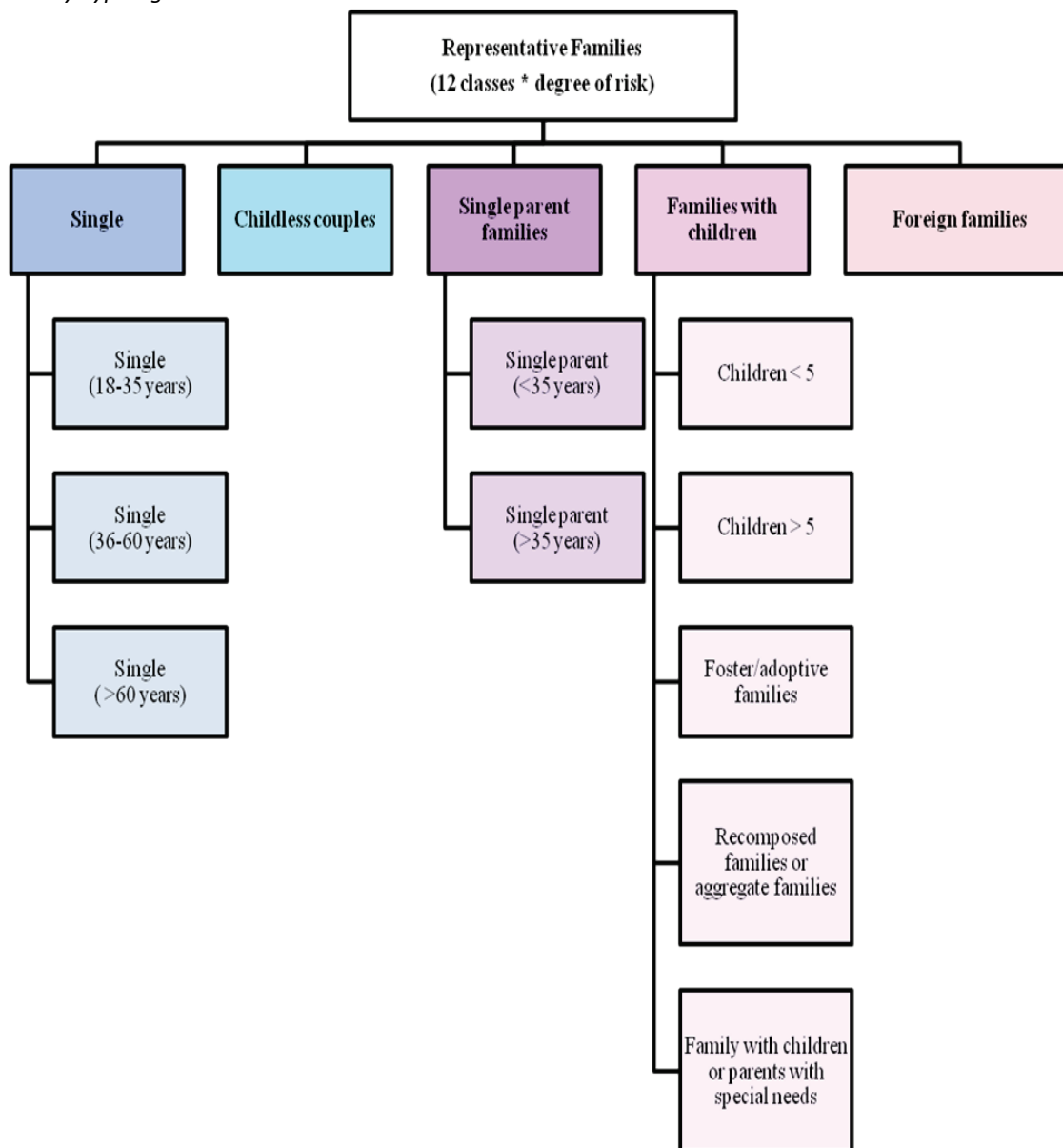
### *Family Typologies*

By considering the data and the descriptions of the families of the Italian National Institute of Statistics, the Republic of Slovenia Statistical Office, and also of the Croatian Bureau of Statistics, we selected 12 kinds of families (see Figure 2). This typology of families could be found in the three Nationalities (Italia, Croatia, and Slovenia) of Medea project partners.





Figure 2. -Family Typologies



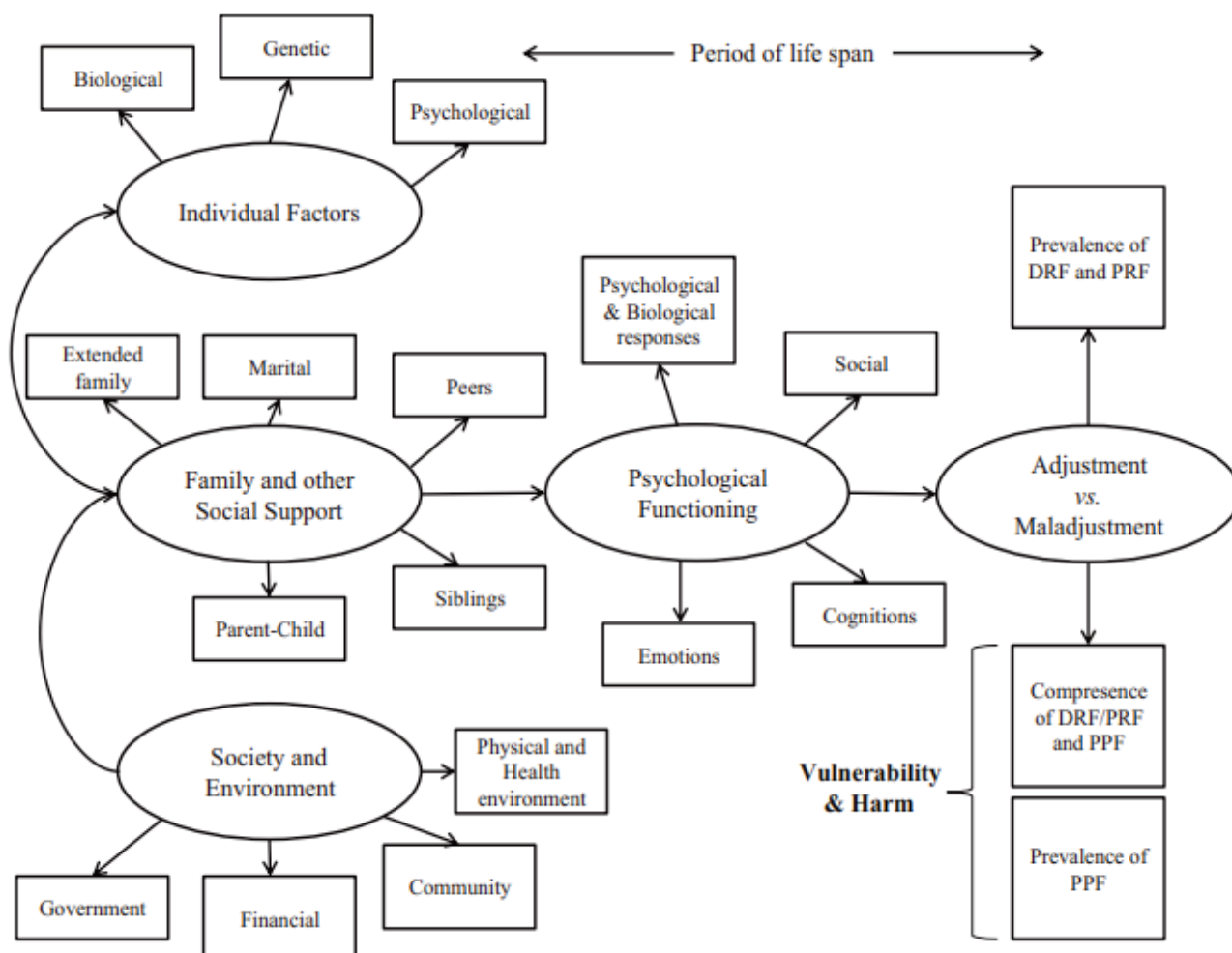
### THE PROCESS-ORIENTED MODEL AND THE DISTAL AND PROXIMAL FACTORS

In the literature of developmental psychopathology, the Process Oriented Model (Cummings, Davies, & Campbell, 2000, Di Blasio, 2005) posits that human development is characterized by mutual influences between different factors and environments, which lead to adaptive or potentially maladaptive patterns. This model (see Figure 3) has been modified and articulated by Di Blasio, 2005 to fit the family violence literature and the risk assessment about parenting behaviors (Di Blasio, 2005; Milani, Miragoli, Grumi, Di Blasio, 2019; 2020). The model's left side highlights the contribution of genetic, biological, and psychological factors of individuals, which interact with family functioning, and environmental factors in determining parental attitudes toward offspring. The central part of the model focuses on the "here-and-now" psychological



functioning that mediates between contextual factors and adaptive/maladaptive trajectories. The right side of the model presents the outcomes of the process: social competence on one side and maladjustment on the other. Social competence is a developmental outcome related to families with a preponderance of proximal protective factors. In these instances, parents can express positive parenting and buffer the impact of eventual adverse events (e.g., loss of job, death of a relative). On the other hand, maladaptive outcomes can be characterized by those instances when parents are not able to buffer the effects of adverse events – or personal difficulties – and expose their children to situations of vulnerability or clear harm via a significant prevalence of distal and proximal risk factors (Milani et al., 2020).

Figure 3. - The Process Oriented Model



Therefore, according to this model, high-risk conditions are not necessarily equivalent to maladaptive outcomes. In fact, it is often difficult to assign a “clear-cut” score of damaging potential to many life events, due to the complexity of the mutual interaction of the factors in play. Thus, to better discriminate those



factors that directly *influence* the developmental trajectories and those that are indirect, we could refer to the significant distinction by Baldwin, Baldwin, & Cole (1990) between distal and proximal factors. The term “*Distal*” is used because these factors are supposed to have an indirect effect on adjustment/maladjustment and can be thought of as a humus on which more proximate events and factors build their influence. Proximal factors have a direct influence on family processes and can overturn frail points of balance, often exacerbating covert tensions and conflicts. Distal risk factors (e.g. chronic poverty, low educational level) imply a condition of vulnerability but exert an indirect influence on parental practices and children’s developmental trajectory, while proximal factors have a direct influence on the parent-child relationship. Proximal factors include both risk and protective factors: risk factors (e.g. parental psychopathology, parental substance abuse) exacerbate vulnerability induced by distal factors, increasing the probability that the situation evolve into a harm for the child; on the contrary, protective factors (e.g., self-esteem, desire to improve oneself) are proximal resources that may buffer the negative impact of distal and proximal risk factors.

#### **THE DISTAL AND PROXIMAL RISK FACTORS FOR THE ONSET OF PTSD IN SEISMIC CASES**

Thanks to the consideration of the literature about the “*Process-Oriented Model*” (Cummings, Davies, & Campbell, 2000, Di Blasio, 2005) and the *Distinction between the Distal and Proximal Factors* (Baldwin, Baldwin, & Cole, 1990; Di Blasio & Camisasca, 2005; Milani et al., 2019; 2020), we further classified the risk factors associated to the onset of PTSD, in case of seismic events. Specifically, by considering two distinct developmental stages (children/adolescent and Youths/Adults/Elderly) we classified the most significant PTSD risk factors (identified by the systematic review, Section 1) as distal or proximal factors which could have *indirect or direct* influences on the onset of PTSD. See the following figures (4 and 5) for the categorization of PTSD distal and proximal risk factors by considering children/adolescents or youths/adults/elderly.



Figure 4. -Children and Adolescents: Distal and Proximal Factors for PTSD

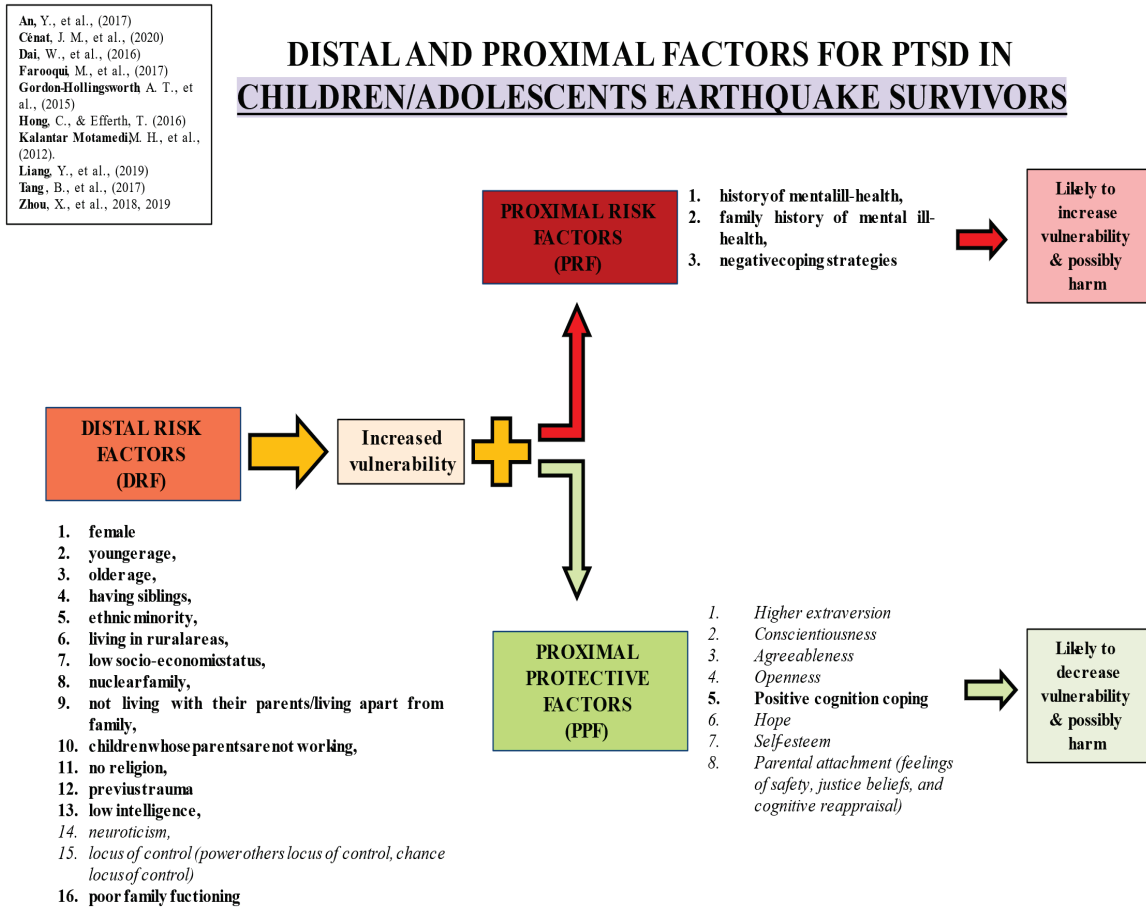
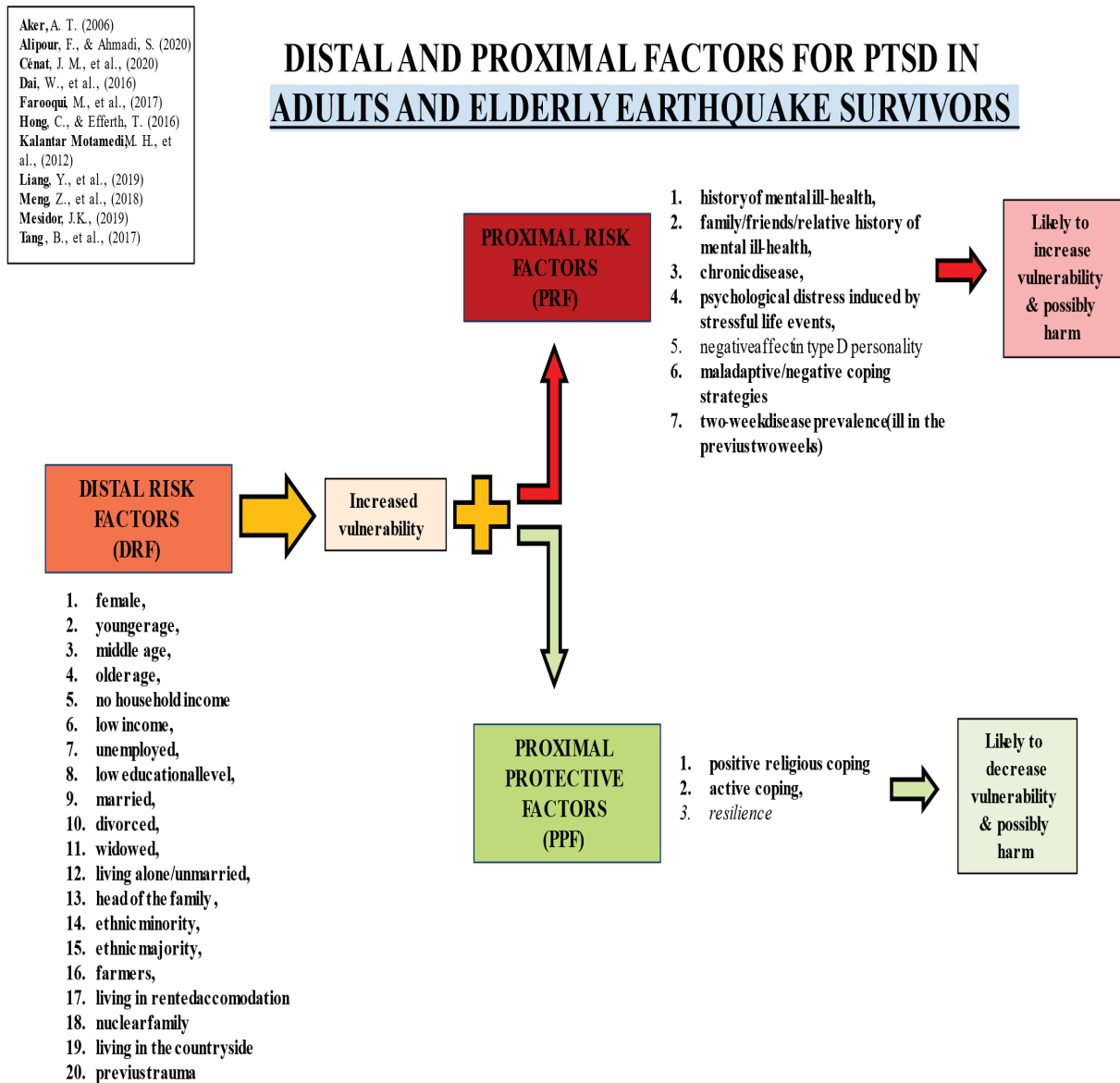




Figure 5. -Youths, Adults and Elderly: Distal and Proximal Factors for PTSD

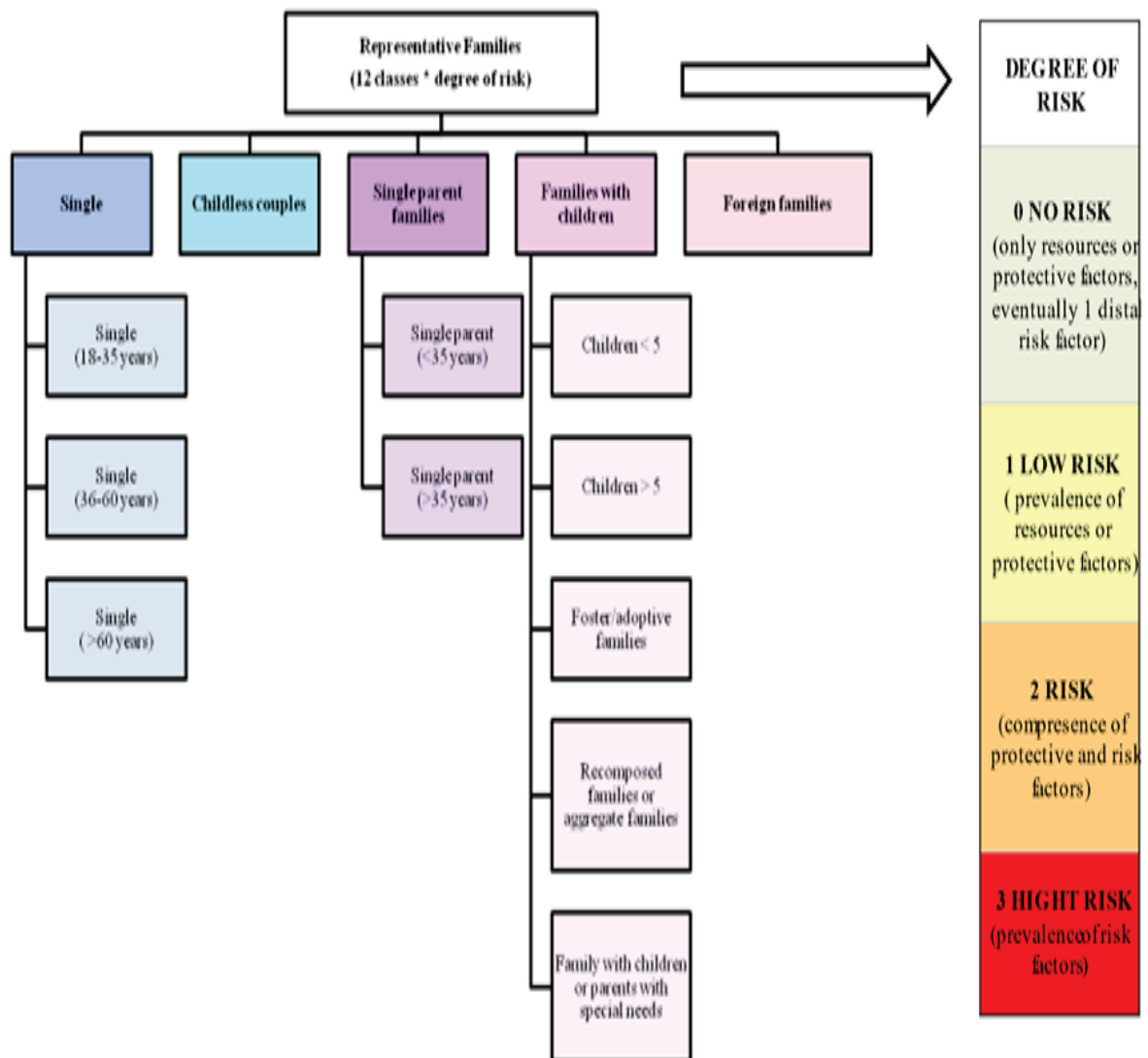




### THE IDENTIFICATION OF THE TARGET FAMILIES

Thanks to the joint consideration of the typology of families and of the *distal and proximal* PTSD risk factors, we identified the representative families with distinct levels of risk for the insurgence of PTSD in case of seismic events. More specifically, by considering the possible presence of distal and proximal risk factors and the presence of resources and protective factors, each typology of the family was classified (see Figure 6) based on a distinct degree of risk (from no risk to high).

Figure 6.- The Representative (Target Families)



Moreover, for each representative families, we indicated the most significant risk and protective factors that were detected through the sistematic review (see Section 1).



The Representative (Target) Families and Their Degree of Risk

	1 SINGLE				DEGREE OF RISK
	RESOURCES - 0.5	PROTECTIVE FACTORS -1	DISTAL RISK FACTORS 0,5	PROXIMAL RISK FACTORS +1	
<b>1 SINGLE</b>	1. High income, 2. high educational levels, 3. male	1. positive religious coping 2. active coping, 3. resilience	1. female 2. younger age, 3. middle age, 4. older age, 5. no household income 6. low income, 7. unemployed, 8. low educational level, 9. divorced, 10. widowed, 11. living alone/unmarried, 12. ethnic minority, 13. ethnic majority, 14. farmers 15. living in rented accommodation 16. nuclear family 17. living in the countryside 18. previous trauma	1. history of mental ill-health, 2. family/friends/relative history of mental ill-health, 3. chronic disease, 4. psychological distress induced by stressful life events, 5. negative affect in type D personality 6. maladaptive/negative coping strategies 7. two-week disease prevalence (ill in the previous two weeks)	<b>0 NO RISK</b> (only resources or protective factors, eventually 1 distal risk factor)
					<b>1 LOW RISK</b> (prevalence of resources or protective factors)
					<b>2 RISK</b> (compresence of protective and risk factors)
					<b>3 HIGHT RISK</b> (prevalence of risk factors)



	2 CHILDLESS COUPLES				DEGREE OF RISK
	RESOURCES - 0.5	PROTECTIVE FACTORS -1	DISTAL RISK FACTORS 0,5	PROXIMAL RISK FACTORS +1	
<b>2 CHILDLESS COUPLES</b>	1. High income, 2. high educational levels, 3. male	1. positive religious coping 2. active coping, 3. resilience	1. female 2. younger age, 3. middle age, 4. older age, 5. no household income 6. low income, 7. unemployed, 8. low educational level, 9. married, 10. divorced, 11. widowed, 12. ethnic minority, 13. ethnic majority, 14. farmers 15. living in rented accommodation 16. living in the countryside 17. previous trauma	1. history of mental ill-health, 2. family/friends/relative history of mental ill-health, 3. chronic disease, 4. psychological distress induced by stressful life events, 5. negative affect in type D personality 6. maladaptive/negative coping strategies 7. two-week disease prevalence (ill in the previous two weeks)	0 NO RISK (only resources or protective factors, eventually 1 distal risk factor)
					1 LOW RISK (prevalence of resources or protective factors)
					2 RISK (comprencence of protective and risk factors)
					3 HIGHT RISK (prevalence of risk factors)





	3 SINGLE PARENT FAMILY				DEGREE OF RISK
	RESOURCES - 0,5	PROTECTIVE FACTORS -1	DISTAL RISK FACTORS 0,5	PROXIMAL RISK FACTORS +1	
3 SINGLE PARENT FAMILY	1. High income, 2. high educational levels, 3. male	1. positive religious coping 2. active coping, 3. resilience	1. female 2. younger age, 3. middle age, 4. older age, 5. no household income 6. low income, 7. unemployed, 8. low educational level, 9. divorced, 10. widowed, 11. living alone/unmarried, 12. head of the family 13. ethnic minority, 14. ethnic majority, 15. farmers 16. living in rented accommodation 17. living in the countryside 18. previous trauma	1. history of mental ill-health, 2. family/friends/relative history of mental ill-health, 3. chronic disease, 4. psychological distress induced by stressful life events, 5. negative affect in type D personality 6. maladaptive/negative coping strategies 7. two-week disease prevalence (ill in the previous two weeks)	0 NO RISK (only resources or protective factors, eventually 1 distal risk factor)
					1 LOW RISK (prevalence of resources or protective factors)
					2 RISK (compresence of protective and risk factors)
					3 HIGHT RISK (prevalence of risk factors)



4 FAMILY WITH CHILDREN					DEGREE OF RISK
PARENT	PARENT/RESOURCES -0,5	PARENT/PROTECTIVE FACTORS -1	PARENT/DISTAL RISK FACTOR + 0,5	PARENT/PROXIMAL RISK FACTORS +1	
4 FAMILY WITH CHILDREN	1. High income, 2. high educational levels, 3. male	1. positive religious coping 2. active coping, 3. resilience	1. female 2. younger age, 3. middle age, 4. older age, 5. no household income 6. low income, 7. unemployed, 8. low educational level, 9. married, 10. divorced, 11. widowed, 12. head of the family 13. ethnic minority, 14. ethnic majority, 15. farmers 16. living in rented accomodation 17. nuclear family 18. living in the countryside 19. previous trauma	1. history of mental ill- health, 2. family/friends/relative history of mental ill-health, 3. chronic disease, 4. psychological distress induced by stressful life events, 5. negative affect in type D personality 6. maladaptive/negative coping strategies 7. two-week disease prevalence (ill in the previuos two weeks)	0 NO RISK (only resources or protective factors, eventually 1 distal risk factor)
					1 LOW RISK ( prevalence of resources or protective factors)
					2 RISK (compresence of protective and risk factors)
					3 HIGHT RISK (prevalence of risk factors)



CHILD ADOLESCENT	CHILD- ADOLESCENT/RESOURCES -0,5	CHILD ADOLESCENT /PROTECTIVE FACTORS - 1	CHILD ADOLESCENT /DISTAL RISK FACTOR + 0,5	CHILD- ADOLESCENT /PROXIMAL RISK FACTORS +1	DEGREE OF RISK
4 FAMILY WITH CHILDREN	1. High income, 2. high educational levels, 3. male	1. Higher extraversion 2. Conscientiousness 3. Agreeableness 4. Openness 5. Positive cognition coping 6. Hope 7. Self-esteem 8. Parental attachment (feelings of safety, justice beliefs, and cognitive reappraisal)	1. female 2. younger age, 3. older age, 4. having siblings, 5. ethnic minority, 6. living in rural areas, 7. low socio-economic status, 8. nuclear family, 9. not living with their parents/living apart from family, 10. children whose parents are not working, 11. no religion, 12. previous trauma, 13. low intelligence, 14. neuroticism, 15. locus of control (power others locus of control, chance locus of control) 16. poor family functioning	1. history of mental ill-health, 2. family history of mental ill-health, 3. negative coping strategies	0 NO RISK (only resources or protective factors, eventually 1 distal risk factor)
					1 LOW RISK (prevalence of resources or protective factors)
					2 RISK (compresence of protective and risk factors)
					3 HIGHT RISK (prevalence of risk factors)



	5 FOREIGN FAMILY				DEGREE OF RISK		
	RESOURCES - 0.5	PROTECTIVE FACTORS -1	DISTAL RISK FACTORS 0,5	PROXIMAL RISK FACTORS +1			
5 FOREIGN FAMILY	1. High income, 2. high educational levels, 3. male	1. positive religious coping was the strongest predictor 2. active coping, 3. resilience	1. female 2. younger age, 3. middle age, 4. older age, 5. no household income 6. low income, 7. unemployed, 8. low educational level, 9. married, 10. divorced, 11. widowed, 12. head of the family 13. ethnic minority, 14. ethnic majority, 15. farmers 16. living in rented accommodation 17. nuclear family 18. living in the countryside 19. previous trauma	1. history of mental ill-health, 2. family/friends/relative history of mental ill-health, 3. chronic disease, 4. psychological distress induced by stressful life events, 5. negative affect in type D personality 6. maladaptive/negative coping strategies 7. two-week disease prevalence (ill in the previous two weeks)	0 NO RISK (only resources or protective factors, eventually 1 distal risk factor)		
						1 LOW RISK (prevalence of resources or protective factors)	
							2 RISK (presence of protective and risk factors)
							3 HIGH RISK (prevalence of risk factors)



## SECTION 3: THE PRELIMINARY INVENTORY OF PERI-TRAUMATIC AND POST-TRAUMATIC PTSD RISK FACTORS

### INTRODUCTION

In the present section, we introduce the preliminary version of the *Inventory* about the most significant *peri-traumatic and post-traumatic* events and conditions which could promote the insurgence of PTSD disorder. The peritraumatic and post-traumatic experiences and conditions (included in the Inventory) indicated in the Inventory were identified thanks to the work of the systematic literature review (see Section 1). The accurate knowledge, and consideration of these factors could help rescues to detect, monitor and support the individuals at more risk for the insurgence of PTSD disorder.

This preliminary Inventory contains two sections: one for children and adolescents and the other one for adults and elderly. The listed peri-traumatic and post-traumatic experiences and conditions were: the personal and the close ones' exposure to the seismic events, the post-seismic events living conditions, the post-seismic events cognitions, behaviors, and perceived social support.

PERI-TRAUMATIC AND POST-TRAUMATIC FACTORS INVENTORY FOR CHILDREN AND ADOLESCENTS	
<b>1</b>	<p><b><u>EXPERIENCES DURING AND AFTER THE EARTHQUAKE</u></b></p> <p><b>1. Self-exposure to Traumatic Events</b></p> <ul style="list-style-type: none"> <li>€ Buried or trapped</li> <li>€ Personal injury</li> <li>€ Severe personal injury</li> <li>€ Hospitalized</li> <li>€ Operated</li> <li>€ Amputated</li> <li>€ None/Other</li> </ul> <p><b>1.2: Having been in serious danger during the earthquake?</b></p> <ul style="list-style-type: none"> <li>€ 0 = No</li> <li>€ 1=Slightly</li> <li>€ 2 = Markedly</li> <li>€ 3 = Extremely</li> </ul> <p><b>1.3: Intensity of your fear during the earthquake</b></p> <ul style="list-style-type: none"> <li>€ 0= No fear at all</li> <li>€ 1= Slight fear</li> <li>€ 2= Marked fear</li> <li>€ 3= Extremely severe fear</li> </ul> <p><b>1.4: Fear for the safety of close ones during the earthquake (o worry?)</b></p> <ul style="list-style-type: none"> <li>€ 0= No fear at all</li> <li>€ 1= Slight fear</li> </ul>



	<p>€ 2= Marked fear € 3= Extremely severe fear</p> <p><b>1.5: How anxious/fearful have you been lately thinking about other possible earthquakes in the near future?</b></p> <p>€ 0 = Not anxious/fearful at all € 1 = Slightly anxious/fearful € 2 = Markedly anxious/fearful € 3 = Extremely anxious/fearful</p> <p><b>1.6: How much control do you have over your life at present?</b></p> <p>€ 0 = Not at all in control / Feeling very helpless € 1 = Slightly in control € 2 = Markedly in control € 3 = Completely in control / Not feeling helpless at all</p> <p><b>1.7: Participation in rescue work after the earthquake</b></p> <p>€ Yes € No</p> <p><b>1.8: How close were you to the epicenter during the earthquake?</b></p> <p>€ Within 50 km € 50 to 100 km € More than 100 km</p> <p><b>1.9: Did you experience seismic tremors?</b></p> <p>€ No € Yes</p> <p><b>1.10: Where were you during the earthquake?</b></p> <p>€ In a building € In my house € On the street € In a transport vehicle € Other</p> <p><b>1.11: Current worries</b></p> <p>0 = No € 1= Slightly € 2 = Markedly € 3 = Extremely</p>
2	<p><b><u>EXPOSURE OF FAMILY MEMBERS AND /OR CLOSE ONES</u></b></p> <p><b>2.1: Did any of your close ones die in the earthquake?</b></p> <p>€ No € My mother € My father € My brothers/sisters € My relatives € My friends € My teachers € My classmate € My neighbors € Other _____</p>



	<p><b>2.2: Did any of your close ones injured in the earthquake? –</b></p> <ul style="list-style-type: none"> <li>€ No</li> <li>€ My mother</li> <li>€ My father</li> <li>€ My brothers/sisters</li> <li>€ My relatives</li> <li>€ My friends</li> <li>€ My teachers</li> <li>€ My classmate</li> <li>€ My neighbors</li> <li>€ Other _____</li> </ul> <p><b>2.3: Did any of your close ones have these consequences due to the earthquake?</b></p> <ul style="list-style-type: none"> <li>€ Buried or trapped</li> <li>€ Hospitalized</li> <li>€ Amputated</li> <li>€ Operated</li> <li>€ Disabled</li> <li>€ Other consequences?</li> <li>€ No consequence</li> </ul>
<p><b>3</b></p>	<p><b>WITNESSED THE DEATH OF SOMEONE:</b></p> <ul style="list-style-type: none"> <li>€ No</li> <li>€ Yes, my mother</li> <li>€ Yes, my father</li> <li>€ Yes, my sisters or brothers</li> <li>€ Yes, close relatives</li> <li>€ Yes, friends</li> <li>€ Yes, my teachers,</li> <li>€ Yes, my classmates</li> <li>€ Yes, my neighbors</li> <li>€ Yes, strangers</li> <li>€ Yes, other _____</li> </ul>
<p><b>4</b></p>	<p><b>WITNESSED INJURY of SOMEONE:</b></p> <ul style="list-style-type: none"> <li>€ No</li> <li>€ Yes, my mother</li> <li>€ Yes, my father</li> <li>€ Yes, my sisters or brothers</li> <li>€ Yes, close relatives</li> <li>€ Yes, friends</li> <li>€ Yes, my teachers,</li> <li>€ Yes, my classmates</li> <li>€ Yes, my neighbors</li> <li>€ Yes, strangers</li> <li>€ Yes, other _____</li> </ul>
<p><b>5</b></p>	<p><b>WITNESSED A COLLAPSE OF:</b></p> <ul style="list-style-type: none"> <li>€ buildings</li> <li>€ own house</li> <li>€ other _____</li> <li>€ None</li> </ul>



6	<b>MISSING DUE TO THE EARTHQUAKE</b> € No € Yes, my mother € Yes, my father € Yes, my sisters or brothers € Yes, close relatives € Yes, friends € Yes, my teachers, € Yes, my classmates € Yes, my neighbors € Yes, other _____
7	<b>HOUSE DAMAGE</b> € completely destroyed, € partially destroyed, € mildly damaged, € not damaged at all
8	<b>CURRENT LIVING CONDITION</b> € My usual house € A new house € A tent € Temporary shelter € Other _____ <b>8.2: OVERNIGHT OUTDOOR AFTER EARTHQUAKE</b> € Yes, < 6 night € Yes, > 6 nights € No
9	<b>SCHOOL</b> <b>9.1: Absence from school since the earthquake EVEN IF THE SCHOOL was not closed</b> € Yes € No <b>9.2: School closed <math>\geq</math> six days after the earthquake</b> € Yes € No
10	<b>Visiting affected areas after the earthquake</b> € Yes € No <b>Did your parents participate in the rescue work?</b> € Yes € No
11	<b>At Risk behaviors</b> € Smoking € Excessive Alcohol € Substance misuse € None € Altro?





<b>12</b>	<p><b>OTHER EXPERIENCES AFTER THE EARTHQUAKE</b></p> <p><b>12.1: Perceived sense of security and support by parents</b></p> <p>€ Yes € No</p> <p><b>12.2: Perceived sense of security and support obtained from relatives</b></p> <p>€ Yes € No</p> <p><b>12.3: Perceived sense of security and support obtained from teachers</b></p> <p>€ Yes € No</p> <p><b>12.4: Perceived mutual support among peers</b></p> <p>€ Yes € No</p> <p><b>12.5: Exposure to touching content about the earthquake in news reports</b></p> <p>€ Yes € No</p> <p><b>12.6: Exposure to encouraging content about the earthquake in news reports</b></p> <p>€ Yes € No</p>
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<b>PERI-TRAUMATIC AND POST-TRAUMATIC FACTORS INVENTORY FOR ADULTS AND ELDERLY</b>	
<b>1</b>	<p><b><u>PERSONAL EXPERIENCES DURING AND AFTER THE EARTHQUAKE</u></b></p> <p><b>1.1: Personal exposure to Traumatic Events</b></p> <p>€ Buried or trapped € Personal injury € Severe personal injury € Hospitalized € Operated € Amputated € None/Other</p> <p><b>1.2: Having been in serious danger during the earthquake?</b></p> <p>€ 0 = No € 1 = Slightly € 2 = Markedly € 3 = Extremely</p> <p><b>1.3: Intensity of your fear during the earthquake</b></p> <p>€ 0 = No fear at all € 1 = Slight fear € 2 = Marked fear € 3 = Extremely severe fear</p> <p><b>1.4: Fear for the safety of close ones during the earthquake</b></p> <p>€ 0 = No fear at all € 1 = Slight fear € 2 = Marked fear € 3 = Extremely severe fear</p> <p><b>1.5: How anxious and fearful have you been lately thinking about possible earthquakes shortly?</b></p>



	<p>€ 0 = Not anxious/fearful at all          € 1 = Slightly          € 2 = Markedly          € 3 = Extremely anxious/fearful</p> <p><b>1.6: How much control do you have over your life at present?</b>          € 0 = Not at all in control / Feeling very helpless          € 1 = Slightly in control          € 2 = Markedly in control          € 3 = Completely in control / Not feeling helpless at all</p> <p><b>1.7: Participation in rescue work after the earthquake</b>          € Yes          € No</p> <p><b>1.8: How close were you to the epicenter during the earthquake?</b>          € Within 50 km          € 50 to 100 km          € More than 100 km</p> <p><b>1.9: Did you experience seismic tremors?</b>          € No          € Yes</p> <p><b>1.10: Where were you during the earthquake?</b>          € In a building          € In my house          € On the street          € In a transport vehicle          € Other _____</p> <p><b>1.11 Current worries</b>          € 0 = No          € 1 = Slightly          € 2 = Markedly          € 3 = Extremely</p>
2	<p><b><u>CLOSE ONE'S EXPOSURE</u></b></p> <p><b>2.1: Did any of your close ones die in the earthquake?</b>          € No          € My mother          € My father          € My brothers/sisters          € My son/sons          € My partner          € My close relatives          € My friends          € My colleagues          € My neighbors          € Other _____</p> <p><b>2.2: Did any of your close ones injured in the earthquake?</b>          € No          € My mother          € My father</p>



	<ul style="list-style-type: none"> <li>€ My brothers/sisters</li> <li>€ My son/sons</li> <li>€ My partner</li> <li>€ My close relatives</li> <li>€ My friends</li> <li>€ My colleagues</li> <li>€ My neighbors</li> <li>€ Other _____</li> </ul> <p><b>2.3: Did any of your close ones have these consequences due to the earthquake?</b></p> <ul style="list-style-type: none"> <li>€ Buried or trapped</li> <li>€ Hospitalized</li> <li>€ Amputated</li> <li>€ Operated</li> <li>€ Disabled</li> <li>€ None</li> </ul>
<p><b>3</b></p>	<p><b>WITNESSED THE DEATH OF SOMEONE:</b></p> <ul style="list-style-type: none"> <li>€ No</li> <li>€ My mother</li> <li>€ My father</li> <li>€ My brothers/sisters</li> <li>€ My sons</li> <li>€ My partner</li> <li>€ My close relatives</li> <li>€ My friends</li> <li>€ My colleagues</li> <li>€ My son's teachers</li> <li>€ Strangers</li> </ul> <p>Other _____</p>
<p><b>4</b></p>	<p><b>WITNESSED INJURY TO SOMEONE:</b></p> <ul style="list-style-type: none"> <li>€ No</li> <li>€ My mother</li> <li>€ My father</li> <li>€ My brothers/sisters</li> <li>€ My sons</li> <li>€ My partner</li> <li>€ My close relatives</li> <li>€ My friends</li> <li>€ My colleagues</li> <li>€ My neighbors</li> <li>€ Strangers</li> </ul> <p>€ Other _____</p>
<p><b>5</b></p>	<p><b>WITNESSED A COLLAPSE OF:</b></p> <ul style="list-style-type: none"> <li>€ Buildings</li> <li>€ Own house</li> <li>€ Other _____</li> <li>€ No</li> </ul>



6	<b>DID ANY OF YOUR CLOSE ONES MISSING DUE TO THE EARTHQUAKE?</b> € No € My mother € My father € My brothers/sisters € My sons € My partner € My close relatives € My friends € My colleagues € My neighbors € Other _____
7	<b>HOUSE DAMAGE</b> € completely destroyed € partially destroyed € mildly damaged € no damage
8	<b>CURRENT LIVING CONDITION</b> € My usual house € A new house € A tent € Temporary shelter € Other  <b>STAYING OUTDOORS OVERNIGHT AFTER THE EARTHQUAKE</b> € Yes < 6 nights € Yes > 6 nights € No
9	<b>VISITING AFFECTED AREAS AFTER THE EARTHQUAKE</b> € Yes € No
10	<b>UNHEALTHY BEHAVIORS AT-RISK</b> € Smoking € Alcohol € Drug € None
11	<b>EXPERIENCES AFTER THE EARTHQUAKE</b>  <b>11.1: Perceived sense of security obtained from close relatives at a post-earthquake time period</b> € Yes € No  <b>11.2: Perceived sense of social support at a post-earthquake time period</b> € Yes € No



<p>11.3: Exposure to touching content about the earthquake in news reports</p> <p>€ Yes</p> <p>€ No</p> <p>11.4: Exposure to encouraging content about the earthquake in news reports</p> <p>€ Yes</p> <p>€ No</p>
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#### SECTION FOUR: RESEARCH PROTOCOL: "Seismic events and post-traumatic consequences: Early identification of at Risk Families"

The present section describes the Research Protocol for the empirical study that will be conducted in the pilot areas of the Medea project (see WP6). The present Research Protocol **was approved by the Ethical Commission** of e-Campus University (nr. 05/2023), in July 2023.

#### AIMS OF THE PRESENT RESEARCH

The research aims to identify individual and relational factors that could promote or hinder the resilience of individuals and families involved in seismic events. More specifically, based on the literature review (see section 1), the present study aims to understand and detect the most significant and less explored factors which could make individuals and families resilient or vulnerable to the insurgence of depressive, anxious, and post-traumatic symptoms. To this aim, the research will focus non-only socio-demographic and individual risk factors but also relational and family functioning factors which could be associated with the onset of PTSD symptoms in case of seismic events. The Medea intelligent system will use the psychological results of the research for multidimensional seismic risk assessment in cross-border areas. This system will use artificial intelligence to estimate the losses caused by an earthquake based on the predicted damage to structures (e.g., buildings), also forecasting the psychological consequences for the individuals involved. Indeed, the system will have a knowledge base (KB) containing reference structures and families represented using technical and psychological parameters. These serve as a representative set of the structures and families in existing areas. The KB also contains the effects of reference seismic actions on reference structures and families, measured using Engineering Demand Parameters (EDPs) and psychological parameters. Concerning an earthquake that has occurred or may occur in existing areas where the knowledge of structures(families) may also be incomplete, the system associates existing structures(families) to similar reference structures(families) of the KB based on available data. The system then combines analytical/numerical methods with eXplainable Artificial Intelligence (XAI) models to estimate the damage to structures, the losses, and the psychological consequences for the individuals involved. The system will also help identify/support families at risk of psychological consequences in the medium/long term, e.g., low-income families, those who have already experienced traumatic events, or with children affected by disability. The

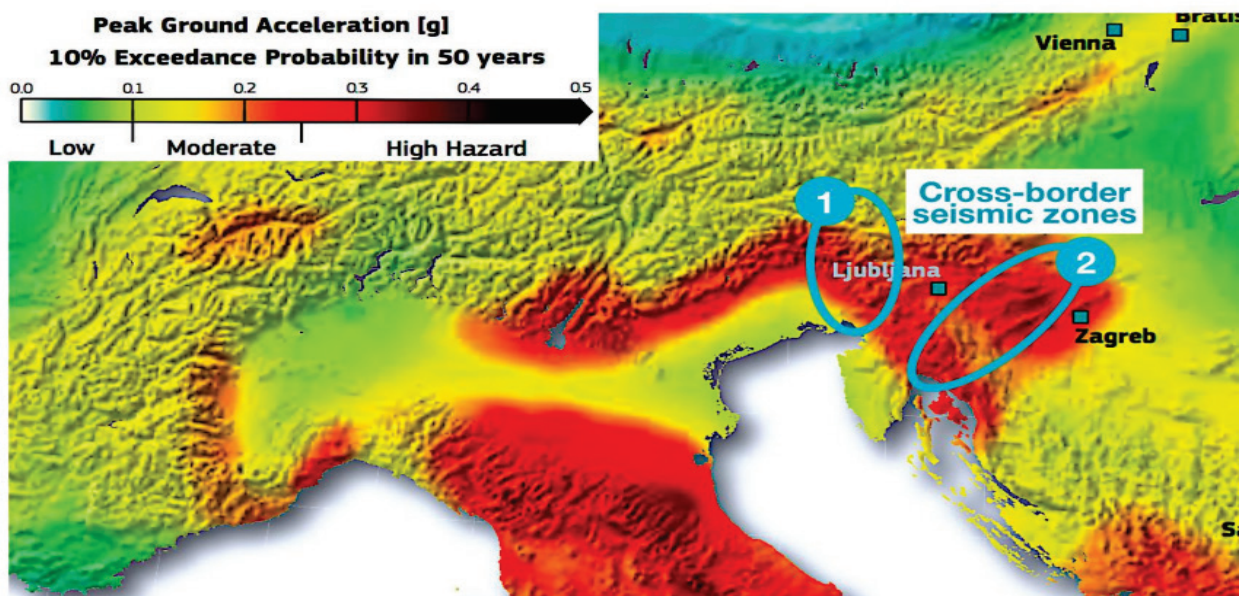


study results will therefore help create intervention guidelines for operators and psychologists involved in rescue operations. These guidelines aim to achieve early identification and support of the most vulnerable individuals and families. Such lines guide will be produced in collaboration with the Italian Society for the Study of Stress Traumatic (SISST) and with the Stella Maris Foundation (FSM).

## PARTICIPANTS, PROCEDURE AND MEASURES

**Participants** will be the representative families described in Section 2 (see the following Tables) composed of adults (18-80 years) and children (aged 4-17). Participants will be recruited thanks to the collaboration of Associazione Nazionale Comuni Italiani (ANCI), the Head of Civil Protection Service in Medjimurje country (Croatia), and Gasilska Zveza Slovenije (GZS, Fire Brigade Association of Slovenia), partners of Medea project.

Figure /. The Pilot Areas of the Empirical Study



## Procedure

In the first phase of the research, all participants will be asked for their personal consent to participate in the research. In addition, both parents and/or legal representatives of minor participants will be asked for further consent for children's participation. In the second phase of the research, some self-report measures will be administered to the participants online to ensure maximum protection and safety of participants e



allow participation in complete harmony with the work and daily commitments of the families. More specifically, adults having obtained the LINK to access can complete the questionnaires with total autonomy. Children and adolescents will receive the LINK from their parents to fill the measures.

### **Measures for Youths, Adults and Elderly**

**1. Socio-demographic Inventory** for evaluating socio-demographic factors, family composition, and health conditions. *Non vedo l'esposizione ad eventi traumatici*

**2. Posttraumatic Stress Disorder Checklist (PC-PTSD-5; Prins et al., 2016)** to assess the vulnerability to the onset of PTSD symptoms.

**3. Multidimensional Scale of Perceived Social Support (MSPSS; Zimet, Dahlem, Zimet & Farley, 1988, Italian validation of Di Fabio & Busoni, 2008)** to assess the perceived social support.

**4. Brief Assessment of Family Functioning Scale (BAFFS; Mansfield, Keitner & Sheeran, 2019)** to assess the quality of family functioning.

**5. Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski, Kraaij & Spinhoven, 2001; Italian translation of Ubbiali, Donati, Chiorri, & Hampton)** to assess the cognitive and emotional strategies to regulate emotions

**6. World Health Organisation-Five Well-Being (WHO-5; World Health Organization, 1998, Italian translation of the World Health Organization),** to assess the general psychological well-being

**7. Brief Cope (Carver, 1997, Italian validation by Bongelli et al., 2022)** to assess the coping strategies.

**In addition, if adults are parents of children aged 4- 17 years,** they also will fill the following measures:

**8. Coparenting Relationship Scale (CRS; Feinberg, Brown, & Kan, 2012, Italian validation by Camisasca et al., in press)** to assess the quality of the co-parenting relationship.

**9. Parenting Stress Index – Short Form (PSI-SF; Abidin, 1995, Italian validation by Guarino, Di Blasio, D'Alessio, Camisasca & Serantoni, 2008)** to assess parenting stress

**10. Child Behavior Checklist – only PTSD items (CBCL 4/18; Achenbach, 1991; Italian validation by Frigerio, 2001)** to assess children's vulnerability to PTSD symptoms.

### **Measures for Children and Adolescents**

**1. Socio-demographic Inventory** for evaluating socio-demographic factors, and health conditions.

**2. Child Revised Impact of Event Scale (CRIES-8 Children and War Foundation, 1998, Italian translation by Gravante, 2010)** to assess the vulnerability to the onset of PTSD symptoms

**3. Lum Emotional Availability of Parents (LEAP; Lum & Phares, 2005; Italian version by Babore, Candelori &**



Picconi, 2012) to assess their perceptions about parents' availability

4. **Cognitive Emotion Regulation Questionnaire** (CERQ; Garnefski, Kraaij & Spinhoven, 2001; Italian translation of Ubbiali, Donati, Chiorri, & Hampton) to assess the cognitive and emotional strategies to regulate emotions

5. **Coparenting Relationship Scale for children/adolescents** (CRS-C; CRS-A Camisasca & Feinberg, 2020) to assess the children's perceptions of their parents' co-parenting relationship.

6. **Children's coping strategies checklist-revision1** (CCSC-R1; Ayers & Sandler, 1999, Italian validation by Camisasca, Caravita, Milani & Di Blasio, 2012) to assess coping strategies

7. **World Health Organisation-Five Well-Being** (WHO-5; World Health Organization, 1998, Italian translation of the World Health Organization), to assess the general psychological well-being.





**THE REPRESENTATIVE FAMILIES AND THE RESEARCH PROTOCOL (TARGET FAMILIES)**

1 SINGLE				DEGREE OF RISK	RESEARCH PROTOCOL
RESOURCES -0.5	PROTECTIVE FACTORS -1	DISTAL RISK FACTORS 0,5	PROXIMAL RISK FACTORS +1		1. Inventory of socio-demographic and mental health factor
1. High income, 2. high educational levels, 3. male	1. positive religious coping 2. active coping, 3. resilience	1. female 2. younger age, 3. middle age, 4. older age, 5. no household income 6. low income, 7. unemployed, 8. low educational level, 9. divorced, 10. widowed, 11. living alone/unmarried, 12. ethnic minority, 13. ethnic majority, 14. farmers 15. living in rented accommodation 16. nuclear family 17. living in the countryside 18. previous trauma	1. history of mental ill-health, 2. family/friends/relative history of mental ill-health, 3. chronic disease, 4. psychological distress induced by stressful life events, 5. negative affect in type D personality 6. maladaptive/negative coping strategies 7. two-week disease prevalence (ill in the previous two weeks)	0 NO RISK (only resources or protective factors, eventually 1 distal risk factor)	2. PC-PTSD-5 (Posttraumatic Stress Disorder Checklist)
				1 LOW RISK (prevalence of resources or protective factors)	3. MSPSS (Multidimensional scale of perceived social support)
					4. Brief family functioning scale
				2 RISK (compresence of protective and risk factors)	5. Cognitive Emotion Regulation Questionnaire (CERQ)
3 HIGHT RISK (prevalence of risk factors)	6. Psychological Well-being (WHO-5)				
	7. Brief Cope				



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2 CHILDLESS COUPLES				DEGREE OF RISK	RESEARCH PROTOCOL
RESOURCES -0.5	PROTECTIVE FACTORS -1	DISTAL RISK FACTORS 0,5	PROXIMAL RISK FACTORS +1		1. Inventory of socio-demographic and mental health factor
1. High income, 2. high educational levels, 3. male	1. positive religious coping 2. active coping, 3. resilience	1. female 2. younger age, 3. middle age, 4. older age, 5. no household income 6. low income, 7. unemployed, 8. low educational level, 9. married, 10. divorced, 11. widowed, 12. ethnic minority, 13. ethnic majority, 14. farmers 15. living in rented accomodation 16. living in the countryside 17. previus trauma	1. history of mental ill-health, 2. family/friends/relative history of mental ill-health, 3. chronic disease, 4. psychological distress induced by stressful life events, 5. negative affect in type D personality 6. maladaptive/negative coping strategies 7. two-week disease prevalence (ill in the previous two weeks)	0 NO RISK (only resources or protective factors, eventually 1 distal risk factor)	2. PC-PTSD-5 (Posttraumatic Stress Disorder Checklist)
				1 LOW RISK (prevalence of resources or protective factors)	3. MSPSS (Multidimensional scale of perceived social support)
					4. Brief family functioning scale
				2 RISK (compresence of protective and risk factors)	5. Cognitive Emotion Regulation Questionnaire (CERQ)
3 HIGHT RISK (prevalence of risk factors)	6. Psychological Well-being (WHO-5)				
	7. Brief Cope				



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SINGLE PARENT FAMILY				DEGREE OF RISK	RESEARCH PROTOCOL			
RESOURCES -0.5	PROTECTIVE FACTORS -1	DISTAL RISK FACTORS 0,5	PROXIMAL RISK FACTORS +1		1. Inventory of socio-demographic and mental health factor			
1. High income, 2. high educational levels, 3. male	1. positive religious coping 2. active coping, 3. resilience	1. female 2. younger age, 3. middle age, 4. older age, 5. no household income 6. low income, 7. unemployed, 8. low educational level, 9. divorced, 10. widowed, 11. living alone/unmarried, 12. head of the family 13. ethnic minority, 14. ethnic majority, 15. farmers 16. living in rented accommodation 17. living in the countryside 18. previous trauma	1. history of mental ill-health, 2. family/friends/relative history of mental ill-health, 3. chronic disease, 4. psychological distress induced by stressful life events, 5. negative affect in type D personality 6. maladaptive/negative coping strategies 7. two-week disease prevalence (ill in the previous two weeks)	0 NO RISK (only resources or protective factors, eventually 1 distal risk factor)	2. PC-PTSD-5 (Posttraumatic Stress Disorder Checklist)			
				1 LOW RISK (prevalence of resources or protective factors)	3. MSPSS (Multidimensional scale of perceived social support)			
					4. Brief family functioning scale			
				2 RISK (comprensence of protective and risk factors)	5. Cognitive Emotion Regulation Questionnaire (CERQ)			
					6. Psychological Well-being (WHO-5)			
				3 HIGHT RISK (prevalence of risk factors)	7. Brief Cope			
					8. CRS (Coparenting relationship scale)			
					9. Parenting stress index			
								10. CBCL (child behaviour checklist) - PTSD



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4 FAMILY WITH CHILDREN				DEGREE OF RISK	RESEARCH PROTOCOL			
PARENT/RESOURCES - 0,5	PARENT/PROTECTIVE FACTORS -1	PARENT/DISTAL RISK FACTOR + 0,5	PARENT/PROXIMAL RISK FACTORS +1		1. Inventory of socio-demographic and mental health factor			
1. High income, 2. high educational levels, 3. male	1. positive religious coping 2. active coping, 3. resilience	1. female 2. younger age, 3. middle age, 4. older age, 5. no household income 6. low income, 7. unemployed, 8. low educational level, 9. married, 10. divorced, 11. widowed, 12. head of the family 13. ethnic minority, 14. ethnic majority, 15. farmers 16. living in rented accommodation 17. nuclear family 18. living in the countryside 19. previous trauma	1. history of mental ill-health, 2. family/friends/relative history of mental ill-health, 3. chronic disease, 4. psychological distress induced by stressful life events, 5. negative affect in type D personality 6. maladaptive/negative coping strategies 7. two-week disease prevalence (ill in the previous two weeks)	0 NO RISK (only resources or protective factors, eventually 1 distal risk factor)	2. PC-PTSD-5 (Posttraumatic Stress Disorder Checklist)			
				1 LOW RISK (prevalence of resources or protective factors)	3. MSPSS (Multidimensional scale of perceived social support)			
					4. Brief family functioning scale			
				2 RISK (compresence of protective and risk factors)	5. Cognitive Emotion Regulation Questionnaire (CERQ)			
					6. Psychological Well-being (WHO-5)			
				3 HIGHT RISK (prevalence of risk factors)	7. Brief Cope			
					8. CRS (Coparenting relationship scale)			
					9. Parenting stress index			
								10. CBCL (child behaviour checklist) - PTSD



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CHILD-ADOLESCENT/RESOURCES -0,5	CHILD ADOLESCENT /PROTECTIVE FACTORS -1	CHILD ADOLESCENT /DISTAL RISK FACTOR + 0,5	CHILD- ADOLESCENT /PROXIMAL RISK FACTORS +1	DEGREE OF RISK	RESEARCH PROTOCOL FOR CHILDREN AND ADOLESCENTS
1. High income, 2. high educational levels, 3. male	1. Higher extraversion 2. Conscientiousness 3. Agreeableness 4. Openness 5. Positive cognition coping 6. Hope 7. Self-esteem 8. Parental attachment (feelings of safety, justice beliefs, and cognitive reappraisal)	1. female 2. younger age, 3. older age, 4. having siblings, 5. ethnic minority, 6. living in rural areas, 7. low socio-economic status, 8. nuclear family, 9. not living with their parents/living apart from family, 10. children whose parents are not working, 11. no religion, 12. previous trauma, 13. low intelligence, 14. neuroticism, 15. locus of control (power others locus of control, chance locus of control) 16. poor family functioning	1. history of mental ill-health, 2. family history of mental ill-health, 3. negative coping strategies	0 NO RISK (only resources or protective factors, eventually 1 distal risk factor)	1. Inventory of socio-demographic and mental health factor
				1 LOW RISK (prevalence of resources or protective factors)	2. CRIES 8 (Child revised impact of event scale)
				2 RISK (compresence of protective and risk factors)	3. LEAP (Lum emotional availability from parents)
				3 HIGHT RISK (prevalence of risk factors)	4. Cognitive Emotion Regulation Questionnaire (CERQ)
					5. CRS-C (Coparenting relationship scale for children)
					6. Children's coping strategies checklist
					7. Psychological Well-being (WHO-5)



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5 FOREIGN FAMILY				DEGREE OF RISK	RESEARCH PROTOCOL			
RESOURUCES -0.5	PROTECTIVE FACTORS - 1	DISTAL RISK FACTORS 0,5	PROXIMAL RISK FACTORS +1		1. Inventory of socio-demographic and mental health factor			
1. High income, 2. high educational levels, 3. male	1. positive religious coping was the strongest predictor 2. active coping, 3. resilience	1. female 2. younger age, 3. middle age, 4. older age, 5. no household income 6. low income, 7. unemployed, 8. low educational level, 9. married, 10. divorced, 11. widowed, 12. head of the family 13. ethnic minority, 14. ethnic majority, 15. farmers 16. living in rented accomodation 17. nuclear family 18. living in the countryside 19. previus trauma	1. history of mental ill-health, 2. family/friends/relative history of mental ill-health, 3. chronic disease, 4. psychological distress induced by stressful life events, 5. negative affect in type D personality 6. maladaptive/negative coping strategies 7. two-week disease prevalence (ill in the previus two weeks)	0 NO RISK (only resources or protective factors, eventually 1 distal risk factor)	2. PC-PTSD-5 (Posttraumatic Stress Disorder Checklist)			
				1 LOW RISK (prevalence of resources or protective factors)	3. MSPSS (Multidimensional scale of perceived social support)			
					4. Brief family functioning scale			
				2 RISK (comprensence of protective and risk factors)	5. Cognitive Emotion Regulation Questionnaire (CERQ)			
					6. Psychological Well-being (WHO-5)			
				3 HIGHT RISK (prevalence of risk factors)	7. Brief Cope			
					8. CRS (Coparenting relationship scale)			
					9. Parenting stress index			
								10. CBCL (child behaviour checklist) - PTSD



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