DEPARTMENT OF PSYCHOLOGY

SELF-REGULATION MECHANISMS AS PROCESSES ENHANCING RESILIENCE IN EARLY ADOLESCENTS EXPOSED TO DIFFERENT LEVELS OF TRAUMATIC STRESS

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Self-regulation mechanisms as processes enhancing resilience in early adolescents exposed to different levels of traumatic stress

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The present doctoral dissertation was submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy of the University of Cyprus. It is a product of original work of my own, unless otherwise mentioned through references, notes or any other statements.

Myria Ioannou

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ΠΕΡΙΛΗΨΗ

Η παρούσα διδακτορική διατριβή αφορά την διερεύνηση των μηχανισμών αυτορρύθμισης ως διαδικασίες που συντελούν στην ανάπτυξη και διατήρηση ψυχικής ανθεκτικότητας σε εφήβους μετά την έκθεση σε πιθανά τραυματικά γεγονότα. Επίσης, η έρευνα έχει σκοπό να εξετάσει το ρόλο των παραμέτρων που σχετίζονται με την έκθεση σε τραυματικά γεγονότα ως προς το να επηρεάζουν τα επίπεδα των μετα-τραυματικών συμπτωμάτων και τον ρυθμιστικό ρόλο των μηχανισμών αυτορρύθμισης στη σχέση προστατευτικών παραγόντων στο περιβάλλον και ψυχικής ανθεκτικότητας. Εξετάστηκε επίσης η υπόθεση διαφορικής ευαλωτότητας στο στρες, και η επίδραση των οικογενειακών παραμέτρων ανθεκτικότητας στην ατομική ψυχική ανθεκτικότητα των εφήβων. Ακόμα, σκοπός της έρευνας ήταν να εξετάσει την διαχρονική σχέση της ψυχικής ανθεκτικότητας και των μηχανισμών αυτορρύθμισης για ένα σύντομο χρονικό διάστημα. Επιπλέον, διερευνήθηκε η εννοιολογική εγκυρότητα της ψυχικής ανθεκτικότητας και των μετα-τραυματικών συμπτωμάτων αξιοποιώντας διαφορετικά εργαλεία μέτρησης από διαφορετικούς πληροφοριοδότες. Η παρούσα διατριβή διεξήχθηκε κάτω από τέσσερις μελέτες, ώστε να εξεταστούν τα παραπάνω ερωτήματα. Στην πρώτη μελέτη οι έφηβοι συμμετέχοντες (n= 475) έλαβαν μέρος σε συμπλήρωση ερωτηματολογίων αυτό-αναφοράς. Στην δεύτερη μελέτη συμμετέχοντες ήταν οι έφηβοι μαζί με τους γονείς τους (n= 216), οι οποίοι συμπλήρωσαν ερωτηματολόγια αυτό-αναφοράς για την αξιολόγηση μεταβλητών που αφορούσαν το παιδί τους και τα δυναμικά της οικογένειας. Στην τρίτη μελέτη συμμετέχοντες ήταν οι ίδιοι με αυτούς της πρώτης μελέτης (n= 368) οι οποίοι κλήθηκαν ξανά να απαντήσουν σε ένα ερωτηματολόγιο αυτό-αναφοράς μετά από 4 μήνες από την πρώτη μελέτη. Επίσης, ένα μικρότερο δείγμα αυτών συμμετείχε σε γνωστικά (n= 67) και συναισθηματικά (n= 31) έργα αυτορρύθμισης. Στην τέταρτη μελέτη οι συμμετέχοντες ήταν όλοι οι προαναφερόμενοι, και επιπρόσθετα οι υπεύθυνοι

καθηγητές μιας μικρότερης μερίδας συμμετεχόντων της πρώτης μελέτης που αξιολόγησαν την ψυχοκοινωνική προσαρμογή των μαθητών τους (n= 22). Τα αποτελέσματα έδειξαν ότι ο πιο σημαντικός παράγοντας πρόβλεψης των μετα-τραυματικών συμπτωμάτων ήταν ο βαθμός κεντρικότητας των γεγονότων για την ταυτότητα των ατόμων. Επίσης, έφηβοι με πιο πρόσφατη έντονη ανάμνηση του τραύματος και που βίωσαν το χειρότερο τραυματικό γεγονός σε μεγαλύτερη διάρκεια είχαν περισσότερα μετα-τραυματικά συμπτώματα. Η ανθεκτικότητα προβλεπόταν από το χρόνο που μεσολαβούσε από το πρώτο τραυματικό γεγονός. Φάνηκε να υπάρχει διαφορική ευαλωτότητα στο στρες, αφού οι έφηβοι με πιο πολλή ευαλωτότητα στο στρες είχαν περισσότερη προοπτική για να γίνουν και πιο ψυχικά ανθεκτικοί. Οι προστατευτικοί παράγοντες από μόνοι τους δεν εξηγούσαν σημαντικά την ανθεκτικότητα και τα μετα-τραυματικά συμπτώματα, καθώς ρυθμίζονταν από τα επίπεδα των μηχανισμών αυτορρύθμισης. Η οικογενειακή ανθεκτικότητα φάνηκε να μην έχει στατιστικά σημαντική επίδραση στην ατομική ανθεκτικότητα των εφήβων, λαμβάνοντας υπόψη τα επίπεδα οικογενειακού στρες, παραγόντων κινδύνου και τα μετα-τραυματικά συμπτώματα. Οι μηχανισμοί αυτορρύθμισης προέβλεπαν τα επίπεδα ανθεκτικότητας μετά από 4 μήνες, λαμβάνοντας υπόψη το σχηματισμό διασταυρούμενων επιδράσεων. Τα εργαλεία αξιολόγησης διαφορετικών πτυχών της ανθεκτικότητας έδειξαν ότι δεν υπήρχε ένας γενικός παράγοντας περιεχομένου, αλλά τέσσερις διαφορετικές έννοιες. Υπήρχαν σημαντικές επιδράσεις των πληροφοριοδοτών στην αξιολόγηση των επιπέδων τραύματος και ανθεκτικότητας. Τα αποτελέσματα της έρευνας συζητούνται στο πλαίσιο της υπάρχουσας βιβλιογραφίας, προσφέροντας θεωρητικές προεκτάσεις και πρακτικές εισηγήσεις σε ότι αφορά την αξιολόγηση των μετα-τραυματικών συμπτωμάτων και των επιπέδων ψυχικής ανθεκτικότητας, καθώς και την καλλιέργεια των μηχανισμών αυτορρύθμισης.

ABSTRACT

This dissertation explores the mechanisms of self-regulation as processes that contribute to the development and maintenance of psychological resilience in adolescents after exposure to potentially traumatic events. The research also aims to examine the role of trauma-related in terms of affecting post-traumatic symptom levels and the role of self-regulatory mechanisms in the relationship between available protective environmental factors and resilience. The hypothesis of differential susceptibility to stress was also examined, as well as the effect of family resilience parameters on adolescents' individual resilience. Furthermore, the aim of the research was to examine the cross-lagged effects between resilience and self-regulation mechanisms that were measured at two time-points with 4-month interval. In addition, the construct validity of resilience was investigated using different measurement tools from different informants. This dissertation was conducted under four studies to examine the above questions. In the first study, adolescent participants (n = 475) completed self-report questionnaires. Participants in the second study were adolescents of the first study with their parents (n = 216), who completed self-report questionnaires to assess variables concerning their child and family dynamics. In the third study, participants were the same as those in the first study (n = 368) who were again asked to answer a resilience questionnaire 4 months after the first study. Also, a smaller sample of them participated in cognitive (n = 67) and emotional (n = 31) self-regulation computerized and paper–and-pencil tasks. In the fourth study, the participants were all of the above, in addition to the teachers of a smaller portion of participants of the first study who assessed the psychosocial adjustment of their students (n = 22). The results showed that the most important factor in predicting post-traumatic symptoms was the centrality of events for the individual's identity. Also, adolescents with more recent hotspot memories of traumatic exposure

and who reported having experienced a worst traumatic event with longer duration had higher levels of post-traumatic symptoms. Resilience was predicted from the time of the first traumatic event. Evidence of differential susceptibility to stress was found, as adolescents with high stress susceptibility were more likely to also have significantly higher levels of resilience. Protective factors alone did not significantly explain resilience or post-traumatic symptoms, as they were moderated by the levels of self-regulation mechanisms. Family resilience did not appear to have a statistically significant effect on individual adolescent resilience, while taking into account family stress, risk factors, and post-traumatic stress symptoms. Self-regulation mechanisms predicted resilience after 4 months, taking into account the cross-lagged effects between them. Evidence from measures that capture different aspects of resilience construct showed that there was not a single general content factor, but four different concepts. There were significant method effects of informants assessing trauma and resistance levels. The findings of the current project are discussed in the context of existing literature, offering insight into resilience theories and providing clinical implications about the assessment of post-traumatic symptoms and levels of resilience, and programs for building self-regulation mechanisms.

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"To all the children, who fight, tolerate, strive…"

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Chapter 1: INTRODUCTION

1.1 Statement of the problem

Victimization and trauma prevalence is alarmingly increasing, with child abuse and neglect being the most prevalent types of trauma experienced in the modern world (Syed, Cranshaw, & Nemeroff, 2020; Connor, Ford, Arnsten, & Greene, 2015; Perez-Fuentes et al., 2013). New insights are needed on childhood trauma research in order to inform prevention and intervention and deal with its detrimental effects (Danese, 2020). It is estimated that by the time children become adolescents the vast majority will have experienced at least one type of traumatic event and many of them will be exposed to multiple types of adverse childhood experiences or traumatic events (McLaughlin, Koenen, Hill, Petukhova, Sampson, Zaslavsky, & Kessler, 2013). Using the National Child Traumatic Stress Network's Core Data Set (NCTSN-CDS) which includes data across more than 50 sites in USA from youth between 0- to 21-years-old, Grasso and colleagues (2016) supported that a percentage of 38.8% of adolescents were experiencing probable chronic polyvictimization that was evidenced in all three cohorts (0-5 years, 6-12 and 13-18 years). Previous large-scale studies showed that about 71% of people aged 2 to 17 years old experienced at least one type of victimization during the last 12 months (Finkelhor, Ormrod, Turner, & Hamby, 2005). The socioeconomic disadvantage of countries with increased trauma prevalence is enormous, with the costs exceeding 100 billion per year in some countries (D'Andrea, Ford, Stolbach, Spinazzola, & van der Kolk, 2012). Despite the significant progress made in understanding childhood trauma and its effects over the past century, research paradigms for investigating trauma still need development (Danese & McCrory, 2015). Children who experience adverse childhood experience may struggle for years

with unemployment, problems in education and development of complex psychopathology (Jaffee et al., 2018; Schaefer et al., 2018). Children in US that are presented with cognitive, emotional and behavioral conditions had disproportionately survived traumatizing adverse childhood events at a percentage of 71% (Bethell, Gombojav, Solloway, & Wissaw, 2017).

Traumatic stress can have devastating effects on children, and especially on their physical, emotional, cognitive and social aspects of development. Brain architecture and the body's major stress response systems do affect, and of course, are affected by increasing stress (McLaughlin, Sheridan, Tibu, Fox, Zeanah, & Nelson, 2015). A recent study supported the moderating role that childhood trauma had on the relationship between inhibitory control and stress-related activation of the anterior cingulate cortex (Zhai, Yip, Lacadie, Sinha, Mayes, & Potenza, 2019). That is, childhood trauma may portend neurodevelopmental changes, which later on impede the proper recruitment of control-associated anterior cingulate cortex functioning during distress, which may relate to dysregulation of stress-induced affective responses. Exposure to traumas during the childhood period has been related to a variety of other social, neuropsychiatric and medical problems, such as adolescent pregnancy, antisocial behaviour, low achievement in school or early school drop-out, development of post-traumatic stress disorder, conduct disorders or dissociation, heart diseases and asthma (Grasso, Dierkhising, Branson, Ford, & Lee, 2016; Perfect, Turley, Carlson, Yohanna, & Saint Gilles, 2016). It may affect a number of domains of a child's functioning, and may usually have long-term consequences such as; cognitive disturbances, interpersonal impairment, withdrawal, distortion of attention and consciousness, neurohormonal abnormalities, higher anxiety, increased distress and depression, higher phobic disorders and alcohol dependence rates, lower educational attainment, higher delinquency and other negative behaviours such as substance

abuse and violence (Perfect et al., 2016; D'Andrea et al., 2012). Individuals who experience victimization at some point of their lives have been shown to be at increased risk for subsequent victimization and for the development of psychopathology in their later life (Fairbank, 2008; Widom, Czaja, & Dutton, 2008).

Given the increasing percentages of childhood trauma and victimization and the remaining questions on how to best measure and deal with trauma rates at the individual, the school and the societal level, research on strength-based models and resilience seems highly desired (Danese, 2020; Finkelhor, Turner, Shattuck, & Hamby, 2015). Resilience research could provide us with the knowledge to manage trauma and its consequences, and also to develop the proper prevention and intervention programs for children in low and high traumatic-stress populations. In other words, resilience studies are of great importance not only for research purposes, but also because of their potential to shape a framework for policy change and practice innovation (Christmas & Khanlou, 2019; Masten, 2018). Self-regulation mechanisms, including cognitive, emotional and behavioral self-regulation, that involve the acts of managing emotion and cognition to enable goal-directed behavior (Murray, Rosanbalm, Christopoulos, & Hamoudi, 2015), seem to be a valuable addition to resilience studies. Self-regulation mechanisms are a needed add-in for resilience research, as they could operate as a bridge from theory to policy and practice (Brom, Pat-Horenczyk, & Ford, 2009; Murray et al., 2015).

Recent biopsychosocial models recognize the major role that self-regulation emerges in explaining psychopathology outcomes after experiencing a severe threat or a traumatic event (McLaughlin & Lampert, 2017). Also, even though self-regulation has been proposed as a main process underlying resilience in adolescents (e,g, Dias & Cadime, 2017; Dishion & Connell,

2006) no integrative approaches exist to link traumatic exposure, self-regulation and resilience. This inhibits potentially fruitful theoretical and clinical implications.

1.2 Aims of the present project

Previous research on trauma, self-regulation and resilience has mainly been conducted in isolation. Thus, research from the trauma literature emphasized on looking at the self-regulation mechanisms that can increase the risk for psychopathology development, and research from the resilience literature emphasized on investigating protective processes at the levels of individual, family, school and community. The main aim of the present project is to examine the effects of traumatic stress exposure on resilience and examine self-regulation mechanisms as processes that potentially enhance resilience after exposure in trauma, while considering the available risk and protective factors in family, school and community.

It is acknowledged that many factors may be related to the development of resilience. It is also recognized that the processes retrieved by individuals in order resilience to be developed may differ depending on the type of trauma, and also that low-traumatic stress populations may show different outcomes and processes compared to high-traumatic stress populations, given the differential susceptibility to stress hypothesis (Belsky & Pluess, 2009). The present study aims to test the hypothesis that individuals not exposed to traumatic stress have lower potential to develop resilience, whereas the resilience potential seems to be higher for individuals exposed to higher levels of traumatic stress. A range of risk and protective factors has already been identified, that seem to be similar when examining samples with different types of trauma (Bonanno, Galea, Bucciarelli, & Vlahov, 2007; Punamaki, Qouta, & El-Sarraj, 2001) and samples without severe trauma experiencing only daily hassles (Diehl, Hay, & Chui, 2012).

Therefore, it may be that the processes employed to achieve adaptation are similar in low-traumatic stress and high-traumatic stress populations, even though the potential for resilience development may be different. The present study aims to bring an insight to all the above questions.

Specifically, the research program aims to identify a theoretical and structural model for the role of self-regulation processes in the development of resilience after psychological trauma. Through the project it will be explored if the model stands for early adolescents with different types and levels of trauma, without assuming standard levels of trauma associated with particular traumatic events. The testing of the differential susceptibility to traumatic stress hypothesis (Belsky & Pluess, 2009) described earlier, will be able to approach and explain the pathways for differential development of resilience based on the level of trauma. Importantly, the trauma and resilience constructs will be considered continuous. Level of trauma will be based on three indexes, namely traumatic history, traumatic impact and centrality of traumatic events. Adolescents with traumatic history but without traumatic impact will be able to be differentiated from those with both traumatic history and traumatic stress. The indexes of trauma will be able to be used (a) separately on the hypothesized model, (b) as observed variables forming a latent factor and (c) as a combined score based on the cut-off scores used for each of the trauma measures. This procedure will allow for specific investigations based on the type of trauma conceptualization and for the concurrent conceptualization of trauma level based on various dimensions.

Further, the project aims to examine the self-regulation mechanisms enhancing resilience during the sensitive period of early adolescence at different points in time, acknowledging the dynamic process of resilience development and the rapid changes occurring in the biological and

socio-emotional development of early adolescents and the reports that traumas occurring before adolescence have the most longitudinal and toxic effects on development (e.g., Ehlert, 2013; Ogle, Rubin, & Siegler, 2013). The project aims to involve individuals at this developmental stage, because they have been systematically ignored from previous literature, even though many psychopathology disorders have their onset during adolescence (Coleman, 2011).

The present study also aims to test the longitudinal associations between the basic variables of the study, namely trauma, resilience, self-regulation mechanisms and protective factors. A cross-lagged effects methodology with a four-month interval was used in order to test these associations. At the same time, comparisons were be made on the self-regulation mechanisms of participants with and without trauma in order to investigate if differences on self-regulation mechanisms are attributable to traumatic exposure and traumatic stress.

The dissertation is organized under four studies with the following *aims*:

1) The first study aims to examine the factors predicting resilience in adolescents with different levels of traumatic stress. This study emphasizes on the investigation of the trauma parameters and their independent and additive effect on traumatic stress reactions and resilience. This study also examines the interaction between trauma parameters, self-regulation mechanisms and protective factors, in order to predict traumatic stress and resilience.
2) The second study aims to examine the impact of family, school and community on adolescent outcomes. This study emphasizes on the examination of family stress and related risk factors in the context of school and community that may impact adolescent traumatic stress reactions, psychopathology and resilience.
3) The third study aims to examine the changes in resilience across a short period of

time (ranging from 3-4 months) and the self-regulation mechanisms' effect on resilience, while controlling for the previous levels of resilience. This study specifically emphasizes on the investigation of the effect of executive skills and emotion regulation on traumatic stress reactions and resilience.

4) The fourth study aims to examine the consistency of resilience measures. This study involves the comparison among the assessment of resilience using different approaches: a) resilience as a process outcome after traumatic stress, b) resilience as a compilation of protective factors, c) resilience as reflected by psychosocial adjustment indicators and d) resilience as the absence of psychopathology. Also, this study aims to investigate the comparison of resilience scores based on self-report, parental report and teacher report. The use of facial metrics on arousal, fear and heart beat analyzed by FaceReader will be considered as a state measure of resilience, based on correlations with the above.

1.3 Significance of the project

The present project will provide an overview of previous literature on trauma and resilience, with emphasis put on the self-regulation theories linked to both that could inform practice. The project explores the mechanisms of self-regulation as processes that contribute to the development and maintenance of psychological resilience in adolescents after exposure to traumatic events. Importantly, measurement of trauma, resilience and self-regulation mechanisms is based on previous reviews (e.g., Pai, Suris & North, 2017; Saunders & Adams, 2015; Windle, Bennett, & Noyes, 2011) and agrees with recent recommendations (Danese, 2020).

The investigation of the self-regulation mechanisms as processes enhancing resilience after trauma, will add new evidence both in the theoretical background for trauma, resilience and self-regulation. Integration of these areas of research will advance our understanding on the unique and cumulative and/or interaction effects among those constructs. With the recognition that a complex of factors cumulatively and collectively interplays with interpersonal mechanisms, the project aims to overcome the pitfalls of previous studies that tended to measure isolated risk and protective environmental factors.

As the identification of separated protective characteristics concerning the individual (e.g. age, education) and the family (e.g. spirituality, financial management), more interactive effects on resilience development are absent. The investigation of self-regulation mechanisms as processes along with individual resilience may be the key not only to a more integrated conceptualization of resilience, but also to the identification of the linkage between contextual and individual factors with the processes involving the actions towards goal-directed behavior in order resilience trajectories to follow. The mechanisms of self-regulation may be the prerequisite to resilience development after significant trauma, as they may be the processes needed to prepare, use and evaluate the protective factors and resources that are already available. In this process, familial parameters such as family stress and family resilience may enhance our understanding on the interaction between the individual and their context after exposure to trauma.

At the long-term, the project will be able to elucidate the needed elements for prevention and intervention programs which aim to develop resilience. Even if the focus of previous investigations used to be on protective factors, a considerable amount of them are stable or cannot easily be acquired (e.g. absence of parental psychopathology, existence of siblings).

Therefore, an in depth exploration of the self-regulation processes leading to resilience, will aim to specify new potential pathways for clinical practice with children and adolescents exposed to psychological trauma, and to identify the relationships between self-regulation mechanisms and use of protective assets. Further, the project will be able to identify the potential of family stress and family resilience as processes with significant contributions on individual resilience that should be considered in prevention and intervention programs.

To our knowledge, this is the first study examining the prevalence of exposure to traumatic events in adolescents in Cyprus. At the same time, there is scarce empirical investigation of the differential susceptibility to stress hypothesis, and the present study will add in the theoretical background regarding this hypothesis. The integration of multiple-leveled influences on adolescents, by individual processes, family, school and community gives the potential of theoretical adaptation and a range of clinical implications to enhance resilience. The measurement of trauma and resilience in a continuous way that considers multiple parameters and conceptualizations, along with the use of data from different informants is unique and offers the opportunity to examine the constructs' validity and consider method effects.

1.4 Theoretical and practical contributions of the project

The project adds in the theoretical background of trauma and resilience, as it investigates the unique and cumulative effects of variables that have been already proposed in the literature, but have not been usually integrated. Some examples include the protective factors available in the environment, the emotion regulation or the attentional focusing. The project examines the differential susceptibility to stress hypothesis, in order to extract theoretical implications of which trauma-related parameters cause extra risk and low potential for individuals to be more

resilient. The project also deals with the validity of resilience construct, in order to inform theoretical literature with regard to the most consistently valid conceptualizations of resilience, which have the best and more reasonable associations to other constructs.

At the practical level, the project contributes to the areas of assessment, prevention and intervention. The findings aim to assist efforts related to developing valid trauma and resilience measures that would allow exploration of different trauma-related parameters, such as number of traumatic events experienced, traumatic exposure duration and centrality of event to self. Those parameters might be important determinants of resilience that would identify individuals who are at low- and high- risk to develop resilience, in order to plan preventive programs and early interventions. The findings of the project may also be used to build cost-effective treatment programs that emphasize on the development of self-regulation mechanisms.

1.5 Basic concepts

1.5.1 Trauma

A traumatic event is considered an event that includes exposure to an actual, or a threat for, death, severe injury, illness, or violence by direct experience, witnessing or learning about the event, or experiencing exposure to the aversive details of an event (APA, 2013). The traumatic event usually comes with the experience of fear, anxiety, threat or other intense emotions and may cause psychological, emotional, social, and/or physical harm. The more severe presentation of symptoms experienced after exposure to a traumatic event may result to the diagnosis of post-traumatic stress disorder (PTSD).

1.5.2 Resilience

Resilience captures the pathways and processes of positive adaptation during or after significant adversity or risk (Masten, 2014) and this identification should be based on a) the exposure to significant adversity or risk that could predict high levels of negative or undesirable outcomes and b) the adequate adjustment despite adversity (Motti-Stefanidi, 2018). Resilience has been described as the capacity that a dynamic system has to rebound from disturbances that threaten the functionality, viability and/or development of the system (Masten, 2007). Due to the dynamic interactions inherent in resilience which includes many processes in between many systems, Masten (2018) argues that resilience should not be considered a singular or stable trait. The research area of resilience is complex, as it encompasses findings from biological, psychological, cultural, social and spiritual dimensions in multiple levels, such as the individual, school, household, community, and even the broader social and political economy (Christmas & Khanlou, 2019). Based on the way we understand resilience, the strategies used in research, policy and practice for prevention, intervention and promotion are influenced (Masten, 2018). Panter-Brick (2014) raised the issue of variability in the potential dimensions of adversity and the respective variability in the domains of functioning that may be relevant to health and well-being and may thus reflect potential resilience indicators. Christmas and Khanlou (2019) noted that there is a key difference between defining resilience and mental health, as the WHO definition of mental health implies that people cope with "normal stresses of life", whereas resilience definitions more explicitly state the "struggle with significant adversity of risk".

1.5.3 Family resilience

Family resilience has emerged as a term because of the multidimensionality of resilience and due to the conceptualization of family as the entity which encounters stress, challenges or crises during various stages in life. Hence, family resilience develops as a result of the interaction between family strengths and the stressors encountered at each family life stage (Simon, Murphy, & Smith, 2005). Based on the system processes, family resilience develops through the mechanisms of the belief systems of the family, the organizational pattern of the family and the degree of communication between the family members. Those family processes enable the family system to move from stress and crises to adaptation (Walsh, 2016a; Walsh, 2003), fostering individual resilience of the family members as well. A framework of family resilience emphasizes the strengths of the family, which may vary over time and may depend on different variables of the context, such as family values, family structure, available resources for social support and various life challenges. The functioning of family and the development of family resilience are fostered by the beliefs of the family regarding growth and problem solving, which assist the family members to make meaning of the trauma, to gain a sense of coherence and to facilitate hope (Walsh 2016b; Walsh, 2003). On the other hand, the interpretations of traumatic events by families in a way that is characterized by anxiety, guilt or shame may prohibit the development of resilience, since children will experience their trauma, with widely held but faulty assumptions about trauma by their family, that might reduce the opportunities for optimal adaptation (Walsh, 2002).

1.5.4 Self-regulation

Self-regulation mechanisms have received various definitions and been described with a

number of terms, including “willpower”, “effortful control”, “self-control”, “executive control”, “emotion regulation” and “self-management”. The concept of self-regulation has been proposed about four decades ago by Carver and Scheier’s (1981), who conceptualized self-regulation as involving control, preparation, direction, evaluation and correction of one’s own actions, with the aim to move toward or away from various goals. Adding on their self-regulation theory, Carver and Scheier (1990) also suggested that in the process of regulating one’s self, emotions do not simply react to whether a discrepancy exists or not. Emotions are better designed to register change, and are suggested to react to the rate of progress toward the goal or standard. If an individual is moving toward his goal on or ahead of schedule, he will feel positive emotions. On the other hand, if progress is overly slow, negative emotions will be felt by the individual (Carver & Scheier, 1990). The novel contribution to the theory is that positive affect can be felt long before one reaches one’s goal, simply because an individual may feel that he is making satisfactory progress (Baumeister, Schmeichel, Vohs, & Petrocelli, 2007). Based on these suggestions, it is evident that as individuals grow, self-regulation becomes more identical to emotional regulation (Diamond & Aspinwall, 2003).

From an applied perspective, self-regulation is defined as the act of managing cognition and emotion to enable behavior that is goal-directed, including organization of behavior, impulse control and constructive problem solving (Murray et al., 2015). While emotional and cognitive domains serve as the building blocks for regulated behavior, it is recognized that these processes interrelate in complex ways and that it may be difficult to disentangle the empirically separate the separate domains, especially in children (Raffaelli, Crockett, & Shen, 2005).

Based on the model of self-regulation proposed by Murray and colleagues after a review on the literature (2015), cognitive self-regulation includes focused effortful attentional control,

executive control and planning (including also cognitive flexibility and mental shifting), goal-setting, self-monitoring, attributions, problem-solving, perspective taking (including also theory of mind and future orientation) and decision making. Emotional self-regulation is conceptualized as the active management of strong and unpleasant feelings that results in adapting functioning during emotionally arousing situations. Emotion regulation skills include feelings identification, awareness and understanding of emotions, ability to self-soothe and tolerance or management of internal distress. Emotion regulation includes efforts to modify one's own experience or expression, or the emotion-eliciting situation (Diamond & Aspinwall, 2003), a process that may involve attention shifting, appraisal and cognitive restructuring (Murray et al., 2015), due to the bi-directional influences and interactions with cognitive regulation skills (Blair & Ursache, 2011). Behavioral self-regulation includes following rules, delay of gratification, persistence to a task, impulse control, goal-oriented behaviors (such as organization of time needed to complete a task) and enactment of coping strategies (e.g., physical activity, breathing relaxation exercises and seeking support).

1.6 Hypotheses

The hypotheses set for the first study are:

(a) trauma parameters will differentially predict traumatic stress reactions. We expect that the centrality of the traumatic event will be the best predictor of traumatic stress.

(b) self-regulation mechanisms and protective factors will significantly predict traumatic stress reactions and resilience.

(c) self-regulation mechanisms will have a higher effect on traumatic stress reactions and resilience compared to protective factors.

(d) self-regulation mechanisms will moderate the protective factors used by the adolescents to predict traumatic stress reactions and resilience.

(e) the differential susceptibility to stress hypothesis will be confirmed, thus those with more traumatic exposure will have higher resilience scores.

The hypotheses for the second study are:

(a) family resilience will significantly predict adolescent resilience, traumatic stress and psychopathology symptoms.

(b) family stress will moderate the relationship between family resilience and adolescent post-traumatic stress reactions.

(c) community, school and family risk factors will moderate the effect of family resilience on adolescent resilience.

The hypotheses for the third study are:

(a) resilient outcomes will be maintained across time.

(b) self-regulation will significantly explain the level of resilience corresponding on traumatic stress exposure and when controlling for previous resilience levels.

The hypotheses for the fourth study are:

(a) significant method effects will be found based on the resilience measure used.

(b) significant method effects will be found based on the informant of adolescent outcomes.

Chapter 2. REVIEW OF THE LITERATURE

2.1 Theoretical background in trauma

2.1.1 Cognitive theories of psychological trauma and their suggestions for trauma assessment

There are conflicting opinions regarding trauma measurement, as far as the coherence of the victims' memory is concerned. Based on the dual representation theory for traumatic events, the memories about trauma are not always accessible by language, and may often be presented as poorly organized and vague (Brewin & Burgess, 2014; Brewin, Gregory, Lipton, & Burgess, 2010; Brewin, Dalgleish, & Joseph, 1996), suggesting that traumatic memories are incoherent and difficult to be fully retrieved and integrated. That happens possibly because of the dissociative symptoms of trauma and the mechanisms that the victims employ in order to be prevented from recurrent access to their traumatic memories (Ehlers & Clark, 2000). Indeed, studies on dissociation have supported that in order to be prevented from re-experiencing a traumatic event, victims of trauma may hinder the emotional and cognitive processing of the trauma, underestimating its impact, in order to lessen their discomfort and protect themselves from overwhelming emotions (Merckelbach & Muris, 2001). Due to fantasy proneness which is related to dissociation, individuals exposed to trauma who also present high dissociation may be presented with positive response bias with regard to autobiographical traumatic memories. Therefore, they may overreport trauma or evaluate an ambiguous event as more traumatic, compared to individuals with low dissociation due to hypersensitivity to elements that remind them the trauma (Rassin & Rootselaar, 2006). Rassin and Rootselaar (2006) have found negative correlations between labeling of trauma and dissociation, suggesting that individual differences

have an important role in the perceptions of trauma, as some people may be more possible to appraise an event as traumatic compared to others. Under this framework, past victims of trauma are more susceptible and sensitive to experience stress by another traumatic event. Because of these individual differences regarding the perceptions of trauma, self-reports may reflect analogous differences in the validity of the reports (Rassin & Rootselaar, 2006). Indeed, it remains controversial to define the presence of trauma not only objectively, but also by the emotional reactions by the victim (McNally, 2009).

On the other hand, researchers support that the degree of coherence of the trauma memory depends on whether the trauma fits into the rest of life memories, and on the extent to which the victim considers trauma a central part of his/her life (Berntsen & Rubin, 2006). Those conceptualizations suggested that traumatic memories are substantially more coherent and not less integrated in one's life story (Rubin, 2011). Rubin (2011) has not only showed that traumatic memories are more coherent compared to other memories, but also that there is no interaction with the traumatic event, in a sense that the coherence of memories does not depend on the type of trauma; suggesting homogeneity and comparability across the traumatic memories of different traumatic events. Research has supported that victims of trauma tend to evaluate trauma more objectively when they adopt the visual perspective or an observer, usually because of fear, or as a mean of cognitive avoidance (Robinaugh & McNally, 2010). Other characteristics are also important when trying to assess the coherence of traumatic memory and its congruence with oneself, as the degree to which one feels guilty or ashamed because of the trauma. In this framework, low shame with high levels of guilt are associated with lower distress and lower trauma evaluation, because of the limited connection of a memory to one's life narration (Robinaugh & McNally, 2010); hence pointing to the need to consider self-referential shame.

According to Kindt and Engelhard (2005) reasoning and attribution styles and catastrophic interpretations in general, may add independently or concurrently to the development of post-traumatic stress disorder following trauma exposure. Berntsen and Rubin (2006) agree that the influences of attribution styles and meaning making occur at a higher degree when an event is considered negative, unpredictable and rare. In this case, a person not only creates specific attributions of meaning for the current event, but also generated expectations for the future. This may also explain the presented symptoms of seemingly unnecessary worries, extensive rumination, and compulsions to avoid similar events or traumatic situations in the future. However, attribution style and meaning making may be also indicative of the increased accessibility of highly traumatic memories, which along with high worry and rumination, prompts the person to overestimate the general frequency of the traumatic event and the likelihood of future exposure to traumas as well (Berntsen & Rubin, 2006); thus ruining the objectivity in the measurement of trauma. Depending on the attribution style and meaning making of the trauma, the traumatic event may be considered as central to one's identity and highly important for the understanding of oneself, or as not central (Bernard, Whittles, Kertz, & Burke, 2015; Blix, Birkeland, Solberg, Hansen, & Heir, 2016; George, Park, & Chaudoir, 2016). On the other hand, dissociation coping styles may function alternatively, preventing the individual from higher evaluations and overestimations of traumatic frequency and severity, although the traumas may be still considered central to one's identity and self-understanding. The differences between traumatic reactions (dissociation or ruminative negative worrying) may rest on individual differences and on the degree of vividness and intrusiveness of a memory that is phenomenologically very painful to be relived (Berntsen, Willert, & Rubin, 2003). Based on this conceptualization, it may be more appropriate to assess traumas at least one month after the

traumatic event, in order to prevent the memory from considerable dissociation or rumination effects (Cohen, 2010).

In any case, the cognitive organization of the traumatic memory should be measured, as it is considered to mediate the relationship between the experience of trauma and the presentation of post-traumatic stress symptoms, or resilience in the other end of the continuum (Berntsen & Rubin, 2006). Information processing theories have been consistently correlated with a number of particular elements of the processing of traumatic events (Kindt & Englhand, 2005), such as thought inhibition (as it is related to the ability to inhibit undesirable stimuli or thoughts before they reach the level of consciousness), working memory (which is related to the intentional effort to suppress intrusive thoughts), memory disorders (as related to memory fragmentation) and cognitive appraisal (which has been related to the experience of associative reactions).

The cognitive model (Ehlers & Clark, 2000) has been the most empirically supported theory for psychological trauma. Based on this model, pathological reactions to trauma occur when people process the information that has to do with trauma in a way that they perceive a sense of current threat; either external that has to do with the safety of the individual, or internal, that has to do with the future and the possible changes in the sense of self. The processes that cause the sense of current threat have to do with individual differences in the cognitive appraisal of trauma and in the nature of traumatic memory and its association with other autobiographical memories. According to the model (Ehlers & Clark, 2000), previous negative assumptions for one's self may be responsible for the mental defeat presented after trauma, during which the individual perceives himself as weak, ineffective or unable to protect himself. Previous traumatic experiences and despair increase the vulnerability to threat. The traumatic memory is poorly processed, with an incomplete context in terms of time and place, with inadequate integration in

autobiographical memories. This leads to the difficulty to intentionally retrieve the traumatic memories and to phenomena such as reliving the past, lack of association between the traumatic memory and related contextual information and easy triggering of the memory by physically similar stimuli.

Since a number of peri-traumatic effects during memory coding may affect the modality and characteristics of the traumatic memory (Ehlers & Clark, 2000), these should be assessed during measurement for trauma. Such peri-traumatic effects may be dissociation, inability to self-report the traumatic experience, emotional numbness and lack of cognitive ability to evaluate the trauma. The psychological impact of a traumatic event is maintained by behavioral strategies in which people engage, such as thought suppression, distraction, avoidance of stimuli that remind trauma, use of alcohol or medication for managing anxiety, abandonment of previous activities, use of safety behaviors for the prevention or limitation of negative results related to trauma, and also by dysfunctional cognitive styles, such as selective attention on threatening stimuli, rumination and dissociation (Ehlers, 2010). The relationship between traumatic memory and cognitive appraisals for trauma and its consequences is reciprocal. As the person is unable to remember all the details of the event, the sense of threat is maintained, and an analogous effect happens with the emotions of the person (e.g., loneliness is interpreted as a sign that one's relations have permanently changed to the worse).

The cognitive model for psychological trauma has received good support in adult populations (e.g., Ehlers, Clark, Hackmann, McManus, & Fennell, 2005; Ehring & Watkins, 2008) and some support in children and adolescent populations aged 5 to 19 years (e.g., Bryant & Guthrie, 2007; Ehlers et al., 2003; Meiser-Stedman, Yule, Smith, Glucksman, & Dalgleish, 2005). A recent meta-analysis on the factors that are longitudinally related to symptoms of

posttraumatic stress in young populations (Alisic, Jongmans, van Wesel, & Kleber, 2011) found that the most significant predicting variables were the posttraumatic stress symptoms of parents and parental distress, the short-term and acute stress symptoms of young people after the event, as well as their depressive symptoms and anxiety.

2.1.2 Emotional theories of psychological trauma

Even though a great emphasis in the literature has been given to the cognitive models explaining the development and maintenance of psychological trauma consequences and posttraumatic stress symptoms, emotions play a considerably important role. The emotional-processing theory (Capaldi, Zandberg, & Foa, 2017; Foa & McLean, 2016; Foa & Rothbaum, 1998) suggested that individuals with stricter positive and stricter negative views of themselves and the world before trauma are those who are more vulnerable to posttraumatic stress symptoms due to the incongruence of trauma with the positive views and the confirmation of the negative views through the trauma, respectively. Due to the need to activate fear in order to emotional process the traumatic event, this theory was one of the first that clearly supported prolonged exposure as a treatment for trauma. The mechanisms through which exposure is effective have to do with (a) the systematic reliving of the event that promotes fear habituation and strengthening of the belief that anxiety will pass, (b) the prevention of the negative reinforcement of avoidance of the event, (c) the inclusion of safety information in the traumatic memory because of the repetition in a safe environment, (d) the better discrimination between the trauma and other threatening events, (e) the opportunity to experience the traumatic event while having a sense of mastery, (f) the rejection of previous negative appraisal that are incongruent with the information related to trauma and (g) the formation of a more organized memory that is more possible to be

integrated into the rest of memory system (Brewin & Holmes, 2003; Iyadurai et al., 2019; Zoellner et al., 2002).

Also, the literature concerning the emotional aspects of trauma, posits that individuals that have experienced a traumatic event are usually presented with self-dysregulation (Brom et al., 2009). Self-dysregulation is strongly related to the overactivation or underactivation or avoidance of emotions and interpersonal processes, with the central emotions being anger, distress and dissociation. Frewen and Lanius (2006) have supported that the overactivation of emotion is usually evident through excessive suppression, stimulation inhibition, emotional numbing, dissociation, de-realization and out of body experiences. On the other hand, underactivation of emotion is usually presented by lower ability to inhibit and control fear and distress and reliving traumatic experiences (Frewen & Lanius, 2006). However, overactivation of emotion should be first evident before the expression of too little emotion, in order one to safely interpret this as a sign of low inhibitory ability, or increased suppression.

The cognitive models on psychological trauma clearly focus on basic emotions involved in response to trauma, namely shame, guilt and disgust. The recognition of hotspots during the narration of a traumatic event seems to be the most strongly related part to emotions, since hotspots cause the highest distress during narration (Holmes, Grey, & Young, 2005). Investigating the emotions related to the hotspots, Holmes and her colleagues (2005) found that the most common emotion was fear, but very frequently the observed emotions were dissociation, sadness, surprise, anger, helplessness, shame and guilt. According to Ehring and Quack (2010), the severity of post-traumatic stress symptoms could be predicted by difficulties in emotion regulation, with emphasis on lack of emotional clarity, since trauma has been also related to alexithymia, negative stance on emotional expression, a tendency to suppress or

withhold negative emotions and reports of difficulties in regulating emotions. Importantly, the emotion regulation difficulties have been the most significant predictor of post-traumatic stress symptoms, regardless of characteristics that had to do with trauma, such as trauma type and duration (Ehring & Quack, 2010).

Emotion regulation difficulties seem to be indirectly related to the maintenance of post-traumatic stress symptoms, because of their negative effects on interpersonal relationships and global functioning (Cloitre, Koenen, Cohen, & Han, 2002). Tull, Barrett, McMillan, and Roemer (2007) found that the relationship between posttraumatic stress symptoms and emotion dysregulation focused on the lack of emotional acceptance, on the difficulties with impulse control and on the lack of access to effective regulation strategies. Especially traumas such as sexual abuse are considered to impact on the children's and adolescents' ability to achieve developmental goals that have to do with emotion regulation and development of interpersonal relationships (Chaung et al., 2018; van der Kolk, 1996). Adding on their emotion regulation difficulties, individuals exposed to psychological trauma usually experience fear to experience and difficulties to express their anger. Also, their temporal dissociative experiences confirm their beliefs that they are unable to deal with intense emotions.

A major step in the literature linking trauma to emotion regulation difficulties has been the application of a program which included training in emotional and interpersonal regulation in the first phase, in order to prepare the participants for the second phase of exposure (Cloitre et al., 2002). The first phase included recognition and labeling of emotions, anger and anxiety management, distress tolerance, emotional acceptance and long experience of positive emotions, recognition of interpersonal schemata that are based on the traumatic event(s) and their activation in daily life, recognition of the conflict between the emotions stemming from trauma

and their current interpersonal goals, role plays to enhance self-control and role-plays for the development of flexibility in interpersonal relationships. The results of the trial showed that controlling for post-traumatic symptoms, the enhanced interpersonal effectiveness and the improvement in emotional processing were the best predictors of change in post-traumatic symptoms at the end of the treatment.

Even though literature has been suggesting the importance of the emotional component in trauma (e.g., Chang, Kaczkurkin, McLean, & Foa, 2018), no recent theoretical perspectives have been proposed. Previous arguments thought, that emotion processing theories alone cannot fully explain the reactions to traumatic events, therefore considering cognitive processing of trauma is also warranted (Ullrich & Lurgendorf, 2002). Recent theoretical models support that emotion regulation difficulties may be related to individual differences in autobiographical memory (Goodman, Goldfarb, Quas, Narr, Milojevich, & Cordon, 2016). Also, there is growing literature supporting the effects of emotion regulation in specific aspects of PTSD (e.g., Aldao, Nolen-Hoeksema, & Schweizer, 2010). Increasing evidence has to do with the effect of emotion dysregulation on dissociation in particular. For example, Powers, Cross, Fani and Bradley (2015) investigated a sample of women with PTSD and found that emotion dysregulation predicted dissociation even after controlling for the level of traumatic exposure and alexithymia. Most researchers agree, that the effects by emotion regulation and cognitive appraisals are hard to be disentangled (e.g., Zalewski, Lengua, Wilson, Trancik, & Bazinet, 2011). On the other hand, researchers who chose concurrent examination of both usually support cognitive variables as explaining more variance of post-traumatic symptoms compared to emotion regulation strategies. For example, in a study examining multiple mediation models to predict post-traumatic stress symptoms after the experience of childhood abuse, trauma appraisals effect was found to

significantly stronger than the indirect effect by emotion regulation difficulties (Barlow, Turow, & Gerhart, 2017).

A biopsychosocial model has been proposed by McLaughlin and Lambert (2017) to explain how risk and resilience factors may interact with strategies to process threat. Enhanced threat processing performed by individuals who experience trauma exposure may result to information processing biases, difficulties with emotion regulation, heightened emotional reactivity and altered emotional learning. Those processes may result in outcomes that have to do with mental health internalizing problems, externalizing problems or PTSD. Based on that model, PTSD is conceptualized as a separate outcome from internalizing and externalizing problems, in order to be in line with its current classification in a different category in DSM-5, named 'Trauma and stressor-related disorder'.

2.1.3 Theoretical links from family stress to child's trauma

Three main theories have tried to explain the relationship between parental stress and parental post-traumatic symptoms with children's stress and development of dysfunctional symptoms and disorders. According to the psychodynamic theories which include the attachment theories, cumulative trauma develops as the result of the limited ability of the parents to constitute a protective shield for their children, in order their children to form secure attachment relationships and to develop stabilized intra-psychic functions (Khan, 1963; Bowlby, 1980). Based on the psychosocial stress theory, trauma in children is considered as the result of unpredictable extreme events that lead to the suppression of children's coping strategies and defense mechanisms. In this context, poor parenting and inadequate parental responses in terms of psychological and physiological reactions to their children, combined with many other factors

that place the family in the position of psychosocial stress (e.g. parental abuse, family violence) form types of recurrent traumatization of children. This secondary traumatization that happens as a result of both children's exposure to stress and parental symptoms because of stress, has more possibilities to be transmitted transgenerationally (e.g., Yehuda & Bierer, 2007).

Finally, the cognitive theory introduced the concepts of information processing through the formation of schemata in children that include maladaptive representation of the self, the others and the world and prevent children from the healthy development of their self-confidence and feelings of safety for the world. In this way, the experience of trauma by parents, influences children's frame of reference, assertiveness in personal interactions, general functioning in intimate relationships, sense of self-confidence, autonomy and security (McCann & Pearlman, 1990). Children may also display the same symptoms as the symptoms expressed by their parents and integrate the traumatic events of their parents within their individual schemata. Based on the cognitive theory, traumas are transmitted to children through the silence of parents, who avoid discussing the trauma. Because of this, children come to the position to fantasize the actual traumatic events. Also, traumas are transmitted through identification, based on which children avoid talking about the traumatic events in order to feel recognized and accepted, but at the same time may feel guilty in an analogous way as their traumatized parents (Danielli, 1998). Trauma might also be transmitted through over-disclosure by parents, during which children are silent and try to repress the traumatic memories in order to protect their parents. Transmition of trauma can occur through re-enactment as well, during which parents try to relive the event, in order to retest the degree of validity of their new view of the world, and transform the world-view that they had acquired as a result of traumatic exposure.

2.2 Measurement of trauma and the role of family stress

Even though more than 35 instruments exist for the assessment of trauma in children and adolescents, very few of them concurrently measure the history of the trauma exposure, the trauma's impact and the presented symptoms following trauma (Strand, Sarmiento, & Pasquale, 2005). The assessments of trauma through different raters is more comprehensive, since children and adolescents are considered as better reporters of internalizing symptoms than their parents and parents report externalized or behavioral symptoms better than their children (Greenwald & Rubin, 1999a, 1999b). The potential threats to validity of trauma measurement could be overcome by introducing more raters than only children or adolescents (Saunders & Adams, 2015). Interviews with parents seem to be the most valuable method, especially when they are asked questions regarding the family psychiatric history, the child's developmental history and life prior trauma, the traumatic experiences of their child and the consequences of trauma, their expectations about child's reactions and their actual reactions to trauma, the treatment history after trauma and the current functioning of their child (Perrin, Smith, & Yule, 2000). Given that parents tend to under-report trauma (Perrin et al., 2000), the combination of parental and children's report could be able to give a more accurate account of trauma. Importantly, the use of parental reports only would not have been able to give enough estimation of trauma, since the child's subjective experience of the traumatic event is at least as valuable and important as any other objective characteristics of the trauma (Foy, Madvig, Pynoos, & Camilleri, 1996). Time of measurement is also important. Importantly, Newbury and colleagues (2018) showed that only fair agreement was found between prospective and retrospective reports (all Kappa's ≤ 0.31) of childhood maltreatment. Therefore, the authors suggested that retrospective and prospective measures capture groups of individuals that do not overlap with each other, and specifically

when young adults are assessed there is an increased risk for psychopathology due to maltreatment memory recall and associated memory biases.

Family stress is considered an important factor in the relationship between a child's trauma and its aftermath, regardless of the aftermath, which may be post-traumatic stress disorder, resilience, or other tremendous outcomes. Daud, Skoglund, and Children (2005) showed that children of traumatized parents had not only significantly higher scores of post-traumatic stress disorder, behavioral disturbances, anxiety and somatization problems, adjustment problems, psychosocial stress and depression compared to children of non-traumatized parents, but had also significantly higher psychosocial stress, anxiety and depression than their traumatized parents.

2.3 Theoretical background in resilience

2.3.1 The waves of resilience research

Resilience as a term emerged almost five decades ago, but a consensus with clarity and consistency about its operationalization is still lacking (Khanlou & Wray, 2014). Resilience was at first conceptualized as an individual trait that could lead to adaptation in the context of adversity (Sapienza & Masten, 2011; Wright, Masten & Narayan, 2013). Four waves of research have been featured in resilience literature (Sapienza & Masten, 2011). The first, individualistic wave entailed descriptions and investigations of personal traits and characteristics that could lead to positive adaptation in the face of significant adversity (Wright et al., 2013). The first wave was focused on research regarding factors that are related to resilience. These factors concerned individual characteristics at the beginning of the first wave and then, more recently, concerned family characteristics and contextual or community factors. The second wave emerged soon,

because of the gaps of the previous to explain the processes involved in resilience development. Using advanced longitudinal methodologies and a developmental approach, that wave focused on the trajectories that could lead to different or similar outcomes according to the interacting systems and timing (Khanlou & Wray, 2014). The first two waves had already identified well-replicated protective factors and some interaction processes between risk and protective factors that could be used for the aims of the third wave; to intervene and promote resilience (Sapienza & Masten, 2011). Therefore, the third wave of resilience research led to efforts to reprogram or build resilience through intervention and prevention programs, respectively (Khanlou & Wray, 2014). The fourth wave has come to highlight the role of neurobiology (Russo, Murrough, Han, Charney, & Nestler, 2012) and contextual specificities (Harvey & Delfabbro, 2004). This wave emerged after the recognition that personal agency has been overemphasized and that the same factors could act as risk and protective ones, depending on the context (Harvey & Delfabbro, 2004). The fourth wave is centralized on the embodiment of resilience in the cultural and contextual systems, which provide individuals with resources (assets) to improve their adaptation.

Thus, contemporary definitions of resilience encompass community resilience after collective adversities, and conceptualize personal resilience as the individuals' ability to navigate the available social assets to manage adaptation. The ecological view of resilience is being studied, mostly with populations that have survived a community trauma (such as war, physical catastrophe, being a minority etc.). Especially in "high-risk" environments, such as the above, resilience is reported to depend more on the availability of contextual resources/assets (Ungar, 2011). Based on Bronfenbrenner's ecological theory (1979; see also Houston, 2017), resilience of children in communities who experience significant adversity stems from multiple layers,

namely the individual (e.g. age), the microsystem (e.g. religion practices), the mesosystem (e.g. family-school relationship) and the macrosystem (e.g. economy). The four waves have resulted to the conceptualization of resilience as a dynamic, multi-dimensional and multi-level concept, which is currently utilized by multiple systems and disciplines.

A contemporary way in assessing resilience comes from the research in immigrant youth (Motti-Stefanidi, 2018). Cultural differences in the way resilience is understood and measured are especially important for this population, as the criteria for positive adaptation are bounded in cultural and historical context and thus migration may hold increased challenges due to the change in living context.

2.3.2 The models proposed by resilience theory

During the developments in resilience research, six models of resilience theory have been identified (Fergus & Zimmerman, 2005), in order to explain the interactions between risk and protective factors and their effects on outcomes characterized by either resilience or not resilience. According to the compensatory model, a promotive factor has a direct effect on the outcome, operating in the opposite direction of a risk factor. The second model, the protective one suggests that a protective factor comes to reduce the effect of risk and to moderate the emergence of a negative outcome. To illustrate, there seems to be an interaction between the risk and the protective factor. The protective model has also two sub-models: (a) the protective-stabilizing model, where the protective factor erases the effect of the risk factor, neutralizing it; and (b) the protective-reactive model, where the protective factor reduces the effects of the risk factor on the outcome, but without completely removing them. Another model related to the above is the protective-protective model, according to which a protective factor enhances the

effect of another protective factor to the outcome (Brook, Whiteman, Gordon, & Cohen, 1989). Based on the challenge model, moderate levels of stress and adversity are what provides to an individual the needed competence to adapt after overcoming a traumatic event. On the other hand, individuals with low or high levels of risk and trauma are associated with negative outcomes. For example, if a child is exposed to very little levels of victimization at school may never have the opportunity to cope with it and/or to develop problem-solving skills to learn how to overcome it. Through this formulation, the inoculation model was developed, according to which low-risk helps individuals to be more prepared to overcome adversity, and thus repeated low levels of a risk factor may be the prerequisite to a healthy developmental process (Yates, Egeland, & Sroufe, 2003). However, as it is evident, risk and protective factors have been studied at a simplified form, suggesting that one event happens at a time, and consistently ignoring the simultaneous interactions between a range of risk and protective factors and traumatic events (Masten & Obradovic, 2006). Also, research on processes focused on factors which are rather stable characteristics of people or communities, notwithstanding that processes should be dynamically changing constructs. Barber and Doty (2013) argue that it is not clear if the protective factors supported by previous research are uniquely and specifically related to resilience development, or if they constitute protective factors of positive functioning regardless of the levels of risk exposure.

The pathways of resilience development have been described extensively over the past few years (see Figure 1). One of the main trajectories is gradual recovery that includes prolonged levels of distress or difficulties with functioning in main areas of life and or the emergence of psychopathology (Mayou, Ehlers, & Bryant, 2002). Other trajectories include delayed-onset symptomatology, subclinical levels of symptomatology below the diagnostic threshold, or

minimal impact resilience which is characterized by rather stable levels of psychological and physical health when comparing before to after a potentially traumatic event (Bonanno & Diminich, 2013). Importantly, the findings for resilience trajectories are often based on the type of modelling is used to capture this trajectory and of course, on the methodological design of the study (e.g., longitudinal or prospective). A recent review (Galatzer-Levy, Huang, & Bonanno, 2018) showed that most studies examine cohort samples in longitudinal designs emphasizing on one single potentially traumatic event and measure PTSD as a primary outcome to identify usually four trajectories; resilience, chronic stress, recovery and delayed-onset psychopathology.

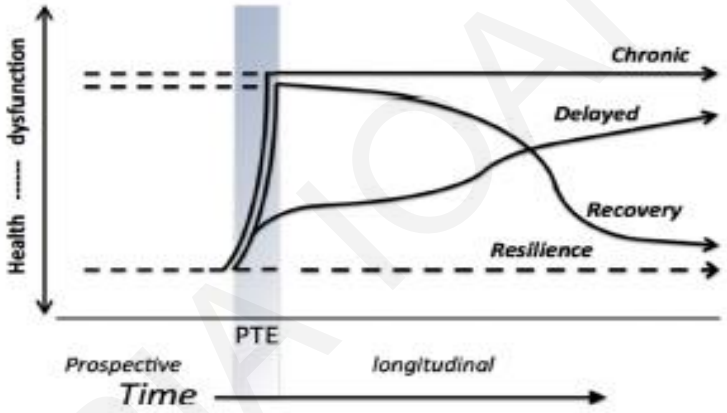

Figure 1. Potential trajectories in response to trauma.

Adapted from "Loss, trauma, and human resilience: Have we underestimated the human capacity to thrive after extremely adversity events?", by B. A. Bonanno, 2004, American Psychologist, 59(1), 20-28.

2.3.3 Family resilience and theoretical links to individual resilience

Based on the resilience model of family stress and coping (McCubbin, 1993), families tend to respond to life events and major life changes which cause stress, with gradual steps from adjustment to adaptation. These two phases of response to life stressor and traumas include the recognition of the family vulnerability and the patterns of family functioning, the appraisal of the stressor and its severity, the development of problem solving techniques and finding of resources. If the family is not able to cope or adjust to the major stressors, then a pattern of crises and maladaptation occurs, which gradually leads to recognition of stressors and family transitions, appraisal and meaning of the family and the cognitive schemas for the family, pursuit of social support and development of family strength resources, which may result in positive coping and adaptation to the stress, or to continued crises and need for family assistance (McCubbin, 1993).

Hawley and DeHaan (1996) have underlined that risk and protective factors of individuals are embedded in their context, and thus the influences of stressful events and the way they are experienced are strongly defined through the interplay with the environment. Most approaches on family resilience examine the meanings of trauma held by each family member. However, there is also a need to identify a family ethos that is commonly perceived by all members of the family, in order to help them frame their traumatic events and the distress caused in a more positive way; hence the construct should be measured through the examination of whether the family has managed to return at a previous level of functioning which is identical to the levels of functioning prior to the stressors or traumatic experiences (Hawley, 2000; Hawley & DeHaan, 1996). Therefore, the approach towards the development of growth and adaptation

becomes a collaborative effort between family and individuals, which should focus on mutual support and empowerment of available family resources (Walsh, 2002).

2.4 Gaps and pitfalls in resilience and trauma literature

Previous research on resilience was considerably eliminating because of the conceptualization of traumatized populations based on the experience of a particular event, which was estimated by the researchers as an indication of significant adversity or trauma without the use of subjective trauma measures. Specifically, the great percentage of research has been engaging with populations that have survived traumas like bullying, domestic violence or war. That approach not only takes as such that the traumatic symptoms and experiences are identical to all individuals (Zolkoski & Bullock, 2012), but consistently excludes certain types of traumatic events. Therefore, some populations may have been described and considered as expressing resilient outcomes, without actually having been exposed to true risk based on their subjective experience (since traumatic impact was not subjectively measured). These approaches, have not only extremely limited the generalizability of the findings to individuals with other types of trauma, but also eliminated resilience research, by hypothetically estimating that the examined populations had experienced comparable levels of trauma. When risk is not substantial according to the subjective evaluation of one's own experience, it is more possible that risk is not related to increased probabilities of adjustment difficulties and other problems (Barber & Doty, 2013). In this case, it is possible that the findings of previous studies were misleading. Some researchers have agreed that a measure of complex trauma is needed for such studies, capturing the continuum of trauma exposure with the objective accounts of traumatic events' history, along with the subjective accounts of the post-traumatic impact for victims; in order to allow for the

existence of differential trauma levels, deriving from identical types of traumas (D'Andrea *et al.*, 2012).

Measuring specific traumas without controlling for other types of victimizations when evaluating the impact of a particular trauma has unfortunately been the rule in resilience and trauma literature (Saunders, 2003). Since the definitions of resilience do not have uniformity, different measures are used to capture the variables related to resilience as well (Klika & Herrenkohl, 2013). It has been evident that the instruments tend to focus only on the two ends of high adversity and high competence in resilience literature (Luthar, Cicchetti, & Becker, 2000). The problem becomes worse when researchers measure resilience with their already defined expected two-ends of the continuum (e.g. for academic resilience they define the outcomes as success or failure). Only some studies have measured resilience and positive outcomes in a continuum, with most of the studies measuring them in a categorical, deterministic form of resilient and non-resilient individuals. Instead, resilience should be approached and measured as a non-dichotomous outcome, letting space for individuals who may be 'near resilience' (Kassis, Artz, Scambor, Scambor, & Moldenhauer, 2013) and discriminating between resilience and adaptation in differential levels of functioning.

Other disagreements consider the issue if resilience should be defined and measured as normal adaptation after adversities, or as just exceptional unexpected adaptation (Kolar, 2011). It is recognized now, that researchers have underestimated people's ability to thrive and bounce back from difficult and traumatic experiences, conceptualizing resilience as the exception instead of the norm (Bonanno, 2008). This is not true, thus the conceptualization of resilience as positive but not exceptional adaptation, predominates. It is unclear whether resilience should be assessed based on the level of PTSD symptoms, on the existence of strong personality traits, the handing

of important environmental protective factors or something else. A review by Windle and colleagues (2011) examined fifteen different measures of resilience based on their psychometric abilities. The authors concluded that there is not a "gold standard measure" for resilience. However, three measures stood out as the best three, based on the highest overall ratings: The Connor-Davidson Resilience Scale (CDRISC), the Resilience Scale for Adults (RSA), and the Brief Resilience Scale (BRS). Those three measures have significantly different perspectives on what resilience is and how it could be reflected in behavior. For example, the CDRISC focuses on core personality traits that are related to resilience, such as spiritual coping, hardiness, self-efficacy and goal orientation. The RSA on the other hand examines five areas, including personal competence, social competence, family coherence, social support, and personal structure, whereas the BRS includes six questions that ask directly with positively and negatively worded items the extent to which an individual is able to recover after traumatic stress.

Similar difficulties as those outlined above, occur with the measurement of family resilience as well, since family resilience is a multifactorial construct and cannot be easily narrowed down and examined. The reciprocal interactions between the protective and resilience factors of the family and also between the family and the individuals are rarely addressed (Black & Lobo, 2008). Furthermore, research has focused on the measurement of development and adaptation showed by different family members, whereas family resilience is considered something more than the sum of individual levels of resilience. It is not clear yet what is the congruency between family and individual resilience and, what is the role of the family in the management of traumatic exposure and the development of resilience in adolescence, which is period in which a number of changes occur in the relationship between adolescents and their families. Theoretically, evidence on the interrelationships between family and individual

resilience could bring an insight to the processes through which resilience develops and to the extent to which self-regulation mechanisms remain important for individual resilience, over and above the potentially mediating effects of family resilience. At a practical level, a better insight in the relationship between family and individual resilience interrelations will show the need to investigate family intervention and prevention programs aiming to foster resilience, apart from the recent efforts for community programs to increase resilience.

Also, given the fact that arguments exist regarding the need for all individuals to experience trauma in order to strengthen their attributes and develop (e.g. Seery, 2011), and the parallel application of global prevention programs (Masten, 2014), the promotion of resilience may eliminate low-risk populations to develop resilience in their later life. Other researchers have also supported the need to examine the potentially differential processes of resilience in low-risk and high-risk individuals (Luthar *et al.*, 2000; Rutter, 2006). Since it is unclear if "adversity" is defined by extreme situations or daily hardiness, it is vague if an adversity can be considered as adversity for everyone, and if adaptation has thresholds to be defined as positive, neutral or negative. It remains to be answered if everyone has the potential to be resilient.

According to the diathesis-stress model (Belsky & Pluess, 2009), high susceptibility to negative outcomes implies high susceptibility to positive outcomes as well. Research with low-risk populations would contribute to the identification of this issue, showing if protective factors have similar functions for high and low risk populations. The differential susceptibility to stress hypothesis is in line with the biological sensitivity to context theory (Boyce & Ellis, 2005). Based on the theory, physiological reactivity is conceptualized as an index of plasticity supporting that highly reactive children might be more susceptible to both positive and negative influences by their environments. For adaptive reasons, a curvilinear U-shaped relation between

the levels of environmental supportiveness and stressfulness is expected, with high reactivity being emerging disproportionately in social environments which are highly stressful and those which are highly protected. Thus, higher levels of physiological reactivity have been linked to resilient adaptation, even though this is considered a risk factor when faced with adversity (Obradovic, 2012). Differential susceptibility to stress may be reflected in phenotypic differences (e.g., temperament interacting with adverse parenting style), in endophenotypic differences (e.g., cardiovascular reactivity interacting with childhood stress) and using genetic markers (e.g., levels of serotonin receptor gene interacting with child exposure in traumatic events) (Belsky & Pluess, 2009).

Some research supports that resilience may be developed after the continuous experience of low stress (Rutter, 2006), however recent holistic prevention programs that apply to all populations (with lower and higher risk) may actually harm the low-risk populations, preventing them from the experience of some adversity and thus the development of resilience. Indeed, in the field of resilience interventions there is not general agreement about whether and when one should intervene in the face of significant adversities. At the moment, given the different conceptualizations of resilience, interventions may target to reduce the risk, or may indirectly target to increase the available assets. On the other hand, it is suggested that interventions targeting more synergetic effects could be the most effective (Panter-Brick & Leckman, 2013), or that interventions should focus on wherever change seems more plausible, from neurobiology to culture (Cicchetti, 2013). Given the practices of some cultures to put children in risk situations to become more resilient (Boyden & Mann, 2005), one could argue that pre-existing threats are actually those which make a child resilient. According to Braverman (2001), 'fixing the children' or their environments is a misinterpretation of resilience research, leading to potentially needless

or even harmful prevention and intervention programs, especially for the children with zero subjective levels of trauma, who may be prevented to develop their own strategies to overcome adversities. Especially when it comes to measuring resilience in children, a recent review on resilience trajectories found lower probabilities of resilient outcomes (Galatzer-Levy et al., 2018). Most studies had examined chronic stressors that affect children, such as domestic violence or school bullying, that were found to increase the rates of recovery. Such conceptualizations of potentially traumatic events that have systematic and chronic nature may eliminate the understanding we have regarding children's responses to acute stress and other forms of adversities.

2.5 The role of self-regulation mechanisms

2.5.1 Theoretical links to trauma

It is supposed that after the experience of trauma, an individual has to give meaning to his experience, to control his emotions and attention, acknowledging his beliefs and the way he has managed to overcome previous traumas (Brom *et al.*, 2009). Based on the models of psychological trauma, however, one should note that not all self-regulation mechanisms may be adaptive, as traumatic stress can be maintained because of suppression or negative appraisals of trauma (emotional non-adaptive regulation skills) or because of selective attention to threat-related stimuli, avoidance and use of safety behaviors (cognitive and behavioral non-adaptive regulation skills) (Ehlers & Clark, 2000). Trauma can have lifelong influences on multiple areas of one's functioning, especially when it is repeated and cumulative. In this case, trauma is considered complex and may lead to the development of complex post-traumatic stress disorder or to other disorders of extreme stress. These disorders that may occur in the context of early and

severe interpersonal trauma are usually associated with different problems in the domains of one's functioning, including alterations in emotion regulation, consciousness and attention, perceptions about one's self, perceptions for the general belief system regarding the perpetrators of the trauma and systems of meaning regarding the understanding of self and their suffering (Courtois, 2004). Also, children exposed to early interpersonal trauma often present alterations in their relationships with others and usually present somatization or other medically related problems. In this framework of the problems outlined above, connected alterations happen in the children's trust towards others and degree of intimacy expressed in interpersonal relationships, and also in the perceptions of the children regarding guilt and self-blame about the traumatic event. Trauma was found to be also related to repetitive negative thinking, rumination and intrusive memories and to other forms of recurrent cognitions that may include efforts to suppress negative or positive affectivity, experiential avoidance, denial and emotional numbing or arbitrary control (Ehring & Watkins, 2008). The number of traumatic events has been also linked to higher levels of post-traumatic stress symptoms and distress (Im & Folette, 2016), potentially due to more rumination in which people engage when experiencing additional traumatic events which exacerbate pre-existing trauma-related symptomatology.

Self-regulation can be disrupted by prolonged traumatic stress and adversity, creating toxic neurobiological effects and contributing to impaired inhibitory control, impulsive thinking, impaired delay of gratification and excessive or blunted emotional responses (e.g., Ford, 2009). On the other hand, it is hypothesized that children who have self-regulation skills and environmental support with an array of resources can balance risk and protective factors and moderate the negative impact of traumatic stress on them (Murray et al., 2015). Parenting and family functioning have been showed to impact on children's executive functioning and on their

self-regulatory abilities in general (Bernier, Carlson, & Whipple, 2010). It is recognized that self-regulation is dependent on co-regulation provided by parents and other caregiving adults, through coaching, support and modelling aiming to facilitate a child's ability to understand, express and modulate thoughts, feelings and behaviors (Blair & Raver, 2012; Odgers & Jaffee, 2013).

Recent investigations have managed to inform the literature about some relations between the different self-regulation mechanisms and the levels of other acquired mechanisms in maltreated and non-maltreated children. Tugade and Fredrickson (2004) studied the impact of positive emotions and emotion regulation on resilience and cardiovascular responses to negative emotions in 57 undergraduates. They showed that positive emotions help people explore the possibilities they have to regulate their emotions and broaden their subsequent thoughts and actions to promote resilience. Specifically, the experience of positive emotions resulted to efficient emotion regulation, since the participants had quicker cardiovascular recovery after negative emotional arousal and could find more positive meaning in negative occasions, thus showing higher resilience. Alink, Cicchetti, Kim, & Rogosch (2009) investigated the processes of emotion regulation and child-mother relationship quality in 111 maltreated and 110 non-maltreated children. The results indicated that children had higher risk to develop psychopathology and not resilience only if they had emotion dysregulation. This relationship though, was detected only for children with an insecure type of relatedness to their mother, indicating the potentially moderating role of attachment as protective factor related to co-regulation (Murray et al., 2015). In another study investigating the role of self-regulation in children exposed to bullying, Mahady Wilton Craig, and Pepler (2000) showed that emotion regulation skills are the core coping assets related to adaptation, since the victims have to make

use of emotion regulation in order to control their emotions and appraise the behavior of the bully, and in order to subsequently integrate the needed information to develop coping and resilience.

2.5.2 Empirical evidence on self-regulation after traumatic exposure

As informed by the cognitive model of psychological trauma (Ehlers & Clark, 2000) and other theories of trauma, a number of studies have investigated the effects of traumatic exposure on a number of distinct self-regulatory processes. Emphasis has been given to cognitive impairments evident after trauma. In particular, it was found that children with maltreatment related posttraumatic stress performed significantly poorly in measures of attention, abstract reasoning and executive functioning compared to their sociodemographically similar peers (Beers & De Bellis, 2002). Their problems concerned sustained attention and freedom from distractibility, as measured by the digit vigilance test and the Stroop interference test and maltreated children completed fewer categories on the Wisconsin Card Sorting Test. Children with traumatic stress have showed to perform more poorly than controls in a number of neuropsychological tests, including the Controlled Oral Association Animal Naming Test, the California Verbal Learning Test, the Rey-Osterrieth Complex Figure and the Judgement of Line orientation (Beers & De Bellis, 2002). Importantly, De Bellis, Hooper, Spratt, and Woolley (2009) showed that regardless of the type of trauma in which children have been exposed, children with post-traumatic stress had significantly lower scores on a number of visual memory tasks (such as the Rey Osterrieth Complex Figure and the Face Memory test from the NEPSY; Korkman, Kirk, & Kemp, 2007) and lower scores on tests measuring attention control and behavior inhibition from the Conners' Continuus Performance Test II (Conners, 2000).

It was also showed that 30 adolescents between 12 and 17 years old with trauma had lower cognitive flexibility, as indicated from their lower scores on the Wisconsin Card Sorting Test (Spann et al., 2012). Examining children aged 5-12 years old, Bucker and colleagues (2012) showed that children who had experienced physical or sexual abuse had lower scores than controls on working memory tests from the WISC-IV, compared to controls. These effects demonstrated on cognitive tasks maintained even when controlling for the duration of traumatic exposure. Difficulties with attentional shifting and inhibition control as evident with poor scores on the Stroop test have been replicated in a number of studies (e.g., DePrince, Weinzierl, Combs, 2009; Freeman & Beck, 2000).

Children exposed to trauma tend to have problems with inhibitory control, which are responsible for the persistence of intrusive memories over extended periods on portion of children experiencing traumatic stress even after the first few months following trauma (Ehlers, 2010; Sherin & Nemeroff, 2011). According to Shucard and colleagues (2008) attentional problems in individuals with post-traumatic stress are related to slowed central processing when inhibition response is required, and also to impairment in the ability to screen irrelevant information. Problems with inhibitory control related to PTSD have been replicated using fMRI during a go/no-go inhibition task in a sample of participants with post-traumatic stress and a sample of controls (Falconer et al., 2008). PTSD participants showed lower activation of the brain areas normally involved in behavior inhibition, with PTSD severity being positively related to problems in inhibition. Also, the increased somatosensory cortical activation found in participants with PTSD seems to be consistent with a state of enhanced stimuli processing that places a demand on the cortex (Falconer et al., 2008). These seem to also result in attentional

biases to threat observed in anxious individuals (e.g., Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & Van Ijzendoorn, 2007).

Avoidance of intrusive memories is considered a coping mechanism at least for the short-term, but research shows that individuals exposed to trauma may also have problems with the voluntary suppression of unwanted memories when confronted with a reminder (i.e., suppression-induced forgetting) (Anderson & Green, 2001; Catarino, Kupper, Werner-Seidler, Dalgleish, & Anderson, 2015). Problems with emotion regulation in individuals with traumatic stress seem to be largely dependent on the effects of trauma on cognitive parameters, like sustained attention and inhibitory control. In particular, it has been showed that maltreated children tend to show heightened attention to sad faces for long periods following the experience of a sad emotional state (Romens & Pollak, 2012). Tull and colleagues (2007) reviewed a number of studies showing emotion regulation difficulties related to traumatic stress, including alexithymia, poor understanding of emotions, limited ability to discriminate between feelings and bodily sensations of emotional arousal, engagement in impulsive behaviors to control emotions such as alcohol and substance abuse, and limited access to goal-directed behavior.

2.5.3 Theoretical links to resilience

According to Brom and colleagues (2009) the linkage between theory of resilience and its use for prevention and intervention practices rests on the mechanisms of self-regulation. Self-regulation has to do with the notion of thinking first to collect information from cognitive, physiological and psychological resources of the self and then to think while acting, making connections between previous and new learning. Therefore, self-regulation is considered to be vital for adaptation (Sokol & Muller, 2007), regardless of the theoretical approach that is

followed. Self-regulation mechanisms have been considered important for long-term functioning across a number of domains, including social, educational, health and psychological (e.g. Berger, 2011; Berger, Kofman, Livneh, & Henik, 2007; Moffitt et al., 2011; Raver, Carter, McCoy, Roy, Ursache, & Friedman, 2012).

2.5.4 Gaps in self-regulation literature

Even though recent studies have started exploring the role of self-regulation mechanisms for the development of other mechanisms, or for their importance in high-stress situations, there is not yet a general consensus of what the broader concept of self-regulation includes (Locke & Latham, 2006). That leads to the investigation of mutually related constructs (such as executive function or emotion-regulation), which however is far from an exploration of their concurrent role in resilience development. To illustrate, even though a range of positive outcomes (i.e. school engagement, higher academic achievement, healthy eating behaviors, peer acceptance and avoidance of the negative behaviors of violence and substance abuse) have been related to high self-regulation (Bandy & Moore, 2010), no studies have searched the simultaneous involvement of self-regulation mechanisms in the process to develop resilience after different levels of trauma exposure. The processes of self-regulation may be not only those who help people overcome traumatic stress and enhance resilience, but also, those which help people determine which available assets and resources to employ (as a prerequisite to manage and use protective factors). Based on this conceptualization, self-regulation mechanisms may strengthen the efforts to link resilience knowledge to practice.

Chapter 3. METHODOLOGY

3.1 Participants

The targeted sample of participants for the main study was 400 adolescents. This number was based on the power analysis performed using G*power 3.1, which suggested a required sample size of 173 participant to achieve effect size of f= .15 and with a number of predictors tested concurrently at 10. However, for the purposes of the Structural Equation Models planned, bigger samples are required. Using the rule of thumb that suggests to have at least 10 participants for each observed sample inserted in a model (Byrne, 2009), the maximum number of intended parameters examined concurrently in a model was 35. This would suggest a number of at least 350 adolescents was the target. We also intended to have parents of at least half of the adolescents participating.

Adolescents should age 12-17 years and would be invited from secondary schools in Cyprus. The parents of adolescents signed an informed consent form after being given information about the study, in order their children to be able participate. Adolescents also provided their written informed consent in order to be able to participate. The inclusion criteria required participants to be (a) 12 to 17 years old and (b) fluent speakers of the Greek language. As mentioned above, the parents of adolescents were also invited to participate in the study. Parents had to provide informed consent for themselves in order to participate in the study and had to be fluent speakers of the Greek language. As per the third study, participants who took part in the main study were invited to participate to the so-called ‘second phase’ of the study, in which they completed a resilience measure and computerized self-regulation measures. For the purposes of the fourth study, we also invited 10 teachers of adolescents to provide information about their psychosocial adjustment. The total number of students for whom we invited their

teachers to assess their psychosocial adjustment was 100. The inclusion criteria for teachers were (a) at least one of their students also participated in the study, (b) were teaching classes to the student that they completed the questionnaire about for at least 6 months, and (c) were fluent speakers of the Greek language.

3.2 Measures

Measures used for the first study are described below:

Trauma Measures:

Participants were measured on their level of trauma exposure, using the *Traumatic Events Screening Inventory for Children self-report* (TESI-C-SR; based on TESI-C by Ribbe, 1996). The TESI-C-SR is a self-report inventory for previous trauma exposure which derived from an interview-based clinician administered inventory. The inventory is considered suitable for children and adolescents aged 12 to 18 years old who have been exposed to a range of possible traumatic events and stressful situations and is used for research and clinical purposes. It is considered one of the best measures for the assessment of multiple traumas, especially for the measurement of trauma history (Strand et al., 2005). The TESI-C-SR was translated and adapted in Greek language for the aims of the present study. A forward-backward translation method was used to translate from English to Greek language by two independent competent speakers of both languages. The inventory was piloted with a sample of 20 participants aged 12 to 17 years old who gave feedback regarding the clarity of each item. The pilot administration and examination between the consistency of self-report and interview-administered TESI forms, supported that the items of the TESI-C-SR were perceived as clear and valid for the measure of past stressful events. TESI-C-SR measured all the traumatic events that the individual has been exposed to

from the beginning of their lives up to one month before the time of questionnaire administration, as post-traumatic symptoms and resilience are suggested to be measured not prior to 1 month after traumatic exposure (e.g., Alisic et al., 2014). TESI-C-SR also includes additional items for each of the events in which the individual has been exposed, specifically assessing the time of onset (youngest age at which the individual experienced the event), the duration of the event (number of times the individual was exposed or duration of continuous exposure to the event), the consequences of the event (descriptive details on the effects of the event on self and others), the emotional reactions of the individual (experience of intense anxiety, stress, fear when exposed to the event), the most recent exposure (age or time that the individual lastly experienced the event), the worst exposure (age or time that the individual experienced the worst event in case the event occurred more than once), and the reactions of the individual with regard to the trauma management (whether they reported the event, received support or other therapy because of it). Because of the conceptualization of traumatic events as those resulting in significant levels of stress or other intense emotions, we did not code as traumatic the events that were reported by adolescents but not with accompanying significant levels of fear or other intense emotions. Therefore, the traumatic events reported below reflecting the prevalence of trauma in the sample only represent the events noted as causing significant levels of distress by adolescents. Importantly, age of the adolescents was used to compute the extracted metrics from the TESI-C-SR. For example, for the computation of the index of how recent the worst memory of a traumatic event was, we subtracted the age of the adolescent when the worst memory of a traumatic event occurred from the current age of the adolescent. Similarly for the computation of the index of the time since the first event was occurred, we subtracted the age in which the first traumatic event occurred from the current age of the adolescent. Both

indices were coded in months. Importantly, current age of the adolescents was not used in a covariate in the models tested as it was already used for the computation of the metrics described above.

Two other measures to examine related dimensions of the trauma were used; the *Centrality of Event Scale* (CES; Berntsen & Rubin, 2006) which assesses the centrality of the trauma in terms of its role in self-understanding and self-identity (a measure related to trauma interpretation and meaning making) and the *Revised Impact of Event Scale* for children (Horowitz, Wilner, & Alvarez, 1979; Yule et al., 1997), which is considered the most reliable test to assess the cardinal symptoms, avoidance and arousal of children older than 8 years old who are exposed to traumatic stress (Perrin et al., 2000). Following the suggestions by Strand and colleagues (2005), the level of trauma should be assessed using these 3 indexes; traumatic history, traumatic impact and centrality of trauma. These three indexes were not be combined for the aims of the present study, but consisted separate observed variables for the estimation of the trauma latent variable.

Self-regulation Measures:

Participants were asked to rate their self-regulation skills with reference on the skills used after the traumatic exposure. The following self-regulation measures were used:

The *Emotion Regulation Questionnaire for Children and Adolescents* (ERQ-CA; Gross & John, 2003; Gullone & Taffe, 2012), which is a self-report questionnaire consists of 10 items and was based on the adult version of the questionnaire. The two emotion regulation strategies assessed by this measure are (a) cognitive reappraisal, a strategy used to achieve cognitive change by trying to redefine an emotionally arousing situation in such a way that its emotional

impact is altered; and (b) expressive suppression, a strategy used to inhibit the emotional expressive behavior by modulating the response to an emotionally arousing situation.

The *Cognitive Emotion Regulation Questionnaire* (CERQ; Garnefski & Kraaij, 2007) is a multidimensional questionnaire constructed in order to identify the cognitive emotion regulation strategies (or cognitive coping strategies) someone uses after having experienced negative events or situations. Contrary to other coping questionnaires that do not explicitly differentiate between an individual's thoughts and his or her actual actions, the present questionnaire refers exclusively to an individual's thoughts after having experienced a negative event. The short form of CERQ is a self-report questionnaire consisting of 18 items on a Likert-type scale (1 almost never to 5 almost always). The questionnaire is designed to be completed by individuals aged 12 years old and older, who are considered to have the cognitive abilities to grasp the meaning of the items. Earlier studies have showed satisfactory psychometric properties of the CERQ with Cronbach alphas ranging from .63 to .83 for the subscales and from .85 to .92 for the whole scale.

The adolescents were also asked to complete the *Post-traumatic Cognitions Inventory – child version* (cPTCI; Meiser-Stedman, Smith, & Dalgleish, 2009) designed to be a child and adolescent version of the adult PTCI (Foa, Ehlers, Clark, Tolin, & Orsillo, 1999), a measure of negative post-traumatic appraisals that has been shown to closely relate to adult post-traumatic stress. The post-traumatic cognitions measured were mainly inspired by other research that has been aimed at testing Ehlers and Clark's (2000) cognitive models of PTSD in adults (e.g. Dunmore, Clark, & Ehlers, 2010; Steil & Ehlers, 2000).

Attentional Control Scale: The attentional control scale (Derryberry & Reed, 2002) is a self-report scale measuring people's ability to control attention. ACS is a 20-item scale, which measures one's ability to focus perceptual attention, switch attention between tasks, and flexibly

control thought (Derryberry, 2002). The scale is based on the view that the executive mechanisms, usually associated with attention and the frontal lobe, regulate the more reactive networks of the posterior cortex and very good approximate the intentional nature of voluntary self-control (Derryberry & Tucker, 2006) and that individuals put an active effortful control to cope with their reactivity (Derryberry & Reed, 2008). Underlined by anterior system effortful control, as part of executive attention, is viewed as involved in the awareness of one's planned behaviors and subjective feelings of voluntary control of thoughts and feelings, and is believed to come into play when resolving conflicts, correcting errors, and planning new actions (Eisenberg, Smith, Sadovsky, & Spinrad, 2004). In more recent studies, Derryberry and Reed (2002) have combined the attentional focusing and shifting scales to form a measure of effortful attentional control, as these scales were positively correlated. Sample items of the ACS include "It is hard for me to break from one way of thinking to another" and "When trying to focus, I have difficulty blocking out distracting thoughts". In order to have an index of state attentional control, participants were asked to respond to this self-report scale having in mind the traumatic event and its impact to their life.

Behavioral self-regulation: Behavioral self-regulation was measured with *Self-Regulation Questionnaire* (Brown, Miller, & Lawendowski, 1999). Self-regulation questionnaire is a self-report of behavioral self-regulation, conceptualized as the ability to develop, implement, and flexibly maintain planned behavior in order to achieve one's goals (Carver & Scheier, 1981). Behavioral self-regulation as measured by this self-report includes seven steps: 1. Receiving relevant information 2. Evaluating the information and comparing it to norms 3. Triggering change 4. Searching for options 5. Formulating a plan 6. Implementing the plan 7. Assessing the plan's effectiveness (which recycles to steps 1 and 2). Although this model was developed

specifically to study addictive behaviors (Miller & Brown, 1991), the self-regulatory processes it describes are meant to be general principles of behavioral self-control. The Self-Regulation Questionnaire (SRQ; Brown et al., 1999) was developed as a first attempt to assess these self-regulatory processes through self-report. Test-retest reliability for the total SRQ score was high ($r = .94$, $p < .0001$) and internal consistency of the scale was also quite high ($\alpha = .91$), consistent with the idea that its items contain much redundancy (Carey, Neal, & Collins, 2004). The SRQ consists of 63 items that are answered on a 5-level Likert scale ranging from "strongly disagree" to "strongly agree". Sample items of the SRQ include "I set goals for myself and keep track of my progress.", "Once I have a goal, I can usually plan how to reach it".

Available protective factors and assets measure: A checklist will be created in order to measure this variable. The checklist will include a range of personal and familial factors and societal assets as informed by theory and research, particularly based on recent reviews on protective factors related to resilient outcomes (e.g., Zolkoski & Bullock, 2012). The checklist will be piloted with an adolescent sample before being used for the aims of the current study.

Resilience measures: Two measures will be used for the evaluation of resilience in adolescents. The first instrument will be the *Child and Youth Resilience Measure -28* (CYRM-28; Ungar et al., 2008). The CYRM-28), is a 28-item measure that evaluates individual, family, community and cultural factors associated with resilience and competency in youth using a 5-point Likert scale ranging from 1=not at all to 5=a lot. The CYRM-28 has been translated and adapted in many countries, showing satisfactory psychometric properties, with the Cronbach alphas for the subscales based on the factors' categorization (individual, family and community) ranging from .64 to .84 and around .88 for a total score (e.g. Daigneault, Dion, Hébert, McDuff,

& Collin-Vézina, 2013). The CYRM-28 has been translated in Greek and standardized with a Cypriot population by the research team of Dr. Georgiou and Dr. Stavrinides at the University of Cyprus. The *Brief Resilience Scale* (BRS) developed by Smith, Dalen, Wiggins, Tooley, Christopher, and Bernard (2008) will be also used in this study. The BRS assesses the ability to bounce back and consists of six items; three negative items and three positive items. The participants will be asked to answer each question by indicating their agreement with each statement by using the scale ranging from 1=strongly disagree to 5=strongly agree. The BRS has demonstrated good internal constancy with the value of Cronbach's alpha ranging from .80 to .91 (Smith *et al.*, 2008).

Psychopathology symptoms of adolescents were assessed using the *Youth Self- Report* form of the Child Behavior Check List (YSR; Achenbach & Rescorla, 2001). The YSR is a widely used measure to assess the emotional and the behavioral problems of youth aged 11 to 18 years old. The YSR includes that are rated as 0 (not true), 1 (somewhat or sometimes true), or 2 (very true or often true) and the measure yields syndrome and competence profiles that correspond to the DSM-IV diagnostic profiles. Participants are asked to self-report whether now or within the past six months they had the problems stated. The sixteen socially desirable items included in the YSR and the open-ended question regarding physical symptoms they may report are not used for scoring purposes. This measure was shown to have high reliability and to correlate appropriately with other symptom measures (Ebesutani et al., 2011).

Controlling Variables: One should note that in order to limit the possibility that emotional regulation presented is not attributable to callus-unemotional or psychopathic traits, the short version of the *Youth Psychopathic Traits Inventory* (YPI-S; van Baardewijk, Andershed, Stegge, Nilsson, Scholte, & Vermeiren, 2010), was completed by adolescents. YPI-S

consists of 18-items and is a self-report which is scored on a 4-point Likert scale ranging from 0 (does not apply at all) to 3 (applies very well). The scale yields three factors, namely the callous-unemotional, the grandiose-manipulative and the impulsive-irresponsible. Adaptation and use of this measure is Greek showed acceptable psychometric properties (e.g., Antoniadou & Kokkinos, 2013; Fanti, Kyranides, Drislane, Colins, & Andershed, 2015). Participants also completed the *Alexithymia Questionnaire for Children* (AQC; Rieffe, Oosterveld, & Terwogt, 2006). The AQC consists of 20 items and is a self-report that yields three factors, namely the difficulty identifying feelings, the difficulty describing feelings and the externally-oriented thinking. This measure is based on the original adult questionnaire for alexithymia (TAS-20) developed by Bagby et al. (1994). Furthermore, participants completed the *Child and Adolescent Mindfulness Measure* (CAMM; Greco et al., 2011) which provides a score of absence of mindfulness. Research supports that trait mindfulness is associated with higher levels of psychological resilience after exposure to traumatic events and that coping strategies that involve emotional avoidance are related to higher PTSD severity and levels of psychopathology (Thompson, Arnkoff, & Glass, 2011). CAMM is suitable for children and adolescents aged 10 to 17 and has been validated in Greek (Theofanous et al., 2020). CAMM consists of 10 items and assesses the extent to which an adolescent is aware of the present moment and holds a non-judgmental stance towards thoughts and emotions.

Additional measures used for the aims of the second study, as completed by parents are described below:

Family stress and resilience: The *Family Events Checklist* (Fisher, Fagot, & Leve, 1998) was used as an additive measure of current family stress will be needed to give a holistic

understanding or current stressors and hassles of the family, apart from the traumas in which their adolescent child has been exposed. This measure has been found to have high reliability during the assessment of multiethnic families, and to be able to discriminate among families of low, medium and high risk, while concurrently giving indications for three major family components that affect stress, being the daily hassles, the economic stress and the internal family conflict (Fisher, Fagot, & Leve, 1998). The *Family Resilience Assessment Scale* (FRAS; Sixbey, 2005) was used for the assessment of family resilience, as it is considered a new measure with good psychometric properties that is based on Walsh's conceptualization of family resilience. The FRAS has been validated in a Maltese population, which is very similar to the Cypriot one, yielding the same six factors as the validation studies in USA, namely family communication and problem solving, maintaining a positive outlook, ability to make meaning of adversity, outreach, community and friendship outlook and family connectedness (Dimech, 2014).

Also, since multiple informants are preferred and the addition of traumatic information by the caregiver always increases the diagnostic accuracy of trauma in children and adolescents (Cohen, 2010), one of the parents of the adolescents was asked to assess their child's traumatic exposure and reactions. Parents completed the *Traumatic Events Scale for Children - parent report* (Ribbe, 1996) and the *Parent Report of Post-Traumatic Symptoms* (Greenwald & Rubin, 1999a, 1999b), to provide their account regarding the extent of exposure to stressful events and the symptoms related to that. The TESI-PRR consists of 24 items that correspond to the stressful events assessed in the self-report. The procedure used to code the parental responses on this scale was similar to that followed for the TESI-C-SR, such that reported events were considered as traumatic only if the parents reported that their children had been significantly impacted by the experience of each event. The PROPS consists of 30 items that assess the symptomatology after

a traumatic event based on the account of the parent. The factorial structure of the PROPS consists of three subscales, namely internalizing symptoms, externalizing symptoms and somatic symptoms/sleep problems.

Measures used to examine "state" self-regulation for the aims of the third study, along with the BRS are described below:

Inhibition Go-no Go task (PEBL experiment platform; Mueller, 2012; Mueller & Piper, 2014): At the default trial the participants were asked to press the mouse button each time they viewed the "P" letter and not when viewing the "R" letter. given one set of two trials (default, reversed). At the reversed inhibition trial the participant were asked to press the mouse button each time they viewed the "R" letter and not when viewing the "P" letter. The Go no Go task includes a practice phase during which participants are given feedback for their correct and incorrect responses. Participants are also given the option to have a small break in between the default trial and the practice phase of the reversed inhibition trial.

Corsi visual memory span (PEBL experiment platform): The participants are presented with nine blue boxes that are spread in the desktop. The blue boxes are lightened up for a duration of 2 seconds and return back to blue color. The number of boxes that are lightened up is gradually increased. Participants are asked to recall the sequence in which the boxes were lightened up and to press the boxes in the right order. As in a typical memory span, participants are asked to recall a sequence of specific number of items twice (e.g., 2 trials with 2 lightened up boxes, lightened up boxes and so on). The task stops when the participant fails to provide the correct sequence twice for a given number of lightened up boxes (Kessels, van Zandvoort, Postma, Kappelle, de Haan, 2000).

Wisconsin Cart Sorting Test (PEBL experiment platform): The computerized version of the WCST, consisting of four stimulus cards and 128 response cards, was used (Heaton, Chelune, Talley, Kay, & Curtiss, 1993). The test proceeds through a number of shifts in set (sorting principles) that varies along three dimensions (color, form and number). Successful performance on the WCST requires the participant first to determine the correct sorting principle on the basis of computer feedback, and then to maintain this sorting principle or set. This instrument is commonly regarded as ‘‘the gold standard executive function task’’ (Ozonoff, Goodlin-Jones, & Solomon, 2005). It promises to be a highly sensitive indicator of executive functions, especially such as mental flexibility, planning, and set maintenance (e.g., Kaland, Smith, & Mortensen, 2008). This task involves monitoring of conflict, with the aim to adjust goal representation flexibility, while new information about current state are increasing, in order to achieve self-regulatory success (Blair & Ursache, 2011; Hofmann, Friese, Schmeichel, & Baddeley, 2011). Self-regulation mechanisms related to cognitive flexibility suggest to not rigidly set the means and plans to attain a goal, but instead to have the ability to adjust to changing circumstances (Vallacher & Wegner, 1987).

Stroop Interference Task: The Stroop task (Stroop, 1935) involves cognitive inhibition of over-learned reading responses. The participants are asked to name the color of boxes in the first trial and to read the black-ink written words of colors in the second trial. For the third trial the participants are instructed to name the color of ink in which a word is written (e.g., the word “blue” written in red ink requires the response of “red”). This inhibition-switching task requires switching between reading the color word, and naming the color in which the color word is printed. Longer times to complete these tasks, and more errors (e.g., reading the color word

instead of naming the color) indicate more difficulties with inhibition and cognitive control (e.g. Bridgett, Oddi, Laake, Murdock, & Bachmann, 2013).

Trail-making test: The Trail-Making test is a well-known neuropsychological test that provides information about visual search speed, scanning, speed of processing, mental flexibility, and attentional shifting (Reitan, 1958; Tombaugh, 2004). The test requires a person to connect a sequence of 25 consecutive targets on a sheet of paper. For the first part the targets are all numbers (1, 2, 3, etc.) and the participant needs to connect them sequential order, and for the second part the participant alternates between numbers and letters (1, A, 2, B, etc.).

In order to control for the executive functions skills of the adolescents participating in the third study (i.e., Go/no Go, Corsi, Wisconsin Card Sorting, Trail-Making and Stroop test), the adolescents also completed the *Cubes* and the *Vocabulary* subscales of the WISC-III (Wechsler, 1991). Those subtests provided an index of the verbal and non-verbal intelligence of the adolescents.

Feelings identification and emotion regulation strategies used during emotionally-arousing films: Six short video clips drawn from earlier studies (e.g. Bourne, Frasquilho, Roth, & Holmes, 2010; Schartau, Dalgleish, & Dunn, 2009; Woud, Holmes, Postma, Dalgleish, & Mackintosh, 2012) and from accessible movies were used to qualitatively examine the in vivo strategies used to regulate emotion. At first, participants completed a paper-and-pencil feelings identification task. Participants were presented with 6 faces (of no identifiable gender) and were asked to identify the emotional expression demonstrated on each face. The emotional expressions depicted on the faced reflected the six basic emotions: sadness, fear, joy, anger, disgust, surprise. The number of correct responses was noted by the experimenter. In case a

participant gave a no response or an incorrect response about one or more of the facial expressions depicted, the experimenter provided the participant with the correct response by the end of the facial expression identification task. The participant did not continue with the in vivo emotion regulation task before being able to name and discriminate among the emotions reflected on the facial expressions. Afterwards, the participants were given instructions on the following task with the emotionally-arousing films. Participants were informed that they would need to be videotaped during watching a series of films and were asked to provide their informed consent before starting with the task. To enhance self-relevance, participants were asked to view the film "as if they were there, a bystander at the scene of the events, and to pay attention to the film as later there may be questions about film content". At the end of each film, participants were asked to rate the degree to which the film induced any of the six basic emotions on a Likert scale from 0 to 8 (9-point scale). In order to verify engagement with the films, participants were then asked to provide qualitative information on the level of attentiveness to the video, whether they had seen the film in the past, the extent to which the traumatic event was expected, the degree of relevance with their own experiences and their reactions to the video (in terms of dissociation, empathy towards the actors, difficulty to return to present after the video clip ended, strategies used to regulate their emotions).

Participants were asked to look towards the camera and were given a simple subtraction task in order to concentrate. The video camera was placed on the top of a laptop's display and the laptop computer used had a 15.6 inch screen. They were asked to subtract 7, starting from a given number. After one minute, the experimenter stopped the participant and explained that they were about to start with the first video. The participants watched a neutral video at the beginning and at the end of the emotionally-arousing video clips. The neutral video was a

compilation of nature-related images. The emotionally-arousing video clips were presented in a random order to the participants and included scenes from films with the following stressful events: a terrorist attack, a vehicle accident, a bullying incident, a robbery with the use of gun, a domestic violence scene and a life-threatening disease scene. Participants were not asked to regulate their emotions during the first three videos, even though they were asked to identify any emotion regulation strategies used by the end of each video. After watching the first three emotionally-arousing films, participants completed a middle evaluation, during which they were asked to identify the most stressful video among the three and the worst scene of that video. Participants were given the chance to talk about the scene if needed, and were asked by the experimenter if they were ready to continue with the rest of the films. Participants were given the instructions that they would be asked to employ a particular emotion regulation strategy for each of the following video clips. The experimenter explained that the participants would be given guidelines before each video clip on a particular strategy, that they would have the option to use during the video if needed. The experimenter randomly gave instructions for the emotion regulation strategies of cognitive restructuring, distraction/suppression and values-based acceptance for each of the following three emotionally-arousing films at the beginning of each. Along with the rest of the questions asked at the end of each film, participants were also asked to qualitatively assess the extent and result of using the emotion regulation strategy they were given instructions about.

Psychosocial adjustment was assessed by teachers (participants of the fourth study) using the *Walker–McConnell Scale of Social Competence and School Adjustment* (Walker & McConnell, 1988). The instrument consists of three subscales (the Teacher-Preferred Social

Behavior, the Peer-Preferred Social Behavior, and the School Adjustment Behavior) reflected in 43 items that describe the social adjustment skills of their students.

A table presenting all measures used in summary can be found in Appendix I.

3.3 Procedure

After bioethical approval of the study by the Centre of Educational Research and Evaluation of the Ministry of Education (no. KEEA/107212/2410/2017), the measures were prepared. We followed a forward-backward translation for the questionnaires that were not available in Greek language. A random selection (1 every three schools for each district) of 10 secondary schools from Cyprus was made using the list of schools provided by the Ministry of Education. The school majors were approached and informed about the study and were invited to participate. Nine high schools agreed to take part in the study. The school counselors together with the school principals were involved in the selection of the classes that would be invited to participate, for those schools that accepted to participate in the study. The school counselors selected a small sample of classes of the schools that included at risk adolescents and then the counselors with the school principals and the research administrators randomly chose 2-3 classes from each school using a coin-selection procedure.

Consent forms for parents and students were sent at homes through the students. The consent forms included a brief description of the study aims, and procedure. The packet with questionnaires to be completed by parents was sent to them from the beginning (along with the consent forms) with guidelines to be completed by all parents who would give their consent for participation. Parents were asked to return the questionnaires back to school in a sealed envelope which was provided by the study coordinators in case they would decide to take part in the study

and had completed the questionnaires. Parents were asked to return the questionnaire empty in case they decided not to take part in the study. Parents had the chance to take part in the study only by their own, to give consent only for their children or both themselves, and their children could participate in the study. Participants were informed about the so-called "second phase" of the study, that would take place in schools and in which their children would complete computerized measures of cognitive and emotional regulation and were asked to provide separate informed consent so that their children could take part. Adolescents were also asked to give their consent for participation, for both the first phase and the second phase. Participants were fully informed about the aims of the study and the procedure before completing the self-report questionnaires. One should note that adolescents were informed a priori that in case severe types of traumatic events (i.e., sexual abuse, sexual harassment) would be reported, confidentiality would break and the school counselors would be informed in order to perform further screening and assessment of the severity. Adolescents were informed that they would be also referred to receive psychological treatment in case sexual abuse was reported in the traumatic events screening done for the aims of the project.

The participants completed self-report questionnaires at Time 1 (total duration 45 min) only after they had return their informed signed consents by themselves and their parents to schools. All adolescents were given a unique code that was used for identifying purposes in case the participants expressed their interest to also participate in the second phase (described above as Study 3). This id number matched across the questionnaires of the adolescent, the parents and the teachers and was also the same number used for the computerized and the paper and pencil tasks. The school counselors and the research coordinator were the only people which had access to the document linking the id to the names of the participants. Those documents were destroyed

after the data collection. All self-report measures were completed independently by the adolescents in their classrooms. Participants who expressed interest for participation in the second phase should indicate their interest on a separate consent form that was again signed and returned to schools by themselves and their parents. During the second phase, adolescents completed the computerized self-regulation tasks and the paper-and-pencil tasks, along with the Brief Resilience Scale (BRS) in a quiet room provided by the schools which accepted to participate in the second phase of the study. The computerized self-regulation tasks were administered on three laptops used for the aims of the study. For the aims of the second phase of the study, participants were informed that they would complete some cognitive and emotional tasks on the computer, a short self-report questionnaire (BRS) and some paper-and-pencil tasks.

They were fully informed that they would be monitored and recorded by camera while watching short videos and they were given the option to participate only in the cognitive tasks without participating in the task with the videos. Full debriefing was provided to adolescents after the end of the second phase and especially in case adolescents participated in the task with the emotionally provoking videos. Specifically, the participants were asked about any potential intrusive thoughts, images or emotions of any traumatic events after participating in that task and were offered participation in a group therapy. The data collection was conducted by the three post-graduate students in school psychology which were research collaborations. After each day of data collection the data files were retrieved from the PEBL program that saved the data in a PEBL documents folder and were saved on an external disk that was kept in an office in the Department of Psychology at the University of Cyprus. The same occurred with the completed self-report questionnaires from the first data collection point, which were kept in a locked office

at the Department. Only the research collaborators that took part in the data collection had access to the data, as they were the ones responsible for the data entry.

Free seminars at the schools were offered on behalf of their participation at the project. The students were not compensated for their participation. Parents were informed that they would be able to receive a report concerning their child's results after the end of the study, if the adolescents participated in the second phase of the study. The psychometric report outlined their performance at the intelligence and the executive function skills examined by the tasks used in the third study.

3.4 Statistical Analyses

Data were entered in SPSS 24.0 and then descriptive statistics were derived. All measures were examined for univariate normality. The data were screened for missing values and a missing value analysis was run to examine if there were systematically missing values in particular items. Reliability analyses were performed in SPSS using the Cronbach's alpha and also in JASP using the 95% CI of the alpha and the McDonald's omega. JASP follows a list-wise exclusion of missing data, therefore was used in order to validate the reliability estimates extracted from SPSS and to provide the confidence intervals of the indices. Exploratory factor analyses (EFA) for the measures were also performed in SPSS using Principal Axis Factoring and examination of the best solution was based on Eigenvalues criterion (>1), on the evaluation of the scree plot and on the Parallel Analysis (extracted from JASP). The EFAs were performed in split sample where sample size was adequate, using the SPSS option of "Data > Select cases >

Random sample of cases" in order to perform the exploratory analysis in half of the sample a confirmatory factor analysis (CFA) on the other half sample.

All structural equation models (SEM) were conducted using Mplus 7.3 (Muthén, & Muthén, 1998-2012). SEM were preferred against regression models, in order to account for measurement error and to avoid Type I error (Byrne, 2009; Kline, 2011). The assumptions of univariate and multivariate normality were examined first, in order to assess the feasibility of applying maximum likelihood estimation. The raw data matrix was analyzed. Model fit was a priori decided to be evaluated with the chi-square test, as well as the following approximate fit indices: the Root Mean Square Error of Approximation (RMSEA) that quantifies badness of fit, t the Bentler's Comparative Fit Index (CFI), for relative improvement in the fit of the hypothesized model over a baseline one that assumes that factors are independent, the Tucker-Lewis Index (TLI) which is preferable for smaller samples and the Standardized Root Mean Square Residual (SRMR). For an adequate model fit, most of the indices should be met, with the CFI, and the TLI > .90 (>.95 is considered to have excellent fit), and the RMSEA and the SRMR <.05, with <.08 being satisfactory as well (Hu & Bentler, 1999). Model comparison was performed using the $\Delta\chi^2$ and the model with the significantly lower chi square value was selected. The critical values of chi square distribution provided by Nist Sematech were used (https://www.itl.nist.gov/div898/handbook/eda/section3/eda3674.htm). Bayesian Information Criterion (BIC) was examined (estimated using maximum likelihood ML estimator) as an index of parsimony (difference > 10 was considered very strong evidence that the model with the lower BIC value was better than the comparison models) (Raftery, 1995). When models were not nested and model comparison could not be performed using the change in chi square, the AIC

and BIC indices were tested. The models with lower AIC and BIC indices were preferred, as they are considered more parsimonious.

The ML was used for all models that achieved univariate and multivariate normality. For models with categorical data (e.g., protective factors) the estimator used was the weighted least square mean and variance adjusted (WLSMV) which is a robust estimator for ordinal data that do not assume variables with normal distribution (Brown, 2006). We exploited all available data including the ones partially missing, under the assumption of data missing at random (Little & Rubin, 2002). Prior to testing the models, identification analysis was performed by estimating the number of observations in the model and the number of parameters to be estimated. In the case the subtraction of these numbers was zero or less, the model was considered not identified and no further exploration of the model was done. Also, Bootstrap with 10000 resamples was used for the CIs of each parameter estimate. Bootstrap is a computer-intensive resampling technique that is used to test direct and indirect effects in order to ensure that the ML symmetric CIs have not resulted in biased statistical inferences (Wang & Wang, 2012).

Multi-level modelling was considered due to having students from different schools in different districts. The potential clustering effects were evaluated using an interval estimation of interclass correlation coefficient (ICC) and design effect (DEFF). The design effect (DEFF) has been described as a correction factor that needs be calculated based in order to test clustering effects (Alimohamadi & Sepandi, 2019). The following formula was used for the computation of the design effect: DEFF = 1 + (m-1)*ICC, where m represents the average number of cluster sample size and ICC represents the interclass (or intercluster) correlation coefficient. The ICC is computed using the following formula: Intraclass Correlation Coefficient= VB/ (VB+VW), where VB is between-cluster variance and VW is within-cluster variance. The rule of thumb for

the design effect suggests that when this effect is lower than 2 and there is not a cluster size less than 10, then there is justification for not accounting for the multilevel or clustered structure in the data (Lai & Kwok, 2014).

In order to evaluate moderation, we used the Mplus code proposed by Stride, Gardner, Catley, and Thomas (2015), Latent Moderated Structural Equations (LMS) have been showed to be accurate in terms of estimated effects and confidence intervals, when compared to regression, which underestimates the magnitude of effects and provides inaccurate confidence intervals (Cheung & Lau, 2017). At the same time, multi-group analyses can be performed as well, which correspond in type to Hayes' PROCESS analysis (Stride et al., 2015), with the aim to examine the changes in the model for those with low, moderate and high levels of the moderating variable. The way that the groups are formed is based on the mean score of the moderating variable and the standard deviation (i.e., one SD above and below the mean represent the moderate level, one SD below constitutes the low level and one SD above is considered the high level).

For the aims of the fifth hypothesis concerning adolescents with high and low susceptibility to traumatic stress, we used Latent Profile Analysis in order to create profiles of adolescents based on the level of traumatic exposure they had and then class membership was used to compare extracted classes on resilience and demographic variables. LPA was conducted using full-information maximum likelihood estimation with robust standard errors (Muthén & Muthén, 2010). The optimal number of latent classes fitting the data was determined by first, calculation and evaluation of the 2- to 6-class solutions. These solutions were compared based on fit statistics, the extent to which they could be interpreted based on their significant differences, and theoretical considerations, as recommended (Vermunt & Magdison, 2002). The main indices used to evaluate model fit were the Bayesian Information Criterion (BIC) and Bootstrap

Likelihood Ratio Test (BLRT). The BIC is considered to balance fit with parsimony, and decreases of BIC values for 10-points or more suggest improved fit (Raftery, 1995). The BLRT statistically compares model fit, as p-values that meet the significance criterion (below 0.05) suggest superior fit for a model with *k* classes versus *k*−1 classes. We also evaluated entropy for each solution, considering values closer to 1 suggest improved classification accuracy. As entropy should not be evaluated in isolation (Nylund, Asparouhov, & Muthén, 2007), we emphasized on the examination of other model fit indices. After determining the optimal number of classes each participant was assigned to one class based on the latent conditional probabilities extracted, and the Mplus statistical estimate of most likely class membership. SPSS 24.0 was used for subsequent analyses. To examine the characteristics of each class, analyses of variance (ANOVA) or independent sample t-tests were decided to be used (depending on the number of latent classes) in order to evaluate between-class differences in continuous variables. Chi-square tests using Crosstabs were computed to evaluate between-class differences for categorical variables (e.g., types of traumatic events experienced).

The current project used a crossed-lagged design with two time-points. Resilience and self-regulation were measured at two time points being four months apart. This design is considered suitable for the investigation of mutual causation and inter-individual change or covariance stability over time (Finkel, 1995). Cross-lagged panel design also allows the examination of the hypothesized direction of the associations in the same model and simultaneously controls for baseline values and covariates. In other words, this design is considered able to demonstrate if traumatic exposure, self-regulation mechanisms and protective factors explain and account for significant variance of the construct of resilience at a later time, apart from the autocorrelations existing with resilience levels as measured at the beginning.

According to Kenny (2014), the two conditions of synchronicity and stationarity must be met in order to assume that a causal model based on crossed-lagged panel correlations is valid. Synchronicity requires that dependent variables be collected at the same point each time, a condition that was met in the current study. Stationarity assumes that the structural equation for a variable is not different at the two measurement points.

For the examination of cross-lagged effects, the two time-point measurements of resilience and self-regulation were inserted in the model and model fit was evaluated. Using a recursive model, the reciprocal effects from resilience on Time 1 on self-regulation on Time 2 and from self-regulation on Time 1 on resilience on Time 2 were examined.

Multi-trait multi-method (MTMM) analysis procedure was used to investigate the validity of resilience construct using different theoretical approaches and measures, and also to detect potential method effects based on informant. Method effects represent the potential bias that can stem from using the same method of assessment to examine different traits. This results in the correlations being higher between these different traits compared to those measured by different methods (Byrne, 2013). The objectives of the MTMM analysis are to determine the extent to which measurement of different traits using the same method are concordant (Dumenci, 2000). Therefore, MTMM analysis is important in providing construct validity evidence. At the same time, when raters are interchangeable and structurally different, as in the case of adolescents and parents, multi-level modeling is not recommended even for homogeneous trait variables (Eid, Nussbeck, Geiser, Cole, Gollwitzer, & Lischetzke, 2008). Instead, in those cases the CFA-MTMM is considered more appropriate (Eid et al., 2008).

Last, preliminary analyses were performed on the emotion-provoking short clips, in order to examine their validity a physiological resilience measure. Noldus FaceReader 6.1 was used for

this analysis, which is offered as a tool for automatically analyzing emotions based on facial expressiveness (Loijens & Krips, 2008). The metrics extracted were the mean heart rate, mean facial expression of fear, mean valence and arousal levels for the baseline and for the neutral video. Also, we extracted the mean heart rate, mean facial expression of fear, mean valence and arousal levels for three randomly chosen videos among the six watched by the participants. Then, the mean change in these scores was computed in two ways, a) by subtracting from baseline indices and b) by subtracting from indices while watching the neutral video. Furthermore, we extracted data on the time needed from presentation of the stressor in the video, after the first change in scores was identified (any change) until heartbeat, arousal, and fear scores would return to a) baseline levels, and b) levels observed during watching the neutral video. Due to the small number of participants expected to participate in this preliminary study, the analyses were performed using linear regression and bivariate correlations in SPSS.

Importantly, there is very little research on the usability of FaceReader in analyzing emotions while working on a computer instead participating in human-to-human interaction, and there is no research on its potential use as a resilience index. Terzis, Moridis, and Economidades (2010) compared FaceReader reported emotions to human observers, and found FaceReader's assessment of the emotion to be comparable to the human observers with the exception of disgusted and angry emotions being recognized less effectively. Lewinski, den Uyl and Butler (2014) reported an average of 88% accuracy of basic emotion recognition based on their validation study of FaceReader using still images reflecting emotions. Recent evidence also supports consisted accurate classification of FaceReader and manual facial action coding system to be approximately 80% (Skiendziel, Rösch, & Schultheiss, 2019).

According to Wolf (2015), use of Electromyography (EMG) for analyzing emotion expression based on the activation of facial muscles proven to provide accurate information on a number of emotional states. Due to the technical limitations EMG can only be used in laboratory settings, however (Wolf, 2015). Manual facial expression analysis, on the other hand, is a labor intensive and relatively slow method which usually involves a human observer viewing video recordings in slow motion to record very short lived changes in facial display (action units) of emotions. It has been estimated that approximately 100 hours of training is required for the observer to be able to track facial displays with acceptable accuracy, and even with training, this method is susceptible for bias (Cohn, Zlochower, Lien, & Kanade, 1999). While manual facial coding to some extent relies on human observer interpreting facial expressions, automated facial coding (AFC) systems such as FaceReader software use algorithm to identify variation in facial display based on video recording of the research participant. FaceReader software identifies basic human emotions as defined by Ekman (1973): happy, sad, angry, surprised, scared, disgusted and neutral. Additionally FaceReader recognizes contempt. The expression recognition is a three-step process involving (1) Face finding; (2) Face modeling, or creating a 3-D image of the face with 500 key points; (3) Face classification, which involves analyzing the changes in the location of the key points and classifying the expressions based on the changes (Loijens, Krips, van Kuilenburg, den Uyl, & Ivan, 2015). FaceReader may be used in conjunction with other physiological measures such as heart rate registration or EEG to gather more complete picture of the participant's state during research (Lewinski et al., 2014). Importantly, the newer versions of Facereader, provide heart beat data as extracted from remote photophethysmography. Computation of arousal does not correspond to arousal as measured in psychophysiological research, but reflects that more action units of emotions are activated concurrently. Near accurate

identification of emotion based on still pictures may not suffice, thus videos were used in the present study.

FaceReader analyses include, on a scale from 0 (not present) to 1 (fully present), the intensity of each of the seven (plus neutral) FaceReader identifies emotions at any given time, on time intervals of 0,04 seconds. Additionally FaceReader reports participant's emotional state based on a dominant emotion, or emotion with highest intensity as well as arousal and valence (Loijens et al., 2015). When a dominant emotion changes and is present for more than 0,5 seconds, the state log is updated with the new emotional state. Valence is calculated by deducting the intensity of the negative emotion with the highest intensity from the intensity of happy, the only positive emotion FaceReader recognizes. Only heart rate, arousal and the facial expression of fear were used for the aims of the present project.

Chapter 4. RESULTS

4.1 Preliminary analyses, missing value analysis and achieved power

Hierarchical multilevel modeling was considered, due to the two levels of clustering related to adolescents' school and schools' district. Clustering in populations used in research is considered a phenomenon that exists prior to the empirical investigation. Due to this clustering, it is likely that the observed dependent variable scores at the time of data collection are correlated within higher order units (Raycov & Marcoulides, 2015). Clustering effects were evaluated using an interval estimation of interclass correlation coefficients and design effects (described in more detail in the Methodology section).

The computation of the ICC and DEFF for the aims of the present study showed that ICC= -.003 (95% CI -.008, .004), suggesting that observations are nearly independent and that the Type I error rate is low (e.g., Musca, Kamiejski, Nugier, Méot, Er-Rafiy, & Brauer, 2011). The smallest cluster size was equal to 20 participants. Therefore, computation of the DEFF resulted in DEFF= 1.136 (95% CI 1.186, 1.372), suggesting no justification for a hierarchical structure based on district and school. Apart from that, there were not enough reasons to account for hierarchical structure of the data, given that there was no evidence supporting that specific traumatic events might had been experienced by only some people living in one district or in one school. Due to the low interest in these higher-level predictors of district and school and the evidence from metrics that clustering effects were low, multilevel models were not considered essential for the aims of the present study.

The missing value analysis performed on the data from the first study supported that the percentage of missing data was <2% and that the data were missing at random. One missing data pattern was identified, in which data from the questionnaires of alexithymia and psychopathic

traits tended to be missing together in participants. One possible reason is that those questionnaires were at the end of the questionnaire packet and the participants may have left them out due to running out of time. It is considered less probable that participants avoided those two questionnaires on purpose, as no other missing data patterns were identified when considering the rest of the questionnaires measuring traumatic exposure, resilience or self-regulation mechanisms. When the data from the second study were added, the percentage of missing data was up to 3.52% for one item from the FRAS. No missing data patterns were identified for the parent sample using the missing value analysis.

The final sample size that participated in the main study was 475 adolescents. Based on the post-hoc power analysis using G*Power 3.1, the achieved power having a number of tested predictors at 20 and effect size of .15, the achieved power was equal to .999. The final sample of parents that participated in study 2 was 216. The post-hoc analysis showed that the achieved power having a number of concurrently tested predictors at 15 and effect size of .15, the achieved power was equal to .968. The sample of adolescents from study 1 that also participated in study 3 was 67. The post-hoc analysis showed that the achieved power having a number of concurrently tested predictors at 5 and effect size of .15, the achieved power was equal to .634. Teachers provided data only for 22 students. The post-hoc analysis showed that for a number of concurrently tested predictors at 3 and effect size of .15, the achieved power was equal to .247.

4.2 Reliability analyses for all measures

Reliability reflects the extern to which a measure consistently captures what is intended to measure (Field, 2013). Internal consistency reliability analyses were conducted using Cronbach's alpha and McDonald's omega. Due to the assumptions on which the accuracy of coefficient alpha depends that include uncorrelated item errors, unidimensionality of the scale (a

single construct or factor is reflected by the measure), all items having the same true score variances and all items having the same relationship to the construct which is measures (that means equal factor loadings of the items), coefficient omega was also calculated (Watkins, 2017). Omega should be reported as it reflects the proportion of variance that is explained by all factors in cases of multidimensionality, based on a factor analytic framework (Green & Yang, 2015). The coefficients and confidence intervals of each measure are presented on Table 1.

Table 1. Presentation of the reliability coefficients for the scales of the study.

Scale	Number of items	Reliability analysis (Cronbach's alpha)	Cronbach's alphas (with missing excluded listwise)	Reliability analysis CI 95% for alphas (with missing excluded listwise)	Reliability analysis (McDonald's omega)
PROPS	30	.928	.990	.989, .991	.992
FEC	28	.866	.841	.820, .861	.864
A.Interpersonal Tension	8	.674	.473	.398, .542	.608
B.Financial Difficulties	9	.823	.613	.559, .663	.732
C.Child-related problems	10	.691	.650	.601, .695	.666
FRAS	66	.914	.984	.982, .986	.987
A.Belief Systems	19	.842	.935	(.926, .943)	.943
A1.Making meaning of adversity	8	.742	.766	(.733, .797)	.794
A2.Maintaining positive outlook	7	.785	.939	(.930, .947)	.947

A3.Transcendence and spirituality	4	.808	.839	(.814, .861)	.883
B. Organizational Patterns	27	.766	.958	(.953, .964)	.966
B1.Flexibility	5	.529	.792	(.761, .820)	.823
B2.Connectedness	6	.354	.792	(761, .819)	.832
B3.Social and Economic Resources	16	.736	.952	(.946, .958)	.961
C. Communication/Problem solving	20	.849	.957	(.951, .962)	.960
C1.Clarity	7	.702	.900	(.885, .913)	.911
C2.Open Emotional Expression	6	.400	.877	(.859, .893)	.896
C3.Collaborative Problem-Solving	7	.822	.893	(.878, .907)	.896
TESI -PR	24	.670	.628	(.577, .675)	.690
TESI -SR	26	.679	.986	(.985, .988)	.986
Child Youth Resilience Measure -28	28	.923	.992	(.991, .993)	.993
A.CYRM Individual	11	.867	.978	(.974, .980)	.979
B.CYRM Caregiver	7	.859	.975	(.972, .979)	.976
C.CYRM Context	10	.755	.980	(.977, .982)	.980

Brief Resilience Scale	6	.952	.738	(.699, .773)	.872
Impact of Events Scale-Revised	22	.943	.996	(.995, .996)	.996
A.Intrusion	8	.888	.988	(.986, .989)	.988
B.Avoidance	8	.868	.991	(.989, .992)	.991
C.Hyperarousal	6	.839	.982	(.979, .984)	.982
Centrality of Events Scale	20	.955	.993	(.992, .994)	.993
Child & Adolescent Mindfulness Measure	10	.928	.928	(.918, .938)	.930
Post-Traumatic Cognitions Inventory	36	.939	.994	(.993, .995)	.995
A.Negative cognitions about self	21	.928	.989	(.987, .990)	.990
B.Negative cognitions about world	7	.838	.975	(.971, .978)	.977
C.Self-blame	5	.697	.967	(.962, .971)	.970
Cognitive Emotion Regulation Questionnaire	36	.924	.993	(.992, .994)	.995
A.Self-blame	4	.804	.956	(.949, .962)	.953
B.Acceptance	4	.651	.945	(.936, .953)	.948
C.Rumination	4	.780	.928	(.917, .938)	.931

D.Positive Refocusing	4	.749	.946	(.937, .953)	.949
E.Refocus on Planning	4	.775	.948	(.940, .955)	.950
F.Positive Reappraisal	4	.673	.780	(.746, .811)	.887
G.Putting into perspective	4	.765	.824	(.797, .849)	.867
H.Catastrophizing	4	.668	.962	(.956, .967)	.965
I.Other-blame	4	.599	.994	(.993, .994)	.994
Emotion Regulation Questionnaire	10	.807	.981	(.978, .983)	.981
A. Emotion Regulation Questionnaire - Suppression	4	.711	.950	(.942, .957)	.950
B.Emotion Regulation Questionnaire - Reappraisal	6	.795	.971	(.967, .975)	.971
Alexithymia	20	.848	.982	(.979, .984)	.983
A.Difficulty Identifying Feelings	7	.854	.946	(.939, .953)	.951
B.Difficulty Describing Feelings	5	.605	.950	(.943, .957)	.952
C.Externally-Oriented Thinking	8	.648	.957	(.951, .963)	.960
Attention Control Scale	20	.722	.994	(.993, .994)	.994

A.Difficulty focusing	10	.673	.989	(.987, .990)	.989
B.Attentional shifting	10	.658	.985	(.983, .987)	.985
Self-Regulation Questionnaire	63	.972	.998	(.998, .998)	.998
A.Receiving	9	.818	.985	(.983, .987)	.986
B.Evaluating	9	.795	.981	(.978, .983)	.981
C.Triggering	9	.575	.984	(.982, .986)	.984
D.Searching	9	.882	.988	(.986, .990)	.989
E.Formulating	9	.826	.983	(.980, .985)	.983
F.Implementing	9	.804	.985	(.983, .987)	.985
G.Assessing	9	.846	.986	(.984, .988)	.986
Walker-McConnell	43	.934	.934	(.925, .942)	.978
A.Teacher Preferred	16	.970	.970	(.965, .973)	.970
B.Peer Preferred	17	.713	.713	(.674, .750)	.957
C.School Adjustment	10	.882	.882	(.866, .897)	.896
Youth Psychopathic Inventory	18	.818	.998	(.997, .998)	.998

A.Interpersonal Dimension	6	.553	.988	(.987, .990)	.989
B.Affective Dimension	6	.672	.994	(.993, .995)	.994
C.Behavioral Dimension	6	.607	.993	(.992, .994)	.993
Youth Self-Report	119	.982	.997	(.997, .997)	.998
A.Anxious /Depressed	13	.840	.983	(.981, .986)	.983
B. Withdrawn /Depressed	8	.818	.974	(.970, .977)	.975
C.Somatic Complaints	10	.927	.987	(.985, .989)	.988
D.Social problems	11	.705	.949	(.942, .955)	.972
E.Thought problems	12	.897	.977	(.974, .980)	.977
F.Attention problems	9	.669	.975	(.972, .979)	.976
G.Rule-breaking behavior	15	.921	.983	(.981, .985)	.984
H.Aggressive behavior	17	.855	.968	(.964, .972)	.979
Internalizing problems	31	.951	.992	(.991, .993)	.992
Externalizing problems	32	.945	.987	(.986, .989)	.991
Total problems	95	.979	.997	(.996, .997)	.997

Other problems	10	.864	.971	(.967, .974)	.972
Depressive problems	13	.887	.980	(.977, .982)	.980
Anxiety problems	9	.707	.976	(.973, .979)	.977
Somatic problems	7	.961	.985	(.983, .987)	.985
Attention/Deficit	7	.640	.958	(.952, .963)	.958
Oppositional Defiant	5	.570	.931	(.921, .941)	.932
Conduct problems	15	.885	.966	(.961, .970)	.980
Obsessive-Compulsive	8	.708	.963	(.958, .968)	.963
Stress problems	14	.785	.980	(.977, 982)	.980
Positive Qualities	14	.876	.984	(.982, .986)	.985

4.3 Presentation of results for study 1

4.3.1 Factorial structure of measures used in Study 1

Factorial structure for all questionnaires used was also assessed, in order to evaluate the dimensionality of the measures and to determine the most appropriate coefficient of internal consistency (e.g., Green, & Yang, 2015). The sample was randomly split and factorial structure of the measures was examined using Principal Axis Factoring in half of the sample and was

confirmed using Confirmatory Factor Analyses in the other half sample. The main measures used to test each of the hypotheses are presented below.

The EFA for the IES-R using Principal Axis Factoring which was examined using the criterion Eigenvalues>1 supported that one factor was extracted (Eigenvalue= 9.755), that could explain 64.34% of the variance. The scree plot confirmed that one factor was reflected in the questionnaire and the Parallel Analysis (PA) also suggested using the simulated 95th quantile that one factor structure should be extracted. The CFA for the IES-R was examined using one-factor, two-factor and the proposed by the literature, three-factor structure. The two-factor and the three-factor structures were both significantly better than the one-factor model based on the $\Delta\chi^2$. However, the three-factor model was considered better supported by the theoretical background and the literature, and therefore further modifications were tested on that model, as there was not enough evidence to follow the two-factor model based on the results of the EFA, the PA or the theoretical background. The three-factor structure showed that the correlations between the three symptom categories of intrusion, avoidance and hyperarousal symptoms were high enough to suggest a hierarchical second-order structure of the questionnaire. The higher the intrusions one experienced, the more avoided triggers of the traumatic event (r= .725, SEr= .034, p< .001). Higher intrusion symptoms were also related to higher levels of hyperarousal symptoms (r= .924, SEr= .017, p< .001). The experience of symptoms of hyperarousal was also related to higher levels of avoidance (r= .704, SEr= .038, p< .001). Examination of the second-order model supported that all three latent factors loaded significantly and high (close to .80 and above) on a higher order factor, which was named "PTS" reflecting the experience of post-traumatic stress symptoms. Two modifications were suggested as shown by the modification indices that were well above 20 (MI= 83.75 and MI= 67.89, respectively) and concerned the loading of two items

on different factors than suggested by the original questionnaire. Specifically, item 2 ("I had trouble staying asleep") should load on the "Intrusion" factor based on the manual. However, the modification index was suggesting that this item should load on the "Hyperarousal" instead and this suggested modification was considered appropriate based on the verbal component of the item, which might imply that one has trouble staying asleep due to hyperarousal. The item 12 ("I was aware that I still had a lot of feelings about it, but I didn't deal with them") should load on the "Avoidance" factor based on the manual, however the modification index suggested that it should load with a higher estimate on "Intrusion" factor. Indeed, the first part of the sentence (i.e., I was aware that I still had a lot of feelings) might also reflect intrusive symptoms experienced by the participants. After performing these modifications, the model fit was significantly better (see Table 2 for model comparison). Another suggested modification concerned the covariance between the error terms of Items 18 and 19. Both items load on the Hyperarousal factor and reflect observed difficulties (Item 18: "I had trouble concentrating" and Item 19: "Reminders of it caused me to have physical reactions, such as sweating, trouble breathing, nausea, or a pounding heart."). Due to the semantic similarity between the items, the modification was performed and resulted in a better model fit. The final second-order model with three first-order latent factors is presented on Figure 2. Importantly, due to the conflicting evidence regarding the factorial structure of this measure, all further analyses were performed both with one-factor and three-factor structure of the post-traumatic stress symptoms.

Table 2. Presentation of CFAs in randomly split half sample. Model comparisons are made with the previous model, with the exception of Model C which is compared with Model A.

Model	χ^2 (df)	CFI	TLI	RMSEA (90% CI)	SRMR	AIC	BIC	$\Delta\chi^2$ (df)
One-factor IES-R	1020.492 (209)***	.794	.772	.109 (.102, .116)	.070	20641.290	20891.427	
Two-factor IES-R	754.138 (208)***	.861	.846	.090 (.083, .097)	.057	20376.936	20630.863	266.354 (1)***
Three-factor IES-R (Second order)	868.944 (206)***	.832	.811	.099 (.092, .106)	.070	20495.742	20757.249	151.548 (3)***
Three-factor with modified loadings for Items 2 & 12	723.260 (205)***	.868	.852	.088 (.081, .095)	.060	20352.058	20617.355	145.684 (1)***
Three-factor with modified loadings for Items 2 & 12 and covariance between Items 18-19	580.103 (204)***	.904	.891	.075 (.068, .083)	.054	20212.901	20485.778	143.157 (1)***

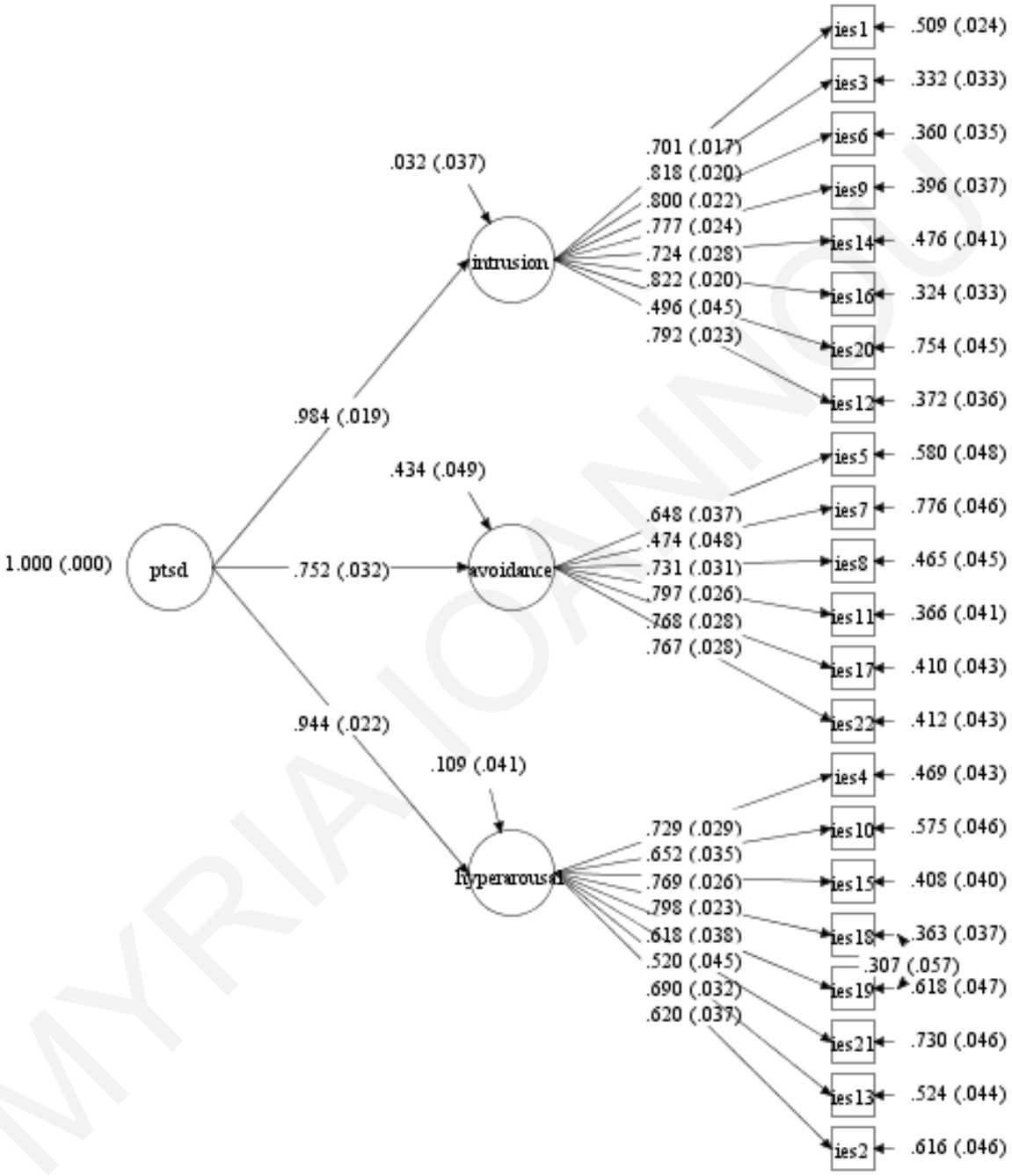

Figure 2. CFA of the IES-R (Final model chosen presenting the standardized estimates).

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The EFA for the BRS using Principal Axis Factoring which was examined using the criterion Eigenvalues>1 supported that one factor was extracted (Eigenvalue= 4.611), that could explain 76.85% of the variance. The scree plot and the PA also confirmed that one factor was reflected in the questionnaire. The CFA for the BRS using one-factor solution supported acceptable model fit (Table 3, Model A). However, some modifications were suggested. The first modification suggested was to account for the covariance between the error terms of items 3 ("It does not take me long to recover from a stressful event") and 5 ("I usually come through difficult times with little trouble"). Those two items are both positively worded (items 2, 4, and 6 in BRS are negatively worded) and there is semantical similarity that would justify the additional relationship between the way these two items are answered. After this modification was performed, model fit was significantly improved, and no more considerable modifications were suggested based on the modification indices of that final BRS model (Figure 3).

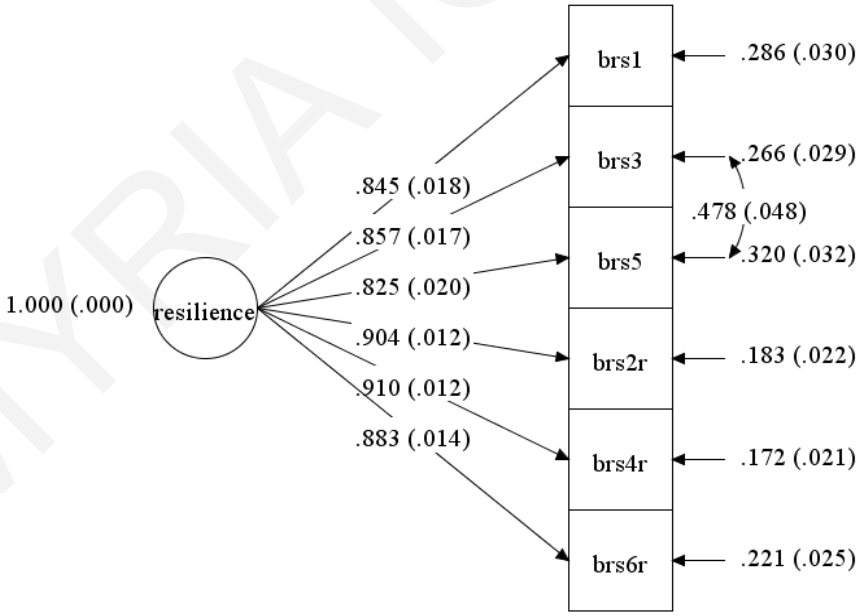

Figure 3. Presentation of the final BRS model, selected based on model comparison. The standardized estimates are presented.

The EFA for the CES using Principal Axis Factoring which was examined using the criterion Eigenvalues>1 supported that one factor was extracted (Eigenvalue= 10.456), that could explain 52.28% of the variance. The scree plot and the PA also confirmed that one factor was reflected in the questionnaire. The CFA for the CES using one-factor solution supported acceptable model fit (Table 3, Model B). One modification was well enough 20 (MI= 34.89) suggesting that the error terms of the items 1 and 2 should be correlated. However, when looking at the items (Item 1: "This event has become a reference point for the way I understand new experiences." and Item 2: "I automatically see connections and similarities between this event and experiences in my present life.") no significant justification could be given for drawing a covariance between the items' errors, in terms of verbal language or semantical similarities. Therefore, no modification indices were considered essential for the one-factor solution of the CES (Figure 4).

The EFA for the protective factors using Principal Axis Factoring which was examined using the criterion Eigenvalues>1 supported that two factor should be extracted (Eigenvalue= 3.479, 2.267), that could explain 33.43% of the variance. The scree plot supported that two factors should be extracted, but the PA supported an one-factor solution. Thus, CFAs using one and two latent factors were also examined prior to deciding the structure. The WLSMV estimator was used, as the observed variables were dichotomous (i.e., participants indicated whether they had or not each protective asset). The model comparison supported that the one-factor CFA for the protective factors had significantly better fit than the two-factor solution (see Table 3, Model C and Figure 5).

Table 3. Presentation of CFAs in randomly split half sample.

Model	χ^2 (df)	CFI	TLI	RMSEA (90% CI)	SRMR	AIC	BIC	$\Delta\chi^2$ (df)
A.One-factor BRS	173.866 (9)***	.923	.872	.229 (.200, .260)	.036	5447.506	5516.846	
A1. Model A with 1 modification	113.192 (8)***	.951	.908	.194 (.164, .227)	.035	5388.833	5462.024	60.674 (1)***
B.One-factor CES	537.779 (170)***	.910	.897	.083 (.075, .091)	.046	16702.833	16944.603	
C.Two-factor Protective	774.696 (208)***	.498	.442	.100 (.093, .108)	.102	6756.147	6997.735	
C1.One-factor Protective	364.549 (210)***	.900	.886	.082 (.065, .089)	.058	6341.999	6576.377	410.147 (2)***

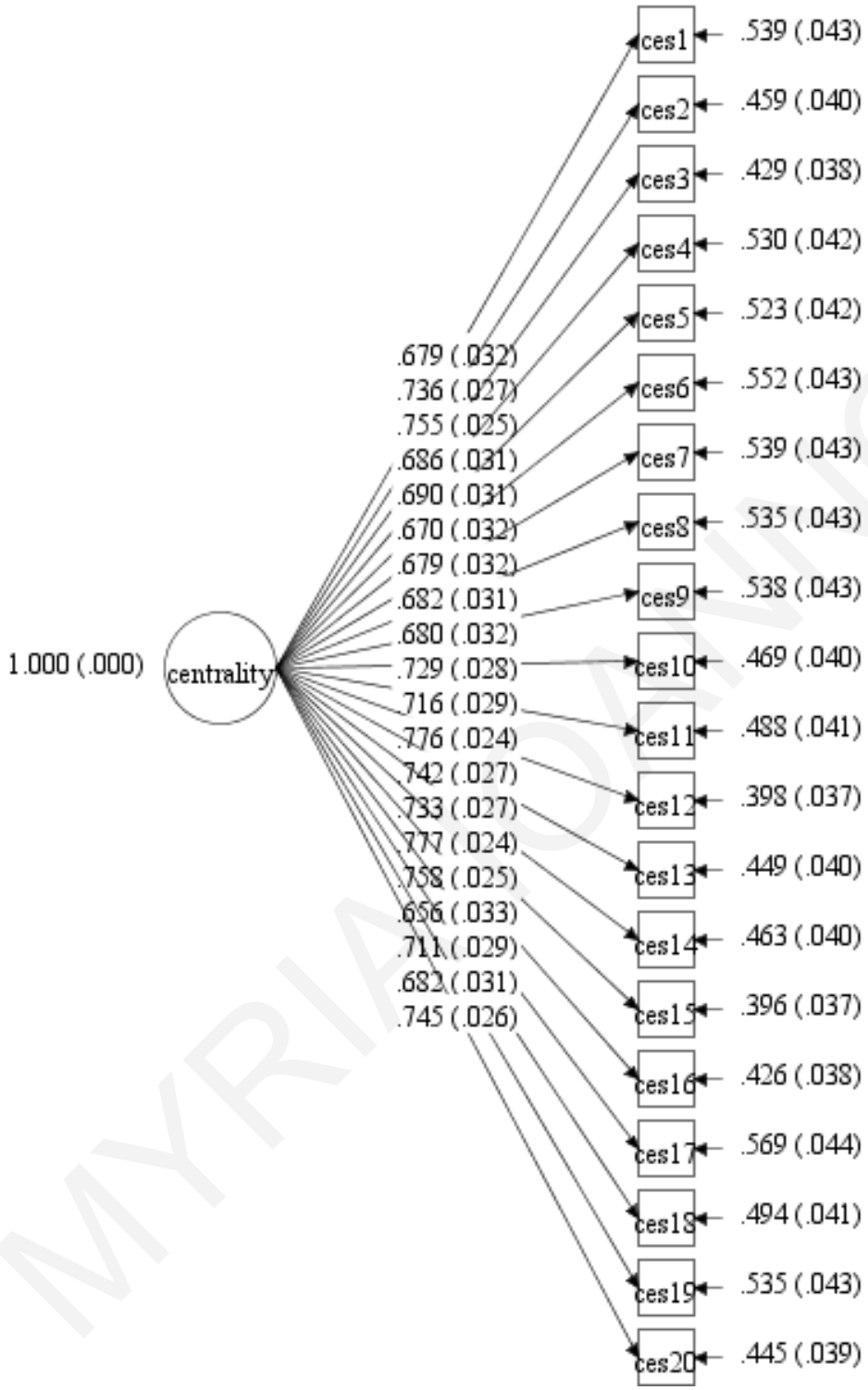

Figure 4. CFA of the CES using one-factor solution and presenting the standardized estimates.

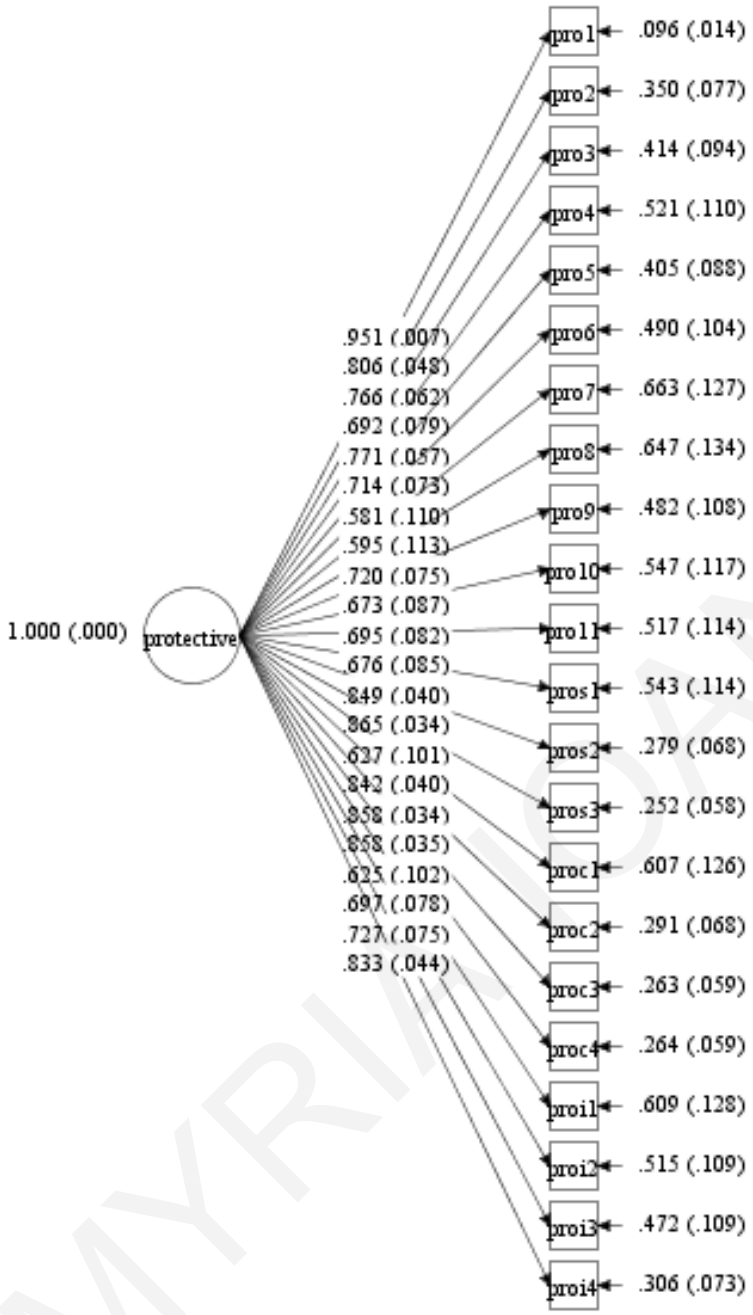

Figure 5. CFA of the protective factors using one-factor solution and presenting the standardized estimates.

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4.3.2 Descriptive statistics for Study 1

The number of adolescents who took part in study one was 475. Among those, 52.4% were males and 46.5% were females, whereas the rest did not provide any data of their gender. The mean age of the sample was 14.78 (SD= 2.49). The majority of the sample (83.7%) had Cypriot nationality. Approximately 5% of the sample had another European nationality (4.8%, from Greece, Bulgaria, Rumania, and United Kingdom), 2% were migrants from Syria and the rest did not provide information about their nationality. The 77.5% of the sample reported having experienced at least one traumatic event. The most commonly endorsed traumatic events were experiencing the illness of a closed person, being exposed to war/terrorism presented in the news and having experienced the death of a loved one. The 21.3% of the sample reported being exposed to non-familial violence events, whereas the respective percentage who had experienced domestic violence was 7.7%, with 4.4% being exposed to threats for domestic violence. A percentage equal to 19.3% reported having experienced significant changes in relationships due to the divorce of their parents. A considerable percentage of participants endorsed having been exposed to a dog attack (14%) and a similar percentage (13.8%) reported having witnessed people using substances. Physical attack has been endorsed by 10.1% of the sample and 2.1% endorsed sexual abuse. All main variables were tested for univariate normality. No major violations of skewness and kurtosis were detected (see Table 4). The participants indicated having a high prevalence of presented protective factors in general, in the contexts of family, school, community and personal. Especially for the family protective factors, the majority of the participants indicated having trust in the relationship with their parents, good communication and collaborative decision making. The prevalence of protective and risk factors indicated by the participants is presented on Table 5.

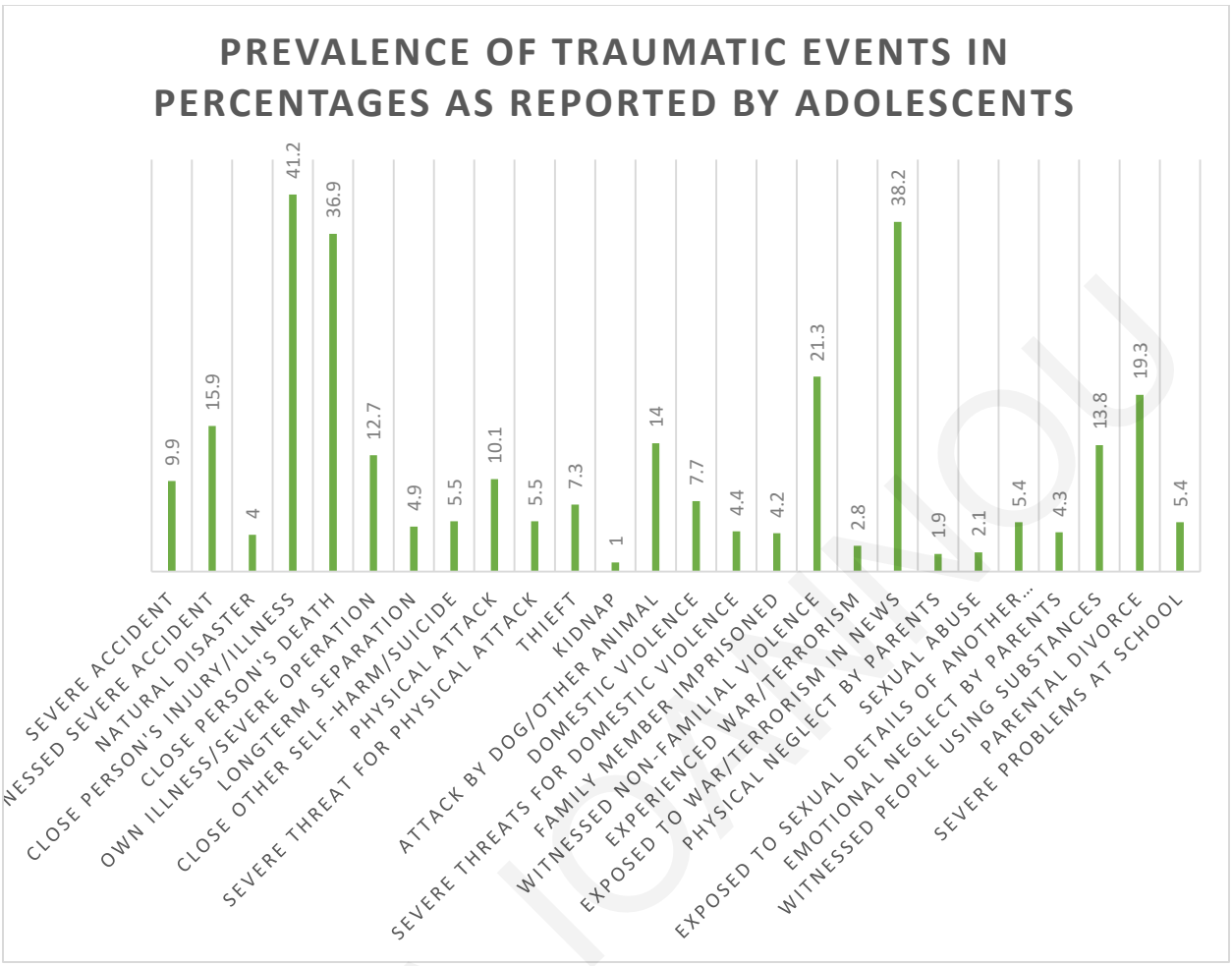

Figure 6. Prevalence of traumatic events (shown in percentages).

Table 4. Descriptive statistics of main variables and covariates.

	Mean	SD	Skewness	SE	Kurtosis	SE
Intrusion	1.254	1.059	1.504	.136	5.061	.271
Avoidance	1.380	.986	.124	.136	-1.059	.271

Hyperarousal	1.048	.958	.874	.136	.069	.271
Total PTS	26.680	19.164	.395	.136	-.409	.271
Total BRS	20.379	7.821	-.534	.133	-1.465	.266
Total CYRM	110.477	19.448	-1.458	.141	4.459	.281
Individual CYRM	44.175	7.840	-1.545	.139	4.106	.276
Caregiver CYRM	29.090	5.452	-1.546	.136	3.172	.271
Context CYRM	36.946	7.972	.038	.137	6.604	.273
Absence of mindfulness	30.910	8.438	-.445	.133	-.734	.266
Behavioral Psychopathic Traits	13.704	4.095	.432	.226	-.238	.447
Affective Psychopathic Traits	13.902	4.520	.066	.239	-.755	.474
Interpersonal Psychopathic traits	14.150	4.328	.238	.241	-.262	.478
Total YPI	41.192	10.709	.213	.249	-.134	.493
Alexithymia	49.456	10.197	.466	.186	-.604	.369

Table 5. Prevalence of indicated protective and risk factors.

	Factor	%
FAMILY PROTECTIVE	Good communication with parents	66.7
	Collaborative decisions with parents	81.3

FAMILY			Trust in the relationship with parents	86.9
			Stable home rules	78.7
			Satisfactory economic resources	76.9
			Help from wider family	66.9
			Free medical services	51.5
			Supportive other family members	68.3
			Participation in community events	44.2
			Participation in religious events	37.1
			Following traditions	48.1
			Stable school rules and sense of safety	48.5
			School accepts divergence	36.8
			Positive student-teacher relationships	62.2
			Good community services	32.3
			Sense of safety in community	62.0
			Community accepts divergence	50.2
			Sense of pride in community	49.6
			Good physical condition	34.0
			Involvement in out-of-school activities/hobbies	49.2
			Close to religion	37.0
			High academic performance	38.5
			Frequent house changes/family moving	24.4
			Single-parent family	13.2
			Parents not working/economic hardship	16.9

OTHER RISK FACTORS	Chronic health problem of one family member	8.9
	Chronic psychiatric problem of one family member	10.2
	Transgenerational trauma	6.7
	Frequent school changes due to disruptive behavior	4.7
	Low accessibility in services due to living in rural area	33.8
	Previous treatment for psychiatric/psychological problem	17.6
	Previous treatment for other difficulties (e.g., speech therapy, occupational therapy)	5.2

Participants reported their levels of cognitive dysregulation, based on the self-reports from the post-traumatic cognitions inventory (PTCI) and the attentional control scale (ACS), the levels of emotional regulation (cognitive reappraisal measured by the ERQ and adaptive cognitive emotion regulation strategies of acceptance, putting into perspective, refocusing on planning, positive refocusing and positive reappraisal as measured by the CERQ). The behavioral self-regulation was indicated through the self-regulation questionnaire (SRQ). None of the questionnaires' subscales violated normality. Descriptive statistics are presented on Table 6. Also, the descriptive statistics extracted for the psychopathology indicators from the youth self-report (YSR) supported no violations of normality (Table 7).

Table 6. Descriptive statistics for self-regulation mechanisms.

	Mean	SD	Skewness	SE	Kurtosis	SE

PCI_negative cognitions for self	1.581	.603	1.638	.183	3.281	.364
PCI_negative cognitions for world	2.631	.930	-.060	.172	-.504	.342
PCI_blaming self	1.799	.824	.944	.169	.235	.337
SRQ_Receiving	29.695	7.708	-1.718	.214	2.065	.425
SRQ_Evaluating	25.167	7.185	-2.081	.221	2.536	.438
SRQ_Triggering	28.183	5.489	-2.236	.216	2.272	.428
SRQ_Searching	28.371	8.631	-1.553	.211	2.478	.419
SRQ_Planning	28.544	7.947	-1.885	.217	2.351	.430
SRQ_Implementing	29.040	7.489	-1.610	.216	1.982	.428
SRQ_Assessing	28.163	8.082	-1.922	.213	1.443	.423
ERQ_Cognitive Reappraisal	3.299	.732	-.695	.179	1.551	.356
ERQ_Expressive Suppression	2.724	.819	.150	.179	.206	.355
CERQ_Selfblame	1.775	.906	1.345	.168	1.558	.335
CERQ_Acceptance	2.563	1.028	.338	.169	-.569	.337
CERQ_Rumination	2.602	1.089	.223	.170	-.867	.339
CERQ_Positive refocus	2.812	1.016	.121	.169	-.585	.337
CERQ_Refocus on planning	2.698	1.084	.044	.169	-.886	.337

CERQ_Positive reappraisal	2.715	.998	.111	.191	-.644	.379
CERQ_Putting perspective	3.195	1.077	-.266	.181	-.631	.359
CERQ_Catastrophizing	2.458	.983	.199	.168	-.800	.334
CERQ_Blaming others	1.892	1.175	2.716	.201	1.468	.399
CERQ_Maladaptive strategiees	2.074	.756	.551	.217	-.524	.430
CERQ_Adaptive strategies	2.779	.814	-.299	.220	.103	.437
ACS_Difficulty focusing	23.944	6.099	.090	.217	.000	.431
ACS_Difficulty with Attentional Shifting	24.734	6.136	-.121	.214	-.096	.425

Table 7. Descriptive statistics of psychopathology subscales from YSR.

	Mean	SD	Skewness	SE	Kurtosis	SE
Anxious_depressed	6.898	6.296	1.220	.233	1.156	.461
Withdrawn_depressed	5.211	5.041	1.316	.231	1.327	.459
Somatic_complaints	4.952	7.202	2.391	.238	5.730	.472
Social_problems	3.991	4.130	1.270	.235	1.055	.465

Thought_problems	6.135	7.886	1.847	.246	2.710	.488
Attention_problems	4.955	3.660	.878	.228	1.178	.453
Rule_breaking	7.462	10.317	2.140	.237	3.732	.469
Aggressive_behavior	8.938	7.589	1.834	.246	4.355	.488
Obsessive_compulsive	4.583	3.950	1.128	.238	.811	.472
Stress_problems	8.495	6.158	.816	.243	.441	.481
Positive qualities	19.330	8.384	-.100	.235	.444	.465
Depressive problems	7.400	8.328	1.935	.236	3.457	.467
Anxiety problems	5.185	4.028	.666	.233	-.038	.461
Somatic problems	7.717	9.220	.889	.206	-.905	.410
Attention problems	4.685	3.384	.936	.229	1.670	.455
Oppositional defiant problems	3.082	2.435	.800	.230	.056	.457
Conduct problems	5.943	7.999	1.981	.235	3.276	.465
Internalizing problems	17.035	17.387	1.837	.261	3.324	.517
Externalizing problems	16.793	18.211	1.907	.258	2.939	.511
Other problems	6.453	6.771	1.992	.247	3.834	.490
Total problems	49.964	49.794	1.693	.322	2.087	.634

4.3.4 Hypotheses testing of Study 1

Associations between trauma parameters supported that centrality of event correlated significantly with a positive correlation only with hotspot memory, with a small magnitude (r=

.133, SEr= .057, p= .007). That is, having experienced the hotspot memory of an event more recently was related to considering the event as more central for one's life and identity. Having experienced events that were considered more "close" to one's self was related to having experienced more traumatic events in general (r= .631, SEr= .028, p< .001) and to having experienced traumatic events earlier in life (r= .362, SEr= .058, p< .001). That is, those adolescents with more severe forms of trauma (physical abuse, domestic violence and sexual abuse) that are considered interpersonal types of trauma, rather than more distant and indirect types of trauma (such as, accidents, natural disasters, injuries, illnesses and deaths of loved ones), were more prone to having experienced multiple types of traumas and to having experienced traumatic events early (developmental traumas or more complex childhood traumas). Having experienced a traumatic event earlier in life was significantly related to having experienced more traumatic events in general (r= .502, SEr= .047, p< .001). Also, having experienced your first traumatic event long time ago was related to having experienced longer duration of a traumatic event which was considered as the worst (r= .279, SEr= .066, p< .001) and to having more recent hotspot memories about a traumatic event (r= .412 SEr= .055, p< .001). The matrix correlation is presented on Table 8.

Table 8. Correlation matrix for trauma-related parameters used the generated estimated correlation matrix with Full Information Maximum Likelihood (FIML) in Mplus.

	2.	3.	4.	5.	6.
1. Centrality of event	-.094	-.039	.153**	.009	.025
2. Total number of events	1	.631***	.002	-.078	.502***
3. Closeness of worst event to self		1	-.020	-.132	.362***
4. Hotspot memory of worst event			1	.012	.412***
5. Duration of worst event				1	.279***
6. Time since first traumatic event was experienced					1

Note: *p< .05, **p< .01, ***p< .005.

Hypothesis 1 stated that trauma parameters would differentially predict traumatic stress reactions. A path model was tested, with centrality of event and post-traumatic stress symptoms as latent variables formed by the twenty and twenty-two items of the related questionnaires each, respectively. Additional observed variables that were added in the model were the metrics extracted from the TESI-SR. Specifically, the trauma-related parameters used were the time since first traumatic event, the duration of the traumatic event that was noted as the worst for the participants, the total number of traumatic events experienced, the closeness of the event to self (larger values represent more severe interpersonal trauma, e.g., sexual abuse) and how recent was the hotspot memory of the worst traumatic event. The number of free parameters was 157.

The model (Figure 7) had good fit, with $\chi^2(1018)= 6910.660$, $p< .001$, CFI= .918, TLI= .908, RMSEA= .058 (90% CI .055, .060), SRMR= .048. Centrality of event was the best predictor of post-traumatic stress (b= .647, SEb= .032, p< .000). Longer duration of the worst traumatic event and a recent hotspot memory of that event resulted in more severe post-traumatic symptoms (b= .120, SEb= .049, p= .014 and b= .128, SEb= .054, p= .017, respectively). The total number of traumatic events experienced, the time since the first traumatic event and the closeness of the event to self were not significant predictors of post-traumatic symptoms. The model explained 46.2% of the latent variable of the post-traumatic stress symptoms ($R^2 = .462$, SE= .040, p< .001). The model suggested some modification indices, but none of them concerned a feasible reasonable modification. Thus, no modifications were performed. The Bootstrap CIs for the standardized estimates are presented on Table 9.

The following model included all three subscales of post-traumatic stress symptoms as separate latent variables, in order to identify the specific effects of trauma-related parameters on traumatic stress symptoms categories. The model had acceptable fit, with $\chi^2(1006)= 10675.950$, $p< .001$, CFI= .890, TLI= .879, RMSEA= .063 (90% CI .060, .068), SRMR= .048. The variance explained by the model was 50.7% for the latent variable of intrusion symptoms ($R^2= .507$, SE= .038, p< .001), 45.8% for the latent variable of avoidance symptoms ($R^2= .458$, SE= .040, p< .001) and 43.4% for the latent variable of hyperarousal symptoms ($R^2= .434$, SE= .041, p< .001). The findings supported that centrality of event was a stable and consistent predictor across all post-traumatic symptom categories. No other trauma-related predictors had significant effect on post-traumatic intrusion symptoms. Avoidance symptoms were predicted by hotspot memory of traumatic event (b= .115, SEb= .055, p= .036) and duration of the worst traumatic event (b= .106, SEb= .050, p= .032). The more recent the hotspot memory of the traumatic event was, and

the longer the duration of the worst traumatic event, the more were the avoidance symptoms of the participants. Hyperarousal was also predicted by the hotspot memory of the traumatic event (b= .116, SEb= .056, p= .036), supporting that hyperarousal symptoms were worst the most recent the hot memory of the traumatic event was. The estimates with Bootstrapped CIs are presented on Table 10 for all three outcomes.

Centrality of event was then examined as a dependent variable that could be potentially explained by the other trauma parameters, in order to validate whether it was an independent predictor of PTSD, or whether it could function better as a mediating variable in the relationship between the other trauma-related parameters and PTSD. Thus, a path model was tested with the latent variable of centrality as outcome and the trauma-related parameters as observed predictors. The model had a good fit, with $\chi^2(265)= 524.706$, $p< .001$, CFI= .968, TLI= .955, RMSEA= .069 (90% CI .061, .077), SRMR= .051, AIC= 11396.094, BIC= 11615.487. None of the trauma-related parameters had a significant effect on centrality of event. The total variance of centrality explained by the model was not significant either, with $R^2= .028$, SE= .023, p= .217. The standardized estimates with Bootstrapped 95% CIs are presented on Table 11.

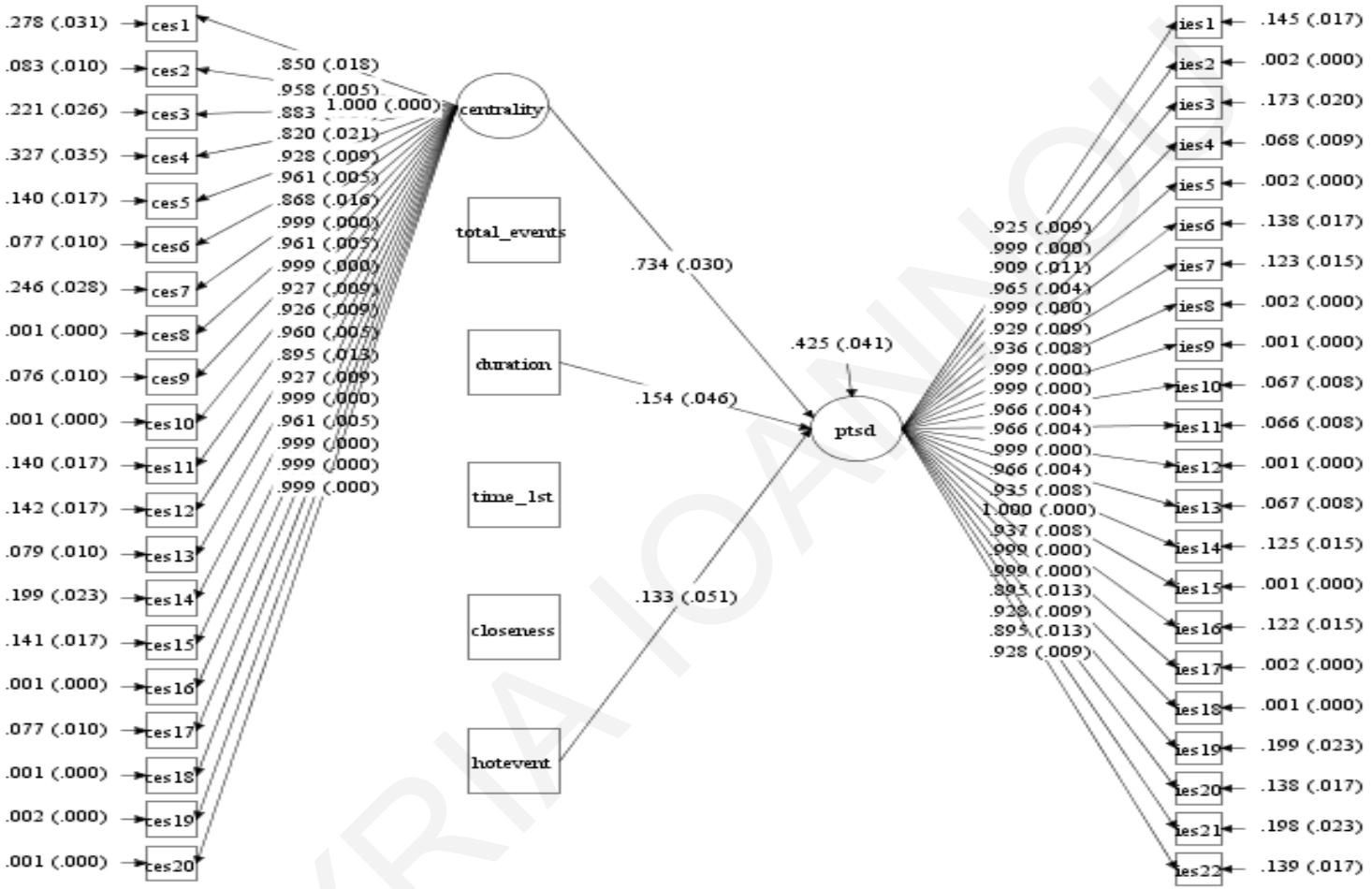

Figure 7. Diagram of the model with trauma-related parameters that predict post-traumatic stress response. Only significant standardized estimates are presented.

Note: The model with trauma-related parameters predicting post-traumatic symptoms showed that centrality of event was the best predictor. Post-traumatic symptoms were also predicted by how recent the hotspot memory of the worst traumatic event was and by the duration of the worst event.

Table 9. Presentation of standardized estimates with Bootstrap 95% CI (direct effects of trauma-related parameters on post-traumatic stress symptoms).

Predictor	Lower 5%	Estimate	Upper 5%
Centrality of event	0.594	0.647	0.699
Total number of events	-0.089	0.009	0.106
Closeness to self	-0.042	0.044	0.131
Hotspot memory recent	0.040	0.128	0.217
Duration of worst event	0.039	0.120	0.200
Time since first traumatic event	-0.181	-0.063	0.055

Table 10. Presentation of standardized estimates with Bootstrap 95% CI (direct effects of trauma-related parameters on post-traumatic stress symptom categories).

	Outcome: Intrusion			Outcome: Avoidance			Outcome: Hyperarousal		
Predictor	Lower 5%	Estimate	Upper 5%	Lower 5%	Estimate	Upper 5%	Lower 5%	Estimate	Upper 5%
Centrality of event	0.655	0.702	0.748	0.594	0.647	0.699	0.572	0.627	0.681
Total number of events	-0.101	-0.006	0.089	-0.097	0.001	0.100	-0.111	-0.011	0.089
Closeness to self	-0.058	0.025	0.107	-0.048	0.038	0.125	-0.052	0.037	0.125
Hotspot memory recent	-0.038	0.050	0.139	0.025	0.115	0.206	0.025	0.116	0.208
Duration of worst event	-0.039	0.041	0.121	0.025	0.106	0.188	0.007	0.089	0.172
Time since first traumatic event	-0.137	-0.018	0.102	-0.166	-0.045	0.076	-0.144	-0.022	0.100

Note: The model with trauma-related parameters predicting post-traumatic symptoms categories showed that centrality of event was the best predictor for all three symptom categories of intrusion, avoidance and hyperarousal. The duration of worst traumatic event and how recent the hotspot memory was were significant predictors of avoidance and hyperarousal.

Table 11. Presentation of standardized estimates with Bootstrap 95% CI (direct effects of trauma-related parameters on centrality of event).

Predictor	Lower 5%	Estimate	Upper 5%
Total number of events	-0.283	-0.142	-0.001
Closeness to self	-0.056	0.069	0.194
Hotspot memory recent	-0.080	0.053	0.185
Duration of worst event	-0.108	0.015	0.139
Time since first traumatic event	-0.035	0.120	0.276

A path model was examined then, to test the effect of PTSD and trauma-related parameters on the development of resilience. The latent variable formed by the observed items from the BRS was used as the latent endogenous variable reflecting resilience and the latent variable formed by the observed items from the IES-R was used as the latent exogenous variable reflecting PTSD. The model had acceptable fit, with $\chi^2(349)= 1330.656$, $p< .001$, CFI= .939, TLI= .926, RMSEA= .078 (90% CI .073, .083), SRMR= .062, AIC= 26068.722, BIC= 26399.746. PTSD symptoms after the experience of a traumatic event had a negative effect on resilience, with b= -.278 (95% CI -.370, -.187), SEb= .056, $p< .001$. Another model including all three PTSD symptom categories was then tested, in order to identify which symptoms were

mostly impacting resilience. Trauma-related parameters were also added to the model, in order to identify their independent and interaction effects on resilience. At first, the trauma-related parameters effect on post-traumatic stress symptoms was constrained to zero, in order to test their unique effects on resilience. The model had a not acceptable fit based on indices, with $\chi^2(1312)= 3037.152$, $p< .001$, CFI= .771, TLI= .762, RMSEA= .074 (90% CI .070, .077), SRMR= .194, AIC= 28855.349, BIC= 29385.668. Hyperarousal post-traumatic symptoms had a significant negative effect on resilience, with b= -.328 (95% CI -.511, -.144), SEb= .112, p= .003. Intrusion symptoms and avoidance symptoms did not seem to have a similar significant relationship to resilience, as b= .108 (95% CI -.088, .303), SEb= .119, p= .366 and b= -.063 (95% CI -.234, .108), SEb= .104, p= .543. Among the trauma-related parameters, resilience was only predicted by the time since the first traumatic event was experienced, with b= .197 (95% CI .056, .338), SEb= .086, p= .022. That is, having experienced your first traumatic event earlier in life predicted higher levels of resilience in adolescence. The rest of trauma-related parameters (centrality of event, total number of traumatic events, how close the worst traumatic event was to self, how recent was the hotspot traumatic memory and duration of the worst traumatic event) did not have significant effects on resilience. Due to the not acceptable fit of the model, it was simplified by looking at the post-traumatic symptoms in a single(latent)-factor structure. The model fit was better but still marginally acceptable based on fit indices, with $\chi^2(1312)= 2962.445$, $p< .001$, CFI= .881, TLI= .872, RMSEA= .072 (90% CI .069, .076), SRMR= .065, AIC= 28780.643, BIC= 29310.148. The findings were consistent with the previous model, suggesting that the only significant effects on resilience were by post-traumatic symptoms (b= .243, SEb= .106, p= .022) and time since the first traumatic event was experienced (b= .173, SEb= .088, p= .040) (Figure 8).

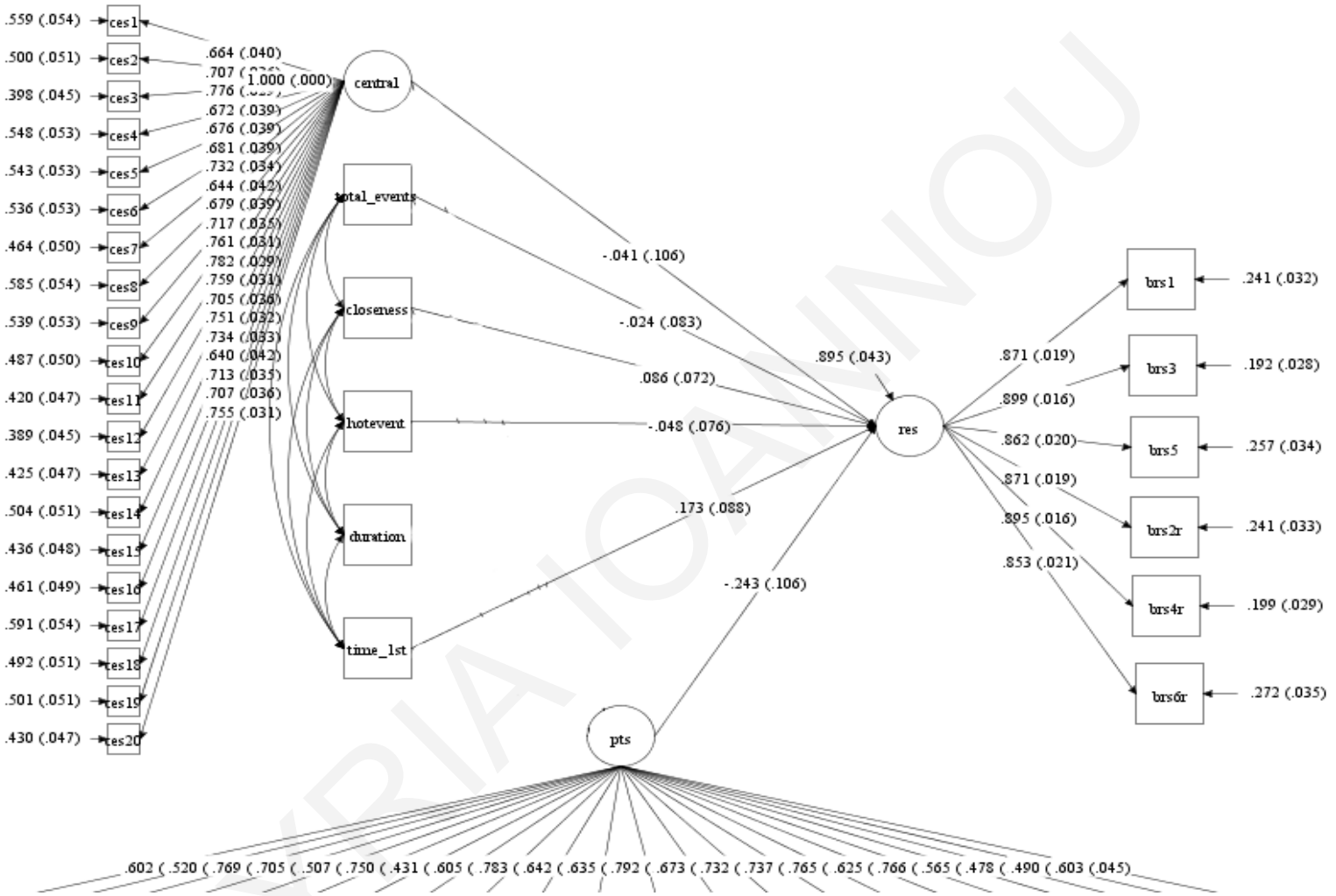

Figure 8. Path model showing the standardized estimates of trauma-related parameters on resilience.

Note: Resilience was predicted only by post-traumatic symptoms (negative relationship) and by how much time passed since first traumatic event was experienced (positive relationship), supporting higher levels of resilience for those exposed to traumatic events earlier in life.

For the aims of the next hypothesis, self-regulation mechanisms were allowed to load on post-traumatic stress symptoms to evaluate their effect (Table 12). Significant effects were detected by the self-regulation mechanisms of evaluation (b= .648, SEb= .150, p< .001), planning (b= -.670, SEb= .141, p= .004), implementation (b= .600, SEb= .109, p< .001), and assessing (b= -.451, SEb= .090, p= .032). That is, better planning ability and higher ability to assess the effectiveness of one's mechanisms to deal with a situation were related to lower post-traumatic stress symptoms. On the other hand, having higher abilities to evaluate the information and compare it to the norms, as well as implementing a plan were related to higher post-traumatic stress symptoms. Implementing refers mainly to having the practical skills to focus on one's plan. Difficulty in attentional shifting was also related to higher levels of post-traumatic symptoms (b= .409, SEb= .147, p= .006). Self-blaming and having negative cognitions about the world were also predictive of higher post-traumatic symptoms (b= .683, SEb= .255, p= .007 and b= .443, SEb= .140, p= .002, respectively). Among the emotion regulation strategies, the latent factor comprising by the strategies of self-blame, rumination, catastrophizing and blaming others was related to higher levels of post-traumatic stress symptoms (b= .450, SEb= .179, p= .012). Adding the total number of available protective assets in adolescents' lives in the model did not result in significant unique effects from protective factors on post-traumatic symptoms. However, considering the total number of protective factors resulted in a significant negative effect from emotional cognitive reappraisal on post-traumatic symptoms (b= -.331, 95% CI -.571, -.091, SEb= .146, p= .023). None of the other predictors' effect was impacted as a result of considering the number of available protective factors. The hypothesized interaction among self-regulation mechanisms and protective factors was therefore tested.

When resilience was examined as the outcome, only emotional self-regulation mechanisms were shown to be predictive (Table 13). Specifically, the latent factor with adaptive emotion regulation strategies (i.e., acceptance, positive refocusing, putting perspective, positive reappraisal and refocus on planning) had significant positive effect on resilience (b= .356, SEb= .160, p= .026). On the other hand, the latent factor with maladaptive emotion regulation strategies (i.e., self-blame, rumination, catastrophizing and blaming others) had a significant negative effect on resilience (b= -.351, SEb= .153, p= .022). Among the behavioral self-regulation mechanisms, only searching was predictive of resilience (b= -.539, SEb= .209, p= .041) such that trying harder to search for options was related to lower levels of resilience. Adding the total number of available protective assets in the model resulted in non-significant estimate, and at the same time resulted in none of the other predictors emerging as significant anymore (emotion regulation strategies, emotion dysregulation strategies and self-regulation searching).

Table 12. Presentation of standardized estimates with Bootstrap 95% CI (direct effects of self-regulation mechanisms on PTS).

Predictor	Lower 5%	Estimate	Upper 5%
SRQ_Receiving	-1.191	-0.642	-0.092
SRQ_Evaluating	0.536	0.648	0.760
SRQ_Triggering	-0.425	-0.066	0.292
SRQ_Searching	-0.783	-0.137	0.510
SRQ_Planning	-0.831	-0.670	-0.409

SRQ_Implementation	0.600	0.733	0.806
SRQ_Assessing	-0.657	-0.451	-0.245
ERQ_Cognitive Reappraisal	-0.529	-0.263	0.003
ERQ_Expressive Suppression	-0.287	-0.100	0.087
PCI_Negative cognitions about self	-0.845	-0.411	0.023
PCI_Negative cognitions about world	0.212	0.443	0.673
PCI_Blame self	0.264	0.683	1.103
ACS_Difficulty with attentional shifting	0.167	0.409	0.652
ACS_Difficulty focusing	-0.079	0.159	0.397
Adaptive Emotion Regulation Strategies	-0.673	-0.290	0.092
Maladaptive Emotion Regulation Strategies	0.156	0.450	0.744

Note: Evaluating information, focusing on implementing a plan, difficulties with attentional shifting, negative cognitions about the world, self-blaming and maladaptive emotion regulation strategies predicted higher levels of post-traumatic symptoms. Higher levels of planning and of assessing the effectiveness of the plan used for a situation predicted lower levels of post-traumatic symptoms.

Table 13. Presentation of standardized estimates with Bootstrap 95% CI (direct effects of self-regulation mechanisms on resilience as measured by BRS).

Predictor	Lower 5%	Estimate	Upper 5%
SRQ_Receiving	-.564	.212	.988
SRQ_Evaluating	-.014	.603	1.219
SRQ_Triggering	-.803	-.306	.190
SRQ_Searching	-.876	-.539	-.201
SRQ_Planning	-.608	.147	.902
SRQ_Implementation	.025	.833	1.641
SRQ_Assessing	-.809	-.065	.679
ERQ_Cognitive Reappraisal	-.512	-.182	.149
ERQ_Expressive Suppression	-.257	.041	.340
PCI_Negative cognitions about self	-.904	-.332	.240
PCI_Negative cognitions about world	-.098	.169	.436
PCI_Blame self	-.369	.096	.561
ACS_Difficulty with attentional shifting	-.241	.093	.427

ACS_Difficulty focusing	-.174	.172.	.519
Adaptive Emotion Regulation Strategies	.282	.356	.580
Maladaptive Emotion Dysregulation Strategies	-.711	-.351	-.118

Note: Higher levels of searching for options and maladaptive emotion regulation strategies predicted lower levels of resilience. Higher levels of adaptive emotion regulation strategies (i.e., acceptance, positive refocusing, putting perspective, positive reappraisal and refocus on planning) predicted higher levels of resilience.

The examination of the effect of protective factors followed. The latent protective factor consisting of all protective factors together supported a small marginally significant negative effect on PTS (b= -.295, SEb= .128, p= .030). The model had acceptable fit, with $\chi^2(819)=$ 508.390, p< .001, CFI= .962, TLI= .945, RMSEA= .076 (90%CI .073, .080), SRMR= .068, AIC= 18140.704, BIC= 18628.946. Examination of the model with categories of protective factors did not result in convergence, as the number of iterations was exceeded. When the number of iteration was manually altered, the model converged and supported that none of the categories of protective factors did not have unique effects on PTS. The model fit of the model was not acceptable, with $\chi^2(896)=$ 2987.637, p< .001, CFI= .595, TLI= .572, RMSEA= .081 (90%CI .078, .084), SRMR= .775, AIC= 28021.538, BIC= 28556.665. None of the protective factors when allowed freely to load on PTS without any constrained latent factors had significant effect. The model was not acceptable based on fit indices, with $\chi^2(693)=$ 1346.912, p< .001,

CFI= .714, TLI= .696, RMSEA= .064 (90%CI .059, .069), SRMR= .065, AIC= 13480.458, BIC= 13786.447.

Importantly, the latent protective factor consisting of all protective factors together supported no significant effects on resilience (b= -.006, SEb= .131, p= .963). The model had an acceptable fit, with $\chi^2(298)= 131.840$, p< .001, CFI= .928, TLI= .919, RMSEA= .089 (90%CI .083, .094), SRMR= .059, AIC= 9291.583, BIC= 9395.907. Examination of the effect on categories of protective factors on resilience showed that only individual protective factors had a small significant positive effect on resilience (b= .117, SEb= .035, p= .001). The rest of the categories (family, school, community protective factors) did not have a significant impact on resilience. The model with the protective factors inserted in categories resulted in a non-acceptable fit, with $\chi^2(343)= 1651.765$, p< .001, CFI= .640, TLI= .603, RMSEA= .105 (90%CI .100, .110), SRMR= .408, AIC= 14277.286, BIC= 14627.836. Further exploration of the separate protective factors for each category supported that the only protective factor which consistently retained significant effect on resilience was being in a good physical condition, with b= .192 (SEb= .069, p= .005). The model with the protective factors inserted in categories resulted again in a non-acceptable fit based on model fit indices, with $\chi^2(140)= 355.529$, p< .001, CFI= .866, TLI= .840, RMSEA= .082 (90%CI .071, .092), SRMR= .053, AIC= 3863.565, BIC= 4007.964. Due to validation of the one-factor structure of the protective factors prior, the use of a single latent protective factor was considered as providing the more valid findings.

Moderation analyses for the aims of the fourth hypothesis were then performed. Based on the Moderation code of Mplus, the groups are formed is based on the mean score of the moderating variable and the standard deviation (i.e., one SD above and below the mean represent the moderate level, one SD below constitutes the low level and one SD above is considered the

high level). Thus, those are available on the tables presented above with descriptive statistics. The moderation analyses when having post-traumatic symptoms as the outcome were examined first. The first model examined the interaction between cognitive reappraisal of emotions and protective factors. The model fit was not acceptable, with $\chi^2(271)= 120.093$, $p< .001$, CFI= .840, TLI= .807, RMSEA= .113 (90%CI .104, .122), SRMR= .092, AIC= 10124.158, BIC= 10335.477. No unique, nor interaction effects were detected (Table 14, Model A). The next model tested examined the interaction between expressive suppression and protective factors. The model fit was not acceptable, with $\chi^2(272)= 124.529$, $p< .001$, CFI= .851, TLI= .819, RMSEA= .114 (90%CI .106, .123), SRMR= .092, AIC= 10278.499, BIC= 10491.116. No unique, nor interaction effects were detected (Table 14, Model B). Examination of the moderating role of searching also resulted in a non-acceptable fit model and no unique or interaction effects, with $\chi^2(272)= 128.879$, $p< .001$, CFI= .770, TLI= .731, RMSEA= .122 (90%CI .111, .133), SRMR= .108, AIC= 7527.775, BIC= 7715.964 (Table 14, Model C). The model examining the interaction between the self-regulation mechanism of receiving and protective factors did not result in an acceptable fit also, with $\chi^2(272)= 144.340$, $p< .001$, CFI= .831, TLI= .788, RMSEA= .127 (90%CI .116, .138), SRMR= .112, AIC= 7190.739, BIC= 7375.806. No unique, nor interaction effects were detected (Table 14, Model D). Similarly the model examining the interaction by the self-regulation mechanism of evaluating resulted in a bad-fit model and no unique or interaction effects, with $\chi^2(2)= 128.242$, $p< .001$, CFI= .800, TLI= .754, RMSEA= .129 (90%CI .118, .140), SRMR= .115, AIC= 6685.806, BIC= 6866.249 (Table 14, Model E). Examination of the main and interaction effects by the self-regulation mechanism of triggering on PTS supported a non-acceptable fit and no significant effects, with

$\chi^2(2)= 150.567$, p< .001, CFI= .751, TLI= .709, RMSEA= .128 (90%CI .117, .139), SRMR= .109, AIC= 7237.601, BIC= 7422.668 (Table 14, Model F).

The investigation of planning as a self-regulation moderator followed. The model fit was not acceptable, with $\chi^2(272)= 138.864$, p< .001, CFI= .829, TLI= .786, RMSEA= .127 (90%CI .116, .138), SRMR= .109, AIC= 7081.484, BIC= 7265.262. However, the standardized estimates with 95% CI supported main effects by protective factors and marginal interaction effects (Table 14, Model G). Protective factors alone had a negative effect on post-traumatic symptoms, such that high levels of protective factors were related to lower symptoms. When planning was considered it was found that for moderate levels of planning, protective factors had a negative effect on post-traumatic symptoms. For low levels of planning and low number of protective factors the post-traumatic symptoms were higher. At the same time, high levels of planning and low number of protective factors resulted in lower levels of post-traumatic symptoms. High levels of planning and high levels of protective factors resulted in higher levels of symptoms (Figure 9).

The examination of the moderating role of the self-regulation mechanism of implementation showed non-significant main of interaction effects and a non-acceptable model based on fit indices, with $\chi^2(272)= 156.896$, p< .001, CFI= .826, TLI= .783, RMSEA= .129 (90%CI .118, .140), SRMR= .112, AIC= 7115.435, BIC= 7299.860 (Table 14, Model H). Similarly, the examination of self-regulation of assessing did not result in a good fit, nor in significant effects, with $\chi^2(272)= 163.749$, p< .001, CFI= .823, TLI= .779, RMSEA= .129 (90%CI .118, .140), SRMR= .110, AIC= 7212.277, BIC= 7397.980 (Table 14, Model I). No significant main or interaction effects where found by post-traumatic negative cognitions about one's self, with $\chi^2(272)= 287.780$, p< .001, CFI= .859, TLI= .828, RMSEA= .123 (90%CI .115,

.132), SRMR= .086, AIC= 11038.973, BIC= 11256.550 (Table 14, Model J). The post-traumatic negative cognitions about the world were then tested, which had main effects on PTS (b= .351, SEb= .157, p= .026, but no interaction effects were detected by protective factors. The model fit was not acceptable, with $\chi^2(272)= 408.715$, p< .001, CFI= .877, TLI= .847, RMSEA= .110 (90%CI .102, .117), SRMR= .086, AIC= 12594.353, BIC= 12820.190 (Table 14, Model K).

Significant main effects were detected when examining the post-traumatic self-blaming as moderator. Also, there was a significant interaction with protective factors, supporting that the level of self-blaming had linear significant positive effect on PTS for low amounts of available assets, but its effect was flattened as protective factors were increased. For high amounts of available protective resources, self-blaming level did not impact PTS (Figure 10). The model fit was marginally not acceptable, with $\chi^2(272)= 440.341$, p< .001, CFI= .898, TLI= .870, RMSEA= .111 (90%CI .103, .118), SRMR= .086, AIC= 12989.539, BIC= 13217.467 (Table 14, Model L). The examination of the moderating role of difficulty with attentional shifting provided a non-acceptable fit model, with $\chi^2(272)= 140.819$, p< .001, CFI= .783, TLI= .745, RMSEA= .129 (90%CI .118, .140), SRMR= .103, AIC= 6890.053, BIC= 7072.516. No unique, nor interaction effects were detected (Table 14, Model M). On the other hand, difficulty focusing had a positive significant main effect on PTS (b= .671, SEb= .228, p= .003). The model fit was still bad, with $\chi^2(272)= 361.473$, p< .001, CFI= .773, TLI= .733, RMSEA= .133 (90%CI .122, .144), SRMR= .104, AIC= 6719.310, BIC= 6900.434 and no interaction effects with protective factors were detected (Table 14, Model N). The model examining emotion regulation maladaptive strategies supported a strong positive main effect on PTS (b= .775, SEb= 256, p= .003), but no interaction effects were detected. The model fit was not acceptable, with $\chi^2(272)= 345.058$, p< .001, CFI= .740, TLI= .698, RMSEA= .137 (90%CI .127, .148), SRMR= .108, AIC= 7258.287, BIC=

7445.864 (Table 14, Model P). Examination of the adaptive cognitive regulation strategies as a moderator on the relationship between protective factors and PTS supported similarly only main effects (b= -.748, SEb= .171, p= .000). No moderation effects were detected and the model had a bad fit, with $\chi^2(272)= 102.133$, p< .001, CFI= .846, TLI= .814, RMSEA= .116 (90%CI .105, .126), SRMR= .097, AIC= 7258.287, BIC= 7445.864 (Table 14, Model O).

Table 14. Presentation of models examining moderation by self-regulation mechanisms in the relationship between protective factors and PTS.

	Lower 0.5%	Lower 2.5%	Lower 5%	Estimate	Upper 5%	Upper 2.5%	Upper 0.5%	S.E.	P
AX.Protective Factors	-.314	-.221	-.170	-.027	.053	.068	.091	.076	.720
AM.ER appraisal	-1.210	-.742	-.536	.061	.430	.466	.607	.330	.852
AI.Interaction	-.039	-.030	-.025	.001	.039	.053	.078	.022	.966
BX.Protective factors	-.191	-.153	-.132	-.038	.041	.056	.080	.052	.463
BM.ER suppression	-.672	-.481	-.370	.070	.537	.609	.783	.272	.798
BI.Interaction	-.042	-.028	-.024	.006	.037	.045	.061	.019	.728
CX.Protective factors	-.302	-.220	-.191	-.041	.066	.086	.131	.078	.599
CM.SRQ_Searching	-.108	-.071	-.055	.010	.067	.080	.095	.038	.788
CI.Interaction	-.006	-.004	-.003	.000	.005	.007	.008	.003	.872
DX.Protective factors	-.317	-.260	-.235	-.075	.093	.130	.201	.096	.437
DM.SRQ_Receiving	-.118	-.093	-.078	-.008	.065	.079	.108	.043	.848
DI.Interaction	-.007	-.005	-.004	.001	.007	.008	.010	.003	.636
EX.Protective factors	-.394	-.307	-.273	-.129	-.004	.018	.091	.083	.118

EM.SRQ_Evaluating	-.180	-.137	-.122	-.039	.031	.046	.081	.047	.409
EI.Interaction	-.005	-.002	-.001	.005	.010	.011	.015	.003	.162
FX.Protective factors	-.341	-.254	-.210	-.008	.201	.268	.384	.129	.953
FM.SRQ_Triggering	-.130	-.082	-.062	.029	.144	.184	.219	.063	.643
FI.Interaction	-.014	-.011	-.008	-.001	.006	.008	.010	.004	.872
GX.Protective factors	-.509	-.407	-.366	-.210	-.069	-.041	.061	.094	.025
GM.SRQ_Planning	-.233	-.192	-.165	-.085	-.018	-.007	.028	.046	.064
GI.Interaction	-.003	.001	.002	.006	.013	.014	.017	.003	.050
HX.Protective factors	-.418	-.331	-.288	-.101	.059	.085	.135	.102	.321
HM.SRQ_Implementing	-.176	-.138	-.116	-.030	.046	.057	.081	.048	.525
HI.Interaction	-.006	-.004	-.003	.003	.009	.011	.013	.004	.406
IX.Protective factors	-.374	-.269	-.251	-.080	.048	.075	.115	.091	.376
IM.SRQ_Assessing	-.147	-.109	-.092	-.019	.046	.056	.071	.042	.645
II.Interaction	-.005	-.003	-.002	.002	.008	.009	.011	.003	.466
JX. Protective factors	-.127	-.107	-.100	-.041	.023	.034	.055	.038	.275
JM. PCI_Negative cognitions for self	-.118	.007	.075	.415	.948	1.026	1.204	.280	.139

JI.Interaction	-.042	-.027	-.019	.023	.054	.061	.069	.024	.340
KX. Protective factors	-.660	-.543	-.484	-.172	.140	.199	.316	.190	.364
KM. PCI_Negative cognitions for world	-.052	.039	.085	.327	.570	.616	.707	.147	.026
KI.Interaction	-.449	-.313	-.244	.119	.482	.551	.687	.221	.590
LX. Protective factors	-.220	-.119	-.067	.203	.473	.525	.626	.203	.216
LM. PCI_Blaming self	.231	.317	.361	.589	.818	.862	.948	.589	.000
LI.Interaction	-.909	-.794	-.735	-.429	-.122	-.063	.051	-.429	.021
MX. Protective factors	-.363	-.305	-.275	-.118	.039	.069	.127	.022	.214
MM. Difficulty with attentional Shifting	-.215	-.060	.020	.435	.851	.930	1.086	.289	.083
MI.Interaction	-.745	-.588	-.508	-.090	.329	.409	.566	.022	.725
NX. Protective factors	-.317	-.258	-.227	-.070	.088	.118	.177	.096	.467
NM. Difficulty focusing	.083	.223	.295	.671	1.047	1.119	1.259	.228	.003
NI.Interaction	-.950	-.805	-.731	-.345	.041	.115	.260	.235	.142
OX. Protective factors	-.263	-.116	-.042	.350	.741	.816	.962	.045	.140
OM. Effective CERQ	-.307	-.413	-.466	-.748	-1.029	-1.083	-1.188	.221	.000
.OI.Interaction	-1.103	-.940	-.856	-.419	.018	.101	.265	.020	.113

PX. Protective factors	-.594	-.435	-.353	.072	.498	.579	.738	.055	.780
PM. Ineffective CERQ	.087	.215	.280	.623	.965	1.030	1.158	.256	.003
PI.Interaction	-1.045	-.841	-.737	-.194	.349	.453	.656	.020	.556

Notes:
1. X signifies the independent variable of protective factors, M signifies the moderation variable and I signifies the interaction term in each model tested.
2. Difficulty focusing, having negative cognitions about the world and maladaptive emotion regulation strategies had main effects on post-traumatic symptoms but no interaction with protective factors. Planning was found to have significant interaction effects with protective factors. Similarly, self-blaming predicted higher levels of post-traumatic symptoms and interaction effects were significant.

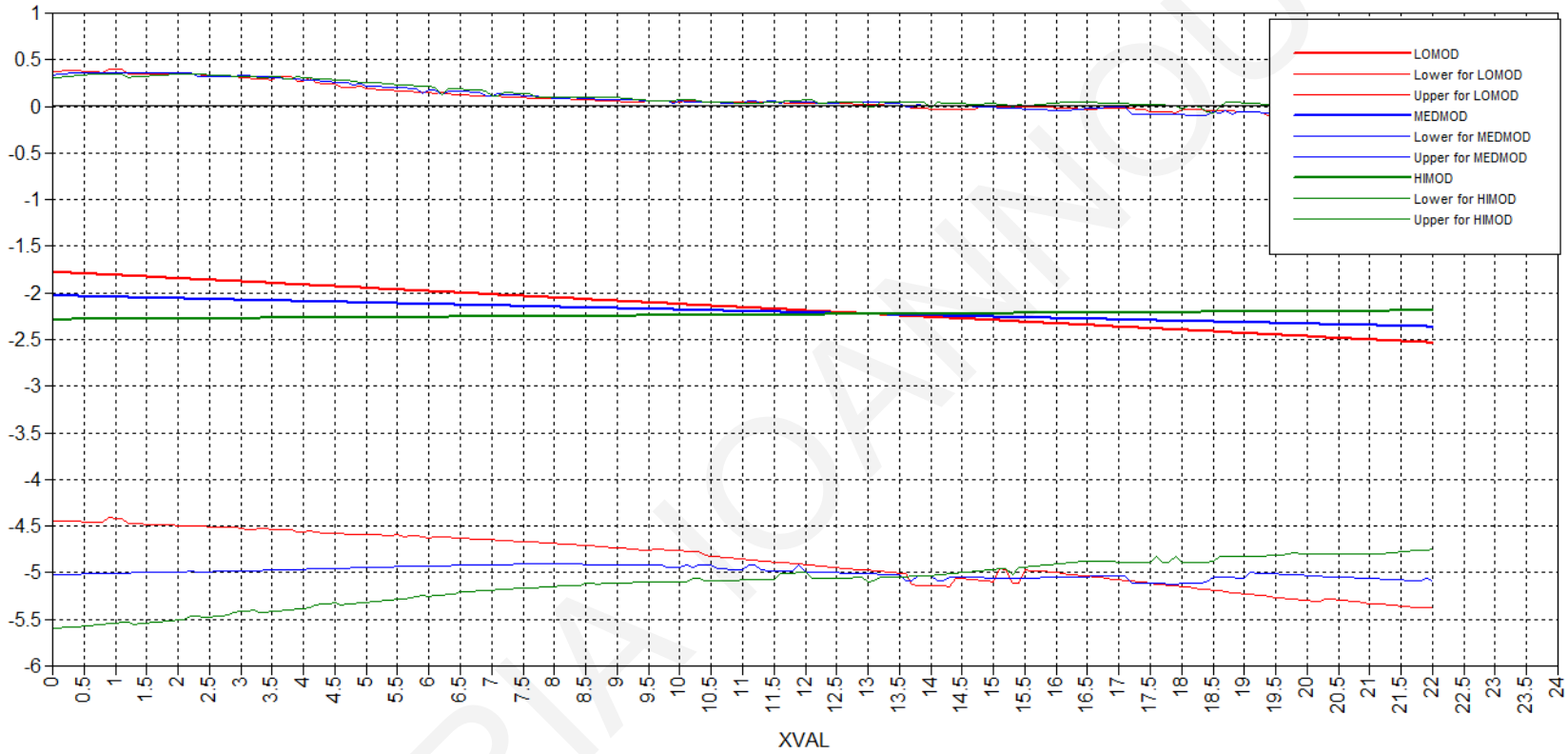

Figure 9. Plot of the effects of protective factors (X-axis) on post-traumatic symptoms (Y-axis) for low (red lines with 95% CIs), moderate (blue lines) and high (green lines) levels of the self-regulation mechanism of planning (moderator).

Note: For low levels of planning and low number of protective factors the post-traumatic symptoms were higher. At the same time, high levels of planning and low number of protective factors resulted in lower levels of post-traumatic symptoms. High levels of planning and high levels of protective factors resulted in higher levels of symptoms and lower levels of planning with higher levels of protective factors resulted in less post-traumatic symptoms.

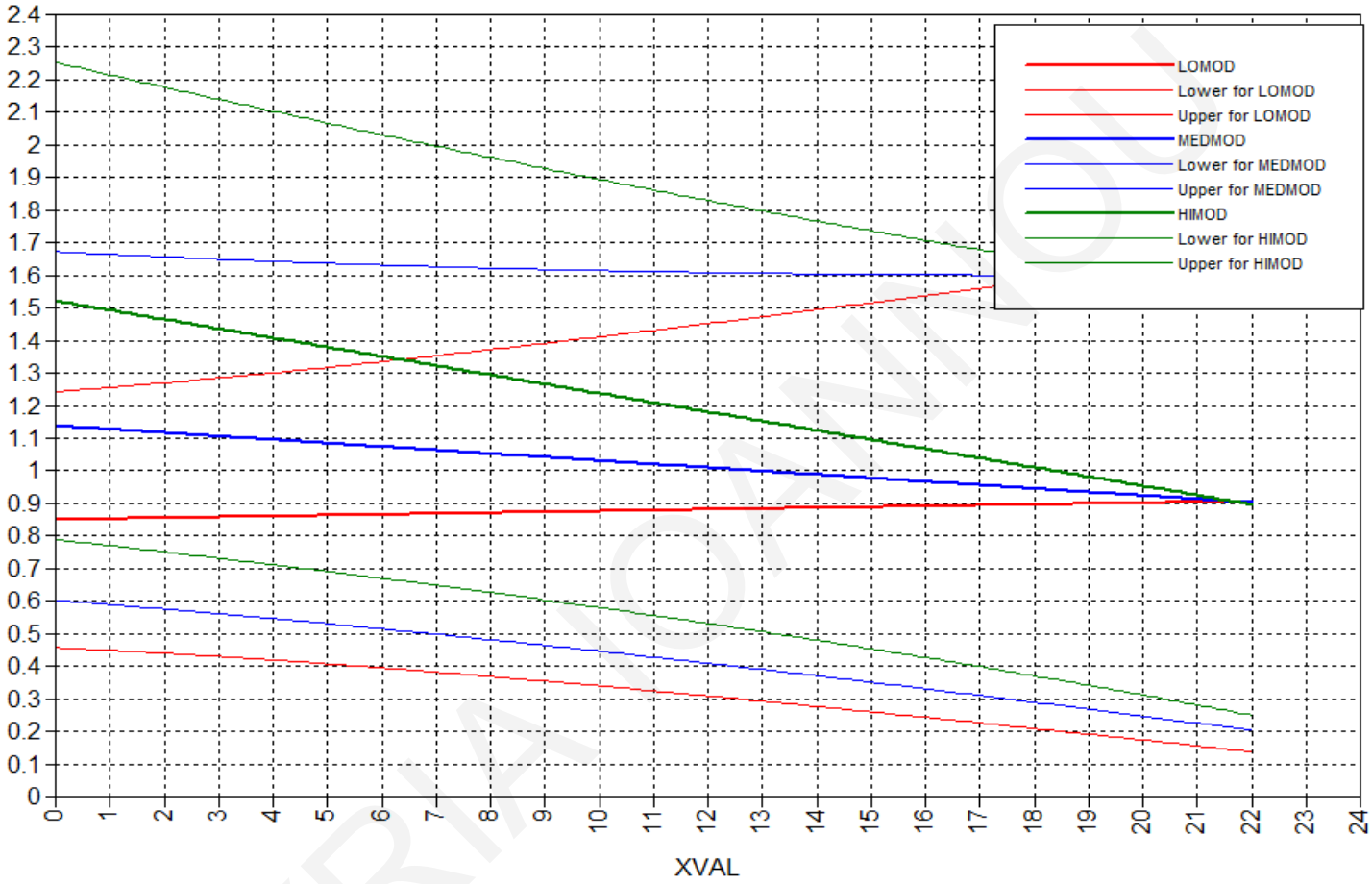

Figure 10. Plot of the effects of protective factors (X axis) on post-traumatic symptoms (Y-axis) for low (red lines with 95% CIs), moderate (blue lines) and high levels (green lines) of post-traumatic self-blaming cognitions (moderator).

Note: The level of self-blaming had linear significant positive effect on PTS for low amounts of available assets, but its effect was flattened as protective factors were increased. For high amounts of available protective resources self-blaming level did not impact post-traumatic symptoms.

Examination of the moderating role of self-regulation mechanisms was performed afterwards in order to evaluate whether having available protective factors in interaction with self-regulation mechanisms could provide meaningful effect on resilience. The first model examined the interaction between cognitive reappraisal of emotions and protective factors. The model fit was good, with $\chi^2(23)= 63.379$, $p< .001$, CFI= .964, TLI= .949, RMSEA= .098 (90%CI .069, .127), SRMR= .033, AIC= 2881.928, BIC= 2952.657. No unique, nor interaction effects were detected (Table 15, Model A). The second model examined the interaction between expressive suppression and protective factors. The model fit was good, with $\chi^2(23)= 71.548$, $p< .001$, CFI= .956, TLI= .937, RMSEA= .107 (90%CI .080, .136), SRMR= .034, AIC= 2891.850, BIC= 2962.579. Protective factors had a marginal negative effect on resilience (b= -.138, SEb= .066, p= .036) but no interaction effects were detected (Table 15, Model B). The third model examined the interaction between protective factors and the self-regulation mechanism of searching. The model fit was good, with $\chi^2(23)= 45.885$, p= .003, CFI= .972, TLI= .960, RMSEA= .087 (90%CI .049, .124), SRMR= .031, AIC= 2052.280, BIC= 2115.535. Both the individual effects and the interaction were significant and negative (Table 15, Model C). Resilient outcomes were related to having low levels of searching and low levels of protective factors, or high levels of searching along with high levels of protective factors (Figure 11). That is, having a lot of available protective factors was not protective if not having also high levels of searching. Having inconsistency between protective factors and searching for options (one high the other low) was related to lower levels of resilience.

The fourth model examined the interaction between the self-regulation mechanism of receiving and protective factors. The model fit was good, with $\chi^2(23)= 41.073$, p= .012, CFI= .978, TLI= .949, RMSEA= .078 (90%CI .037, .117), SRMR= .032, AIC= 2001.860, BIC=

2064.605. No unique, nor interaction effects were detected (Table 15, Model D). The next model examined the interaction between the self-regulation mechanism of evaluating and protective factors. The model fit was good, with $\chi^2(23)= 56.604$, $p< .001$, CFI= .957, TLI= .938, RMSEA= .110 (90%CI .074, .147), SRMR= .041, AIC= 1876.032, BIC= 1937.357. No unique, nor interaction effects were detected (Table 15, Model E). The following model examined the interaction between the self-regulation mechanism of triggering and protective factors. The model fit was good, with $\chi^2(23)= 39.200$, $p= .019$, CFI= .980, TLI= .971, RMSEA= .075 (90%CI .031, .114), SRMR= .033, AIC= 1948.076, BIC= 2010.299. No unique, nor interaction effects were detected (Table 15, Model F). The next model examined the interaction between the self-regulation mechanism of planning and protective factors. The model fit was good, with $\chi^2(23)= 48.200$, $p= .002$, CFI= .969, TLI= .956, RMSEA= .094 (90%CI .056, .131), SRMR= .032, AIC= 1949.155, BIC= 2011.378. No unique, nor interaction effects were detected (Table 15, Model G). The model examining the interaction between the self-regulation mechanism of implementation and protective factors resulted in a good model fit, with $\chi^2(23)= 41.648$, $p= .010$, CFI= .977, TLI= .967, RMSEA= .080 (90%CI .039, .119), SRMR= .028, AIC= 1958.949, BIC= 2021.348. No unique, nor interaction effects were detected (Table 15, Model H). The model examining the interaction between the self-regulation mechanism of assessing and protective factors resulted in a good model fit, with $\chi^2(23)= 42.642$, $p= .008$, CFI= .976, TLI= .965, RMSEA= .081 (90%CI .041, .119), SRMR= .032, AIC= 2027.705, BIC= 2090.621. No unique, nor interaction effects were detected (Table 15, Model I).

The examination of the cognitive regulation mechanisms followed. The model examining the interaction between post-traumatic cognitions for self and protective factors resulted in a good model fit, with $\chi^2(23)= 75.846$, $p< .001$, CFI= .949, TLI= .926, RMSEA= .116 (90%CI

.088, .146), SRMR= .041, AIC= 2745.186, BIC= 2814.174. No unique, nor interaction effects were detected (Table 15, Model J). The following model examined the interaction between post-traumatic cognitions about the world and protective factors. The model fit was good, with $\chi^2(23)= 78.191$, p< .001, CFI= .955, TLI= .935, RMSEA= .111 (90%CI .084, .138), SRMR= .033, AIC= 3125.753, BIC= 3197.872. Protective factors had a marginal negative effect on resilience (b= -.097, SEb= .047, p= .039) but no interaction effects were detected (Table 15, Model K). The next model examined the interaction between protective factors and the cognitive mechanism of blaming self. The model fit was good, with $\chi^2(23)= 66.060$, p< .001, CFI= .965, TLI= .950, RMSEA= .097 (90%CI .070, .125), SRMR= .025, AIC= 3150.500, BIC= 3222.841. The unique effects from protective factors and the interaction effects were significant (Table 15, Model L). The findings supported that when having low levels of blaming self, low levels of protective factors resulted in higher resilience levels. When high self-blaming was present, resilience was lower and the amount of protective factors could not alter the levels of resilience. Having very high levels of protective factors and low self-blaming did not result in higher resilience levels (Figure 12).

The next model examined the interaction between protective factors and difficulty with attentional shifting. The model fit was good, with $\chi^2(23)= 70.975$, p< .001, CFI= .943, TLI= .918, RMSEA= .128 (90%CI .095, .163), SRMR= .040, AIC= 1962.436, BIC= 2025.008. The unique effects from difficulty with attentional shifting and the interaction effect were marginally significant (Table 15, Model M). The findings supported that when having low difficulties in attentional shifting, even low levels of protective factors resulted in higher resilience levels. When high difficulties with attentional shifting were present, resilience was lower regardless of the amount of available protective assets (Figure 13). The following model examined the

interaction between difficulty with focusing attention and protective factors. The model fit was good, with $\chi^2(23)= 77.361$, $p< .001$, CFI= .933, TLI= .905, RMSEA= .138 (90%CI .105, .173), SRMR= .044, AIC= 1898.673, BIC= 1960.719. Protective factors had a small negative effect on resilience (b= -.075, SEb= .023, p= .001) but no interaction effects were detected (Table 15, Model N). The next model concerned adaptive strategies in the relation between protective factors and resilience. The model fit was good, with $\chi^2(23)= 74.843$, $p< .001$, CFI= .933, TLI= .903, RMSEA= .138 (90%CI .104, .173), SRMR= .051, AIC= 1894.076, BIC= 1955.216. No unique, nor interaction effects were detected (Table 15, Model O). The final model concerned the moderation by the maladaptive strategies in the relation between protective factors and resilience. The model fit was good, with $\chi^2(23)= 66.703$, $p< .001$, CFI= .934, TLI= .905, RMSEA= .124 (90%CI .090, .159), SRMR= .047, AIC= 1953.065, BIC= 2015.111. No unique, nor interaction effects were detected (Table 15, Model O).

Table 15. Presentation of models examining moderation by self-regulation mechanisms in the relationship between protective factors and resilience..

	Lower 0.5%	Lower 2.5%	Lower 5%	Estimate	Upper 5%	Upper 2.5%	Upper 0.5%	S.E.	P
AX.Protective Factors	-.289	-.231	-.207	-.080	-.064	.107	.200	.083	.331
AM.ER appraisal	-1.034	-.767	-.643	-.137	.362	.513	.903	.323	.671
AI.Interaction	-.067	-.037	-.027	.009	.051	.062	.072	.024	.702
BX.Protective factors	-.342	-.264	-.249	-.138	-.031	-.005	.059	.066	.036
BM.ER suppression	-1.575	-1.306	-1.184	-.540	-.009	.083	.272	.356	.129
BI.Interaction	-.031	-.014	-.008	.033	.077	.087	.110	.025	.191
CX.Protective factors	-.401	-.362	-.343	-.229	.099	.072	.005	.071	.001
CM.SRQ_Searching	-.237	-.200	-.184	-.105	-.024	-.003	.035	.049	.033
CI.Interaction	.000	.002	.003	.008	.013	.013	.016	.072	.007
DX.Protective factors	-.415	-.352	-.306	-.128	.064	.102	.173	.110	.242
DM.SRQ_Receiving	-.239	-.162	-.129	-.015	.092	.109	.140	.068	.827
DI.Interaction	-.006	-.004	-.003	.003	.009	.011	.015	.004	.377
EX.Protective factors	-.459	-.383	-.347	-.183	-004	.042	.133	.109	.093
EM.SRQ_Evaluating	-.267	-.227	-.195	-.076	.047	.067	.107	.074	.310

EI.Interaction	-.005	-.001	.000	.007	.013	.014	.018	.004	.097
FX.Protective factors	-.771	-.675	-.631	-.344	-.080	-.001	.147	.178	.054
FM.SRQ_Triggering	-.446	-.385	-.345	-.149	.012	.060	.127	.113	.186
FI.Interaction	-.006	-.001	.001	.011	.022	.024	.026	.006	.079
GX.Protective factors	-.335	-.245	-.209	-.026	.150	.190	.252	.109	.813
GM.SRQ_Planning	-.164	-.106	-.077	.041	.148	.171	.207	.069	.549
GI.Interaction	-.011	-.007	-.006	.000	.006	.008	.011	.004	.971
HX.Protective factors	-.424	-.357	-.312	-.162	.042	.101	.229	.113	.152
HM.SRQ_Implementing	-.242	-.184	-.160	-.047	.060	.085	.141	.068	.483
HI.Interaction	-.008	-.004	-.002	.005	.011	.012	.015	.004	.207
IX.Protective factors	-.415	-.333	-.298	-.131	.017	.056	.143	.100	.191
IM.SRQ_Assessing	-.230	-.160	-.141	-.029	.066	.089	.125	.064	.655
II.Interaction	-.006	-.003	-.002	.004	.010	.012	.014	.004	.297
JX. Protective factors	-.256	-.218	-.198	-.091	.015	.030	.065	.068	.181
JM. PCI_Negative cognitions for self	-2.064	-1.779	-1.621	-.575	.083	.160	.266	.544	.290
JI.Interaction	-.058	-.034	-.028	.037	.122	.134	.155	.046	.427

KX. Protective factors	-.203	-.183	-.169	-.097	-.012	.006	.049	.047	.039
KM. PCI_Negative cognitions for world	-.958	-.856	-.775	-.350	.041	.138	.270	.247	.156
KI.Interaction	-.027	-.011	-.004	.028	.059	.065	.072	.019	.126
LX. Protective factors	-.200	-.181	-.173	-.103	-.032	-.018	.004	.042	.014
LM. PCI_Blaming self	-1.391	-1.190	-1.083	-.533	-.048	.032	.155	.314	.089
LI.Interaction	-.010	.002	.007	.047	.086	.092	.108	.024	.047
MX. Protective factors	-.112	-.091	-.085	-.043	.002	.010	.033	.026	.107
MM. Difficulty with attentional Shifting	-1.930	-1.704	-1.539	-.877	-.231	-.122	.079	.403	.030
MI.Interaction	-.016	.000	.009	.053	.098	.106	.122	.027	.051
NX. Protective factors	-.135	-.119	-.110	-.075	-.036	-.030	-.014	.023	.001
NM. Difficulty focusing	-1.825	-1.388	-1.150	-0.328	.042	.091	.219	.370	.375
NI.Interaction	-.047	-.032	-.025	-.006	.057	.074	.101	.028	.841
OX. Protective factors	-.198	-.172	-.158	-.074	.064	.124	.267	.081	.362
OM. Effective CERQ	-1.068	-.929	-.744	-.135	.514	.811	1.610	.464	.770
OI.Interaction	-.119	-.072	-.046	.007	.045	.051	.065	.032	.822
PX. Protective factors	-.155	-.126	-.099	.002	.091	.105	.137	.057	.969

PM. Ineffective CERQ	-1.299	-1.072	-.931	-.345	.185	.273	.405	.339	.309
PI.Interaction	-.066	-.049	-.040	.001	.052	.061	.080	.028	.958

Notes:
1. X signifies the independent variable of protective factors, M signifies the moderation variable and I signifies the interaction term in each model tested.
2. Significant interaction effects were detected for the self-regulation mechanism of planning, for self-blaming and for the difficulty in attentional shifting.

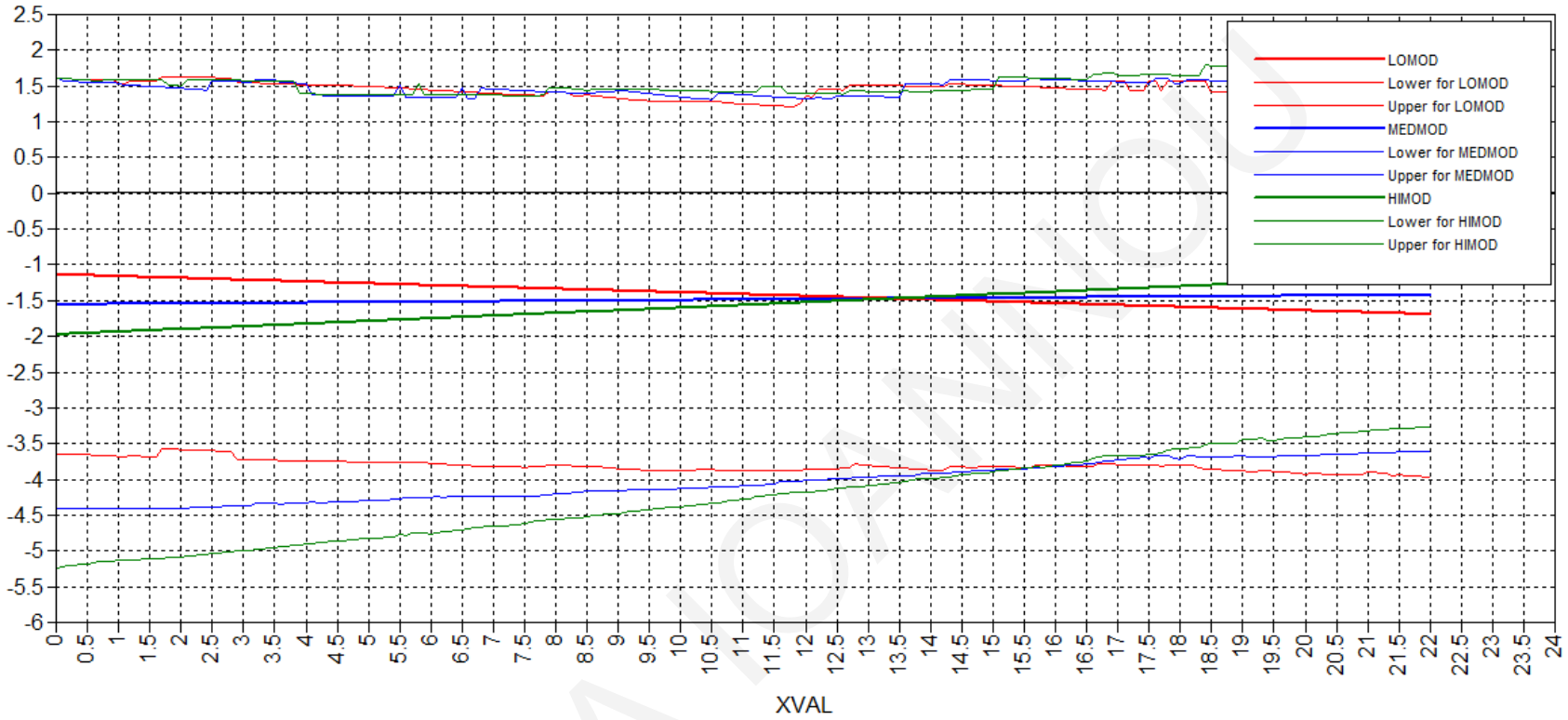

Figure 11. Plot of the effects of protective factors (X-axis) on resilience (Y-axis) for low (red lines with 95% CIs), moderate (blue lines) and high (green lines) levels of searching for options self-regulation mechanism (moderator).

Note: Resilient outcomes were related to having low levels of searching and low levels of protective factors, or high levels of searching along with high levels of protective factors. Having a lot of available protective factors was not protective if not having also high levels of searching. Having inconsistency between protective factors and searching for options (one high the other low) was related to lower levels of resilience.

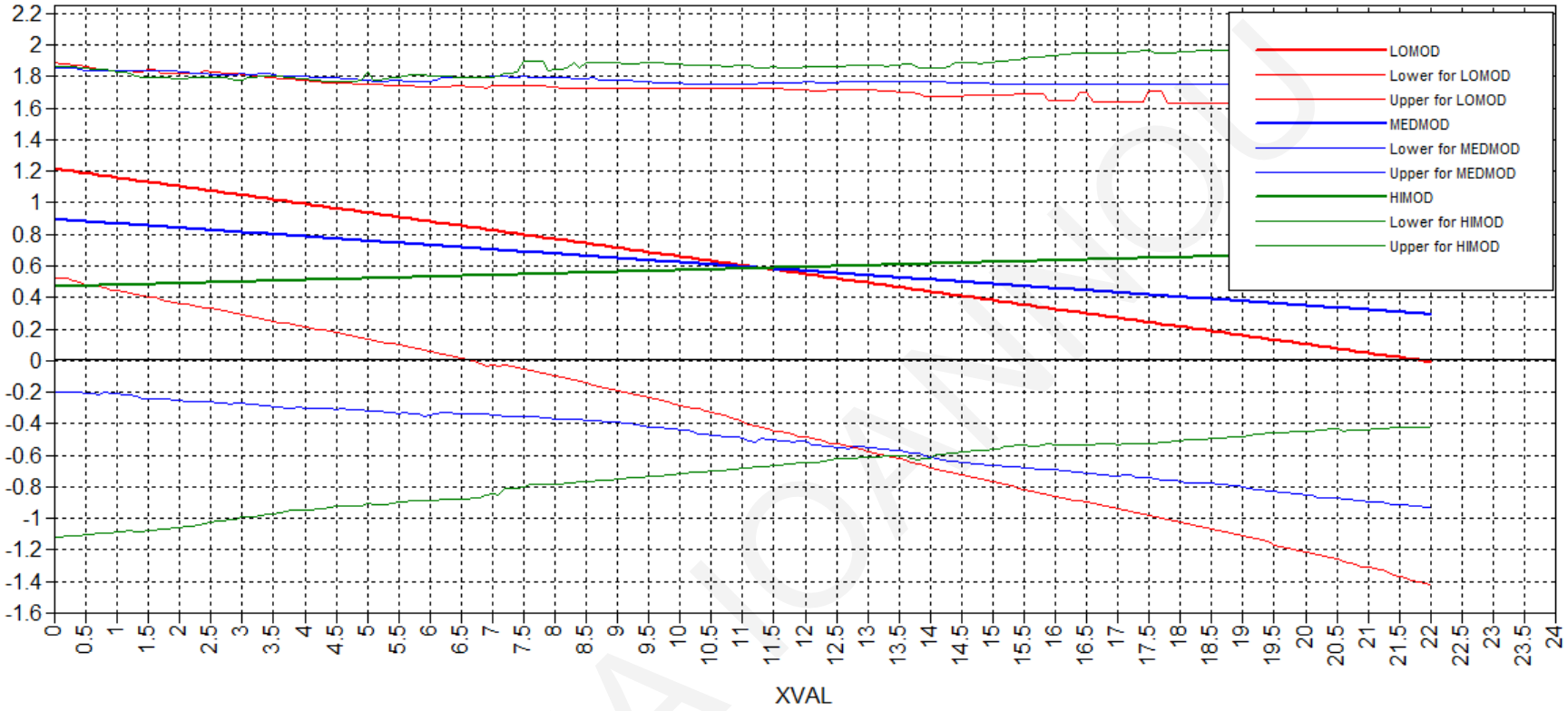

Figure 12. Plot of the effects of protective factors (X-axis) on resilience (Y-axis) for low (red lines with 95% CIs), moderate (blue lines) and high (green lines) levels of blaming self after traumatic events (moderator).

Note: When having low levels of blaming self, low levels of protective factors resulted in higher resilience levels. When high self-blaming was present, resilience was lower and the amount of protective factors could not alter the levels of resilience. Having very high levels of protective factors and low self-blaming did not result in higher resilience levels.

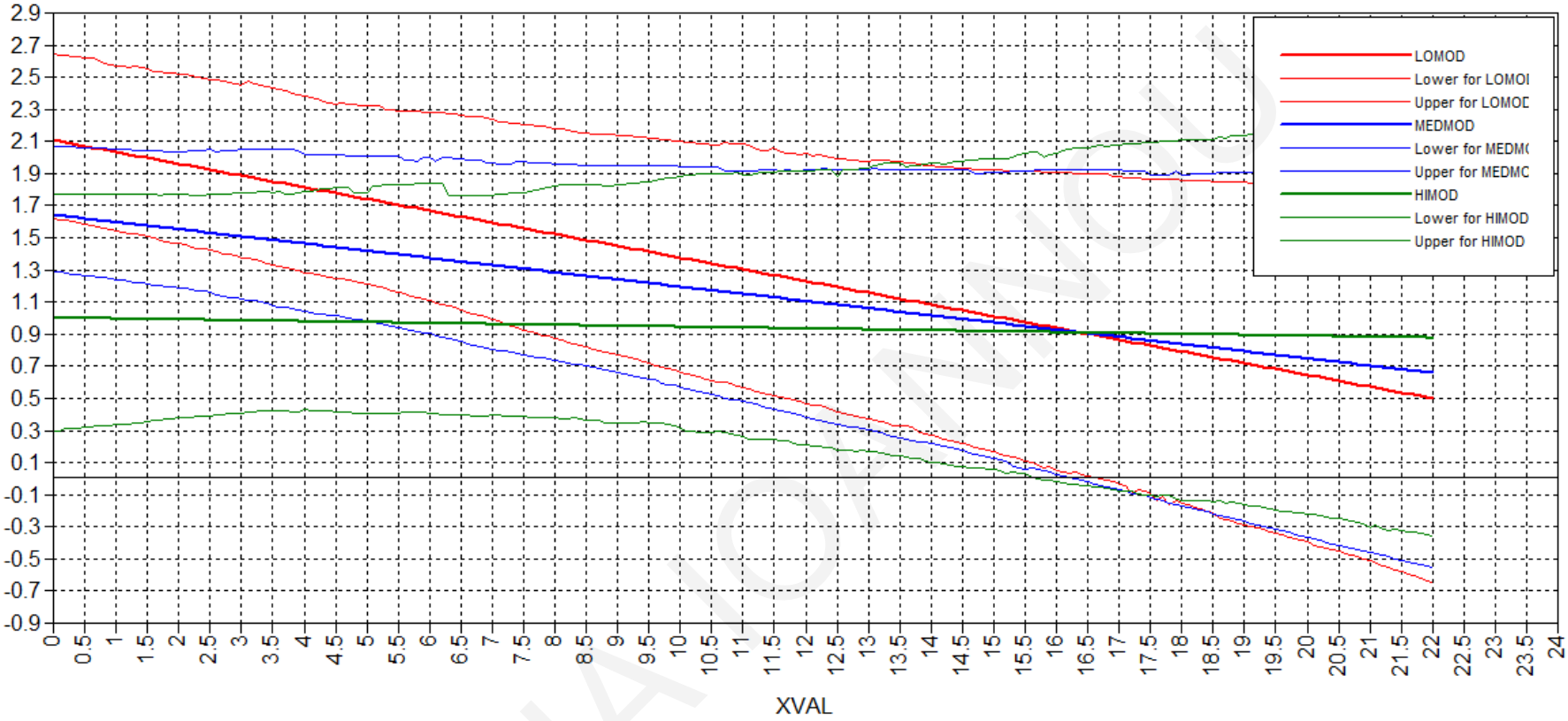

Figure 13. Plot of the effects of protective factors (X-axis) on resilience (Y-axis) for low (red lines with 95% CIs), moderate (blue lines) and high (green lines) levels of difficulties with attentional shifting (moderator).

Note: When having low difficulties in attentional shifting, even low levels of protective factors resulted in higher resilience levels. When high difficulties with attentional shifting were present, resilience was lower regardless of the amount of available protective assets.

The following analyses concerned with the examination of the differential susceptibility to stress hypothesis.

The differential susceptibility to stress hypothesis, found support first, from the model examining the effects of trauma-related parameters on resilience (see Figure 9). In order to validate the results from that analysis, we also run a latent profile analysis. First, the trauma-related parameters were used to create the profiles of traumatic exposure and susceptibility to stress. The two- and four-class models both resulted in significant LMR-A and BLRT result at $p < .05$. As the rest of the models with three, five and sex classes did not have significant values on these indices, they were not considered any further for the final model. The four-class model had lower BIC values and higher entropy compared to the two-class model (see Table 16).

However, the four class model yielded a notification that the best log-likelihood value was not replicated and the solution may not be trustworthy. The number of random starts was increased as advised, but this did not result in resolving the notification, suggesting that it was an indication for model non-identification. Therefore, the two-class model was selected. The two resulted classes were then compared based on the 5 metrics that were extracted to determine the class membership, in order to provide the descriptive labels of the classes. Class 1 consisted of 401 individuals (84.4% of the sample) and had significantly lower number of total traumatic events, traumatic events with lower closeness to self (more accidents, illnesses, natural disasters). Also, members of the Class 1 had experienced a traumatic event with hotspot memory that was less recent and the duration of their worst traumatic event was less than those of the other class. Finally, members of Class 1 had experienced their first traumatic event more recently. This Class was labeled “Low susceptibility”, as had experienced low levels of traumatic exposure. Class 2 consisted of 74 individuals (15.6% of the sample) and had higher number of total traumatic

events experienced and had experienced traumatic events more close to self (physical or sexual maltreatment). Also, members of the Class 2 had a worst traumatic event of longer duration with more recent hotspot memory and had experienced their first traumatic event earlier in life. Thus, this class was labeled “High susceptibility”, as they had experience more traumatic events in terms of number, duration and severity. The mean probabilities of the class membership were considered acceptable, as they were 0.967 for the low susceptibility class and 0.908 for the high susceptibility class. The mean standardized values of the items by their class are shown in Figure 14 and Table 17.

Table 16. Latent profile models and fit indices.

Model	Log-likelihood	BIC	Entropy	LMR-A (p-value)	BLRT (p-value)
2 classes	-5834.561	11767.735	.852	237.116 (.031)	243.528 (<.001)
3 classes	-5534.578	11204.749	1.00	584.170 (.214)	599.966 (.209)
4 classes	-5474.033	11120.640	.959	118.682 (.018)	121.089 (.017)
5 classes	-5404.584	11018.720	.946	126.835 (.230)	129.122 (.226)
6 classes	-5371.095	10988.724	.949	65.791 (.163)	66.977 (.161)

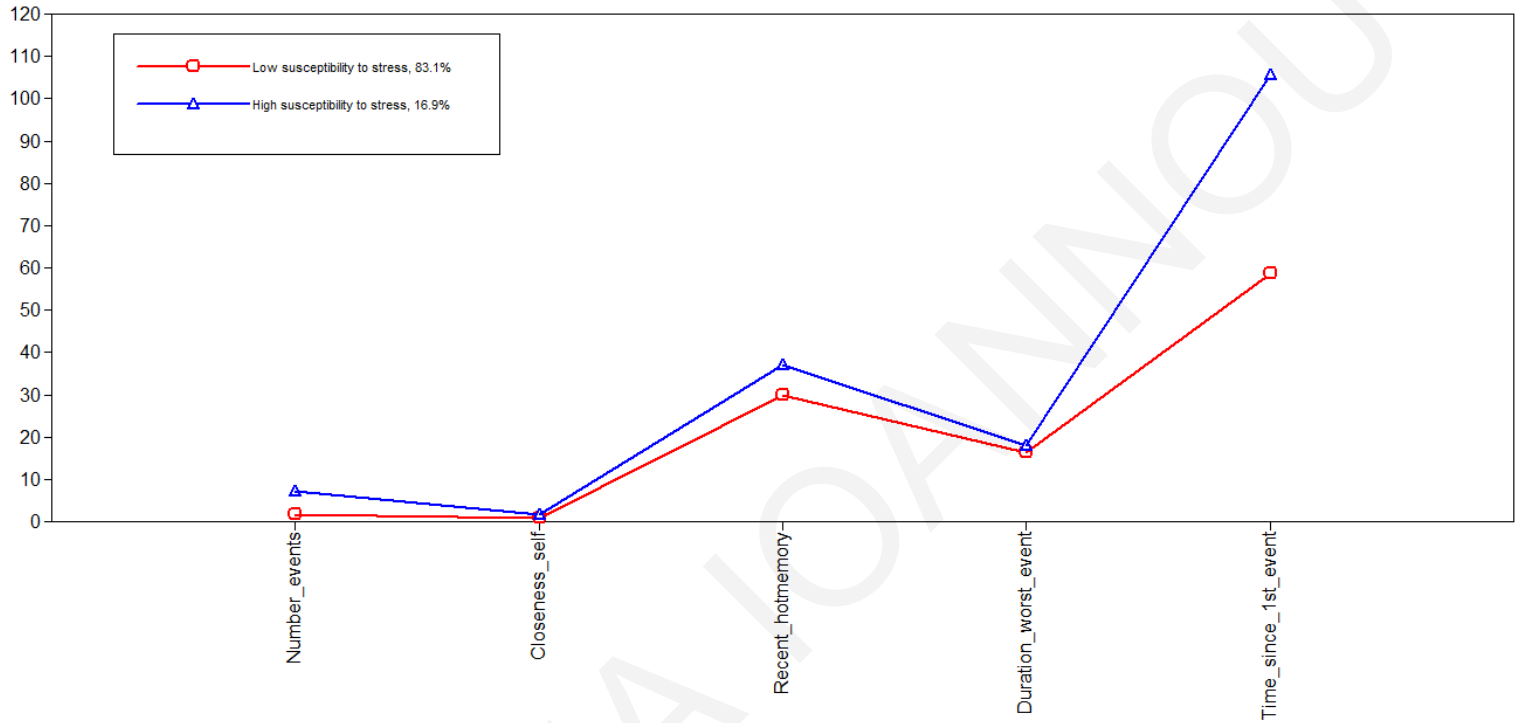

Figure 14. Mean values of susceptibility to traumatic stress items (number of events, closeness of worst event to self, how recent the hotspot traumatic memory was, duration of worst event, time since experience of first traumatic event) for high (blue) and low (red) susceptibility to stress.

Note: The two-classes model was the best fitting model based on model fit indices and interpretability. The two classes were named high and low susceptibility to stress, due to the significant differences in traumatic exposure. The high susceptibility to stress group had significantly more traumatic events, the type of events was more close to self (e.g., physical violence, sexual abuse), had a more recent hotspot memory of the traumatic event and the worst traumatic event was of longer duration. The high susceptibility to stress group had experienced a first traumatic event earlier in their life (significantly more time since first traumatic event).

Table 17. Item characteristics of traumatic exposure for the two classes (standardized mean values presented).

	Class 1: Low susceptibility to traumatic stress		Class 2: High susceptibility to traumatic stress		Comparison
	Estimate	SE	Estimate	SE	P value
Number of events	.986	.065	3.960	.331	<.001
Closeness to self	1.332	.070	2.757	.217	<.001
Recent hotspot memory	.914	.075	1.132	.169	<.001
Duration of event	.514	.048	.571	.146	<.001
Time since 1st traumatic event	1.554	.094	2.803	.227	<.001

The two classes were compared on demographic variables and on resilience. The findings supported that the classes that resulted from the latent profile analysis did not differ gender (χ^2 (1)= 2.357, p= .125), type of family (χ^2 (3)= 3.665, p= .300) or district (χ^2 (4)= 5.990, p= .101). There were significant differences on the types of traumatic events experienced by the participants in each group (shown in Table 18). Except from very few exceptions, the difference was significant supporting significantly more exposure in almost all types of traumatic events by

the high susceptibility class, compared to the low susceptibility class. Independent sample t-tests performed using SPSS supported that the high susceptibility to stress class had higher levels of resilience (M= 22.89, SD= 7.82) compared to the low susceptibility to stress class (M= 20.03, SD= 7.68) and this difference was statistically significant at the <.05 significance point (t= 5.720, p= .025). Importantly, the two classes did not have significant differences on their levels of alexithymia (t= 1.338, p= .249), absence of mindfulness (t= .897, p= .436), nor psychopathic traits (t= .402, p= .528), which were considered potential covariates that could explain the difference among individuals with higher and lower levels of resilience. The same hold true when the intelligence test were examined, as the high and low susceptibility to stress classes did not differ on Cubes (t= .796, p= .429), or on Vocabulary (t= -.533, p= .596). Thus, the differential susceptibility to traumatic stress, has been confirmed.

Table 18. Types of experienced traumatic events by Class membership.

	Class 1 (Low susceptibility) %	Class 2 (High Susceptibility) %	Chi square test
Severe accident	5.1	32.9	52.519***
Witnessed severe accident	11.7	36.1	26.612***
Natural disaster	2.3	12.3	16.050***
Close person injury/illness	36.1	65.8	21.904***
Close person death	31.9	60.6	20.603***
Own illness	12.1	15.5	598 (.439)
Longterm separation	2.0	19.2	38.034***
Other person self-harm/suicide	2.6	19.4	32.991***
Physical attack	4.2	38.4	77.540***

Severe threat	2.6	20.5	37.575***
Thief	4.3	21.9	27.650***
Kidnap	0.6	2.8	3.083 (.079)
Dog attack	8.0	44.9	65.205***
Domestic violence	2.5	32.9	78.093***
Domestic violence threats	1.1	20.8	54.676***
Family member imprisoned	2.6	12.5	14.538***
Witnessed violence	13.0	63.2	85.345***
Experienced war/terrorism	2.3	5.5	2.312 (.128)
Watched war/terrorism in news	31.4	71.2	40.776***
Physical neglect	0.0	8.6	21.322***
Sexual abuse	0.0	12.3	44.460***
Exposure to sexual harassment details	2.5	19.7	34.083***
Emotional neglect	1.4	18.6	41.386***
Exposed to substance abuse of close others	9.2	36.1	36.473***
Severe relationship change/Parental divorce	13.4	48.6	47.636***
Other school problems	3.5	17.2	20.055***

Note *p< .05, **p< .01, ***p< .001.

4.4 Presentation of results for Study 2

4.4.1 Descriptive statistics for Study 2

The final sample of parents who took part in the study was 216. Based on the parental report, 80.5% of parents were living with their husband and children and 11.9% were single parents. 4.8% were living with their family along with a member from the wider family (e.g., grandparent) and 2.9% were living with their children and their new partner. The majority of the parents who completed the questionnaire were mothers (76.85%). The majority of the parents endorsed that their children had been exposed to watching terrorism in the news, to the sudden death of a loved and the illness of a closed other. The prevalence of traumatic events experienced by adolescents as reported by their parents seemed, as expected quite different than the self-reported prevalence of events. The traumatic events reported by parents are presented on Figure 15.

The Inter-rater reliability among the two raters of traumatic events (i.e., parents and adolescents) was calculated using Cohen's Kappa in SPSS. As the responses were dichotomous (endorsed vs. not endorsed a specific traumatic event) the analysis was performed using Crosstabs (adolescent ratings were specified in the Row and parental ratings were specified in the Column). The Kappa showing the degree of agreement between adolescent and parental reports for each of the traumatic events is presented on Table 19. For most of the traumatic events there were acceptable levels of inter-rater agreement. However, for a considerable number of traumatic events there was not significant agreement (e.g., sexual abuse, physical and emotional neglect, exposure to self-harm, physical attacks, or exposure to non-familial violence).

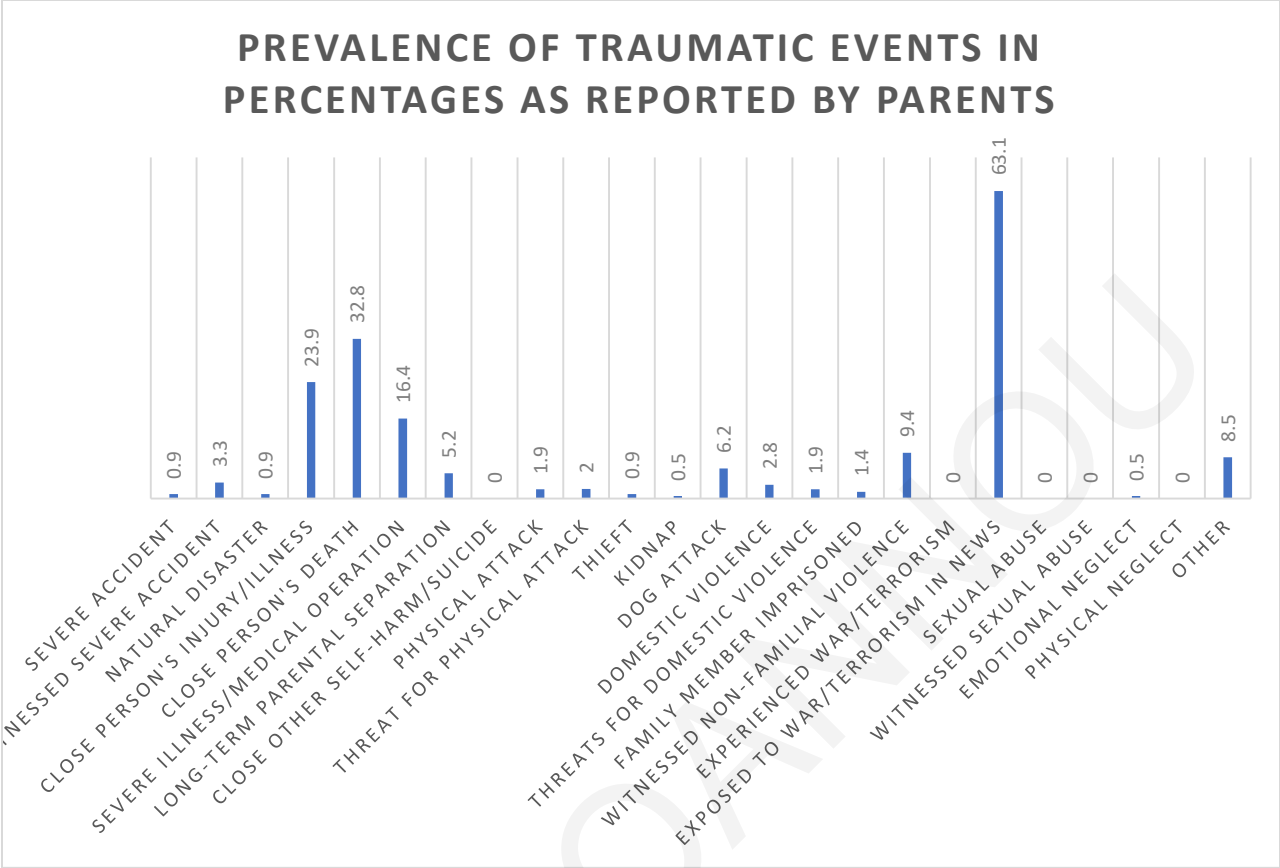

Figure 15. Presentation of the prevalence of traumatic events endorsed by parental reports based on TESI-PRR.

Table 19. Presentation of inter-rater agreement between adolescent and parental report of traumatic events.

Event	Valid N	Cohen's Kappa	SE	Significance
Severe accident	205	.148	.011	.029
Witnessed severe accident	198	.190	.094	.001
Natural disaster	204	.315	.009	.002
Close person's injury/illness	200	.212	.062	.001

Close person's death	176	.509	.068	<.001
Own illness/severe operation	190	.343	.082	.011
Long-term parental separation	200	.380	.132	<.001
Exposed to close other person's self-harm	198	.000	NA	>.05
Physical attack	199	.076	.096	.181
Threats for physical attack	202	-.027	.010	.682
Theft	198	.217	.011	.020
Kidnap	198	.345	.004	.023
Attack by dog/other animal	197	.232	.098	<.001
Domestic violence	201	.205	.139	.002
Threats for domestic violence	202	.181	.172	.009
Family member imprisoned	202	.269	.157	<.001
Exposed to non-familial violence	188	.106	.076	.097
Exposed to war/terrorism	197	.314	NA	.025
Exposed to war/terrorism in news	195	.118	.062	.064
Physical neglect	142	.000	NA	>.05
Sexual abuse	196	.000	NA	>.05
Exposed to sexual abuse details of other person	201	.000	NA	>.05
Emotional neglect	195	-.009	.008	.858
Other traumatic event	186	.164	.111	.023

Note: Low agreement between parents and adolescents was found for exposed to close other person's self-harm, physical attacks, threats for physical attack, exposure to non-familial violence, physical neglect, sexual abuse, exposure to sexual abuse details of other person and emotional neglect.

Overall, the descriptive statistics derived from the questionnaires completed by parents supported that none of them violated normality, as evident from skewness and kurtosis (Table 20).

Table 20. Descriptive statistics for measures completed by parents.

	N	Mean	SD	Skewness	SE	Kurtosis	SE
FRAS A.Belief Systems	186	2.007	.419	-.272	.178	-.065	.355
A1.Making meaning	194	1.873	.410	.034	.175	.031	.347
A2.Positive outlook	205	1.840	.522	.759	.170	1.423	.338
A3.Transcendence and spirituality	207	2.524	.870	.413	.169	.347	.337
FRAS B.Organizational Patterns	177	2.370	.370	-.351	.183	1.356	.363
B1.Flexibility	206	2.010	.541	1.624	.169	1.626	.337
B2.Connectedness	197	2.126	.362	-.583	.173	.213	.345
B3.Social and economical resources	188	2.598	.469	.029	.177	1.924	.353

FRAS	185	1.9714	.38113	-.344	.179	.146	.355
C.Collaborative problem solving							
C1.Clarity	199	1.835	.482	.814	.172	1.326	.343
C2.Open emotional expression	201	2.191	.379	-.552	.172	.251	.341
C3.Communication	197	1.921	.460	-.160	.173	-.068	.345
Internalizing symptoms (PROPS)	169	26.231	8.688	1.262	.187	1.805	.371
Externalizing symptoms (PROPS)	185	12.676	4.588	1.156	.179	1.223	.355
Somatic and sleep problems (PROPS)	203	5.951	2.084	1.146	.171	1.230	.340
Interpersonal tension (FEC)	207	9.720	2.427	2.081	.169	4.967	.337
Child problems (FEC)	198	12.657	3.171	1.844	.173	4.632	.344
Financial difficulties (FEC)	200	12.875	3.524	2.139	.172	5.380	.342

4.4.2 Factor structure of questionnaires used in Study 2

Due to the lower number of individuals in this sample, it was not optimal to split the sample in two subgroups in order to perform EFA on the one and CFA on the other. The EFA for the PROPS supported four factors based on Eigenvalue>1, all together explaining 46.45% of the total variance. The extracted communalities ranged from .334 to .755. The parallel analysis suggested that three factors could be reflected by the items of the questionnaire. Based on those, the communalities ranged from .434 to .801. According to the original research on which PROPS was developed, the measure yields three factors using a scree plot, reflecting the internalizing, the externalizing and the somatic/sleep problems. Following the results from the parallel analysis and as informed by the previous research on the measure, the model fit indices of the CFA using a three-factor model were examined in order to evaluate fit and consider potential modifications suggested. The CFA using a three-factor solution had almost acceptable fit (Table 21) and no modifications among those suggested were considered mandatory (MI<20). Somatic and sleep problems had a very strong correlation with internalizing symptoms (r= .928, SEr= .071, p< .001). Externalizing with internalizing also had high correlation (r= .766, SEr= .040, p< .001), and externalizing with somatic/sleep problems had positive high correlation (r= .647, SEr= .087, p< .001). However, not all correlations were strong enough in order to support a single-factor solution, or even a second-order solution. Examination of a composite latent factor of internalizing and somatic/sleep problems, resulted in a non-significantly better model fit, with $\chi^2(400)= 941.146$, p< .001, CFI= .884, TLI= .865, RMSEA= .081 (90%CI .075, .088), SRMR= .073, AIC= 12891.663, BIC=13207.349. The difference in chi square was not significant, with $\Delta\chi^2$ (Δdf)= 2.22, p> .05. Therefore, the three-factor model was selected.

For the examination of the FRAS structure, multiple CFAs were performed; one for each of the nine subscales using questions as observed scores and one for subscales mean scores as observed scores due to the non-identified model resulting when using all questions as observed. All confirmed the structure proposed by Sixbey (2005), consisting of three main factors (Belief systems, Organizational patterns and Problem solving that have three loadings each). The CFA using the subscale mean scores was selected for the rest of the analyses due to the high complexity of the item-model, as the FRAS consists of 66 items. The three-factor model (belief systems, organizational patterns and collaborative problem solving) resulted in a good fit and was not significantly better than the one-factor model. The correlations among the three factors were very strong though, suggesting a hierarchical structure (Figure 16).

The EFA for the Family Events Checklist supported the extraction of 3 factors based on Eigenvalues>1 and the parallel analysis. Those factors were consisted with the literature and named “Interpersonal tension”, “Child problems”, “Financial difficulties”. Items expressing stress related to other people outside the family loaded on the first factor, items reflecting difficulties to manage children loaded on the second factor and the rest of items reflected difficulties to deal with finances and daily hassles. All three factors explained the 49.21% of the total variance. The CFA was performed using the subscales’ mean scores, due to the increased complexity compared to the rather small number of parent participants. The model fit was excellent, with $\chi^2(3)= 2.488$, $p< .001$, CFI= 1.00, TLI= 1.00, RMSEA= .000 (90%CI .000, .000), SRMR= .000, AIC= 1354.134, BIC=1384.386.

Table 21. Presentation of CFAs for the measures completed by the parent sample.

Model	χ^2 (df)	CFI	TLI	RMSEA (90% CI)	SRMR	AIC	BIC	$\Delta\chi^2$ (df)
A.Three-factor PROPS	938.926 (398)***	.884	.864	.081 (.075, .088)	.073	12893.444	20891.427	
A2.Two-factor PROPS	941.146 (400)***	.884	.864	.081 (.075, .088)	.073	12891.663	13207.349	2.22 (2)ns
B.Three-factor FRAS	56.084 (24)***	.958	.937	.079 (.052, .107)	.046	1810.440	1911.137	
B2.One-factor FRAS	60.474 (27)***	.956	.941	.076 (.051, .102)	.047	1808.830	1899.458	4.39 (3)ns
C.Three-factor FEC	2.488 (3)	1.00	1.00	.000	.000	1354.134	1384.386	

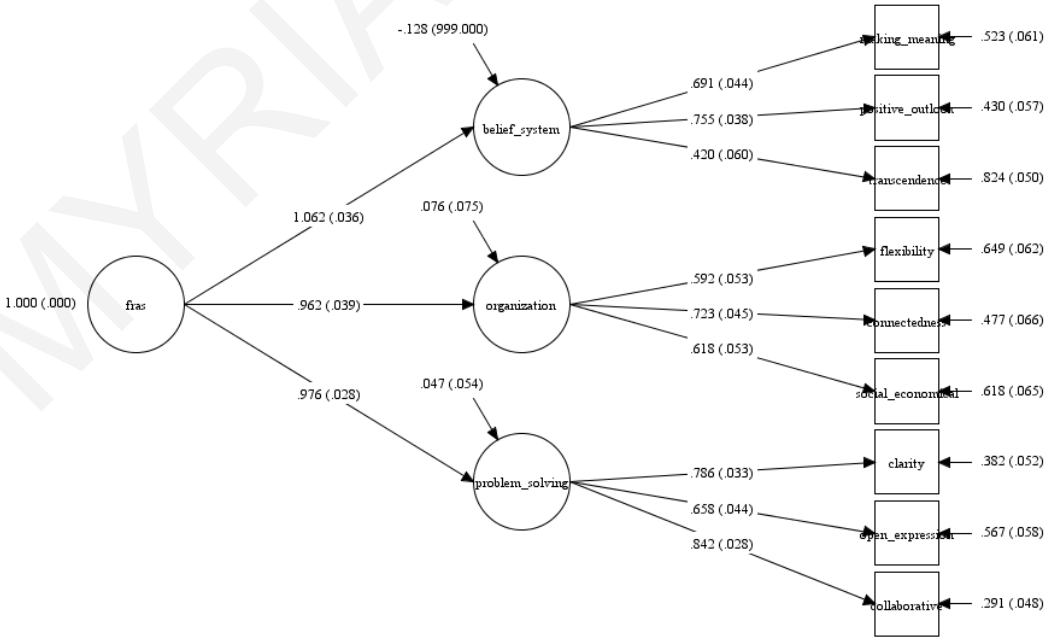

Figure 16. Second-order CFA of FRAS using subscale mean scores as observed variables.

4.4.3 Hypotheses testing for Study 2

A model with family resilience as an exogenous latent second-order variable and adolescent resilience as an endogenous latent variable was performed to test the hypothesis concerning the link between family and individual adolescent resilience. The number of observations for this analysis was 418, and 57 cases were not included as they were missing on all variables. The model was over-identified, as the number of free parameters was 49. The model fit was good, with $\chi^2(86)= 293.827$, $p< .001$, CFI= .926, TLI= .913, RMSEA= .076 (90%CI .067, .086), SRMR= .062, AIC= 7259.479, BIC=7457.217. Family resilience was not predictive of adolescent resilience (b= -.065, 95% CI -.222, .091, SEb=.095, p= .492)(Figure 17).

Similar non-significant findings were detected when examining the effect of family resilience on PTS based on self-report (IES-R). The final number of included cases was 406, the model was over-identified, as the number of free parameters was 97. The model fit was acceptable, with $\chi^2(430)= 293.827$, $p< .001$, CFI= .915, TLI= .900, RMSEA= .071 (90%CI .067, .085), SRMR= .071, AIC= 22451.255, BIC=22839.392. When the PTS were examined based on parental report (PROPS), the effects by family resilience were consistently non-significant. The number of cases included in the model was 214 and the model was over-identified as the number of free parameters was 125. The fit of that model was not acceptable, with $\chi^2(694)= 1557.783$, $p< .001$, CFI= .743, TLI= .726, RMSEA= .076 (90%CI .071, .081), SRMR= .071, AIC= 14889.313, BIC=15310.060. Examination of the model with family resilience and psychopathology supported again, non-significant effects. The model was over-identified, and the number of free parameters was 42. The total number of observations included in this model was 269. The model fit was good, with $\chi^2(48)= 104.414$, $p< .001$, CFI= .948, TLI= .929,

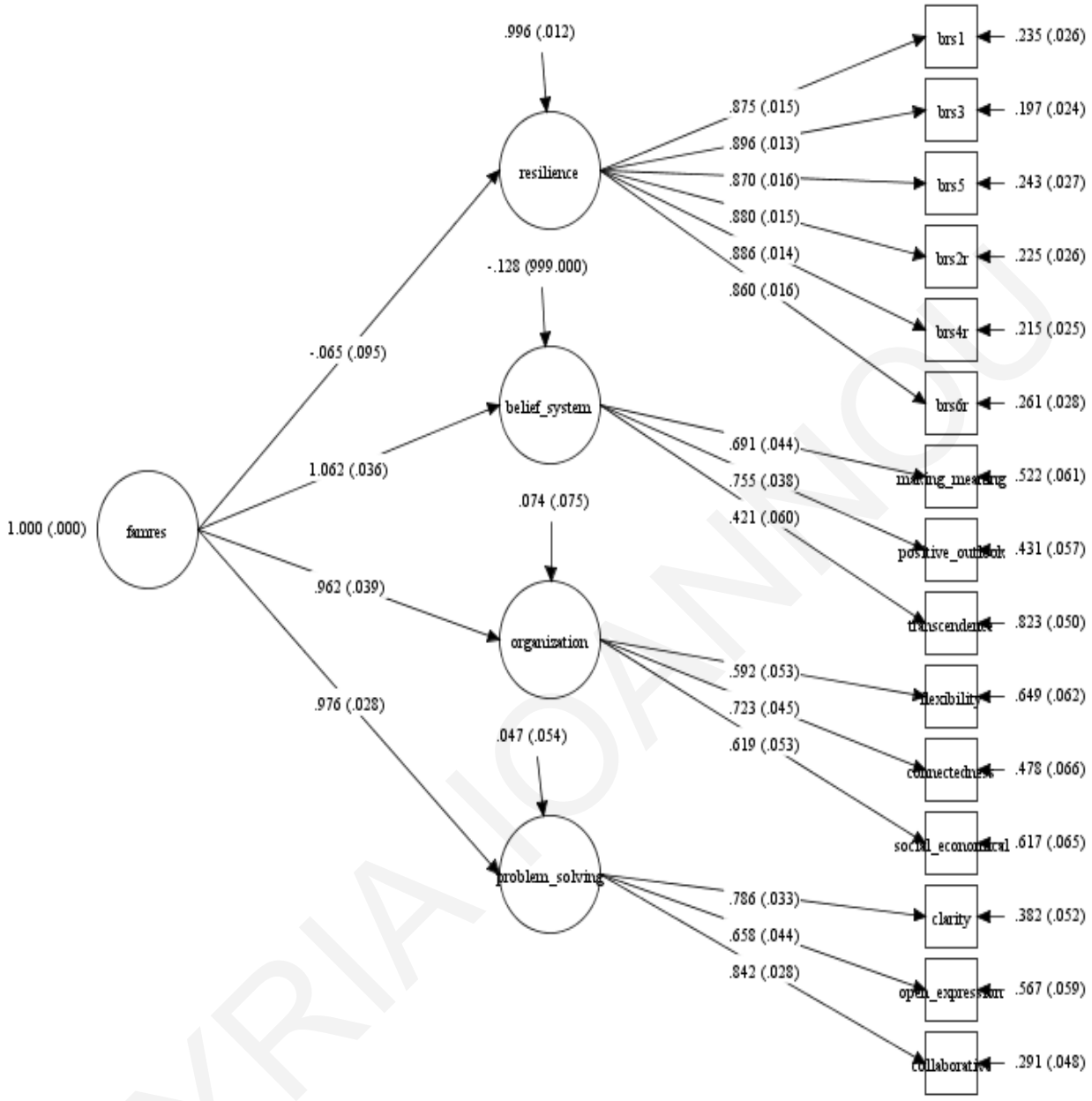

Figure 17. Model with effects of family resilience on adolescent resilience. The effect was not significant (standardized estimates are presented).

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RMSEA= .066 (90%CI .049, .084), SRMR= .098, AIC= 3624.269, BIC=3774.933. Family resilience was not a significant predictor of internalizing problems, externalizing problems, other problems, or total problems, as measured by the YSR (Table 22). Importantly, considering the degree of traumatic exposure as a potential moderator of the relationship between family resilience and adolescent resilience did not alter the non-significant effect (FrasXExposure b= -.239, SEb= .442, p= .589).

Table 22. Standardized estimates of effects of family resilience on adolescent resilience, post-traumatic symptoms and psychopathology.

Outcome	Lower 5%	Estimate	Upper 5%
Adolescent resilience	-.222	-.065	.091
Post-traumatic symptoms (IES-R)	-.004	.145	.293
Post-traumatic internalizing symptoms (PROPS)	-.017	.030	.054
Post-traumatic externalizing symptoms (PROPS)	-.022	.109	.241
Post-traumatic somatic and sleep problems (PROPS)	-.052	.107	.265
Internalizing problems (YSR)	-.091	.170	.432
Externalizing problems (YSR)	-.107	.137	.382
Other problems (YSR)	-.316	-.025	.266

Total problems (YSR)	-.150	.210	.570

The following hypothesis included family stress as a moderator of the relationship between family resilience strategies and post-traumatic stress symptoms. Latent variables were used as independent (family resilience), moderating (family stress) and dependent (post-traumatic symptoms) variables. The total number of observations was 215 and the model was over-identified as the number of free parameters was 130. The model (AIC= 16288.456, BIC= 16726.639) suggested that there was a significant main effect from family stress on adolescents' post-traumatic symptoms (b= .289, 95% CI .195, .384, SEb= .057, p< .001). Moderation effects by family stress in the relationship between family resilience and adolescents' post-traumatic symptoms were not significant (b= .098, 95% CI -.170, .366, SEb= .163, p= .547). The plot extracted also showed that the confidence intervals of the groups representing low, moderate and high family stress were crossing each other, supporting no moderation effects (Figure 18).

Then we examined whether family risk would stand as a moderator in the relationship between family resilience and individual adolescent resilience. Latent variables were used as independent (family resilience), moderating (family risk) and dependent (adolescent resilience) variables. The total number of observations was 418 and the model was over-identified as the number of free parameters was 56. The model (AIC= 8642.762, BIC= 8868.749) suggested that there was a significant main effect from family risk on adolescents' resilience (b= -.520, 95% CI -.680,.361, SEb= .097, p< .001). Moderation effects were not detected (b= -.321, 95% CI -.923, .282, SEb= .366, p= .381), as can be also evident from Figure 19.

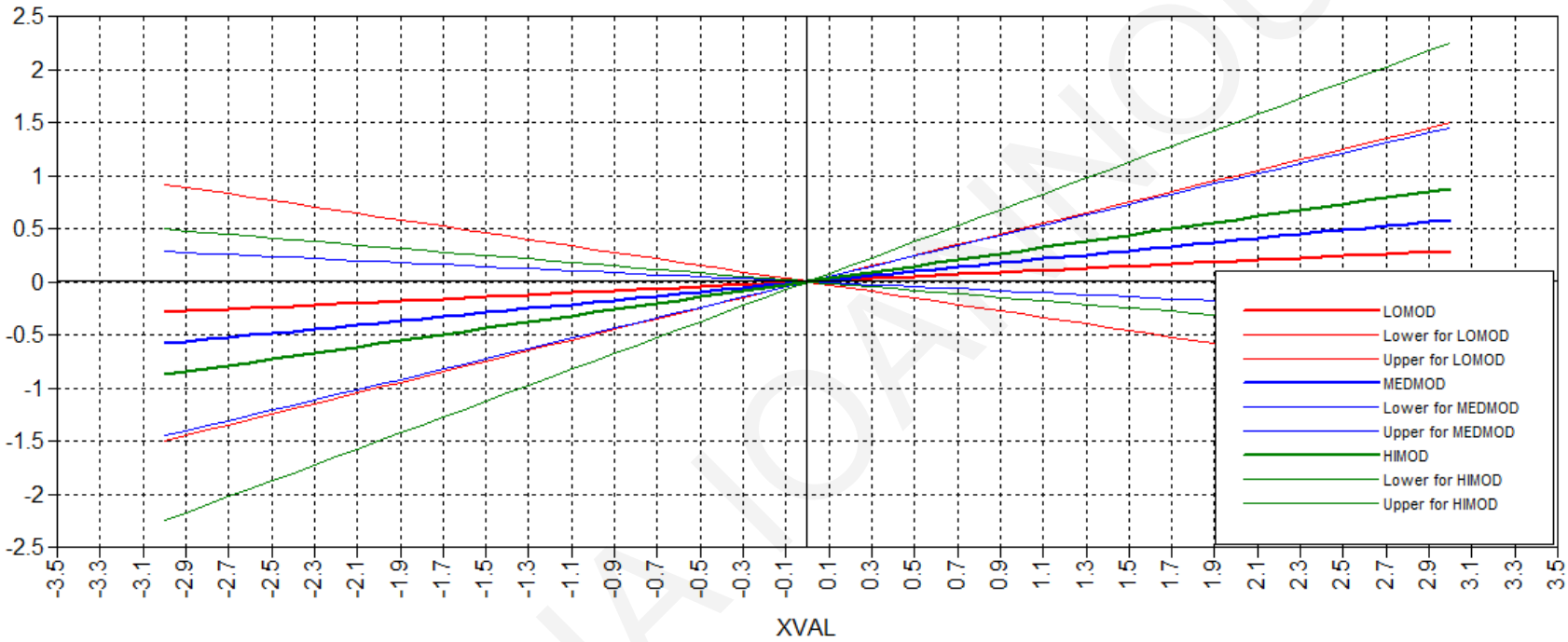

Figure 18. No significant effects in the relationship between family resilience (X-axis) and adolescents' post-traumatic symptoms (Y-axis) for low (red lines), moderate (blue lines) and high (green lines) levels of family stress (moderator).

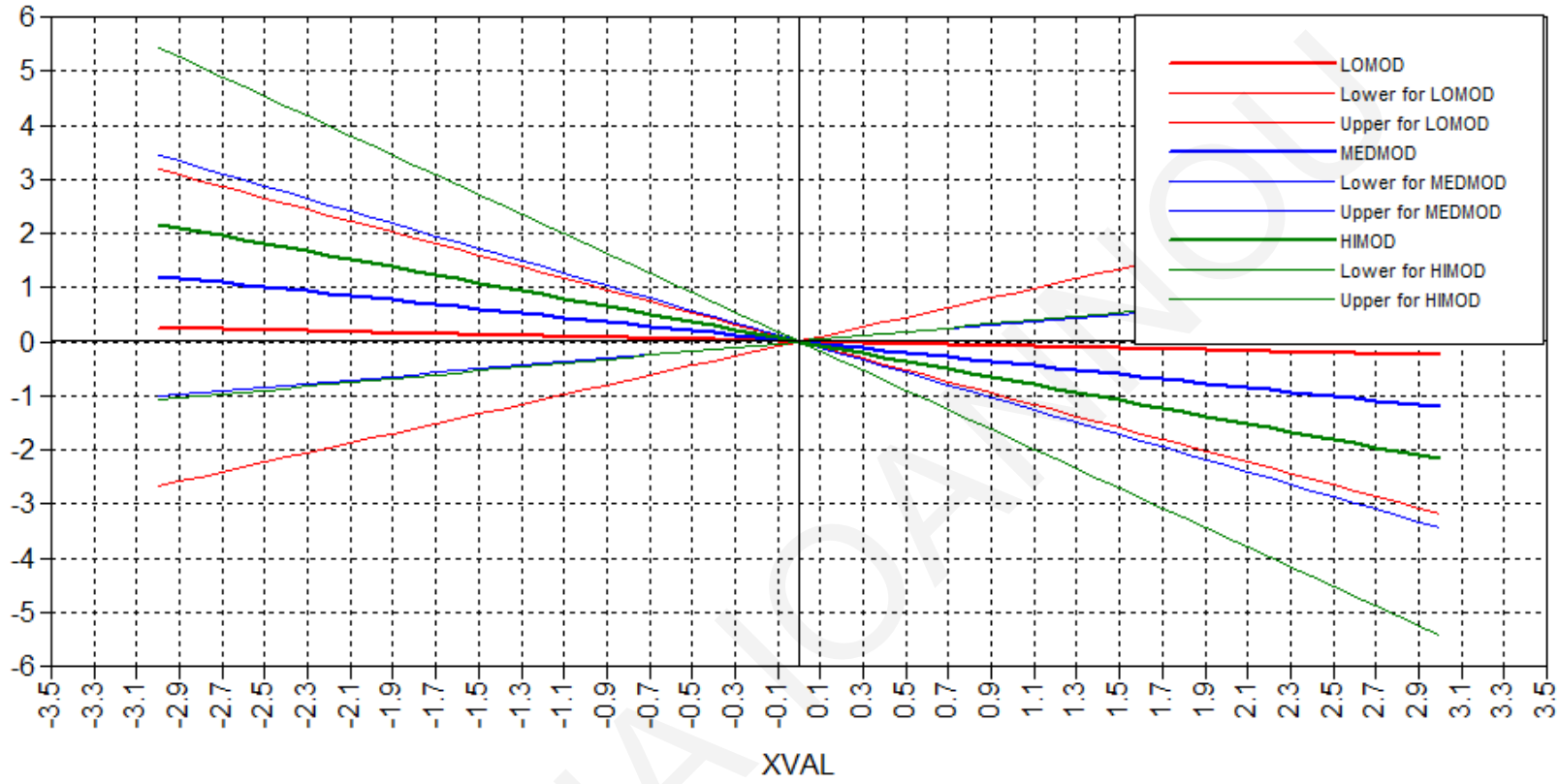

Figure 19. No significant effects in the relationship between family resilience (X-axis) and adolescents' resilience (Y-axis) for low (red lines), moderate (blue lines) and high (green lines) levels of family risk (moderator).

4.5 Presentation of results for Study 3

4.5.1 Hypothesis testing for Study 3

Following analyses included the measurement of resilience at Time 2, which was conducted at schools for 368 of the adolescents who took part in Study 1. The rest of the adolescents were not reached (n= 107) due to difficulties in conducting another data collection at school due to schools schedule (68.48%), missing from school (28.97%), or not wanting to participate (2.55%). The model was over-identified, as the number of free parameters was 39. The model with resilience latent factor from Time 1 regressing on the resilience latent factor from Time 2 provided a model with good fit, with $\chi^2(51)= 213.808$, p< .001, CFI= .960, TLI= .948, RMSEA= .094 (90%CI .082, .108), SRMR= .075, AIC= 15964.987, BIC=16116.328. The resilience factor of Time1 had a very strong positive effect on resilience Time2, with b= .988 (95% CI .984, .993), SEb= .003, p< .001 (Figure 20). The total variance explained was 97.7%.

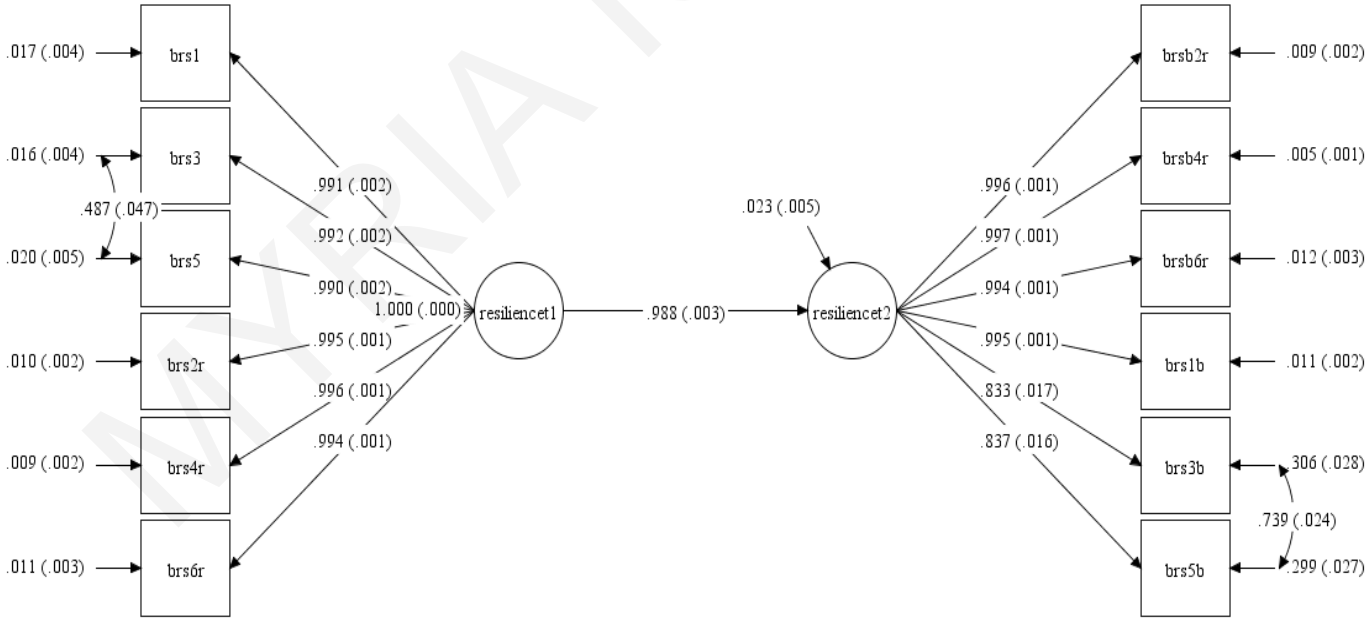

Figure 20. Model presenting the cross-lagged effect of Resilience T1 on Resilience T2.

In order to examine whether self-regulation mechanisms of Time 1 had a unique significant effect on Resilience Time 2, the composite variables of self-regulation mechanisms were added in the model and the Resilience Time 1 to Resilience Time 2 effect was constrained to zero. Significant positive effects were detected from emotion reappraisal, and the self-regulation mechanisms of triggering change and assessing the effectiveness of one's plan to deal with a situation, whereas maladaptive strategies (i.e., self-blame, rumination, catastrophizing, blaming others) and searching for options were negatively related to the resilience levels presented at Time 2 (Figure 21). The adjusted effects of self-regulation mechanisms at Time 1 on resilience at Time 2 were also examined, after including in the model the effects by gender, level of traumatic exposure (latent variable formed by the observed variables of number of traumatic events, duration of worst traumatic event, intensity of hotspot memory based on how recent it is, closeness of worst traumatic event to self, time since first traumatic event experienced), psychopathic traits, alexithymia and previous resilience levels. The adjusted and unadjusted standardized estimates are presented on Table 23. The final adjusted model accounted for 79% of resilience at Time 2 ($R^2 = 0.79$, SE= .089, $p < .001$). Considering the adjusted effects supported that the effects were maintained by maladaptive cognitive emotion regulation strategies, triggering change and assessing the effectiveness of one's plan. Also, implementing had a significant negative effect after adjusting for the effects of the covariates mentioned above.

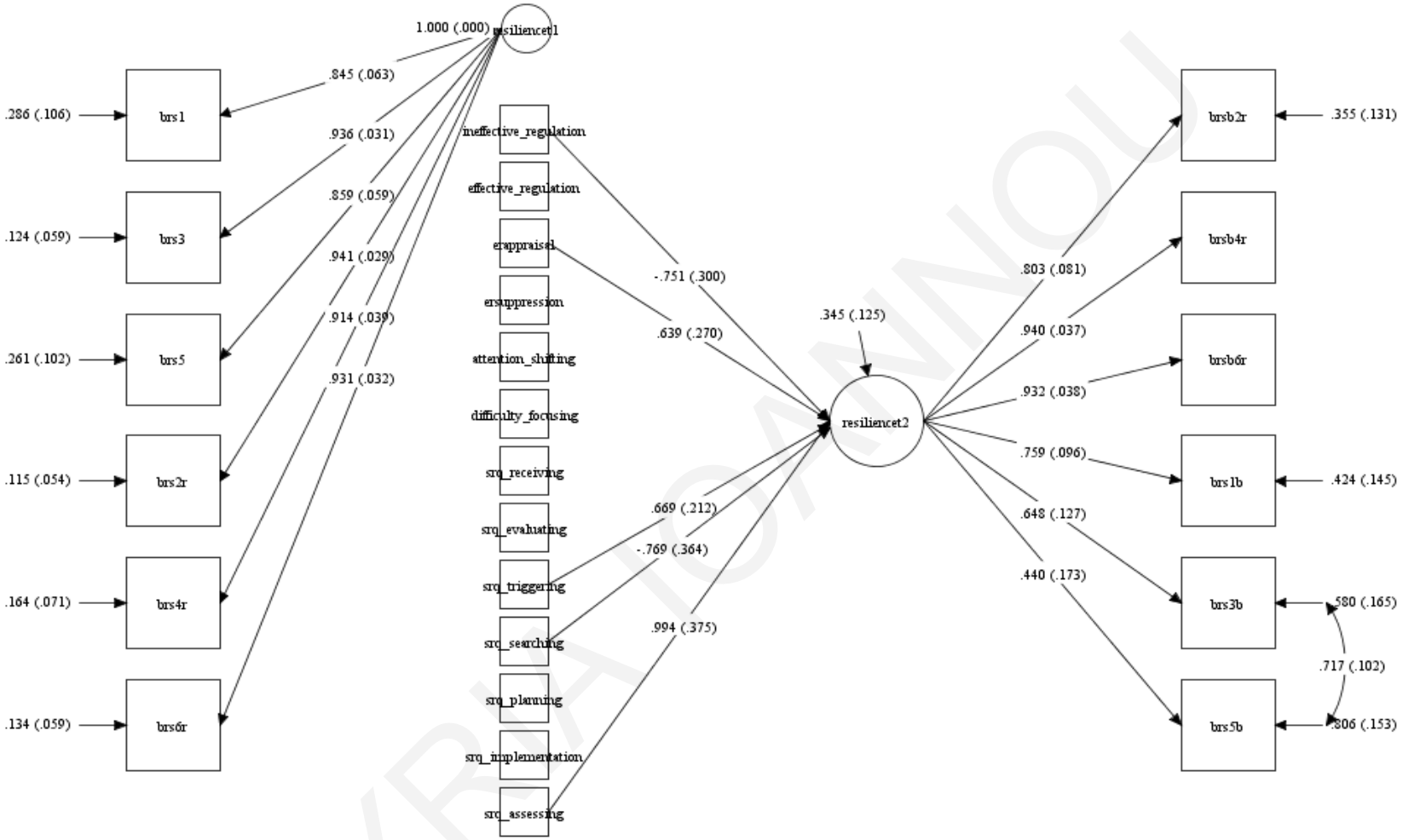

Figure 21. Effect of self-regulation mechanisms at Time 1 on resilience at Time 2, when controlling for the auto-correlation with resilience scores at Time1.

Note: Resilience was predicted by high levels of cognitive reappraisal, triggering change and assessing the effectiveness of one's plan. Higher levels of searching and maladaptive emotion regulation strategies (i.e., rumination, catastrophizing, self-blame and blaming others) predicted lower levels of resilience.

Table 23. Presentation of the unadjusted and adjusted estimates of self-regulation mechanisms effects at Time 1 on resilience at Time 2.

Predictor	Unadjusted			Adjusted		
	Lower 5%	Estimate	Upper 5%	Lower 5%	Estimate	Upper 5%
Maladaptive CERQ	-1.245	-.751	-.257	-1.017	-.558	-.099
Adaptive CERQ	-.155	.259	.672	-.334	.039	.411
ERQ_reappraisal	.195	.639	1.084	-.026	.387	.799
ERQ_expressive suppression	-.375	-.115	.145	-.352	-.113	.126
ASC_difficulty with attentional shifting	-.575	-.081	.414	-.331	.075	.481
ASC_difficulty focusing	-.779	-.362	.056	-.716	-.353	.011
SRQ_receiving	-.799	-.151	.497	-.571	-.038	.496
SRQ_evaluating	-.647	-.162	.324	-.552	-.155	.242

SRQ_triggering	.321	.669	1.017	.415	.712	1.009
SRQ_searching	-1.368	-.769	-.170	-.984	-.432	.120
SRQ_planning	-.451	.120	.690	.-.440	.077	.594
SRQ_implementing	-.941	-.466	.009	-1.055	-.647	-.240
SRQ_assessing	.377	.994	1.611	.394	.970	1.547

Note: Unadjusted effects refer to the effects of self-regulation mechanisms on resilience after considering previous levels of resilience. Adjusted effects refer to the effects of self-regulation on resilience after considering the effects by gender, level of traumatic exposure (latent variable formed by the observed variables of number of traumatic events, duration of worst traumatic event, intensity of hotspot memory based on how recent it is, closeness of worst traumatic event to self, time since first traumatic event experienced), psychopathic traits, alexithymia and previous resilience levels. Examination of the adjusted effects supported that the effects were maintained by maladaptive cognitive emotion regulation strategies, triggering change and assessing the effectiveness of one's plan. Also, implementing had a significant negative effect after adjusting for the effects of those covariates.

4.5.2 Cross-lagged effects between resilience and self-regulation

Measurement of self-regulation at Time 2 was performed in a smaller sample (n= 67), using the computerized and paper-and-pencil tasks described in the Methodology section to measure aspects of cognitive regulation (i.e., processing speed, visual working memory, mental shifting, and behavior inhibition). Independent sample t-tests to evaluate differential attrition suggested that there were not significant statistical differences among those who decided to participate in the next phase of the study, and those who did not. On all measures compared (i.e., gender, district, traumatic exposure, resilience, covariates), the only significant difference was between the number of total traumatic events experienced, as those who participated in the study had experienced significantly less traumatic events (M= 1.567, SD= 1.811) than those who did not participate in the second phase (M=2.836, SD= 2.753), with $t(473)= 4.882$, $p< .001$. The descriptive statistics of the tasks are presented on Table 24. The reaction time metrics from all tasks were used in an EFA to explore whether one time-factor could be extracted. The EFA and the parallel analysis supported that one factor should be extracted (Eigenvalue= 2.835) that could explain 42.94% of the total variance. Similarly, one factor was extracted from the error metrics of those tasks (Eigenvalue= 1.783) that could explain 25.47% of the total variance, and one factor was extracted from the metrics representing the correct responses (Eigenvalue= 2.948) explaining 61.48% of the total variance. Most of the measures had significant correlations with self-regulation self-report measures, in the expected direction, thus providing further validation of the constructs measured (see Table 25). The cross-lagged effects at Times 1 and 2 were examined using the latent variables of self-regulation and resilience. The model was unidentified, as the number of observations was 263 and the number of parameters was 405. Therefore, due to the complexity of the model and the respective not adequate sample size, the composite scores

Table 24. Descriptive statistics for metrics extracted from cognitive regulation tasks at Time 2.

	Mean	SD	Skewness	SE	Kurtosis	SE
TrailA_time	32.065	16.899	2.621	.293	10.772	.578
TrailA_errors	.169	.867	2.956	.293	14.170	.578
TrailB_time	75.512	34.323	.638	.293	1.066	.578
TrailB_errors	3.372	6.553	1.175	.293	5.850	.578
StroopA_time	68.209	12.038	.877	.293	1.901	.578
StroopA_errors	.865	1.041	1.158	.293	3.012	.578
StroopB_time	50.010	6.485	-.263	.293	-.612	.578
StroopB_errors	.257	.559	2.326	.293	8.112	.578
StroopC_time	113.260	22.330	.211	.293	.193	.578
StroopC_errors	2.645	1.624	.305	.293	-.188	.578
Corsi_meantimeneededtostart	1053.002	321.607	1.649	.293	3.140	.578
Corsi_total_correct	8.397	1.526	.737	.293	.772	.578
Memory_span	5.278	.771	.593	.293	.405	.578
Average_completiontime_correcttrials	4112.587	984.857	.585	.293	-.139	.578
WCST_averagereactiontime	1689.549	561.540	1.578	.293	3.299	.578

WCST_totalcorrect	74.661	9.447	-1.407	.293	2.439	.578
WCST_totalerrors	25.181	9.898	1.234	.293	1.726	.578
WCST_Perseverativeresponses	33.678	8.029	-.911	.293	5.156	.578
WCST_Perseverativeerrors	14.957	6.711	.434	.293	1.899	.578
WCST_Nonperseverativeerrors	11.135	9.501	1.998	.293	5.364	.578
Trialstocomplete1stcategory	15.338	12.019	2.639	.293	14.828	.578
Failuretomaintainset	2.199	1.558	.785	.293	1.610	.578
Learningtolearn	1.056	3.086	1.655	.293	6.709	.578
Conceptuallevelresponses	66.901	14.615	-1.124	.293	1.333	.578
Gonogo_Correct	291.311	30.490	-1.815	.293	5.301	.578
Gonogo_errors	28.171	22.072	2.813	.293	11.897	.578
GonogoMeanAccuracy	.910	.079	-1.685	.293	6.606	.578
GonogoMeanError	.104	.106	2.032	.293	5.947	.578

Round1_meanAccuracyforP	.933	.186	-3.114	.293	12.137	.578
Round1_AccuracySDforP	.123	.124	1.491	.293	3.889	.578
Round1_meanaccuracyforR	.616	.188	.057	.293	-.539	.578
Round1_meanAccuracySDforR	.435	.115	-2.237	.293	6.280	.578
Round1_Go_medianRT	457.761	55.133	1.007	.293	1.191	.578
Round1_Go_meanRT	486.286	50.367	.583	.293	.293	.578
Round1_Go_meanSD	120.187	26.913	.118	.293	.640	.578
Round2_meanaccuracyforP	18.800	129.937	6.185	.293	46.128	.578
Round2_meanAccuracySD_forP	.199	.066	.008	.293	.779	.578
Round2_meanaccuracyforR	.959	.052	-1.791	.293	5.730	.578
Round2_meanAccuracySD_forR	.127	.123	.446	.293	-.592	.578

Round2_Go_medianRT	589.999	89.973	-.279	.293	-.794	.578
Round2_Go_meanRT	577.312	51.141	.321	.293	.418	.578
Round2_Go_meanSD	136.654	57.002	.147	.293	-1.229	.578

Table 25. Bivariate correlations between factor scores of extracted metrics and composite scores of self-report self-regulation questionnaires.

	2.	3.	4.	5.	6.	7.
1.SRQ	.351*	.409**	-.568***	-.206*	.150	.426**
2.CERQ	1	.632***	-.324*	.105	.235	.301*
3.ERQ		1	.156	.312	.213	.126
4.ACS			1	-.311*	.621***	-.289*
5.Errors				1	.416*	-.501**
6.RT					1	-.265*
7.Corrects						1

Note: *p< .05, **p< .01, ***p< .001.

were used instead for self-regulation mechanisms, forming a path model (Figure 22). The model had good fit, with $\chi^2(71)= 162.564$, p< .001, CFI= .966, TLI= .957, RMSEA= .070 (90%CI .056, .084), SRMR= .259, AIC= 9144.794, BIC=9316.258. The standardized estimates supported that resilience at Time 2 was significantly predicted by resilience at Time 1 (b= .756, SEb= .093, p= .004) and by self-regulation at Time 1 (b= .332, SEb= .103, p= .026). Self-regulation at Time 2 was significantly predicted by self-regulation at Time 1 (b= .481, SEb= .139, p= .019), but not by resilience at Time 1 (b= .033, SEb= .139, p= .156). This finding supported that the effect direction from self-regulation mechanism on resilience was reasonable, even though the reversed cannot be excluded, especially given the small sample size of participants who completed the self-regulation tasks at Time 2 (n= 67).

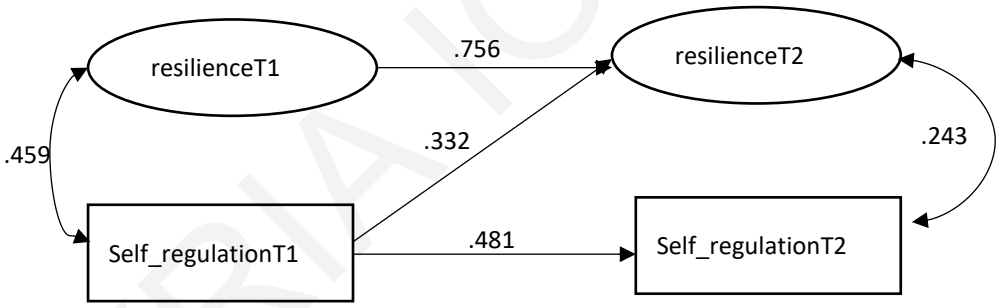

Figure 22. Cross-lagged effects between resilience and self-regulation at Time 1 and Time 2.

4.6 Presentation of results for Study 4

4.61. Hypotheses testing for Study 4

The following analyses employed a MTMM in order to examine the method effects of different informants and different measures. First we evaluated the identification of a model consisting of two traits (resilience and psychopathology) and two methods (parent-report and

self-report). Resilience latent factor comprised by all observed items of the measures of resilience (i.e., BRS, FRAS, Protective factors, CYRM) and psychopathology latent factor was comprised by all observed items of the measures of post-traumatic symptoms (PROPS and IES-R). The two method latent factors were reflected by the self-reported scales (BRS, CYRM, IES-R and Protective factors) and by the parent-reported scales (PROPS, FRAS). However, due to the high complexity of the model and the low number of observations (206), the model was not identified due to the zero number of free parameters. Thus, a shortened version of MTMM was performed using only main concept measures (that is, we did not include the measures of CYRM and protective factors) and following the recommendations by Byrne (2013) and Kyriazos (2018) for the comparing models. The Correlated Trait Multi-Method (CTMM) model was examined first, supporting not acceptable fit and two non-significantly correlated traits of psychopathology and resilience (Table 26, Model A). The Correlated Traits Correlated Method (CTCM) model supported not acceptable fit and also not significant correlations among traits, or among method factors of self-report and parent-report. The model comparison between models A and B did not suggest that one model had significantly better fit over the other. The No-Trait Correlated Method (NTCM) model supported worse fit from both previous models. Also the latent factors of self and parent (method factors) were not significantly correlated (p= .122), thus supporting discriminant processes. The model with Perfectly Correlated Traits Correlated Methods (PCTCM) resulted again in a bad fit. Parent and self-reports now correlated significantly (r= -.602, SEr= .074, p< .001). The Correlated Uniqueness (CU) model was tested afterwards, supporting that it had the best data fit compared to all previous models examined. Importantly though, the family resilience composite scores did not load significantly on the resilience factor.

Even though the CU model had the best fit in the data, the model fit indices still showed a non-acceptable model.

Table 26. Presentation of comparing models examining method effects for conceptualizations of resilience.

Model	χ^2 (df)	CFI	TLI	RMSEA (90% CI)	SRMR	AIC	BIC	$\Delta\chi^2$ (df)
A.CTMM	3952.686 (1709)***	.758	.741	.055 (.053, .058)	.149	39603.515	39819.876	
B.CTCM	3950.312 (1708)***	.758	.741	.055 (.053, .058)	.146	39603.142	40594.706	2.374 (2) ns.
C. NTCM	6297.123 (1770)***	.512	.496	.077 (.075, .079)	.137	41825.953	42565.562	2344.437 (62)***
D.PCTCM	4155.287 (1709)***	.736	.718	.058 (.055, .060)	.101	39806.117	40793.617	202.601 (0)***
E.CU	2894.744 (1244)***	.822	.738	.056 (.053, .058)	.144	39475.574	42352.734	1057.942 (465)***

Note: CTMM; Correlated Traits Multi-Method, CTCM; Correlated Traits Correlated Methods, NTCM; No Traits Correlated Methods, PCTCM; Perfectly Correlated Traits Correlated Methods, CU; Correlated Uniqueness. The comparison of the models is based on Model A (CTMM). The results supported the correlated-uniqueness model was significantly better than the rest, but the model fit indices were still not acceptable.

In order to increase the insight in method effects with more simple models that could increase fit due to freeing some parameters, and also due to the recommendations to use MTMM when having three method factors and more, we further continued by examining bifactor models. Thus, we investigated two bifactor models, one for resilience measures and one for different informants on post-traumatic symptoms. The first had to deal with the multiple conceptualizations of resilience, as a mechanism of recovery after traumatic exposure, as a good psychosocial adjustment, as a compilation of protective factors or as the absence of general (not post-traumatic) psychopathology. The correlations among the latent factors depicting different resilience conceptualizations based on the self-report measures were calculated. The latent variable of recovery after trauma conceptualization was reflected by the variable extracted from the BRS. The latent variable of psychosocial adjustment conceptualization was reflected by the variable extracted from the CYRM-28. The latent variable of protective factors compilation was reflected by the variable extracted from the available assets questionnaire. The latent variable used for the absence of psychopathology conceptualization was extracted by the YSR, and particularly by the summative scores of internalizing, externalizing and other problems. The correlations are presented on Table 27.

Table 27. Correlations among the latent variables reflecting different conceptualizations of resilience.

	2.	3.	4.
1.Recovery from trauma	-.019	.052	-.294***
2.Psychosocial adjustment	1	.416***	-.030
3.Protective factors available		1	.022

4.Absense of psychopathology	1

Note: *p< .05, **p< .01, ***p< .001

In order to evaluate the potential of these measures to grasp a common concept, we evaluated different models. First, we evaluated a model with one latent factor, on which all items/subscales of the aforementioned measures were allowed to load (Table 28, Model A). It was shown that not all measures could significantly load on the latent factor (the CYRM items and some of the protective assets did not load on the latent factor with a significant estimate). Then, we examined a model consisting of four correlated latent factors reflecting method effects due to the use of different conceptualizations of resilience (Table 28, Model B). Last, we examined a bifactor model in which all five latent factors were presented (Table 28, Model C). All items/scales loaded significantly on the method factors, but not all of them load on the general factor (Table 29). The estimates supported significant methods effects based on the way resilience was conceptualized and also suggested divergence in the general concept. Based on the model fit, model B was considered to be the best model, even though the indices were still not acceptable (Figure 23).

Table 28. Presentation of comparing models examining method effects for conceptualizations of resilience.

Model	χ^2 (df)	CFI	TLI	RMSEA (90% CI)	SRMR	AIC	BIC	$\Delta\chi^2$ (df)
A.One general factor	2948.728 (528)***	.458	.424	.115 (.111, .119)	.156	21211.800	21600.872	

B.Four correlated method factors	1446.274 (520)***	.793	.776	.072 (.067, .076)	.095	19725.346	20145.236	1502.454 (8)***
C.Bifactor (one general and four method factors)	1732.482 (493)***	.722	.684	.085 (.081, .089)	.888	20065.554	20589.454	vs.Model A: 1216.246 (35)*** vs.Model B: -286.208 (27)***

Note: *p< .05, **p< .01, ***p< .001

Table 29. Presentation of 95% CI estimates of predictors on general and method-specific factors.

Outcome:	General factor			Method-specific factor		
Predictor	Lower 5%	Estimate	Upper 5%	Lower 5%	Estimate	Upper 5%
BRS Item1	.576	.606	.636	.612	.654	.696
BRS Item2	.440	.500	.560	.779	.818	.858
BRS Item3	.460	.523	.585	.676	.722	.768
BRS Item4	.355	.423	.490	.759	.799	.839
BRS Item5	.397	.462	.527	.628	.657	.729
BRS Item6	.381	.450	.518	.736	.779	.821
CYRM Individual	-.200	-.064	.072	.913	.941	.969
CYRM Caregiver	-.028	.106	.240	.843	.877	.910

CYRM Context	-.053	.079	.210	.744	.785	.827
Good communication with parents	-.099	.011	.120	.936	.949	.961
Collaborative decisions with parents	-.151	-.025	.102	.710	.793	.876
Trust in the relationship with parents	.064	.193	.323	.607	.727	.847
Stable home rules	-.263	-.137	-.010	.563	.692	.821
Satisfactory economic resources	-.097	.029	.156	.664	.761	.858
Help from wider family	-.225	-.097	.030	.594	.713	.832
Free medical services	-.350	-.224	-.098	.430	.601	.773
Supportive other family members	.294	.432	.570	.332	.548	.763
Participation in community events	-.434	-.302	-.170	.621	.741	.860

Participation in religious events	.101	.233	.365	.488	.645	.803
Following traditions	.179	.313	.448	.514	.668	.821
Stable school rules and sense of safety	.160	.295	.430	.528	.672	.817
School accepts divergence	-.352	-.219	-.086	.819	.878	.937
Positive student-teacher relationships	-.227	-.098	.031	.827	.877	.927
Good community services	.197	.328	.459	.399	.587	.775
Sense of safety in community	.095	.228	.360	.738	.820	.901
Community accepts divergence	-.280	-.152	-.025	.812	.866	.921
Sense of pride in community	-.070	.059	.188	.783	.845	.907
Good physical condition	.259	.390	.520	.402	.590	.779

Involvement in out-of-school activities/hobbies	-.132	-.005	.122	.581	.704	.826
Close to religion	.235	.380	.525	.543	.692	.842
High academic performance	-.345	-.214	-.082	.795	.859	.923
Internalizing problems	-.309	-.112	.085	.934	.964	.994
Externalizing problems	-.403	-.213	-.023	.897	.943	.990
Other problems	-.453	-.267	-.081	.832	.890	.947

The method effects based on the informant were examined then, in order to capture the variance explained by method in the tested models. The models examined were a) a model with a general factor capturing post-traumatic symptoms on which the scales of IES-R and PROPS loaded, b) a model with two method factors reflecting the informant in which PROPS scales loaded on the parent-report and IES-R loaded on the self-report and c) a bifactor model with a general and two method factors (for a comparison based on model fit see Table 30). The first model supported that all scales from the PROPS and IES-R would load significantly on the post-traumatic symptoms concept factor. Similarly, the estimates of the second model showed that all items had significant standardized estimates on the method factors of informants. At the same time, no significant correlation existed between the two method factors of parent-informant and self-informant (r= .049, SEr= .102, p=.622). The third model resulted in a better fit when

compared with the previous two models, and all standardized estimates on method factors were significant. Also, most of the items significantly loaded on post-traumatic symptoms concept factor (Figure 24).

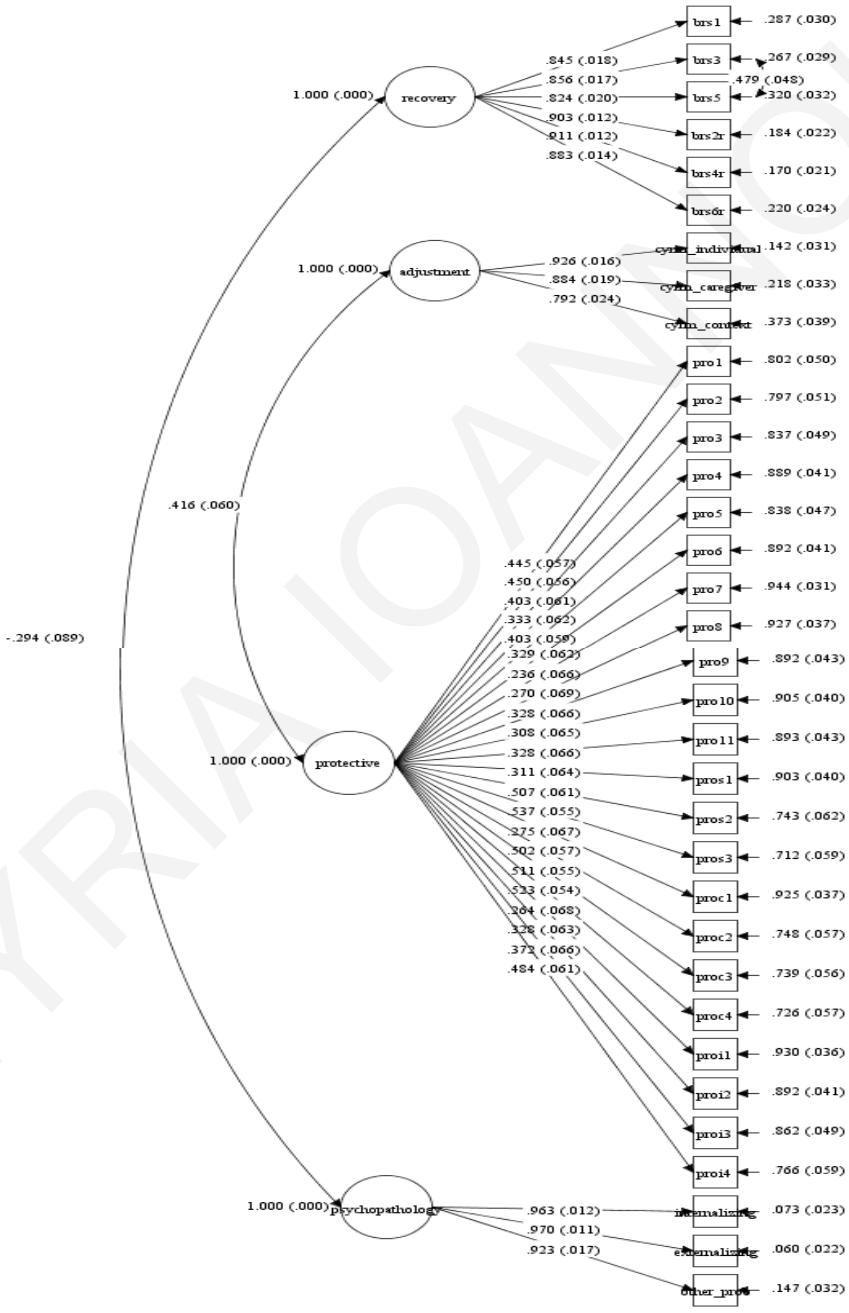

Figure 23. Model with different resilience conceptualizations as method factors (only significant standardized estimates are presented).

Note: The best fitting model was the model consisting of four correlated latent factors reflecting method effects, based on the comparisons made with one general concept of resilience and the bifactor model including both the general factor and the four specific factors. The four specific factors reflected the conceptualization of resilience as a) a mechanism of recovery after traumatic exposure, b) a good psychosocial adjustment, c) a compilation of protective factors, and d) the absence of general psychopathology.

Table 30. Presentation of comparing models examining informant effects for post-traumatic symptoms.

Model	χ^2 (df)	CFI	TLI	RMSEA (90% CI)	SRMR	AIC	BIC	$\Delta\chi^2$ (df)
A.One general psychopathology factor	4498.875 (1275)***	.515	.496	.080 (.077, .082)	.222	35188.524	35806.034	
B.Two correlated informant factors	3151.486 (1275)***	.718	.706	.061 (.058, .064	.093	33841.136	34458.646	1347.389 (0)***
C.Bifactor model (one general and two method factors)	2773.975 (1225)***	.767	.748	.056 (.054, .059)	.156	33563.624	34380.331	vs.Model A: 1724.9 (50)*** vs.Model B: 377.511 (50)***

Note: *p< .05, **p< .01, ***p< .001

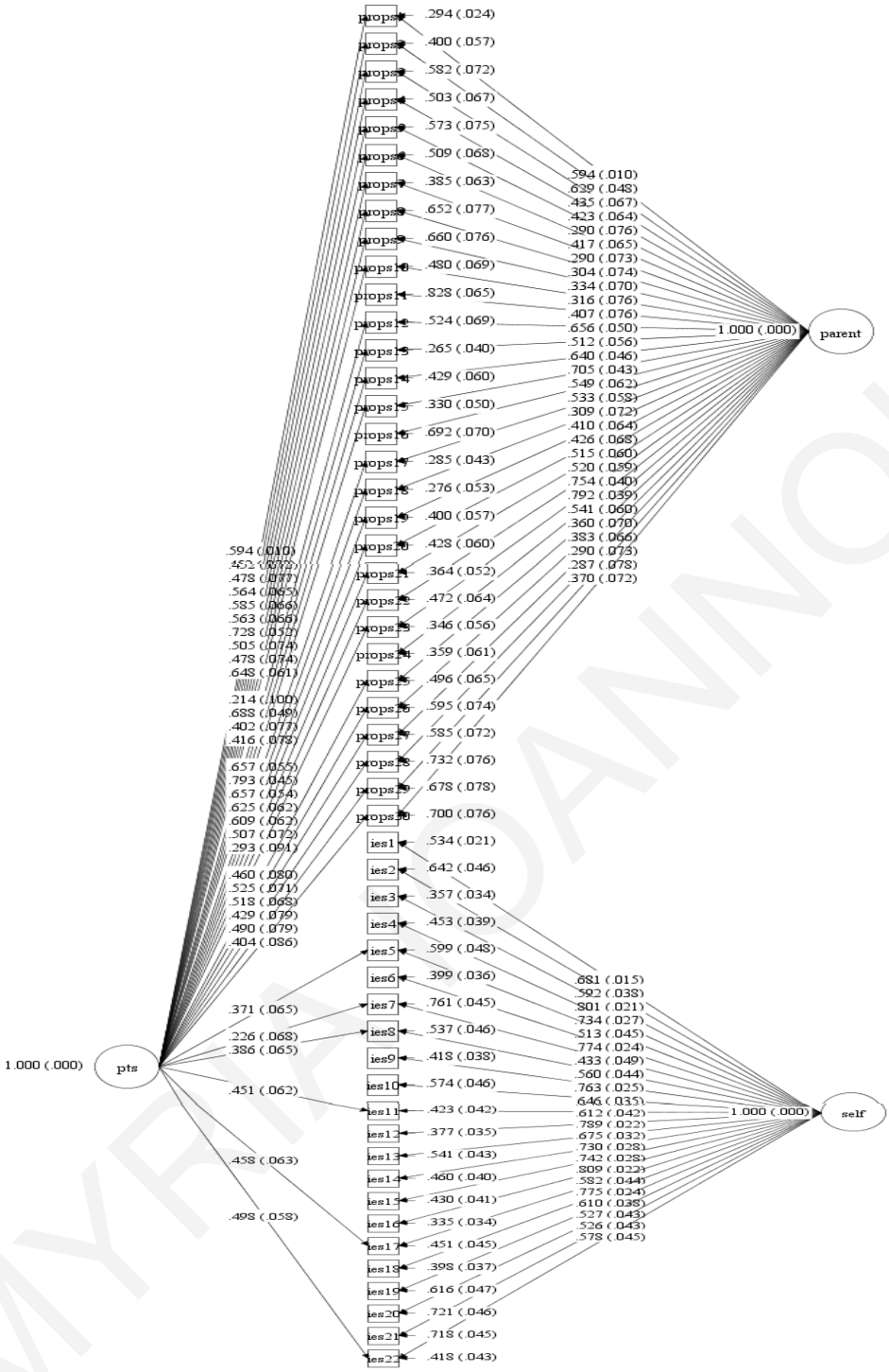

Figure 24. Bifactor model supporting important variance of method variables in addition to the general concept factor of post-traumatic symptoms (PTS).

Note: The best fitting model was the model consisting of one general and two specific method factors reflecting the different informants. No significant correlation existed between the two method factors of parent-informant and self-informant.

4.6.2 Presentation of results from the teacher sample

Due to the low number of teachers that participated in the study, and the related very small number of students for which a teacher report was available (n= 22) the models using teacher report (W-MS, see Table 31 for descriptive statistics) were not identified and none of the tested MTMM models including this measure could reached convergence. Therefore, only bivariate correlations using the composite scores were calculated (Table 32). The psychosocial adjustment as measured by teachers had significant negative correlations in the expected direction with the two psychopathology measures, the self-report (YSR) and the parent-report (PROPS). However, the correlation between the psychosocial adjustment composite score and the composite score derived from the BRS (measuring recovery from traumatic event) did not have the expected direction, as it was significant but negative. Importantly, these findings should be interpreted with caution, given the very small sample of teacher reports.

Table 31. Descriptive statistics for the scale completed by teachers.

	Mean	SD	Skewness	SE	Kurtosis	SE
Teacher-preferred behavior	3.213	.959	.478	.491	-1.286	.953
Peer-preferred behavior	3.238	.744	.503	.491	-1.161	.953
School adjustment	3.150	.675	.894	.491	-.190	.953

Psychosocial adjustment (Total)	137.955	30.752	.835	.491	-.398	.953

Table 32. Bivariate correlations among composite scores of measures assessing adaptation (self-reports, parent and teacher-report).

	2.	3.	4.	5.	6.
1.BRS	-.012	-.039	-.334*	-.056	-.571*
2.CYRM	1	.351***	.045	.007	.198
3.Protective factors		1	.297	.084	.313
4.YSR			1	.048	-.615*
5.PROPS				1	-.655*
6.W-MS					1

Note: *p< .05, **p< .01, ***p< .001 Abbreviations: BRS; Brief Resilience Scale, CYRM: Children and Youth Resilience Measure, YSR: Youth Self-Report, PROPS: Parent Rating Of Post-traumatic Symptoms, W-MS: Walker-McConnell Scale for Social Competence rated by teachers.

4.6.3 Preliminary analyses using the FaceReader software analysis

The FaceReader data were analyzed afterwards. Even though the sample size of study 3 was equal to 67 adolescents, only 31 of them agreed to take part in the emotional task. Among those, the face metrics did not fit the data for 12 adolescents, who were either moving a lot (n= 6), sitting farther than being asked (n=4), or wearing glasses (n= 2).

Due to the limited available literature on the use of FaceReader in order to detect change in HR and in facial expression in general, and specifically due to the absence of any related research in the area of resilience, this exploration was preliminary. The metrics extracted were the mean change in heart rate, the mean change in facial expression of fear, the mean change in arousal level from three stress-provoking videos to baseline. The same metrics were also extracted using the difference observed from the three stress-provoking videos to the neutral video. With regard to reaction time metrics, the ones computed were the metrics (i.e., heart rate, fear facial expression and level of arousal) for the time needed (in seconds) for the metrics to return to baseline and to return to the levels detected when watching the neutral videos. Descriptive statistics for the extracted metrics are presented on Table 33.

Due to the low number of participants for which data were available (n= 19), complex analyses could not be performed. However, bivariate correlations were calculated between the metrics extracted from FaceReader and trauma-related parameters, protective factors, the CYRM total and the BRS total. There were no significant correlations, with two exceptions. The BRS had a significant positive correlation with the mean change in arousal level from neutral video ($r= .547$, $p= .028$), suggesting that the higher the self-report score on resilience, the higher the mean change detected from stress-provoking video compared to the neutral video with regard to arousal. Also, the BRS had a significant negative correlation with the mean time needed to return to the levels of fear in facial expression after watching a stress-provoking scene, when the reference point was the level of facial fear when watching the neutral video ($r= -.552$, $p= .024$). Those were the only significant relationships that emerged.

Table 33. Descriptive statistics of metrics extracted from Facereader.

	Mean	SD	Skewness	SE	Kurtosis	SE
mean_HRchangeB	20.781	9.926	1.238	1.225	NA	
mean_HRchangeN	22.122	5.907	1.577	1.225	NA	
mean_scaredchangeB	-.209	.339	-2.079	.687	4.830	1.334
mean_scaredchangeN	-.077	.157	-1.389	.687	3.089	1.334
mean_arousalchangeB	-.180	.254	.861	.687	-.014	1.334
mean_arousalchangeN	.126	.307	1.782	.687	3.879	1.334
mean_time_HRB	40.278	29.406	1.463	1.225	NA	
mean_time_HRN	43.444	35.265	1.582	1.225	NA	
mean_time_SB	8.110	19.446	2.955	.687	8.963	1.334
mean_time_SN	9.910	19.091	2.790	.687	8.209	1.334

Chapter 5: DISCUSSION

The current project emphasized on the investigation of self-regulation mechanisms and resilience after exposure to traumatic events. The project was conducted under four main studies. The aim of the first study was to increase the insight in the trauma-related parameters that predict traumatic responses (post-traumatic stress symptoms and/or resilient outcomes). Also, the first study examined whether self-regulation mechanisms alone or in combination to protective factors could increase post-traumatic stress symptoms and enhance resilience. The differential susceptibility to stress hypothesis was examined, by comparing the resilience levels of adolescents with low and high traumatic exposure. The aim of the second study was to investigate whether strategies used by families to enhance resilience were related to increased levels of resilience in adolescents. Related to that, the school and community risk factors were considered along with the family risk factors and family stress as potential moderators impacting the relationship between family resilience, adolescent resilience and adolescent post-traumatic symptoms. The aim of the third study was to examine the change in resilience levels across a short period of time and to test the cross-lagged effects between resilience and self-regulation mechanisms. This study used behavioral computerized tasks instead of self-reports to measure self-regulation, thus providing further opportunities to examine the consistency with self-report measures of self-regulation used in the first study. The fourth study aimed on a theoretical examination of the concept of resilience, as different models examining the construct validity of resilience were tested. Along with the estimation of the method effects based on the way resilience has been being conceptualized in the literature, the method effects by the informant were tested. At last, a preliminary analysis was performed using the emotional task analyzed with FaceReader and the potential of such procedure to in-vivo measure 'state' resilience.

5.1 Findings from the first study

The first hypothesis stated that trauma parameters would differentially predict traumatic stress reactions. We also expected that the centrality of the traumatic event would be the best predictor of traumatic stress. Indeed the hypothesis was confirmed, as only some of the trauma-related parameters significantly predicted post-traumatic stress symptoms. Longer duration of the worst traumatic event and a recent hotspot memory of that event resulted in more severe post-traumatic symptoms, as those parameters produced more intense hyperarousal post-traumatic symptoms. The total number of traumatic events experienced, the time since the first traumatic event and the closeness of the event to self were not significant predictors of post-traumatic symptoms. In line with the hypothesis, centrality of event was the best predictor of post-traumatic stress, explaining 46% of the variance in post-traumatic symptoms.

When looking at the correlations among trauma-related parameters, it was shown that having experienced a traumatic event earlier in life was significantly related to having experienced more traumatic events in general. Also, having experienced your first traumatic event long time ago was related to having experienced longer duration of a traumatic event which was considered as the worst and to having more recent hotspot memories about a traumatic event. This might reflect the children who experience childhood complex types of trauma (e.g., developmental trauma, chronic emotional neglect, sexual abuse, domestic violence). Those types of trauma usually start early and last for many years, from childhood up to adolescence, or even early adulthood in many cases. This hypothesis might be reasonable, especially since the number of total events and having experiences traumatic events earlier in life were significantly positively related to having experienced traumas with increased closeness to

self (i.e., interpersonal rather than distant or indirect types of traumatic events, such as physical abuse, domestic violence and sexual abuse). This however, did not necessarily mean that participants would rate the event as more central for their identity, opposed to what was expected. It might be that more suddenly-occurred events are considered more central, as they cause a more "dramatic" change in adolescents' "typical" way of life. Indeed, centrality of event correlated significantly only with how recent the hotspot memory was.

The findings of the first hypothesis are in line with other studies supporting the importance of centrality of event and follow the recommendations made by Strand and colleagues (2005) to measure the centrality of trauma for identity in order to have a valid trauma measure. For example, Barton, Boals and Knowles (2013) showed that post-traumatic cognitions after trauma and centrality of the event had main effects on PTSD symptoms, explaining 46% of the variance in a non-clinical undergraduate and a clinical treatment seeking sample. More recently, da Silva and colleagues (2016) supported that centrality of event was correlated with overall PTSD symptoms and proposed that centrality of event is very important due to facilitating the memory reconciliation of a traumatic event. Indeed, no significant trauma-related predictors were found when centrality of event was the outcome in the present project, thus pointing to the need to understand what factors and mechanisms contribute to the development and maintenance of centrality of traumatic events. On the other hand, this finding is not consistent with previous ones suggesting that the number of traumatic events is related to higher levels of post-traumatic stress symptoms and distress (e.g., Im & Follette, 2016).

When resilience was examined as the outcome, it was found that among the trauma-related parameters, resilience was only predicted by the time since the first traumatic event was experienced. None of the other trauma-related parameters (centrality of event, total number of

traumatic events, how close the worst traumatic event was to self, how recent was the hotspot traumatic memory and duration of the worst traumatic event) had significant effects on resilience. Post-traumatic stress symptoms predicted lower levels of resilience.

Importantly, other studies also agree that the type of traumatic event does not impact resilience. A previous review on resilience trajectories also supported that the type of the potentially traumatic event was not a key factor that could predict consistently the resilience pathway (Galatzer-Levy et al., 2018). The findings of the review supported that studies examining more severe traumatic events, such as severe surgery, natural disaster with displacement, life threat, found higher levels of resilience when compared with stressors that are considered less severe, such as transition to college. The authors supported that individual psychological and biological factors seem to contribute more to the development of resilience or other outcomes, than the objective severity index that researchers could assign to each potentially traumatic event (Galatzer-Levy et al., 2018). Along with this, it was suggested that the number of potentially traumatic events experienced does not necessarily affect the prevalence of resilience. However, only a few studies included in the review had considered multiple potentially traumatic events, thus affecting the reliability and generalizability of this finding. There is previous evidence suggesting that resilience rates were very similar in the military population when comparing those with single and those with multiple military deployments (Bonanno et al., 2012). It remains to investigate whether this might be observed due to increasing potential for resilience when re-experiencing an identical or similar potentially traumatic event, and whether this is affected by the way each person conceptualizes the events. For example, it might be that military personnel is a population that is prepared for military deployments or other traumatic

exposure related to combat. The same may not hold true for populations that re-experience sudden and unpredictable traumatic events.

The second hypothesis of the first study stated that self-regulation mechanisms and protective factors would significantly predict traumatic stress reactions and resilience. The hypothesis was partially confirmed, as some –but not all- self-regulation mechanisms were predicted of post-traumatic symptoms. The self-regulation mechanisms of evaluation and implementation had a positive effect on post-traumatic symptoms. Importantly, the self-regulation mechanism of evaluation includes examination of information and comparison to the norms. That might not be a helpful self-regulation strategy, especially when it comes to adolescents who had experienced traumatic events. Previous reports support the effect of rumination on the development and maintenance of post-traumatic symptoms (e.g., Im & Folette, 2016), which might be related to the comparisons with others. The self-regulation mechanisms of planning and assessing the effectiveness of one's plan were negatively impacting post-traumatic symptoms. That is, being able to plan reactions and organize one's self was related to fewer symptoms. Difficulty in attentional shifting was also related to higher levels of post-traumatic and the same occurred for self-blaming and having negative cognitions about the world were also predictive of higher post-traumatic symptoms Among the emotion regulation strategies, the latent factor comprising by the strategies of self-blame, rumination, catastrophizing and blaming others was related to higher levels of post-traumatic stress symptoms.

On the other hand, the maladaptive emotion regulation strategies (i.e., self-blame, rumination, catastrophizing and blaming others) had a significant negative effect on resilience and the adaptive ones had a significant positive effect. Importantly, searching also had a negative effect on resilience. That is, trying harder to search for options was related to lower levels of

resilience. Interestingly, this might correspond to individuals who may have a lot of available sources or may anxiously look up for them, but may experience difficulties in investing their attention and maintain their focus on the most important ones in order to benefit from their protective effect.

The third hypothesis stated that the main effect of protective factors would be weaker in comparison to that of self-regulation. Importantly, the total number of available protective assets in adolescents' lives in the model did not result in significant unique effects from protective factors on post-traumatic symptoms. Examination of the effect of protective factors on resilience supported similar findings. Thus, the third hypothesis was partially supported based on the data of the present project. In particular, lower effects from protective factors compared to the effects from self-regulation were expected, but we did not expect that protective factors would have no significant main effects on post-traumatic symptoms and resilience. This finding is in line with the point made by Barber and Doty (2013), who argued that it is not clear if the protective factors are uniquely and specifically related to resilience development, or if they constitute protective factors of positive functioning regardless of the levels of risk exposure. That is, protective factors may not be predictive of resilience and post-traumatic symptoms as they are not dynamic. Hence, protective factors are already available in the environment providing increased levels of functionality, and adolescents may intentionally choose to use them in order to be directly linked to resilience development. The process of intentionally choosing whether to use them or not, seems to more closely resemble with the use of self-regulation mechanisms.

Indeed, the fourth hypothesis suggested that self-regulation mechanisms would moderate the effect of protective factors on resilience. Searching for options moderated the effect significantly. Specifically, when having low levels of searching and low levels of protective

factors resilience was higher, whereas having low levels of searching and high levels of protective factors resulted in lower levels of resilience. At the same time, high levels of protective factors and high levels of searching resulted in higher level of resilience, compared to when having lower levels of protective factors and high levels of searching resulted in lower levels of resilience. Having inconsistency between protective factors and searching for options (one high the other low) was related to lower levels of resilience. This finding might show that being able to search for various options, but without actually having accessible protective factors in the environment, may result in disappointment, stress or desperation. It might also show the not so beneficial effects of "having too much" of protective factors without any mechanisms to evaluate, organize and use those factors. Indeed, this was shown also by the moderating role of planning detected in the relationship between protective factors and post-traumatic symptoms. It was found that for low levels of planning and low number of protective factors the post-traumatic symptoms were higher. At the same time, high levels of planning and low number of protective factors resulted in lower levels of post-traumatic symptoms. Having more available protective factors were related to lower post-traumatic symptoms when planning was lower, than when planning was higher. Based on these findings, planning seems important but 'too much' planning in accordance with many available assets may not result in the benefits of planning as an executive function skill. It might also be that too much planning reflects inflexibility, which has been related to more post-traumatic symptoms (e.g., Meyer et al., 2019). Levy-Gigi and colleagues (2016) suggested that low flexibility in using different emotion regulation strategies resulted in increased correlation between traumatic exposure and post-traumatic symptoms in firefighters with differing levels of traumatic exposure.

Moderating role in the relationship between protective factors and resilience was also detected based by blaming self, low levels of protective factors resulted in higher resilience levels. On the other hand, having very high levels of protective factors and low self-blaming did not result in higher resilience levels. That is, having higher skills to regulate negative blaming cognitions after a traumatic event was related to resilience even for low levels of other protective factors. Consistently, moderation effects were detected for PTS also. Based on the interaction, the level of self-blaming had linear significant positive effect on PTS for low amounts of available assets, but its effect was flattened as protective factors were increased. For high amounts of available protective resources self-blaming intensity did not impact PTS. This finding supports the emphasis given by some cognitive interventions on targeting guilt and shame (e.g., Price, MacDonald, Adair, Koemer, & Monson, 2016; Schumm, Dickstein, Walter, Owens, & Chard, 2015). Also, it gives further support to cognitive theories pointing on the impact of early maladaptive schemas developed especially in survivals of interpersonal types of trauma (e.g., Karatzias, Jowett, Begley, & Deas, 2016).

A marginal interaction effect by difficulty with attentional shifting was detected for resilience as well. Specifically, being able to shift attention resulted in higher resilience levels even with few protective factors. Lower shifting ability resulted in lower resilience regardless of the amount of available protective assets. An RCT using attention training to reduce post-traumatic symptoms in university students and supported effectiveness that was related to changes in reducing self-focused attention, increasing emotional attention shifting and attention flexibility (Callinan, Johnson, & Wells, 2015).

These findings are in line with other findings in the literature supporting higher effect from self-regulation mechanisms compared to protective factors' effect on resilience. For

example, Alink and collegues (2009) found that maltreated and non-maltreated children had higher risk to develop psychopathology and not resilience only if they had emotion dysregulation. The importance of self-regulation mechanisms has been described extensively in the literature. Special interest had been given to the mechanisms of managing cognition and emotion to enable behavior that is goal-directed, including organization of behavior, impulse control and constructive problem solving (Murray et al., 2015). The findings about the moderating role of self-regulation mechanisms are in line with the argument that children who have self-regulation skills and environmental support with an array of resources can balance risk and protective factors and moderate the negative impact of traumatic stress on them (Murray et al., 2015).

Importantly, the differential effects found for self-regulation mechanisms, confirm that not all self-regulation mechanisms may be adaptive, as traumatic stress can be maintained because of suppression or negative appraisals of trauma (emotional non-adaptive regulation skills) or because of selective attention to threat-related stimuli, avoidance and use of safety behaviors (cognitive and behavioral non-adaptive regulation skills) (Ehlers & Clark, 2000). This was the case in the present study too, especially for the self-regulation mechanisms of searching for options, which was shown to predict lower levels of resilience. Importantly, the findings of the present study do not assume that those self-regulation mechanisms detected will consistently predict adolescent outcomes. Instead, we follow a flexibility approach that suggests that there is an interaction of specific self-regulation mechanisms with particular protective factors under specific contexts and for specific parameters of traumatic exposure. On similar lines, Bonanno and Burton (2013) supported that the researchers who assume that stable and consistent self-regulation mechanisms are beneficial or not, fall into the assumption the fallacy of uniform

efficacy. The authors argued that researchers should investigate regulatory flexibility, arguing that this more broad term is based on three important parameters that reflect flexibility: the sensitivity based on the context, the availability of a diverse repertoire of regulatory strategies, and the responsiveness to feedback, which has to do with the monitoring of the effectiveness of an applied regulatory strategy in order to maintain, adjust or change the strategy used.

The fifth hypothesis stated that the differential susceptibility to stress hypothesis would be confirmed and that adolescents with higher traumatic exposure (as determined by the latent profile of all previously mentioned trauma-related parameters) were also those with higher resilience levels. Importantly, the differences were not explained by differences of demographic variables or other related covariates, such as intelligence, alexithymia or psychopathic traits.

This finding agrees with the diathesis-stress model (Belsky & Pluess, 2009) and the neurobiological research suggesting that, high susceptibility to negative outcomes implies also high susceptibility to positive outcomes. To our knowledge, this is one of the few studies that empirically examined the differential susceptibility hypothesis in the trauma literature. Importantly, the differential susceptibility to stress hypothesis suggests that children who were pre-assumed as "vulnerable" due to genetic or temperamental reasons have increased susceptibility to the negative impact of environments that are considered risky, and at the same time have increased susceptibility to the positive impact of protective or supportive environments (Belsky, 2013). The present study offered an additional insight in this conceptualization, showing that children how are susceptible to higher levels of traumatic stress may develop resilience not necessarily because of protective environments, but because they develop ways in dealing with increased stress and use their self-regulation mechanisms to carefully manage environments. That is, even when not in supportive environments, children who had been

exposed to higher levels of traumatic stress may have the potential to show resilient outcomes. One might consider the self-centered view of this argument. However, one should note that self-regulation development is a reciprocal dynamic process, in which the individual learns to balance own resources with those of the environment to achieve more beneficial outcomes (Murray et al., 2015).

5.2 Findings from Study 2

The first hypothesis of the second study stated that family resilience would predict adolescent resilience. This hypothesis was rejected, as there was no significant relation among the two. This would not change, even when considering the level of family stress and the level of family risk factors as moderators of the relationship. Theoretical conceptualizations of family resilience suggest that the strategies used in a family as a whole to cope with stress should be fostering individual resilience of the family members as well (Walsh, 2016). The functioning of family and the development of family resilience are fostered by the beliefs of the family regarding growth and problem solving, which assist the family members to make meaning of the trauma, to gain a sense of coherence and to facilitate hope (Walsh, 2003). Importantly, the findings of the present study are not in accordance with the theoretical background on the linkage between family and child resilience. However, one should note that empirical investigations related to the effect of family resilience on child/adolescent resilience have not been published yet. Hence, the available evidence is mostly theoretical. Of course, this is not to say that families are not important in the development of resilience. A number of previous studies support how the early caregiving environment can be protective for young children (McLaughlin et al., 2015). It might be though, that family resilience theory applies more to children of younger age, who have stronger bonds with primary caregivers and have fewer other

environmental influence on how to cope with stress. On the other hand, this might be totally different during adolescent years, where parental influences are decreased. Another reason for not replicating the theory of family resilience might have to do with the divergence of the measures in the concepts reflected. The FRAS used to assess family resilience is considered to be a valid and reliable measure with good psychometric properties for the examination of family's belief systems, organizational structures and problem –solving abilities, and indeed this was also evident in the current study. However, the fact that it does not assess family resilience with specific linkage on a previous traumatic event experienced by the adolescent, as is the case for the BRS, may be the reason not detecting any significant relationship between family resilience and adolescent resilience.

Masten (2018) discusses how sometimes the challenge that families have to face is not to over-nurture their children and offer considerable levels of protection that would not allow children to develop their own mechanisms to deal with stress. Also, Ungar (2016) emphasizes on the importance of cultural and societal systems in which families grow and face challenges and suggests the way families are treated by their community might be more informative than microsystemic processes concerning the quality of the strategies applied by the family to build resilience. In order to understand the variety of possible adaptation patterns presented by the family, one should have in mind the complex intra- and extra- familial stressors. Ungar (2016) proposed various patterns of family resilience, such as post-traumatic growth, minimal impact, unaffected patterns, recovery, avoidant patterns, hidden resilience and maladaptive patterns. This map of family resilience potential is quite extensive, supporting the dynamic nature of family resilience processes and the interactions between acute and chronic stressors that may alter resilient patterns. Henderson and Denny (2015) critically argue that resilience has become a

scientific influential concept that facilitates contemporary inequality, as neoliberal governments, finance organizations, and international development projects collaborating with mental health service providers involve the concept of resilience in urgent projects. Even though resilience is undeniably a needed area of research and practice, the central objects of resilience –the children- should not be projected onto the humanity (Henderson & Denny, 2015).

5.3 Findings from Study 3

The hypothesis of the third study stated that significant longitudinal effects from time 1 to time 2 would be detected for the construct of resilience. This hypothesis was confirmed, as the latent SEM supported strong effects from time 1 on time 2. The second hypothesis concerned the cross-lagged effects from resilience at time 1 on self-regulation at time 2 and from self-regulation at time 1 on resilience at time 2, while controlling for previous levels of self-regulation and resilience. The findings supported the hypothesis, suggesting that the effect from self-regulation at time 1 on resilience at time 2 were significant, compared to the reversed.

The findings point at first to the consistency of resilience levels. Masten (2018) argued that resilience should not be considered a singular or stable trait. The present study supported that the levels of resilience were quite consistent over the 4-month interval between the two time-points. However, the interval was too short to be interpretable that way. At the same time, it might be that individuals who have already coped with previous events effectively may have more insight into the processes that assisted recovery, in order to keep showing high resilience levels. Of course, resilience involves a learning component, however most research on building resilience has been emphasizing building resilience in larger systems rather than at the individual level. In part, this seems important due to the large-scale populations being targeted by these

community building resilience efforts that employ large communities or schools (e.g., Mansfield Beltman, Broadley, & Weatherby-Fell, 2016; Fleischmann, 2018). The majority of these efforts comes from conflict-zone countries.

The reviews by Ager (2013) and Jordans, Tol, Komproe, and de Jong (2009) reported that the huge majority of position papers recommend interventions, compared to the scarcity of evidence-based treatments and community-based service efforts to enhance resilience. International consensus papers, like the Inter-Agency Standing Committee guidelines (IASC, 2007), provide good suggestions for multi-layered pyramid interventions in emergency settings. However, it remains unclear if global resilience programs are necessary (Masten, 2014), or should be avoided because of the cultural variations (Ruiz-Casares, Guzder, Rousseau, & Kirmayer, 2014), the different significance and impact of assets in different environments (Ungar, 2013) and the societies' diversities in size, structure, and faced adversities (Catsleden McKee, Murray, & Leonardi, 2011).

Because of the notable heterogeneity, a critical stance is required by the communities, in order to make the appropriate adaptations of global guidelines. The example of Afghanistan illustrates the fundamental role of family in shaping resilience (Eggerman & Panter-Brick, 2010; Ventevogel, Jordans, Eggerman, van Mierlo, & Panter-Brick, 2013) and the need for ethnographic studies, to address what really matters for whom. Importantly, the implementation of care packages in armed conflict non-western countries (Jordans et al., 2013; Lokuge et al., 2013) highlighted the importance of the packages to be included in the already available system structures. Researchers should investigate the special characteristics of communities, in order to propose context-appropriate measures and needed adaptations of the guidelines. Also, the fact that the IASC guidelines target emergency settings implies last-minute problem-focused solutions, rather than

continuing efforts to build resilience. For this reason, resilience should be the paradigm shift for comprehensive healthcare promotion, for every child and adolescent, beyond the narrow efforts to manage trauma for war-affected children. Since one could argue that pre-existing threats are what makes a child resilient, researchers should establish evidence-based practice, using randomized trials and comparing different types of treatments with wait-list controls and/or lower-risk populations. However, healthcare should be a goal not only for children, and that, should be reflected by maintaining a developmental focus and by directing resilience research to ignored developmental stages, such as very young children and transition to adulthood. Longitudinal resilience assessment in qualitatively different contexts could improve the understanding of ecological systems and promote global planning through the identification of cascading and late-blooming effects and the acknowledgement of critical thresholds and turning points for adaptation (Davoudi et al., 2012).

Even though the contextualization of resilience has been proposed as the mean to bridge the science-practice gap (Vogel, Moser, Kasperson, & Dabelko, 2007), this is not yet the case. Common efforts, such as researchers-stakeholders meetings and translation of research findings into affordable practical implications, seem essential. An equally important point for the interpretation of the research findings is to address the children's perceptions and the meanings they give to traumatic events, treating children as competent social actors (Boyden & Mann, 2005). For this purpose, mixed methods combining quantitative and qualitative measures are necessary.

Resilience is a strength-based, multi-dimensional construct, emphasizing the dynamic non-linear processes of development. Improvements in research methodology suggest promising future developments, but more research is needed in non-western countries. Sensitivity to contextual

specificities, as reflected by research in conflict zones, is important but should not be over-idealized (Tol, Song, & Jordans, 2013).

5.4 Findings from Study 4

The first hypothesis of study 4 stated that significant method effects will be found based on the resilience measure used. The hypothesis was confirmed, as the MTMM models applied and the model comparison supported that the model which fitted the data best was the one with specific method factors referring to the different conceptualization of resilience, and respectively the use of different outcome measures to evaluate resilience. This finding is in line with previous remarks which noted that due to the definitions of resilience not having uniformity, different measures are used to capture the variables related to resilience (Klika & Herrenkohl, 2013). Biases in the construct validity of resilience have been documented before (He & de Vijver, 2015), especially as there is not yet a proposed "gold standard" measure to evaluate resilience (Windle et al., 2011).

The divergence in resilience conceptualizations and the use of different outcome measures to evaluate it, challenges the efforts to review resilience literature and to come to reliable and generalizable conclusions (Fletcher & Sarkar, 2013). This finding suggests that future studies should include multiple measures tapping on resilience as a concept, where the component of resilience that needs to be measured by the study is unclear. For example, general investigation of outcomes after a traumatic event should involve the use of measures to assess both the existence of psychopathology and the subjective extend of recovery. Importantly, not being able to confirm a general latent factor under which all components confirms the divergence

of the literature and the inherent difficulties in generalizing findings corresponding to one 'component' of resilience.

The second hypothesis stated that significant method effects would be found based on the informant of adolescent outcomes. This hypothesis was confirmed, as adolescent outcomes on post-traumatic stress symptoms as measured by parents and self-reports did load on a general factor and also on specific informant factors. As evident also from the studies 1 and 2 which included measures to evaluate traumatic exposure by adolescents and their parents, there was inconsistency in many of the trauma types. This might be due to underreporting by parents, or due to overestimation of the subjective traumatic nature of the situation by the adolescents.

To our knowledge, this is the first study conducted in Cyprus that shows the prevalence of various potentially traumatic events in the general adolescent population. However, the divergence in prevalence rates based on each informant should be kept in mind prior to generalizing these results. Indeed, others have argued that despite the importance of epidemiologic information, the efforts to study and obtain precise estimates of the prevalence and incidence of different types of potentially traumatic events that can occur in childhood is actually problematic (Saunders & Adams, 2015). Our findings are in line with previous evidence supporting underestimation of the traumatic events by some informants, implying also other challenges related to memory biases (Newbury et al., 2018).

The findings from teacher assessment supported significant negative correlations between psychosocial adjustment and measures of psychopathology. However, a significant negative correlation was also observed between the BRS and the W-MS. That is, assessing yourself as more resilient was related to your teacher assessing you as less socially competent. It is unclear how this finding may be interpreted. It might be a concept difference, supporting that being

resilient in the context of recovery from a traumatic event does not necessarily suppose associated social competence. It might also be that teachers have lower involvement in adolescents' holistic functioning and may report generally about each student based on the typical teacher-preferred behaviors. Importantly, due to the low number of data reported by teachers (for only 22 adolescents) the results should be interpreted with great caution. Replications are needed before interpreting this finding.

The findings from FaceReader analyses using the data extracted when watching emotionally-provoking short films were preliminary, as the sample size was considerably small. Data analysis supported that resilience self-report measure (BRS) was positively related to bigger change in arousal levels while watching an emotional video and was negatively related to the time needed to return to previous "normal" levels. These findings might indicate that individuals with higher resilience scores may indeed have more intense autonomic reactions, which in accordance with better self-regulation mechanisms makes them to respond more quickly to recover. This is might be related to the increased levels of mindfulness detected by adolescents who had higher levels of resilience. Also, further support into that conceptualization stems from the finding that having low difficulties in attentional shifting resulted in higher resilience levels even when a low number of other protective assets existed. A recent facial affect recognition task performed in students with various levels of PTSD symptoms showed that when the face and context of the traumatic event scene matched, those who had higher levels of PTSD had significantly better recognition. Because of these findings, Williams, Milanak, Judah and Berenbaum (2018) suggested that people with PTSD have enhanced attention to affective information, which might help them accurately identify the facial expressions of emotion. Tull and colleagues (2007) showed that limited ability to discriminate between feelings and bodily

sensations of emotional arousal was related to difficulties with emotion regulation. It might be that adolescents with lower resilience levels do not necessarily have decreased ability to regulate emotions, but they are less attentive in order to monitor change that would motivate them to identify available options and plan recovery from stress. This "hypersensitivity" or increased arousal to stress might be in line with recent research from brain studies, which supported increased somatosensory cortical activation found in participants with PTSD, consistent with a state of enhanced stimuli processing that places a demand on the cortex (Falconer et al., 2008).

At the same time, the finding about increased arousal may be related to literature supporting changes in stress response systems of the brain due to early childhood trauma. Recent evidence suggests that early traumatic experiences impair the functioning of the components of endogenous stress response system (Monteleone et al., 2020). This evidence stems from a study investigating adults with eating disorders with or without childhood trauma that confirmed that a lower awakening response of cortisol and a dampening in basal activity for those with early childhood trauma. In general, some recent efforts to assess resilience include physiological measurements and studies investigating genomes that have been linked to adaptation (see Scheinfeldt & Tishkoff, 2013). Studies have used the fear conditioning paradigm and showed that individuals with PTSD experienced difficulty to discriminate among safety and danger stimuli when compared to those without PTSD (e.g., Sherin & Nemeroff, 2011). They also exhibited higher startle response to safety stimuli, suggesting disrupted fear inhibition. More research in this area may also give the potential for clinical interventions. However, one should note that there are reports suggesting that people with PTSD who had experienced cumulative trauma might be significantly different than those who had experienced discrete traumatic experiences (McTeague & Lang, 2012). It seems that those with PTSD and cumulative trauma

have blunted affect, and their findings on physiological measures do not agree with the ones for individuals who had experienced discrete traumatic events. As cumulative trauma was not coded for the aims of this project, consistency with those previous findings could not be assessed.

In general the findings of the FaceReader need to be replicated, and also to be concurrently measured with other physiological indications of resilience in order to examine their validity. Importantly, arousal as coded by the FaceReader reflects the number of activated action units of emotion while watching and might not necessarily reflect higher physiological arousal. Based on the way arousal is estimated using this software, it seems to be more a metric of various emotional units activated concurrently. This might mean that multiple emotions are activated in their face and hence they may become aware about their emotions quite fast. That potential explanation seems to also correspond to the finding that those individuals need less time to recover and return to their previous levels of facial fear. In general, one should interpret these preliminary FaceReader results with caution, due to the non-existence of related theoretical background for traumatic stress and the small sample size that took part in this task. It also remains to be investigated, whether arousal in some individuals who present high levels of resilience is increased due to the participants having experienced past trauma and being able to recognize it, or because of genetic differences that may add in biological vulnerability of someone being exposed to traumatic events.

5.5 Summary of the most important findings

The most important findings of the whole project are summarized below:

- The prevalence of traumatic events was consistent with the literature, as 77.5% of the adolescents experienced at least one potentially traumatic event.

- The centrality of event was the best predictor of post-traumatic stress symptoms. How recent the hotspot memory of the worst trauma was and duration of the worst trauma significantly predicted post-traumatic symptoms.
- Resilience was predicted by the time since the first traumatic event, supporting that those who experienced the first traumatic event earlier in life had higher potential to develop resilience.
- Self-regulation mechanisms differentially predicted post-traumatic symptoms and resilience. Post-traumatic symptoms were predicted by low planning, low ability to assess the effectiveness of one's plan, high levels of self-blaming, difficulty with attentional shifting, high evaluation, maladaptive emotion regulation strategies (rumination, catastrophizing, self-blame and blaming others). High abilities to evaluate the information and compare it to the norms, as well as implementing a plan were related to higher post-traumatic stress symptoms.
- Resilience was predicted by higher levels of adaptive emotion regulation strategies (acceptance, positive refocusing, putting perspective, positive reappraisal and refocus on planning). Trying harder to search for options was related to lower levels of resilience.
- None of the protective factors predicted post-traumatic symptoms or resilience. The self-regulation mechanisms of blaming self, and planning had significant interaction effects with protective factors to predict post-traumatic symptoms. The same self-regulation mechanisms and the difficulty in attentional shifting had significant interaction effects with protective factors to predict resilience.
- Those with high susceptibility to stress had significantly higher levels of resilience compared to those with low susceptibility to stress, as extracted by the latent profile

analysis using the traumatic exposure parameters (i.e., number of events, duration of worst event, how recent the hotspot memory was, time since first traumatic event was experienced and closeness of worst traumatic event to self).

- Family resilience did not significantly predict individual resilience. Family stress and family risk factors did not moderate the effects from family resilience on adolescent outcomes.
- There was considerable inconsistency among the traumatic events reported by adolescents and their parents. Parents seemed to under-report some more severe traumatic events (e.g., sexual abuse, physical neglect, physical attacks, exposure to non-familial violence, exposure to other people's self-harming behaviors, emotional neglect).
- Resilience levels at time 1 significantly predicted resilience at time 2. Cross-lagged design effects supported that self-regulation effects on resilience were significant, whereas the same did not hold true for the reversed.
- Self-regulation mechanisms of time 1 that significantly predicted resilience at time 2 were cognitive reappraisal, triggering change and assessing the effectiveness of one's plan. Searching for options and maladaptive emotion regulation strategies at time 1 predicted lower resilience at time 2.
- The way resilience is conceptualized and measured significantly affects the concept of resilience. The findings did not support a general resilience factor, but four specific factors reflecting divergent conceptualizations of resilience as a) recovery from traumatic events, b) compilation of protective factors, c) psychosocial adjustment and d) absence of psychopathology. The conceptualization that most consistently correlated as expected with the other measures was the one reflecting recovery from traumatic events.

- Significant method effects were detected when considering the confirmatory analysis of the latent structure of post-traumatic symptoms and resilience based on informant (self-report and parent-report).
- The teacher report on psychosocial adjustment did not correlate in the expected direction with the subjective report of resilience when conceptualized as the recovery after traumatic events.
- Higher resilience was related to more change in arousal when watching stressful events videos, and to less time needed to return to previous facial fear expressions after the presentation of stressful stimuli, as analyzed using the FaceReader.

5.6 Theoretical implications

The study supported some of the theoretical underpinnings of trauma and resilience research. For example, it had many common elements with the biopsychosocial model proposed by McLaughlin and Lampert (2017) that supported divergence in outcomes of PTSD, internalizing and externalizing psychopathology. The present project provided evidence that adolescents who show resilient outcomes have high levels of some self-regulation processes, but not of others as not all of them may be adaptive. This is important, as looking at the different self-regulation mechanisms in isolation has provided increased insights into the potentials of self-regulatory mechanisms to have even detrimental effects when presented in high levels, or in accordance with other factors. One example is self-regulation mechanism of searching, which was related to lower resilience levels, potentially because this process involves looking at the environment for other alternative options and comparing self to norms may increase avoidance of dealing with the event, difficulty in attentional focusing, and/or higher levels of self-blame,

shame and disappointment due to comparisons with others. Theoretical models should allow integration of multiple levels of influences from multiple contexts. Importantly, the family resilience theory (Walsh, 2016) has not been confirmed by the present project. It might be that the integration of multiple resilience research waves evaluating individual, family, school and community effects had resulted in flattening effects from some resources. Theoretical implications stemming from this finding involve the need to integrate multiple systems in order to fully understand differential resilience pathways (Borge, Motti-Stefanidi, & Masten, 2016; Ungar, 2018).

Also, the current research program contributes to the literature by bridging together at least three waves of the resilience research. Even though the four waves have been described and discriminated well by the already available international literature, it has been stressed that the waves do not share common conceptualizations. That problem further enhanced the absence of consensus regarding resilience definition and measurement, leading to very different formulations of resilience. Therefore, by employing mechanisms and variables that integrate the self with context and environment, and by simultaneously measuring the estimation of the individuals for the available personal and contextual factors, the current work contributes to the literature concerning together the first wave emphasizing the personal risk and protective factors, the second wave emphasizing the processes and interactions between the risk and protective actors and the fourth wave emphasizing the importance of the context and family for the development of resilience. That may lead to a fifth wave encompassing all the previous waves with an integrative and interactive way, which brings an insight into the complexity of humans and events.

Importantly, the project offered support for the differential susceptibility to stress hypothesis in the context of experiencing traumatic events. To our knowledge, this has not been replicated before in this area and holds important implications for theory development. Being exposed to traumatic stress early in life, may provide more potentials to learn self-regulation mechanisms that are effective, which in turn may predict resilient outcomes. This needs to be investigated further using other cultural samples and longitudinal designs with longer intervals between time-points than the ones used in the present project.

5.7 Clinical implications

5.7.1 Implications at the national and international level

The current project was the first to investigate trauma and resilience prevalence among adolescents in Cyprus. The findings can contribute at the local and national level in Cyprus in many ways. At first, the study was the first at a national level that investigated a range of traumatic events. That contribute to new insight regarding the prevalence of trauma based on each type of traumatic exposure. Importantly, the percentage of the participants who experienced at least one type of trauma was 77.5%, very closely resembling to international statistics (e.g., D'Andrea *et al.*, 2012; Grasso et al., 2016). The findings of the present study may create opportunities for change in policies and development of prevention and intervention programs. Important things to consider when applying multi-scale prevention and intervention efforts are the time since the experience of the first traumatic event for the individuals, and the extent to which an individual determines personal identity based on the traumatic exposure (i.e., centrality of traumatic event). At the national level no prevention or intervention programs have been holistically applied to traumatized children yet. The current study brings a new insight as it

demonstrates that not only children with psychopathology have experienced a traumatic event, and at the same time, not all children who had experienced a traumatic event will present more severe forms of psychopathology that would constitute 'observable' symptoms and easily-made diagnoses.

To our knowledge, this is one of the few studies that compared the explained variance of resilience construct as deriving by the processes of self-regulation mechanisms or as coming from the consideration of protective factors, or both. At a clinical level, the findings of the present study suggest that clinical practice should turn their interest in teaching mechanisms (e.g. self-regulation) instead of trying to change personal protective factors and contextual resources, which may be more difficult to change. The findings about the importance of self-regulation are promising, as these are skills seems to be able to be trained. In a recent example, Cohen and colleagues (2016) trained participants in an executive control task and the participants showed reduced amygdala reactivity and also behavioral interference of aversive pictures. That is, individuals who are exposed to traumatic events and as a result have increased amygdala reactivity may be trained on self-regulation mechanisms as a preventive strategy to inhibit the development of post-traumatic stress symptoms.

5.7.2 Implications on assessment

Based on the findings of the present study, multi-informant multi-trait assessment might be enlightening in order to validate a construct. Both in research and clinical practice, it seems that some trauma-related parameters are quite important to be measured and considered. For example, centrality of a traumatic event for self seems to be the best predictor for post-traumatic symptoms and resilience among the trauma-related parameters. Consistently using a measure to

assess centrality may show the extent to which the event has been conceptualized as traumatic by the victim, and also may indicate the meaning making processes of the event that have started to be developed. At the same time, information about the time of first traumatic event experienced and the closeness of traumatic events to self may also inform research and practice about the developmental nature of the trauma. Researchers and clinicians should pay attention to the differential susceptibility to stress hypothesis and choose to measure resilient processes and outcomes without pre-categorizing an individual as at-risk (Masten, 2014).

Assessment of resilience should be made in light of the dynamic nature of this construct and the extensive ways it has been conceptualized. In a concept analysis for resilience, Garcia-Dia, DiNapoli, Garcia-Ona, Jakubowski, and O'Flaherty (2013) outlined a concept mapping (see Figure 25) in order to show the diversity in the components assessed and defined by different studies. Even though that article was targeted to HIV populations, using this framework to map potential resilience components could be informative for research purposes and clinical practitioners.

Importantly, assessment of resilience should be more integrated by different disciplines analyzing this concept. Borge and colleagues (2016) argued on using qualitative and quantitative methods to integrate the assessment of individual and family resilience. The current project could be considered one such effort. Getting closer to real life situations, this project paid attention to the possibility that multiple protective and risk factors, and also processes, are mutually evident in the life of adolescents. These variables should be conceptualized as potentially interact with each other, leading to differential levels of resilience.

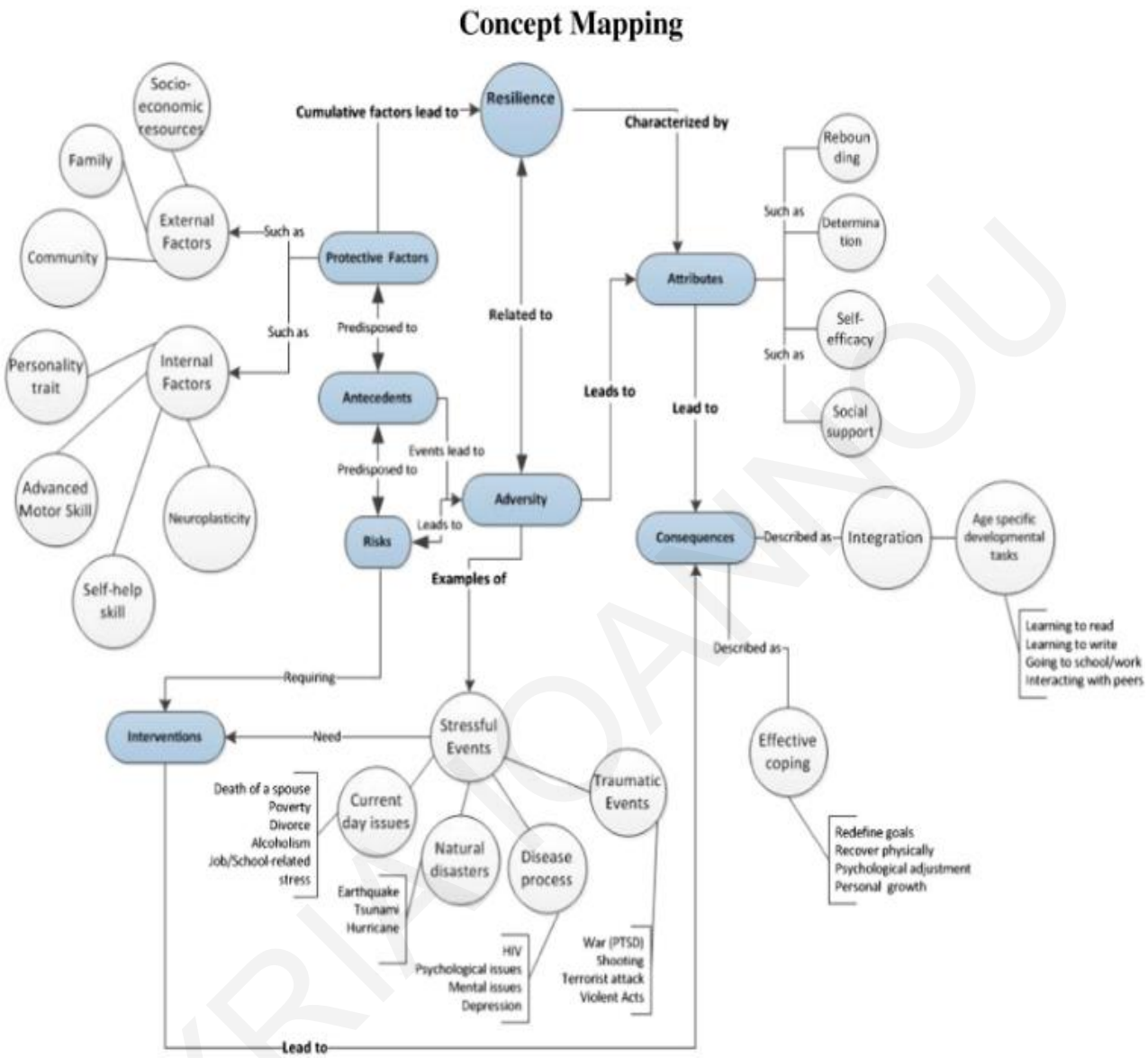

Figure 25. Concept mapping for resilience. (Adapted from Garcia-Dia, M. J., DiNapoli, J. M., Garcia-Ona, L., Jakubowski, R., & O'Flaherty, D. (2013). Concept analysis: resilience. Archives of Psychiatric Nursing, 27(6), 264-270).

5.7.3 Implications for different clinical trauma and resilience profiles and RDoC

A related topic that needs to be addressed has to do with different clinical presentations of adolescents with post-traumatic symptoms. Based on the DSM-5, the post-traumatic stress disorder has been removed from the category of anxiety disorders, and was placed in a new category termed 'Trauma and Stressor-related Disorder' reflecting that post-traumatic symptoms entail other emotions additional to anxiety (Pai, Suris, & North, 2017). The revised criteria for this disorder included the elimination of the subjectivity attached to the way trauma is defined, as the subjective criterion referring to personal response of "intense fear, horror, or helplessness" was removed. However, a consensus about the factor structure of PTSD and the exact factors that contribute to the presentation post-traumatic stress symptom clusters in individuals has not been reached yet (Armour, Mullenova, & Elhai, 2016).

The decision to include dimensional conceptualizations of trauma and resilience is closely related to the Research Domain Criteria framework (Insel et al., 2010), based on which the individuals representing the bigger spectrum of functioning, rather than only the ones with 'pure' diagnoses can be more informative in the efforts to understand the factors and mechanisms that contribute to mental health.

Related to the above, even though complex PTSD is described in the literature, there is limited literature with adolescents diagnosed with PTSD and complex PTSD. Cook and colleagues (2005) have suggested that complex PTSD in children and adolescents may be expressed by impairments in attachment, dissociation, cognition, emotion regulation, biology, self-concept and behavioral control. However, especially when looking at the literature on PTSD for adults, there is a debate on the distinctiveness among PTSD and complex PTSD. More information is needed on that aspect, as subgroups of individuals with PTSD usually require

different forms of treatment, based on other interplaying protective factors, adaptive emotional strategies and cognitive information errors (Crittenden & Heller, 2017). On that note, Frias and Palma (2014) suggested that the main focus of controversy is the validation of 'complex PTSD', a clinical entity which may comprise a subgroup of PTSD-BPD subjects. Cloitre, Garvert, Brewin, Bryant, and Maercker (2013) performed a latent profile analysis and showed that chronic trauma was more strongly predictive of complex PTSD and greater impairment than PTSD. On the other hand single-event trauma was more strongly predictive of PTSD. The LPA analysis was conducted for two populations, one with and one without individuals with BPD, suggesting the stability of these classes regardless of BPD comorbidity. Three classes were derived in their study: (1) a complex PTSD class defined by elevated PTSD symptoms as well as disturbances in three domains of self-organization: affective dysregulation, negative self-concept, and interpersonal problems, (2) a PTSD class with high PTSD symptoms but low scores on those symptoms, and (3) a low symptom class defined by low scores on all symptoms. Using a different approach and a network symptom analysis, Knefel Tran, and Lueger-Schuster (2016) supported that complex PTSD and PTSD were differentiated based on the dissociation symptoms and on two emotion dysregulation symptoms (anger and reckless behavior).

5.8 Limitations

Limitations of the present study include the short interval in which adolescents were reassessed on resilience (3-4 months) and the limited number of time-points (only two). This did not allow the performance of growth model, and instead a path model using a cross-lagged effects panel design was computed in order to account for the effects across time. Furthermore, the number of participants in each study was different and not all measures were available from

all participants. That would increase the power of the third and fourth studies especially, for which more complex models were not advisable based on the non-identification due to low number or absence of free parameters. Related to that, even though there was an effort to have multiple informants for the same constructs this was not possible for all measures. For example, family resilience was only evaluated by parents and the respective appraisal of family resilience and strategies used in the family to recover was not available by the adolescents. Adolescents could have provided a different account on the strategies used by their families in response to their traumatic exposure. Also, family resilience was measured based on the strategies used by families to cope with stress without specific reference to the worst traumatic event in which the adolescents have been exposed. This might have influenced the measurement of family resilience in the present project.

Importantly, adolescents had been informed that confidentiality would need to break in case they report severe traumatic events. This might have resulted in lower levels of prevalence especially for more severe traumatic events. For example, the percentage of adolescents exposed to sexual abuse was lower in the present study, compared to the prevalence reported in other studies. Finkelhor, Shattuck, Turner and Hamby (2014) reported that the lifetime prevalence of sexual abuse us to 17 years of age reached 26.6% for females and 5.1% for males in US. A recent epidemiological study reporting the prevalence of sexual abuse of adolescents and young adults in Cyprus found that a percentage of 33% had reported experiencing some kind of sexual abuse at least once in their lifetime (Karayianni, Fanti, Diakidoy, Hadjicharalambous, & Katsimicha, 2017). One should note that events were only coded as experienced if adolescents reported having experienced significant levels of fear or other intense emotions, and if parents reported that their children had been significantly impacted by the experience of the events.

Hence, the prevalence of traumatic events might not reflect the epidemiology of all events experienced by adolescents.

Due to the procedure used for the computation of indices from the TESI-C-SR, age was not included in analyses as a separate covariate. As current age of the adolescents was used for the computation of the time since the first traumatic event was experienced and of the index reflecting how recent the hotspot memory of the worst traumatic event was, which were shown to be significant predictors of resilience, and post-traumatic symptoms, respectively, the findings reported above were depended on current age of the adolescents. For example, time since the first traumatic event experienced does not necessarily measure a traumatic event with early developmental exposure. Instead, it means that the more time has passed from the first traumatic event, the higher resilience levels were. Based on the way this index was computed, it might be that the older the adolescent, the higher the resilience levels (i.e., as more time had passed since the first traumatic event).

Also, one should note that the participants of study 3 (that is, adolescents from study 1 who agreed to take part in the second phase of the study) significantly differed from those who did not express interest to participate only in terms of the number of traumatic events. Consideration of selection bias and differential attrition suggests that adolescents may have selectively chose to participate when traumatic exposure was lower. However, the information given to participants about the second phase of the study was that they would take part in computerized cognitive and emotional tasks. That is, no direct association was made to prior traumatic experiences so that participants could have avoided participation due to having been exposed to multiple traumatic events.

Due to the chaotic nature of the constructs of "trauma" and "resilience", a number of different indicators were employed in order to account for the different conceptualizations and methodological challenges related to the measurement of these constructs. Even though this tactic may be viewed as overgeneralized and inappropriate, this was inevitable when having in mind that one of the aims of the present project was to examine the consistency of different proposed metrics of the same constructs. Also, the decisions taken for the conceptualizations of trauma and of resilience as continuous constructs, instead of dichotomous may be debatable and not meet general agreement. There is not a general consensus regarding the definition and the measurement of these constructs, and thus the decisions taken constitute only one perspective in resilience and trauma literature (Newbury et al., 2018). However, a considerable group of researchers seem to turn toward the same direction, acknowledging the advantages of treating the variables of trauma and resilience in a continuous way. This is also in line with the non-categorical conceptualizations of psychopathology, and with the Research Domain Criteria (RDoC) framework (see Insel et al., 2010).

Another point to have in mind is that self-regulation mechanisms have been conceptualized as processes that can enhance the management of available protective factors, which have been considered as more already available resources by the present project. Other studies may conceptualize self-regulation skills as individual protective factors. Thus, the findings of the present study should be interpreted while recognizing that the way self-regulation mechanisms is projected as interplaying with other factors may be different from study to study. In line with that, self-regulation has been assessed with participants requested to rate them based on skills they have been using after traumatic exposure. However, we recognize that there are reciprocal effects between traumatic exposure, self-regulation mechanisms and resilience. It was

not possible for the aims of the present study to have known the level of self-regulation skills prior to traumatic exposure and whether these may have been impacted by the traumas. Even though the reciprocal effects between self-regulation and resilience have been modeled using the cross-lagged effects panel design, and the direction of effect seemed to be higher in the effect from self-regulation on resilience compared to the reverse, this might only reflect an effect that was detected for that specific interval of 3-4 months.

Furthermore, some researchers consider early adolescence, as a period where development of emotion regulation may not lead to positive outcomes indispensably. For example, some strategies of emotion regulation are believed to lead to negative outcomes and to enhance the effects of traumatic events and experiences, rather than gradually leading to resilience (e.g., Troy & Mauss, 2011). On the other hand, the reasons for the selection of the current age population was mainly due to the limited literature focus on the transition period to adolescence, instead of due to the specific parameters that characterize emotion regulation abilities during that developmental stage. Also, because of the evidence that the effects of childhood and early adolescent traumas are cumulative and long-lasting, even until middle adulthood, the need to investigate early adolescence strengthens (e.g., Ogle et al., 2013).

Last, the findings on the FaceReader are preliminary and there are no previous studies using this software in the area of resilience. These findings should be interpreted with caution and more research is needed on the consistency of FaceReader metrics with other psychophysiological indications before being able to make hypotheses on the potential indicators of resilience using FaceReader analysis.

5.9 Future research

During the last decade, the application of developmental-behavioural views in resilience research has guided conceptualizing assumptions for "adversity", as something that produces similar outcomes for any child (Felner & DeVries, 2013). For example, Klasen, Oettingen, Daniels, Post, Hoyer, and Adam, (2010) based their methodology on the assumption that their sample of child soldiers had "by definition" experienced trauma. Based on dose-response, the cumulative effect of multiple traumas due to war, brought the war-affected children in the epicenter of intervention implementation (Werner, 2012). Interestingly however, these children might become even more victimized because of being extensively targeted by resiliency researchers (Stark & Wessells, 2013). According to Felner and DeVries, risk and resilience should be probabilistic, instead of supposing that all the members will inevitably develop disorders, or will surely show resilience.

Galatzer-Levy and colleagues (2018) emphasized that the research into biological determinants is steadily increasing. Due to that, even prior studies are being re-analyzed to examine trajectories as an outcome rather than traditional outcomes, and new data sources are being collected explicitly with trajectory analyses in mind (Reijnen et al., 2018; Vermetten, Baker, & Yehuda, 2015). Trajectory analyses require modeling growth using multiple time-points at different developmental stages. As informed by the differential susceptibility to stress hypothesis, the use of measures of physiological reactivity in order to identify physiological variability as biological moderator of contextual and environmental influences is warranted. One should note the linkage between physiological reactivity and executive functions, having in mind that different physiological responses may result in different child self-regulation efforts. Executive functions, emotion regulation and physiological arousal constitute a complex dynamic

system (Obradovic, 2016). More research using experimental manipulation is needed to understand how implicit and explicit emotion regulation strategies result in physiological reactivity. For example children and adolescent might use dynamic executive function skills to actively regulate their physiological arousal and recovery, by inhibiting negative emotions, shifting their attention away from aversive environmental and bodily stimuli. Related to that, Obradovic (2016) suggested that the appraisal of physiological arousal that affects the use of executive function skills and emotion regulation might be subjective and researchers need to examine how and whether children reappraise their physiological reactivity. Related to the above, and in line with the current developments in the neurobiology of resilience, the results of the study could be replicated with the inclusion of measurements from the neurobiological systems that respond to stress and the brain areas that are able to manage the regulation of cognition, emotion and behavior.

At the same time, future research needs to be better able to assess contextual influences and the way children and adolescents appraise and account those influences. In order to better isolate the effects of environmental factors and processes to the development of resilience, future research may also consider the investigation of the same research questions with a sample of monozygotic twins, who share the same percentage of their genetic material. An interesting future direction would be to bring early adolescents-parents dyads to an experimental lab, where participants will be given scenarios that will have to do with traumatic events. The parent may be asked to share the traumatic event with the adolescent. During this process the special characteristics of the sharing will be monitored, with the focus being on emotional sharing of the parent, cognitive appraisal of the event, meaning making, and availability offered to the adolescent through proximity, as well as on the synergetic efforts of adolescents and parents to

move toward mutual goal-directed behaviors. Psychophysiological measurements of both participants of the dyad will be able to demonstrate the biological adaptation to the event (through psychophysiological indicators of heart rate and skin conductance). Also, it could be explored if the levels of self-regulation mechanisms of the adolescent are congruent to those expressed by the parent during their interaction and the sharing of the traumatic event. These future directions will open the possibilities to create virtual environments for prevention and intervention programs, where the protagonist will aim to enhance children's and adolescents' self-regulation mechanisms through cognitive and socio-emotional appraisals of the traumatic events.

5.10 Conclusions

Exposure in potentially adverse or traumatic events is an important topic that should not be overlooked. Investigating the pathways that result in resilient outcomes after exposure in traumatic events can be enlightening, as it can inform theory and practice. The findings that resulted from the data obtained in the current project have a lot to say. At first, they suggest that some trauma-related parameters that have to do with the specifics of traumatic exposure are important predictors of post-traumatic symptoms and resilience and should be directly assessed. Especially important is the centrality of event to an adolescent's identity to predict post-traumatic symptoms. The project using an integrative approach to study resilience, suggested that self-regulation mechanisms might be more important than protective factors in predicting resilience alone. However, as in life nothing happens in isolation, the project supported that having specific levels of particular self-regulation mechanisms could interact with, and moderate the effect of protective factors on post-traumatic symptoms and resilience. Importantly,

protective factors examined in the present study stemmed from a variety of systems, including the individual, the family, the school and the community. The differential susceptibility to stress hypothesis has been confirmed by the present study, supporting that individuals who are highly susceptible to stress (and to traumatic exposure) have also significantly higher potential to develop higher levels of resilience. That is promising especially having in mind the adolescents who may have experienced systematic developmental trauma. The project did not confirm the family resilience theory, as it did not found effects from family resilience strategies to direct levels of individual adolescent resilience. Family stress and family risk did not play a significant role either in explaining or altering effects from family on adolescent outcomes. Overall, there was moderate consistency among the reporting of traumatic exposure by adolescents and their parents. As parents have potentially underreported the prevalence of traumatic exposure of their children, this might also explain the non-expected effects from family resilience on adolescent outcomes. Resilience was shown to be rather stable over a short-period of time and self-regulation mechanisms of cognitive reappraisal, triggering new options to deal with a situation, assessing the effectiveness of one's plan to deal with the situation were predictive of resilience at the long-term. At the same time, high levels of searching for options, along with maladaptive emotion regulation strategies of rumination, catastrophizing, blaming one's self and blaming others predicted lower resilience levels at the long-term, when taking into account previous levels of resilience. The cross-lagged panel design supported the hypothesized direction of effect from self-regulation mechanisms on resilience, rather than the reversed. Resilience as a construct was demonstrated to have low validity as a general factor, but this changed when considering the method effects by the specific factors that considered the ways of conceptualizing resilience as a recovery process from a specific traumatic event, as an absence of

psychopathology, as an array of protective assets or as psychosocial adaptation. Stronger evidence was given to the conceptualization of resilience as a recovery process from traumatic events, as measured by the Brief Resilience Scale, due to the expected and consistent correlations of that measure to the other variables examined. At the same time, significant method effects were detected based on the informant. The use of FaceReader as a potential resilience indicator while watching stressful videos that extracts information about changes in fear and arousal levels seems promising but more research is needed before using it as a resilience metric.

All in all, the project provided a comprehensive framework to study resilience after exposure in potentially traumatic events, considering innovative approaches to overcome challenges related to the assessment of constructs and integration of multiple resilience research waves.

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Appendix**. Measures used in the study (summary presentation by informant).**

Study	Instruments	Informant
STUDY 1	• Traumatic Events Screening Inventory for Children self-report (Ribbe, 1996) • Centrality of Event Scale (Berntsen & Rubin, 2006) • Impact of Event Scale Revised for Children (Horowitz et al., 1979; Yule et al., 1990) • Self-Regulation Questionnaire (Brown et al., 1999) • Attentional Control Scale (ACS; Derryberry & Reed, 2002) • Cognitive Emotion Regulation Questionnaire (CERQ; Garnefski et al., 2001) • Emotion Regulation Questionnaire for Children and Adolescents (Gullone & Taffe, 2012) • Post-Traumatic Cognitions Inventory (Meiser-Stedman, Smith, & Dalgleish, 2009) • Protective factors and assets checklist (based on Zolkoski & Bullock, 2012) • Child and Youth Resilience Measure -28 (Ungar et al., 2008) • Brief Resilience Scale (Smith et al., 2008) • Youth Psychopathic Trait Inventory Short form (van Baardewijk et al., 2010) • Alexithymia Questionnaire for children (Rieffe, Oosterveld, & Terwogt, 2006) • Child and Adolescent Mindfulness Measure (Greco et al., 2011)	Adolescents
STUDY 2	• Traumatic Events Scale for Children - parent report (Ribbe, 1996) • Parent Report of Post-Traumatic Symptoms (Greenwald & Rubin, 1999a, 1999b) • Family Events Checklist (Fischer et al., 1998) • Family Resilience Assessment Scale (Sixbey, 2005)	Parents
STUDY 3	• Brief Resilience Scale (time 2; Smith et al., 2008) • Trail-Making Test (Tombaugh, 2004) • Stroop Interference Test (Stroop, 1935) • Wisconsin Card Sorting Test (Heaton et al., 1993) • Corse visual memory span (Mueller, 2012) • Go/ no Go behavior inhibition task (Mueller, 2012) • Cubes and Vocabulary Tasks from the WISC-III (Wechsler, 1991)	Adolescents

STUDY 4	• Walker–McConnell Scale of Social Competence and School Adjustment (Walker & McConnell, 1988). • Ability to identify feelings, and ability to regulate emotion during a stressor film (Woud et al., 2012) using the FaceReader	Teachers Adolescents