Mental health among correctional populations: Predictors, mechanisms, and long-term trajectories of outcomes

by

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A Thesis Submitted to

The Education University of Hong Kong

in Partial Fulfillment of the Requirement for

the Degree of Doctor of Philosophy

July 2022

Statement of Originality

I, LIU, Huinan, hereby declare that I am the sole author of the thesis and the material presented in this thesis is my original work except those indicated in the acknowledgement. I further declare that I have followed the University's policies and regulations on Academic Honesty, Copyright and Plagiarism in writing the thesis and no material in this thesis has been submitted for a degree in this or other universities.

Abstract

Mental health problems are more common among correctional population relative to the general population, presenting an important relating to public health and safety. To have a comprehensive understanding towards mental health of correctional populations, this dissertation comprises three separate studies that investigated the *predictors, mechanisms,* and *long-term trajectories* of mental health outcomes.

Study 1 investigated the associations of different forms of trauma with mental disorders among prisoners and ex-prisoners. This meta-analysis identified studies published from 1998 to 2021 by searching PsycINFO, PubMed, Medline, and Web of Science. 62 studies were analyzed containing 15,115 prisoners (97.86%) and 330 ex-prisoners (2.14%) across 16 countries. The multilevel meta-analysis found that overall trauma was positively associated with more diagnoses or symptoms of mental disorders (*Z*r=0.198, 95% CI=[0.167, 0.229], $p<.001$). Stronger effect sizes were found between childhood trauma (*Z*r=0.357, 95% CI=[0.147, 0.568], $p<.001$) and sexual trauma (*Z*r=0.326, 95% CI=[0.216, 0.435], $p<.001$) and stress-related disorders. Multilevel moderator analyses showed that effect size was stronger in imprisonment trauma (β=0.247, 95% CI=[0.177, 0.316], $p<.001$), mixed trauma (β=0.234, 95% CI=[0.196, 0.272], $p<.01$), and stress-related disorders (β=0.261, 95% CI=[0.214, 0.307], $p<.001$). Associations between trauma and mental disorders were mediated by social support but not coping.

Study 2 addressed the *behavioral mechanisms* for post-release mental health in the context of everyday life of ex-prisoners. Maladaptive adjustment to post-incarceration life is related to higher chances of common affective disorders and recidivism. Currently, little is known about post-release daily adaptation, not to mention valid and reliable instruments for assessing post-release daily routines pertinent to mental health. This study developed and validated a self-report instrument, hereafter referred to as Post Release Living Inventory for

Ex-prisoners (PORLI-ex). Three separate samples of ex-prisoners were recruited to complete an online survey (N=1,277). The final model evidenced acceptable goodness-of-fit and consisted of 45 items on nine dimensions, which loaded on three second-order factors: Consolidation (three dimensions; e.g., Institutional Routines), Replacement (two dimensions; e.g., Maladaptive Behaviors), and Addition (four dimensions; e.g., Socializing with Ex-prisoner Friends) (α=.695–.915). Convergent validity, discriminant validity, criterion-related validity, and incremental validity were demonstrated.

Study 3 enriched the previous two studies by focusing on trajectories of vulnerability and resilience and multilevel predictors for the trajectories among juvenile delinquents following the conviction of serious crime. This study used Growth Mixture Modeling (GMM) to identify 7-year longitudinal trajectories of probable anxiety and probable depression among juvenile offenders who were first convicted for serious crimes and without detention history (N=574). Lasso logistic regression was adopted to select multilevel factors for predicting memberships of resilience (vs. non-resilience) and chronicity (vs. non-chronicity). Recovery refers to initially high but gradually declining symptoms and was combined into non-resilience group or non-chronicity group in Lasso logistic regression analysis. Three identical trajectories were found for both anxiety and depression: resilience (75.78% to 75.96%), chronicity (10.98% to 15.16%), and recovery (8.89% to 13.24%). Risk factors for resilience included: person-level factors (e.g., neuroticism and exposure to violence), relationship-level factors (peer antisocial behaviors and parental hostility), and context-level (e.g., chaotic neighborhood conditions and father's remarriage). Resilience factors included self-identity, work efficacy, perceived opportunities for work, and community involvement. Predictors of the chronicity included neuroticism, drugs use in the past six months, and father's remarriage.

Keywords: correctional populations, trauma, mental health, post-release adaptation,

trajectories (maximum 5 keywords)

Acknowledgements

My foremost gratitude goes to my supervisor, Dr. Wai Kai Hou for his invaluable advice, continuous support, and patient guidance throughout my PhD study. He is always an inspiration for my academic research because of his wisdom, immerse knowledge, and abundance of experience. He leads me to go through all ups and downs in my study and encourages me to keep moving on strong. He guided me throughout the entire research and writing process of this thesis. I could not have imagined having a better advisor and mentor for my Ph.D. study. I am deeply indebted to my associate supervisor Dr. Esther Lau for always caring about me, thinking of me, and giving support to me. My sincere thanks also give to my associate supervisor Dr. Jeffrey Birk and Professor George A. Bonanno for their insightful comments and technical support to my study.

My gratitude extends to The Education University of Hong Kong (EdUHK) and University Grants Committee (UGC), Hong Kong SAR for the funding opportunity to undertake my studies at the Department of Psychology, EdUHK. I would like to thank the thesis committee for spending time reading my thesis which is far beyond perfect.

I am indebted also to The Society of Rehabilitation and Crime Prevention for their insightful inputs regarding the ex-prisoners. My deepest thanks would be given to Ms. Amy Mok, Mr. Edison Lau, Mr.Roy Lau, Ms. Candice Lee, Ms. Yvonne Yuen, Ms. Cherry Chu for their expert opinions from the perspective of social workers and criminologists and all other colleagues at Chuk Yuen Revival Hub and Tsz Wan Shan Revival Hub for their support and assistance. I want to extend my sincere thanks to peer mentors Mei-lin, Kwok, and Ping for engaging me with ex-prisoners daily lives and making the fieldwork proceed smoothly. Great thanks should also go to service users at SRACP for their trust in me and for sharing their post-release daily living with me. Without their efforts and inspiration, PORLI-ex will not be drafted and established.

I am also grateful for the research and management team of Pathways to Desistance project. Without their approval on the access to the incredible datasets, trajectories study of serious juvenile offenders will not be possible.

I could not have undertaken this journey without Cherry, Lei, Xingxing for cooking with me, doing exercise with me and talking with me. They remind me of keeping a healthy and regular lifestyle. I would also like to thank my friends (Lichee, Desiree, Tiantian, Yufei, Yi Yang, Xiao Zi, Phoebe, Yubing, Meng Zhang, Catrina, Xing Qin, Sisi, Yu Xin, Rebecca Xiao, Michael Chow), my lab mates (Lik, Tsz Wai, Tiffany, Natalie, Teck, Ernest, Abbey, and Jeremy), and all colleagues at Center for Psychosocial Health (Helena, Donald, Frank, Lance, Charlse, Natalie, Karen, Weiwei, and Jie Shuang) for a cherished time spent together in the office and in social settings.

I must thank the gecko (not sure if you like your Chinese name “A-Hu”), who visited my desk whenever a “bug” appeared in R. Thanks for accompanying with me.

Finally, but most importantly, I would like to express my thanks to all my family members especially my parents, cousin, and husband. It would be impossible for me to complete my study without their tremendous understanding and encouragement.

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List of Abbreviations

CFA	Confirmatory Factor Analysis
EFA	Exploratory Factor Analysis
GMM	Growth Mixture Modeling
LASSO	Least Absolute Shrinkage and Selection Operator
MASEM	Meta-Analytic Structural Equation Modelling analyses
PORLI-ex	Post Release Living Inventory for Ex-prisoners

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Chapter 1: Introduction

Global prison population has grown rapidly at 24% in the past 20 years, reaching 10.74 million in 2018 (Walmsley, 2018). The mental health problems experienced by the correctional population are disproportionally high compared with those experienced by the general population, which is not only an important public health issue but also a key public safety concern. Worsening condition of psychiatric disorders increases repeat offending and premature mortality after release (Fazel, Hayes, et al., 2016). Certain psychiatric disorders can substantially increase the likelihood of violent reoffending. Due to the treatable nature of mental disorders, improving mental health in prison could counteract the cycle of reoffending and promote for positive outcomes for both public health and safety (Chang et al., 2015). To gain an in-depth understanding of the mental health of the correctional population, this dissertation involved three separate studies to investigate the *predictors, mechanisms, and long-term trajectories* of mental health outcomes.

I started by investigating trauma as the distal predictor in Study 1 through a meta-analytic review to determine the relationships between mental disorders and different types of trauma among prisoners and ex-prisoners. Four databases PsycINFO, PubMed, Medline, and Web of Science were searched to identify articles published from 1998 to March 31, 2021. Random effects model was used to analyze the data. The study protocol was registered with PROSPERO (CRD42020181587). Sixty-two articles were identified with 15,115 (97.86%) prisoners and 330 (2.14%) ex-prisoners across 16 countries. Overall, the results showed positive correlations between trauma and mental disorders (Zr = 0.198, 95% CI = [0.167, 0.229], $p < .001$). The effect sizes were stronger between childhood trauma and stress-related disorders (Zr = 0.357, 95% CI = [0.147, 0.568], $p < .001$) and between sexual trauma and stress-related disorders (Zr = 0.326, 95% CI = [0.216, 0.435], $p < .001$). The effect size was greater in imprisonment trauma ($\beta = 0.247$, 95% CI = [0.177, 0.316], $p < .001$), mixed trauma

(β = 0.234, 95% CI = [0.196, 0.272], $p < .01$), and stress-related disorders (β = 0.261, 95% CI = [0.214, 0.307], $p < .001$) based on multilevel analysis. Social support but not coping mediated the relationship between mental disorders and trauma. Chapter 2 is a modified version of Study 1 published in *Clinical Psychology Review* and has been reproduced here with the permission of the copyright holder, Elsevier.

Study 2 addressed the behavioral mechanisms for post-release mental health in the context of everyday adaptation to post-imprisonment among ex-prisoners. The number of ex-prisoners worldwide has constantly been increasing in recent years. Maladaptive adjustment to post-incarceration life is closely related to higher chances of common affective disorders and recidivism. Currently, very little is known about post-release daily adaptation, not to mention valid and reliable instruments for post-release daily routines pertinent to mental health. This study aims to develop a self-report instrument, hereafter referred to as Post Release Living Inventory for Ex-prisoners (PORLI-ex). Three separate samples of ex-prisoners were recruited to complete an online survey (N=1,277, age range=17–89 years, 53.2% male, 72% white). The final model evidenced acceptable goodness-of-fit and consisted of 45 items on nine dimensions, which loaded on three second-order factors: Consolidation (Institutional Routines, Active Living, Work Involvement); Replacement (Maladaptive Behaviors, Nonactivity); and Addition (Socializing with Ex-prisoner Friends, Online Leisure, Religious Engagement, Seeking Professional Support) (α=.695–.915). Convergent validity was demonstrated in the correlations with Lawton Instrumental Activities of Daily Living Scale (IADL), Sustainability of Living Inventory (SOLI), Meaning in Life Questionnaire (MLQ), General Self-Efficacy Scale (GSE-6), and Multidimensional Scale of Perceived Social Support (MSPSS). Discriminant validity was demonstrated in the correlations with the Life Events Checklist for DSM-5 and perceived social and personal cost of punishment. Criterion-related validity was demonstrated in the correlations with psychiatric symptoms and

crime-related outcomes and incremental validity in the correlations with these measures independent of the scores on IADL, SOLI, MLQ, GSE-6, and MSPSS. Implications of the PORLI-ex on mental health screening and intervention and reoffending prevention were discussed. Chapter 3 discusses Study 2.

Study 3 enriched the two previous studies by focusing on mental health trajectories (probable anxiety and probable depression) following the commission of a serious crime and by comprehensively exploring multilevel predictors for trajectory membership among juvenile offenders. Mental ill health is more common among juvenile offenders relative to adolescents in general. Little is known about individual differences in their long-term psychological adaptation and its predictors from multiple aspects of their life. This study aims to identify heterogeneous trajectories of probable psychiatric conditions and their predictors. Participants included 574 juvenile offenders who were first convicted for serious crimes and without detention history. The participants were assessed at 11 timepoints over a period of seven years (2000-2010). Self-report instruments on person-level, relationship-level, and context-level predictors were completed at baseline assessment whereas Brief Symptom Inventory (i.e., anxiety and depression subscales) in at least three timepoints over the study period. Growth mixture modeling revealed the same three trajectories for both probable anxiety and probable depression: resilience (75.78%, 75.96%), chronicity (10.98%, 15.16%), and recovery (8.89%, 13.24%). Least absolute shrinkage and selection operator (LASSO) logistic regression identified the three multilevel predictors for memberships of different trajectories. Risk factors against resilience lied within personal (e.g., neuroticism), relationship (e.g., parental hostility), and contextual levels (e.g., chaotic neighborhood). Resilience factors included self-identity, work efficacy, perceived opportunities for work, and community involvement. Predictors of chronicity of probable anxiety/depression included neuroticism, drugs use in the past six months, and father's remarriage. The findings suggest

that both psychopathology and psychological resilience could be predicted by multiple personal, relationship, and contextual factors in the social ecology of juvenile offenders. A holistic approach could reduce risk of reoffending and other behavior problems among this population. Chapter 4 discusses Study 3.

The thesis included three studies. Guided by *life course perspective*, Study 1 is a meta-analysis to assess the relationship between varying types of trauma and mental health disorders or symptoms among prisoners and ex-prisoners. After exploring the distal predictor of trauma, the thesis move more down to the earth to see daily life experience after release among ex-prisoners in Study 2. Unlike trauma, post-release daily activities of ex-prisoners received relatively little attention, and there is currently no validated tool to assess post-release daily routines. Based on *Risk-Need-Responsivity (RNR) model and Drive to Thrive Theory (DTT)*, the purposes of the Study 2 are three-fold: (1) to develop a novel self-report instrument, hereafter referred to as Post Release Living Inventory for Ex-prisoners (PORLI-ex), for measuring key daily routines that are relevant to mental health and desistance among ex-prisoners in the community; (2) to test measurement invariance of POLIR-ex; and (3) to test the convergent validity, discriminant validity, criterion-related validity, and incremental validity of the PORLI-ex. Study 1 and Study 2 both suggested a holistic view to investigate multilevel predictors of mental health. Study 3 is a 7-year longitudinal study that aims to (1) identify heterogeneous trajectories of probable psychopathology (anxiety and depressive symptoms) and (2) examine a list of predictors on person-, relationship-, and context-levels among juvenile offenders in the seven years after committing serious offences. From *socio-ecological perspective*, Study 3 considered both distal factor of trauma (exposure to trauma and violence) and everyday life experience (e.g., self-report offending, substance abuse, unsupervised routines, interactions with peers, and gun access), together with other multilevel predictors.

Chapter 2: Trauma exposure and mental health of prisoners and ex-prisoners: A systematic review and meta-analysis (Study 1)

Introduction

Compared with general population, prisoners experienced more trauma and mental disorders (Andersen, 2004; Blaauw et al., 2000; Cabeldue et al., 2019; Carlson & Shafer, 2010; Croysdale et al., 2008; Fazel & Baillargeon, 2011; Gunter et al., 2012). Prisoners experienced more variety of traumatic events which occurred at an earlier age of their life and lasted for a longer period of time (Dierkhising et al., 2013; Facer-Irwin et al., 2019). There is, however, a significant variation of trauma studies among prisoners in terms of sample examined, the type of trauma studied, the assessment tool used, and a clear picture of trauma and mental disorders associations has yet to emerge. Assessments and interventions using trauma-informed approaches in correctional facilities can benefit from a comprehensive understanding of the relationship between trauma and mental disorders.

The following session will demonstrate how previous studies of prisoners and ex-prisoners have shown ambiguous relationships between trauma types and mental disorders. After defining trauma from a life course perspective, the conceptual basis of trauma–mental disorder association will be presented. Previous meta-analyses and systematic reviews related to the topic will then be discussed. Research gaps will be highlighted.

Trauma and mental health among prisoners and ex-prisoners

Traumatic event is defined in DSM-IV “as one that causes threat to the integrity of the person or others (A1 criterion), with the reaction of the individual characterized by intense fear, helplessness, or horror (A2 criterion)” (Stein et al., 2014). The ambiguous term “threat to physical integrity” was removed in DSM-5, which required “actual or threatened death, serious injury, or sexual violence” for a stressful event to be qualified as trauma (American Psychiatric Association, 2013). The ICD-11 places emphasis on important events that can

precipitate distress in any person, which is a broader definition (Stein et al., 2014). What makes trauma studies in prisoners different from the non-prisoners studies are the unique incarceration experience which can be traumatic. One important hallmark of prison life is victimization. Inmates experience varied types of victimization ranging from physical assault, sexual abuse, and intimidation to destructions of property (Morgan et al., 2019). Victimization during imprisonment could negatively impact mental and physical health of prisoners and increase risk of antisocial behaviors such as substance abuse and reoffending (Favril et al., 2020; Listwan et al., 2013; Teasdale et al., 2016). Trauma among prisoners or ex-prisoners in previous studies were assessed at different stages of their lives, with a focus on childhood trauma (Bowen et al., 2018; Fazel, Hayes, et al., 2016b; K. Green et al., 2019). In terms of the forms of trauma, prisoners and ex-prisoners who experienced interpersonal trauma were likely to suffer from both axis I (anxiety, depression, post-traumatic stress disorder [PTSD], psychosis, etc.) and axis II (personality disorders) mental disorders (Hedtke et al., 2008; Tripodi & Pettus-Davis, 2013).

In consideration of particular types of trauma, its relationships with mental disorders become equivocal. A study of 192 female prisoners participating in psychoeducation programs found that childhood physical abuse was the only trauma form that predicted dissociative symptoms (Roe-Sepowitz et al., 2007). Despite this, sexual abuse in childhood is shown to be associated with significant variations in self-reported dissociative symptoms (Banyard et al., 2001). A meta-analysis revealed that all forms of trauma increase the probability of psychosis (Varese et al., 2012). Nevertheless, recent research on male substance abusers in prison found that emotional abuse in childhood alone is associated with a fourfold increased risk of psychotic symptoms (Capuzzi et al., 2020). It appears that only lifetime physical abuse is capable of predicting antisocial personality disorder and psychopathy of prisoners, regardless of their genders (Gobin et al., 2015). Yet, the antisocial

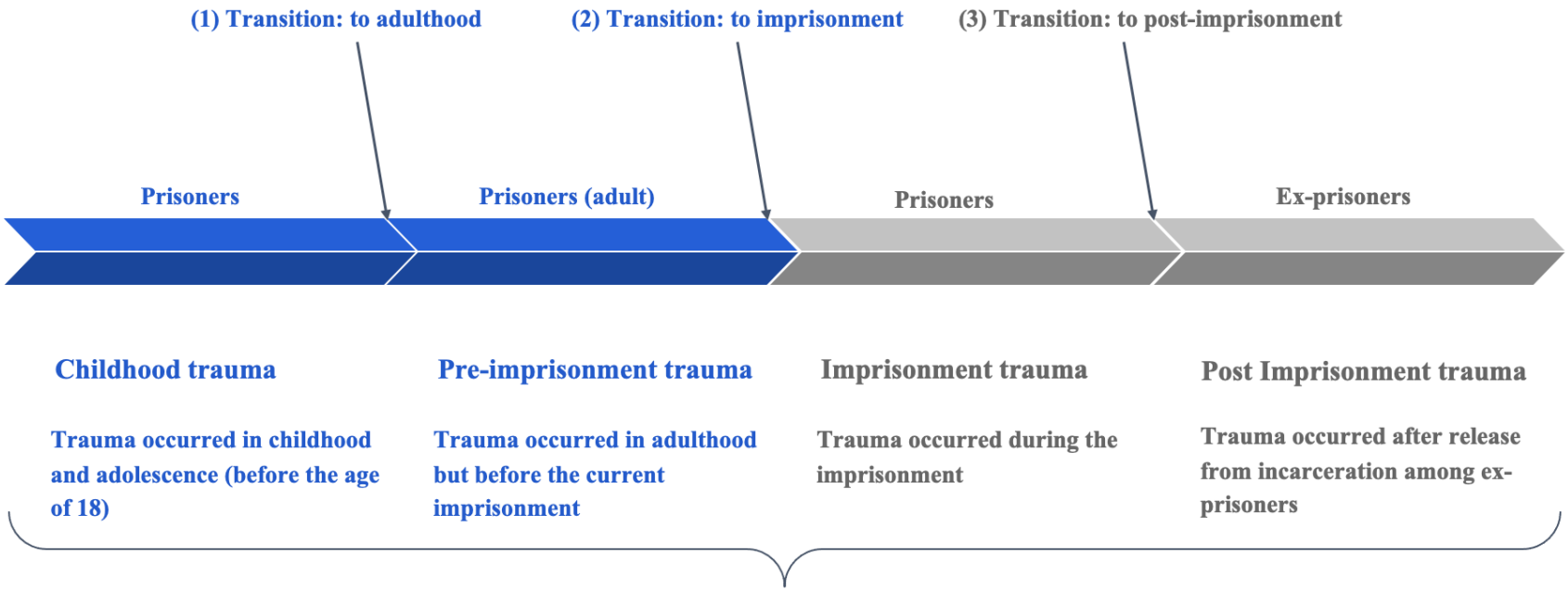
facet of psychopathy is associated with childhood abuse, while lifestyle facet is associated with adulthood abuse (Blonigen et al., 2012). Researchers also identified a gender difference in PTSD, with females being likelier to be influenced by sexual trauma and males being likelier to suffer from other trauma types (Komarovskaya et al., 2011). The relationships between different types of trauma and different mental disorders need to be systematically reviewed and analyzed, with possible demographic, psychosocial, and contextual factors moderating the associations. An in-depth look at the trauma-disorders relationships could assist in developing prevention and treatment programs before, during, and after imprisonment for prison populations.

Trauma: A life course perspective

Life course perspective can guide the current understanding of trauma and mental health among prison populations. According to this perspective, lives of individuals were influenced by their chronological age, major life experiences, and significant social events (Elder & Johnson, 2003). To understand continuities and changes in individuals' lives, both life events and transitions must be considered. A life event refers to an unexpected or drastic change in life with lasting influences, while a transition refers to role and status change that differs significantly from the prior ones (Hutchison, 2009). As one of the major frameworks in criminology, the life course perspective conceptualizes various aspects of criminal offenses and the impacts of life events throughout different developmental stages (Haynie et al., 2009). Trauma studies in the prison population have rarely used this perspective. Childhood trauma, whether directly or indirectly experienced, occurring in the formative stages of development can cause long-lasting functional impairments (Slap, 2020). In line with the life course perspective, evidence shows that trauma that occurred in childhood can elevate the risk of adult victimization (Giarratano et al., 2020). Imprisonment, a significant life event, marks a significant departure from prisoners' current normal lives. The importation model

proposes that individuals' traits (race, beliefs, and education) that they possess before imprisonment determine their adaption to the prison environment (Lahm, 2008). The deprivation model, however, suggests that the poor prison conditions such as overcrowding, unsafe environment, and solitary confinement are directly linked to prisoners' adaptation (Slotboom et al., 2011). Adverse experiences during imprisonment can hinder reintegration into the community upon release (Liem & Kunst, 2013). Institutionalized personality traits may develop in ex-prisoners, characterized by the inability to trust people and establish relationships with intimate partners (Liem & Kunst, 2013). Additionally, earlier evidence also demonstrated the positive association between post-imprisonment trauma and the likelihood of mental disorders following prison release (Port et al., 2002; Sommer et al., 2017).

This study examined three major transitions for prisoners based on the life course perspective. Figure 2-1 depicts the three transitions which can be found in student's previous publication (Liu et al., 2021).



Note. Three transitions were identified with reference to life course perspective: (1) developmental transitions from childhood and adolescence to adulthood, (2) role and status transitions from pre-imprisonment to imprisonment, and (3) other role and status transitions from imprisonment to post-imprisonment. Childhood trauma occurs during childhood and adolescence (before the age of 18). Pre-imprisonment trauma takes place during adulthood but before the current imprisonment. Imprisonment trauma happens during imprisonment, and post-imprisonment trauma occurs after release from incarceration among ex-prisoners. Lifetime trauma that takes place anytime across the lifespan should also be considered.

Figure 2-1 Conceptualization of trauma from the life course perspective

Trauma and mental health: Frameworks and models

The positive relationships between trauma and mental disorders can be explained by several frameworks. The **dose–response model** of psychosis and schizophrenia predicts that trauma determines the likelihood of developing psychosis and schizophrenia based on its duration, severity, and frequency (Read et al., 2005). **General strain theory (GST)**, the widely tested theory in criminology, emphasized the relationship between negative life events and crime (Agnew, 2001, 2015). Victimization is the source of strain that is high in magnitude which may produce detrimental mental and behavioral outcomes and lead to maladaptive coping. GST posits that negative situations do not directly cause behavior to occur. Strainful circumstance causes one to react (e.g., anger, frustration, depression, etc.) and those reactions lead a person to display behavior associated with alleviating the pressure (Bishopp & Boots, 2014). **Development-based trauma framework** conceptualizes the negative mental health sequelae in multiply traumatized individuals and communities as the result of the cumulative impact of poly victimization or poly traumatization rather than of the exposure to any single trauma or even to poly victimization by only one trauma type (e.g., child abuse or maltreatment). It indicates that trauma is viewed as continuous and that there is a positive correlation between prior trauma and the following victimization (Kira et al., 2014; Yehuda et al., 2016). Several traumas result in mental illness rather than a single one (Kira et al., 2014). Another important point to recognize is that trauma may interact with mental disorders via other psychosocial processes (Thompson et al., 2018). Stress occurs when the demands of the situation exceed the available capability or resources to handle them based on the transactional model of coping (Lazarus & Folkman, 1984). Coping refers to the processes through which individuals deal with social, emotional, and psychological challenges that relate to mental health (Taylor & Stanton, 2007). In particular, the available coping resources in the environment determine the type and nature of coping (Lazarus &

Folkman, 1984). Coping resources, according to conservation of resources theory and stress process theory, can be moderator or mediator in the relationship between stress and mental health (Hobfoll, 1989; Milkie, 2009).

A longitudinal study indicates that a reduction in approach coping, defined as method of approaching stressor-related emotions and experiences) is predicted by increasing traumatic experiences over time, and vice versa (Jenzer et al., 2020). In an analysis of a population-representative adolescents sample, lifetime trauma is positively associated with emotion-focused coping, such as venting, as opposed to problem-focused coping, such as identifying problems to solve them (Vaughn-Coaxum et al., 2018). PTSD and depression are likelier to develop in victims of community violence in the absence of adequate social support (Scarpa et al., 2006, 2012). In particular, lifetime trauma is positively associated with mental health symptoms among older prisoners through multilevel (person-, family-, and community- level) coping resources; consequently, trauma reduces resources of coping, leading to higher levels of symptoms (Maschi et al., 2014, 2015). To evaluate trauma and mental disorders associations, it is important to consider coping resources and processes.

Previous meta-analyses

The effects of traumatic experiences on mental health have been reviewed in numerous studies. According to a systematic review of the association between childhood trauma and adulthood psychopathology, adult substance abuse and psychopathy are positively related to adverse childhood events (Bowen et al., 2018). Another review study of the mental health of prisoners showed that the positive association between mental disorders and victimization is bidirectional (Fazel, Hayes, et al., 2016b). Imprisonment trauma has significant positive associations with post-traumatic stress disorder (PTSD), as evidenced in a recent meta-analysis of trauma and mental health (Piper & Berle, 2019). Another review concluded that along with different forms of trauma, people who have had suicidal ideation

or self-harm in the past are likely to self-harm while in prison (Favril et al., 2020). Currently, no quantitative meta-analysis is available on prisoners and ex-prisoners examining trauma and mental health associations at different life stages and investigating various types of trauma and mental disorders.

The present study

The current study aims to (1) determine varying types of trauma experienced by (ex) prisoners; (2) in accordance with the ICD-11, classify varying types or symptoms of mental disorders ; (3) assess the relationship between varying types of trauma and mental health disorders or symptoms; (4) analyze moderating effect (i.e., time frame of trauma, type of trauma, type of mental disorder, assessment method, country type, sampling method, type of sample, age group, gender, and study design) in the trauma-disorders associations; and (5) identify coping resources or processes from all included studies and investigate their potential mediating effects in trauma-disorders associations. It is hypothesized that the degree of trauma exposure is positively associated with symptoms of mental disorders. The positive associations depend on the varying moderators, and trauma influences symptoms of mental health through different types of coping resources or processes.

Methods

Search strategy

Search engines include PsycINFO, PubMed, Web of Science, and Medline. The exact date cutoff for the initial search is until 31 March 2021. Search terms were shown in Table 2-1.

Table 2-1 Search terms in the present meta-analysis

Population of interest	Traumatic experiences	Mental health
prison ex- inmates* OR ex-offender* OR released prisoners* OR former offenders* OR offenders* OR inmates* OR incarcerated adults* OR person in custody*	trauma* or post-trauma* or post- trauma*	substance/drug*/alcohol* abuse/dependence OR schizophrenia* personality* disorder* OR anxiety or anxiety disorder* or anxiety symptom* or anxious feeling* or anxious mood or depression or depressive disorder* or depressive symptom* or depressed feeling* or depressed mood* or post-traumatic stress* or post-traumatic stress disorder* or post-traumatic stress symptom* or post-traumatic stress response* or traumatic stress or traumatic stress disorder* or traumatic symptom* or traumatic response* or psychological distress or psychological symptom* or psychological dysfunction* or emotional distress or psychiatric symptom* or psychiatric condition* or mental health or NSSI or suicid* or self-harm or self-injur* or self-mutilation or overdose or DSH or parasuicid* or mutilation*

Note. Initial search of the literature in the four databases required terms in all three categories

This meta-analysis followed PRISMA criteria. The register number (CRD42020181587) for the study protocol can be found in PROSPERO. A summary of deviations between the present study and the original protocol can be found in Appendix A.

Selection of studies

Studies were included if they (1) were considered empirical and involved (ex)prisoners who were convicted and came from a general prison (defined as prisoners

sampled from a correctional institution without any treatments, for example under prison mental health units), and (2) had quantitatively measured trauma and mental disorders that were clearly defined. Studies were excluded if they (1) included prisoners who had other sentenced status (pretrial, on remand, on probation, or on parole), (2) failed to differentiate between those on remand and sentenced, (3) included selective prisoners samples (i.e., participants in a treatment program), (4) failed to measure trauma and/or mental disorders/symptoms, (5) did not use measurements that have been psychometrically validated , or (6) used language other than English. The current review also excluded studies of forensic patients, prisoners of war, police detainees, or immigration centers detainees. Because of three factors, only sentenced prisoners but not remand prisoners were included. Firstly, the legal status of prisoners sentenced or on remand differs. Prisoners on remand are detained by court orders and are presumed innocent and had not been convicted. They are also exempt from some prison rules, such as those prohibiting them from accessing education, employment, or skill trainings as well as the restriction of family interactions (*Notes and comments on the United Nations Standard Minimum Rules for the Treatment of Prisoners*, 2015). Secondly, the incarceration period for prisoners who were sentenced is typically longer than remand prisoners. Psychoeducation and intervention programs in prison can better be informed by focusing on prisoners who were sentenced. Thirdly, the prevalence of mental disorders varies between sentenced and remand prisoners (Bebbington et al., 2017). It is estimated that suicide risk in prison is four times higher for remand prisoners than for sentenced prisoners (Fazel et al., 2008).

Figure 2-2 illustrates the detailed flow chart of screening processes. After removing duplicates from the result list, initial search and screening were performed by HL and WKH, who reviewed titles and abstracts. Another independent reviewer, LL, further checked eligibility and examined those articles graded as relevant to identify possible eligible studies.

Qualitative synthesis and meta-analysis were then carried out on the full texts of the eligible studies.

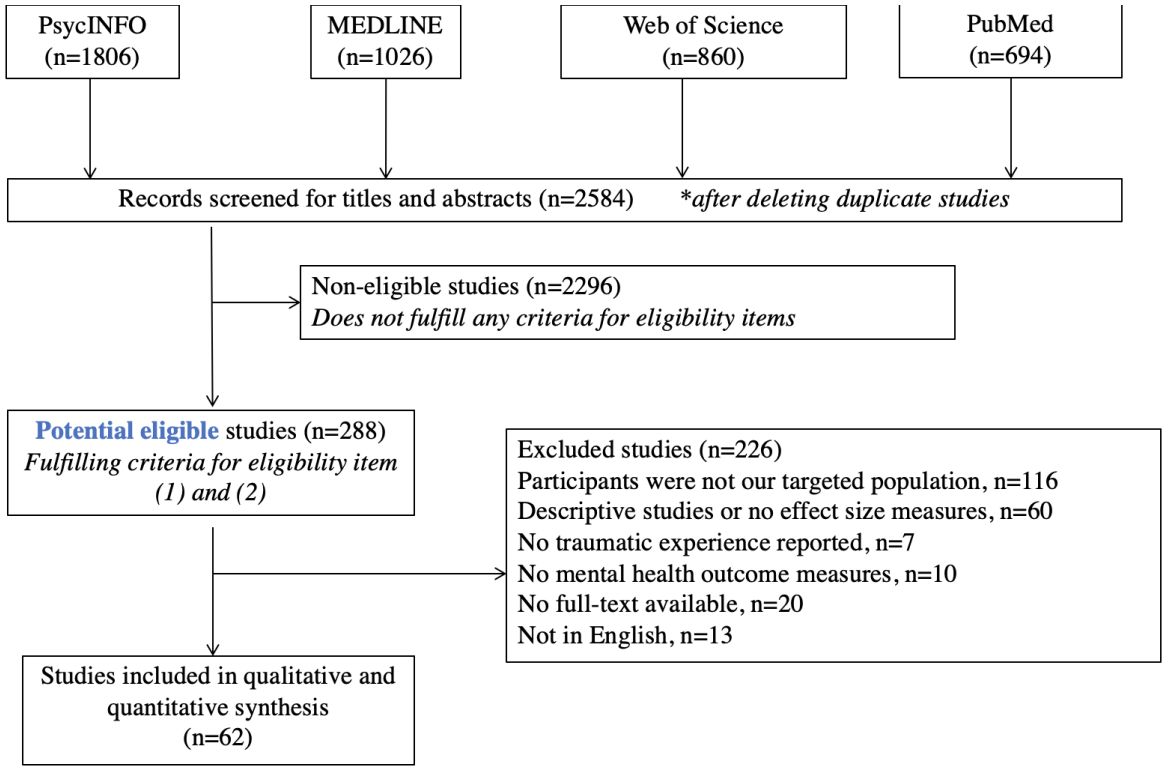


Figure 2-2 Flow diagram of screening process

Figure can be found in student's previous publication (Liu et al., 2021).

Data extraction and coding

The data that were extracted by two independent researchers (HL and TWL) were demonstrated in Table 2-2. To ensure the entire process are valid, around 10% of the articles in the final dataset were randomly selected and reevaluated by the other researchers (LL and WKH). A discussion was held between HL, LL, TWL, and WKH about any disagreements.

Table 2-2 Data extracted from all eligible studies

Predictor	Outcome	Moderator	Mediator
-Measurement of trauma (time and type)	-Measurement of mental disorders (type)	-Assessment method of mental disorders (self-reported symptoms or clinical diagnosis); -Type of country (developing or developed); -Sampling method (convenient or random); -Type of population (prisoners or ex-prisoners); -Age group (adolescents, adults, or mixed); -Gender; -Study design (cross-sectional or longitudinal)	-Coping-related variables, such as processes, strategies, and resources.

Measurement scales

Trauma exposure

Two dimensions were used to categorize trauma. Based on the life course perspective (Elder & Johnson, 2003; Haynie et al., 2009), transition period is the first dimension, which includes (1) childhood trauma, (2) pre-imprisonment trauma, (3) imprisonment trauma, (4) post-imprisonment trauma, and (5) lifetime trauma. Higher trauma scores indicated more frequent occurrence. Childhood trauma refers to traumatic experience happened in childhood and adolescence. Pre-imprisonment trauma occurred prior to the present incarceration in adulthood. Imprisonment trauma occurred during imprisonment. Post-imprisonment trauma happened among ex-prisoners following their release from the imprisonment. Lifetime trauma occurs at any time point in life without specifying when it happened.

Trauma type is the second dimension, which includes, (1) physical trauma, (2) sexual

trauma, (3) emotional trauma, (4) contextual trauma, and (5) mixed trauma. Higher trauma scores indicated a higher level of severity. *Physical trauma* occurs when an individual is physically abused, neglected, or witnesses violence. *Sexual trauma* occurs when an individual is sexually abused or assaulted. *Emotional trauma* happens when a person is emotionally abused or neglected. *Contextual trauma* refers to adverse events that happen in the environment or social ecology (e.g., natural disasters, traffic accidents, bereavement, and living in a problematic family environment with family members who are mentally ill or having drug abuse (Boland et al., 2020; B. L. Green et al., 2016; G. Huang et al., 2006; Konecky & Lynch, 2019; Nowotny et al., 2014; Skarupski et al., 2016; Slotboom et al., 2011). *Mixed trauma* is measured as a summation of multiple types of trauma. Appendix B1 lists the measurements of trauma.

Mental disorders

Mental health data can be categorized according to the ICD-11 (World Health Organization, 2018) classification system as follows: "(1) Anxiety and depressive disorders consisted of internalized disorders including bipolar or related disorder, depressive disorders, and anxiety and fear-related disorders under ICD-11 Chapter 06. (2) Disorders specifically associated with stress, hereafter referred to as stress-related disorders, included 6B40 post-traumatic stress disorder, 6B41 complex post-traumatic stress disorder, 6B42 prolonged grief disorder, 6B43 adjustment disorder, 6B44 reactive attachment disorder, and 6B45 disinhibited social engagement disorder under ICD-11 Chapter 06. (3) Disorders of personality, hereafter referred to as personality disorders, included 6D10 personality disorder under ICD-11 Chapter 06. We were aware that ICD-11 of mental disorder does not include suicide, yet, suicide as an important mental health outcome among prison populations was included in the earlier versions of ICD. In the present study, we also included (4) Suicide attempts included non-completed attempts of suicide. (5) Suicide-related outcomes included

cognitions and behaviors, such as self-harm and suicidal ideation" (Liu et al., 2021, p.5). The analysis excluded other miscellaneous categories of psychiatric conditions (listed in Appendix C1). Across all categories, both clinical diagnoses and self-reported symptoms were included.

Coping

Coping was defined by Lazarus and Folkman (Lazarus & Folkman, 1984) as constantly changing behavioral, cognitive, and emotional efforts in handling the appraised demands that exceed one's resources. Four types of coping were expected to be identified: (1) behavioral coping, (2) cognitive coping, (3) emotional coping, and (4) social support. In the current study, behavioral coping refers to any overt behavior directed toward dealing with or avoiding perceived stress. Any cognitive effort, for example, interpreting the demands and coming up with a plan to deal with them, was defined as cognitive coping (Lazarus, 1991). Any emotion regulation process of reducing emotion intensity under both stressful and non-stressful circumstances was defined as emotional coping (Compas et al., 2001). Social support was described as the actual receive or perceived care and assistance from other people (Cohen & Syme, 1985).

Preparation of effect sizes

As zero-order correlation coefficient (*r*) was most commonly reported across the 396 effect sizes identified (69.95%), correlation coefficient *r* was chosen as the effect size metric of interest. Before pooling effect sizes, reported raw effect sizes in other formats such as standardized regression coefficients (Eq. (1)), $\chi 2$ tests (Eq. (2)), and odds ratios (Eq. (3)) were converted into correlation coefficient *r*:

Eq. (1) $r = \beta + 0.05\lambda$,

Eq. (2) $r = \sqrt{\frac{\chi^2}{n}}$,

Eq. (3) $r = \frac{Log(OR)*\left(\frac{\sqrt{3}}{\pi}\right)}{\sqrt{\left(Log(OR)*\left(\frac{\sqrt{3}}{\pi}\right)\right)^2 + \frac{(n_1+n_2)^2}{n_1*n_2}}}$,

where n denotes the sample size; λ = 1 if β is positive and λ = 0 if r is negative.

Pooling of effect sizes

Fisher's Z_r which was normally distributed was used to correct skewed r distribution. Correlation coefficients were converted into Fisher's Z_r using Eq. (4).

Eq. (4) $Z_r = 0.5ln\frac{(1+r)}{(1-r)}$,

where Z_r is Fisher's Z transformed correlation.

ln represents the natural logarithm, r is the reported zero-order correlation coefficient. Using Eq. (5), the standard error was then calculated. The effect sizes were weighted by inverse variance using Eq. (6) and back-transformed into correlation coefficients for presentation using Eq. (7). The standard error for the pooled correlation was then computed by Eq. (8).

Eq. (5) $SEZr = \sqrt{\frac{1}{n-3}}$,

Eq. (6) Weight $Z_r = n - 3$,

Eq. (7) $r = \frac{e^{2Zr}-1}{e^{2Zr}+1}$,

Eq. (8) $SEZ_r = (1 - r^2)(SEZr)$,

where *e* refers to the base of the natural logarithm.

Study heterogeneity and moderator analyses

Classical meta-analysis assumes independency between effect sizes; however the assumption can be violated in the following conditions: (1) population(s) used in multiple

publications were the same or overlapping, (2) a single publication reported multiple effect sizes, and/or (3) a single publication reported multiple outcomes, or variable of interest was assessed by multiple scales/subscales. Effect sizes that originate from the overlapping population(s) will likely be similar in contrast with those reported in different population(s). In order to address dependency between effect sizes, all eligible studies were carefully examined (i.e., research project(s), assessment tools, and author list) to identify if there is any possible overlapping population(s) across studies. Three-level meta-analytic model, a method for addressing the problems of dependency between effect sizes was used to calculate the aggregate effect size and perform moderator analysis (Cheung, 2015; Houben et al., 2015; Hox et al., 2017). The model accounted for three sources of variance across three levels: sampling variance between effect sizes (level 1), within study variance (level 2), and variance between studies (level 3). The influence of extreme cases was controlled by removing outliers that exceeded three standard deviations from the overall effect size (Viechtbauer & Cheung, 2010). Heterogeneous effect size distribution was indicated by the significant within-study variance (level 2) and between-study variance (level 3). In this case, a moderator analysis was performed to determine potential moderators explaining the observed differences between effect sizes (Assink & Wibbelink, 2016).

"metaphor package" in R (version 3.2.0) was used to perform the multilevel meta-analysis with random effects model (Assink & Wibbelink, 2016). Model parameters were estimated using the restricted maximum likelihood approach. Individual regression coefficients in meta-analytic models and their corresponding confidence intervals were calculated using Knapp–Hartung method (Assink & Wibbelink, 2016; Houben et al., 2015; Knapp & Hartung, 2003). A variety of categorical moderators were tested, including time frame of trauma, type of trauma, type of mental disorder, assessment method of mental disorders, type of country, sampling method, sample type, age group, gender, and study

design.

Mediator analyses

After experiencing adverse life experiences, prisoners and ex-prisoners who cope effectively with trauma are less likely to exhibit psychological distress (e.g., depression and anxiety) and more likely to achieve post-traumatic growth (Vanhooren et al., 2018). Life events that are traumatizing or stressful can cause less effective coping, which increase psychological distress among prisoners (Maschi et al., 2014, 2015). Any coping-related variables in the eligible studies were recorded. In light of previous evidence and conceptual framework (Jenzer et al., 2020), coping-related variables were categorized into behavioral, cognitive, emotional, and social dimensions. Using meta-analytic structural equation modeling (MASEM) analyses, mediating effects of coping variables were tested in the associations between trauma (categorized by time frame and type) and mental disorders (categorized by type) (Cheung, 2015; Cheung & Chan, 2005). "metaSEM package" in R (version 3.2.0) was used to perform the MASEM analyses (Cheung, 2015). Mediation models were tested using the two-stage structural equation modeling (TSSEM) approach. In the first stage, correlation matrices were pooled using random effects modeling based on the correlations between variables (Cheung, 2013). In the second stage, mediation model was fitted on the pooled correlation matrices to test the potential indirect effects. 95% likelihood-based confidence intervals was used to assess the significance of parameter estimates (Neale & Miller, 1997; Roorda et al., 2017). The parameter estimate that did not encompass zero in their 95% CI was regarded as significant at the 5% level. The indirect effect was the product of the parameter estimates of the association between trauma and coping and the association between coping and mental disorders. In case of a non-significant association between trauma and mental disorders, the indirect effect was regarded as full mediation.

Quality assessment

AXIS tool was used to assess study quality (Downes et al., 2016). This assessment tool was developed to evaluate the quality of non-experimental research, so it was appropriate to evaluate studies of prisoners that were mostly observational and cross-sectional (Lannoy et al., 2021; Robson et al., 2020). The AXIS tool evaluates study quality in 20 dimensions (e.g., clarity of study aims, sample size justification, use of validated measures, and statistical methods description). Detailed assessment criteria were listed in Appendix F. Each study received a score between 0 and 20, with higher scores indicating higher study quality.

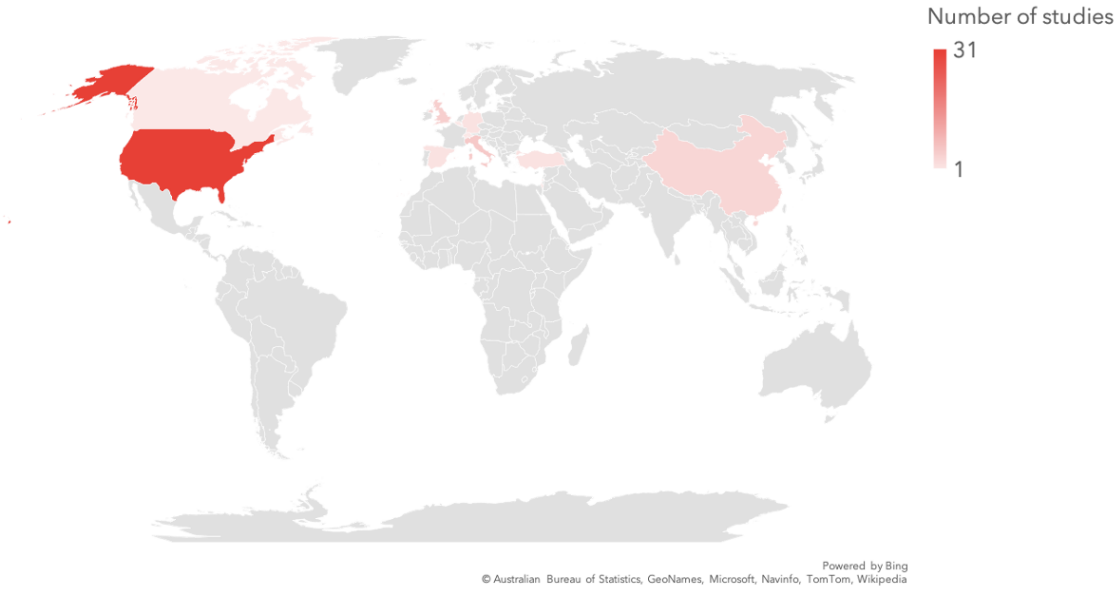
Publication bias

Publication bias was visualized by Begg's funnel plot. Egger's test was used to determine the degree of asymmetry, which was corrected using Duval–Tweedie's trim-and-fill method. Moreover, to determine the number of missing studies required to render the pooled effect size insignificant, the classic fail-safe number (N_R) was calculated. Comprehensive Meta-Analysis software version 3.0 was used to conduct the test for publication bias (Borenstein et al., 2013). Random effect models were adopted, and all tests were two-tailed.

Results

The initial search yielded 4,386 results. After title and abstract were screened, 4,098 studies were deleted because of duplication and not meeting the inclusion criteria, leaving 288 studies. All full articles were screened for eligibility in the second stage, which resulted in 62 studies with 396 effect sizes (k) which contained 15,115 prisoners (97.86%) and 330 ex-prisoners (2.14%) across 16 countries. Figure 2-3 shows the countries that were included. In most studies, convenient sampling (61.29%) was used along with a cross-sectional study design (96.77%). The majority of studies assessed mental disorders by self-reported symptoms (88.71%) rather than clinical diagnosis (11.29%). In terms of timeframe of trauma, childhood trauma represented 55.05% of the reported effect sizes, followed by lifetime

trauma (32.83%), imprisonment trauma (6.06%), pre-imprisonment trauma (5.56%), and post-imprisonment trauma (0.51%). In terms of trauma types, mixed trauma (32.32%) accounted for the most effect sizes, followed by physical trauma (23.99%), sexual trauma (17.42%), emotional trauma (15.15%), and contextual trauma (11.11%). Participants in the present study had an average age of 35.69 years (SD = 13.47). Male prisoners ranged from 0% to 100% across studies. Length of imprisonment ranged from 0 months to 504 months (M = 178.72, SD = 223.38). Year of publication ranged between 1998 and 2021. Appendix C2 and Appendix D summarized study characteristics and reference list. Measurements of predictors and outcomes were assessed using previously validated, standardized, or pro forma instruments.



Note. A total of 16 countries were included and visualized in the global map. The majority of the studies were conducted in the United States (31), followed by Italy (6), UK (5), China (4), Germany (2), Israel (2), Spain (2), Turkey (2), Canada (1), Netherland (1), Switzerland (1), Belgium (1), Swiss (1), Poland (1), Japan (1), and Puerto Rico (1).

Figure 2-3 Global map of the included countries

In general, the aggregated association between trauma exposure and mental disorders

was significant (Z*r* = 0.198, 95% CI = [0.167, 0.229], $p < .001$). Separate analyses were conducted to assess the association between different time frames/types of trauma and the five mental health outcomes (shown in Table 2-2). In terms of timeframe of trauma, the effect sizes ranged from 0.099 (between childhood trauma and suicide attempts) to 0.357 (between childhood trauma and stress-related disorders). In terms of trauma types, the effect sizes ranged from 0.113 (between sexual trauma and personality disorders) to 0.326 (between sexual trauma and stress-related disorders) (shown in Table 2-3).

Table 2-3 Three level meta-analysis of the association between trauma and mental disorders

				Effect sizes							Publication bias (95% CI), *p*-value	
Predictors	Outcome	s	k	Z*r* (95% CI)	*p*	σ2 level2	σ2 level3	%Var. level 1	%Var. level 2	%Var. level 3	Classic fail-safe N	Egger's regression intercept
Trauma (overall)	Outcome (Overall)	54	391	0.198 (0.167, 0.229)	<.0001	0.011	0.008	13.043	36.334	50.623	19264	0.991 (0.49, 1.49), *t*=3.894, *p*= 0.0001
	Anxiety and depressive disorders	10	77	0.189 (0.156, 0.221)	<.0001	0.009	0.000	20.019	2.738	77.243		
	Stress-related disorders	22	102	0.263 (0.206, 0.320)	<.0001	0.020	0.008	13.219	23.560	63.221		
	Personality disorders	11	156	0.165 (0.123, 0.208)	<.0001	0.009	0.002	28.037	15.219	56.745		
	Suicide attempts	5	28	0.099 (0.049, 0.150)	0.0004	0.007	0.001	16.712	8.948	74.340		
	Suicide-related outcomes	7	28	0.175 (0.046, 0.304)	0.0100	0.002	0.023	4.181	88.685	7.134		
Childhood trauma	Anxiety and depressive disorders	5	48	0.176 (0.148, 0.204)	<.0001	0.005	0.000	30.485	0.000	69.515	10218	0.639 (0, 1.28), *t*=1.955, *p*=0.052
	Stress-related disorders	6	10	0.357 (0.147, 0.568)	0.00	0.008	0.043	6.036	79.702	14.262		
	Personality disorders	9	103	0.157 (0.104, 0.211)	<.0001	0.008	0.004	25.463	26.341	48.196		
	Suicide attempts	5	28	0.099 (0.049, 0.150)	0.00	0.007	0.001	16.712	8.948	74.340		
	Suicide-related outcomes	6	26	0.164 (0.012, 0.316)	0.04	0.002	0.027	3.360	90.387	6.253		
Pre-imprisonment trauma	Anxiety and depressive disorders	2	9	0.156 (-0.012, 0.323)	0.06	0.000	0.009	38.777	61.223	0.000	231	5.35 (2.32, 8.38), *t*= 3.457, *p*=0.002
	Stress-related disorders	3	6	0.287 (0.061, 0.513)	0.02	0.027	0.004	26.346	8.611	65.042		

Predictors	Outcome	s	k	Effect sizes Zr (95% CI)	p	σ2 level2	σ2 level3	%Var. level 1	%Var. level 2	%Var. level 3	Publication bias (95% CI), p-value Classic fail-safe N	Egger's regression intercept
	Personality disorders	2	7	-0.008 (-0.091, 0.074)	0.82	0.003	0.000	66.765	0.000	33.236		
	Suicide attempts	-	-	-	-	-	-	-	-	-		
	Suicide-related outcomes	-	-	-	-	-	-	-	-	-		
Imprisonment trauma	Anxiety and depressive disorders	6	17	0.260 (0.169, 0.351)	<.0001	0.023	0.000	13.527	0.000	86.473	1464	1.318 (-0.42, 3.06), *t*=1.483, *p*=0.152
	Stress-related disorders	3	6	0.290 (0.081, 0.499)	0.02	0.017	0.006	26.967	18.465	54.567		
	Personality disorders	-	-	-	-	-	-	-	-	-		
	Suicide attempts	-	-	-	-	-	-	-	-	-		
	Suicide-related outcomes	-	-	-	-	-	-	-	-	-		
Lifetime trauma	Anxiety and depressive disorders	2	2	0.248 (-1.010, 1.506)	0.24	0.003	0.003	71.466	14.267	14.267	3182	0.284 (-1.3, 1.87), *t*=0.351, *p*=0.726
	Stress-related disorders	16	79	0.249 (0.197, 0.301)	<.0001	0.022	0.002	14.395	8.066	77.539		
	Personality disorders	3	46	0.195 (0.088, 0.301)	0.00	0.007	0.005	28.788	28.987	42.225		
	Suicide attempts	-	-	-	-	-	-	-	-	-		
	Suicide-related outcomes	1	2	0.240 (-0.370, 0.850)	0.13	0.000	0.000	100.000	0.000	0.000		
Physical trauma	Anxiety and depressive disorders	5	22	0.184 (0.162, 0.206)	<.0001	0.000	0.000	100.000	0.000	0.000	8475	1.209 (0.41, 2), *t*=2.985, *p*=0.004

Predictors	Outcome	s	k	Effect sizes Zr (95% CI)	p	σ2 level2	σ2 level3	%Var. level 1	%Var. level 2	%Var. level 3	Publication bias (95% CI), p-value Classic fail-safe N	Egger's regression intercept
	Stress-related disorders	7	28	0.206 (0.133, 0.279)	<.0001	0.013	0.003	16.984	16.464	66.552		
	Personality disorders	7	30	0.196 (0.162, 0.231)	<.0001	0.002	0.000	62.585	0.000	37.415		
	Suicide attempts	2	6	0.087 (-0.005, 0.180)	0.06	0.006	0.000	16.585	0.000	83.415		
	Suicide-related outcomes	5	9	0.110 (-0.007, 0.228)	0.06	0.000	0.010	9.277	90.723	0.000		
Sexual trauma	Anxiety and depressive disorders	4	15	0.147 (0.085, 0.209)	0.00	0.006	0.000	35.047	3.496	61.457	9083	1.108 (-0.17, 2.38), t=1.703, p=0.093
	Stress-related disorders	6	18	0.326 (0.216, 0.435)	<.0001	0.014	0.008	15.825	31.219	52.956		
	Personality disorders	8	25	0.113 (0.045, 0.181)	0.00	0.005	0.004	33.925	28.758	37.317		
	Suicide attempts	3	5	0.162 (-0.093, 0.418)	0.15	0.037	0.000	5.421	0.000	94.579		
	Suicide-related outcomes	4	5	0.116 (-0.104, 0.336)	0.22	0.000	0.020	6.093	93.907	0.000		
Emotional trauma	Anxiety and depressive disorders	4	19	0.180 (0.112, 0.248)	<.0001	0.013	0.000	15.547	0.000	84.453	6718	0.978 (-0.33, 2.28), t=1.469, p=0.147
	Stress-related disorders	1	3	0.169 (-0.022, 0.359)	0.06	0.000	0.000	100.000	0.000	0.000		
	Personality disorders	6	24	0.211 (0.113, 0.309)	0.00	0.008	0.007	18.599	37.748	43.653		
	Suicide attempts	1	4	0.082 (-0.061, 0.224)	0.17	0.007	0.000	8.961	0.000	91.039		
	Suicide-related outcomes	3	10	0.010 (-0.012, 0.032)	0.33	0.000	0.000	100.000	0.000	0.000		

Predictors	Outcome	s	k	Effect sizes Zr (95% CI)	*p*	σ2 level2	σ2 level3	%Var. level 1	%Var. level 2	%Var. level 3	Publication bias (95% CI), *p*-value Classic fail-safe N	Egger's regression intercept
Contextual trauma	Anxiety and depressive disorders	2	3	0.144 (-0.500, 0.787)	0.44	0.000	0.038	14.896	85.104	0.000	1697	0.255 (-3.22, 3.73), *t*=0.144, *p*=0.886
	Stress-related disorders	2	18	0.211 (0.127, 0.294)	<.0001	0.003	0.002	49.659	20.378	29.963		
	Personality disorders	2	17	0.076 (-0.052, 0.204)	0.22	0.014	0.005	20.824	19.740	59.436		
	Suicide attempts	2	6	0.101 (-0.112, 0.314)	0.28	0.000	0.012	31.723	68.277	0.000		
	Suicide-related outcomes	-	-	-	-	-	-	-	-	-		
Mixed trauma	Anxiety and depressive disorders	6	18	0.238 (0.159, 0.318)	<.0001	0.017	0.000	12.047	0.000	87.953	16516	0.355 (-0.71, 1.42), *t*=0.655, *p*=0.513
	Stress-related disorders	17	35	0.284 (0.191, 0.377)	<.0001	0.026	0.014	11.179	31.313	57.508		
	Personality disorders	7	60	0.177 (0.103, 0.251)	<.0001	0.009	0.003	32.230	16.832	50.938		
	Suicide attempts	4	7	0.098 (-0.002, 0.197)	0.05	0.002	0.003	31.882	46.491	21.627		
	Suicide-related outcomes	3	4	0.223 (-0.162, 0.607)	0.16	0.017	0.024	5.016	54.883	40.101		

Notes. s=number of studies; k=number of effect sizes; CI=confidence interval; Zr=Fisher's Z transformed correlation; %Var = percentage of variance explained; σ2 level2 = variance between effect sizes within the same study; σ2 level3 = variance between studies. Table can be found in Liu, Li, Liang, & Hou (2021).

According to the grouping of pooled effect sizes imprisonment trauma (Z*r* = 0.265, 95% CI = [0.190, 0.339], *p* < .001) and mixed trauma (Z*r* = 0.232, 95% CI = [0.182, 0.281], *p* < .001) had greater correlations with mental disorders. It is noteworthy that childhood trauma was positively correlated with all mental disorders (Z*r* = 0.099–0.357, 95% CI = [0.012–0.148, 0.150–0.568], *p*s < .05). Pre-imprisonment trauma was positively correlated with stress-related disorders (Z*r* = 0.287, 95% CI = [0.061, 0.513], *p* < .05) and non-significantly correlated with anxiety and depressive disorders (Z*r* = 0.156, 95% CI = [−0.012, 0.323], *p* = .065) and personality disorders (Z*r* = −0.008, 95% CI = [−0.091, 0.074], *p* = .815). Imprisonment trauma was positively correlated with anxiety and depressive disorders (Z*r* = 0.260, 95% CI = [0.169, 0.351], *p* < .001) and stress-related disorders (Z*r* = 0.290, 95% CI = [0.081, 0.499], *p* < .05). Lifetime trauma was positively correlated with stress-related disorders (Z*r* = 0.249, 95% CI = [0.197, 0.301], *p* < .001) and personality disorders (Z*r* = 0.195, 95% CI = [0.088, 0.301], *p* < .01). Among all eligible studies, only one reported the association between post-imprisonment trauma and mental disorders, which was insufficient to perform a three-level analysis.

Physical trauma was positively correlated with all mental disorders (Z*r* = 0.184–0.206, 95% CI = [0.133–0.162, 0.206–0.279], *p*s < .001), except suicide attempts (Z*r* = 0.087, 95% CI = [−0.005, 0.180], *p* = .059) and suicide-related outcomes (Z*r* = 0.110, 95% CI = [−0.007, 0.228], *p* = .063). Sexual trauma was positively correlated with anxiety and depressive disorders, stress-related disorders, and personality disorders (Z*r* = 0.113–0.326, 95% CI = [0.045–0.216, 0.181–0.435], *p*s < .01) but not with suicide attempts (Z*r* = 0.162, 95% CI = [−0.093, 0.418], *p* = .153) and suicide-related outcomes (Z*r* = 0.116, 95% CI = [−0.104, 0.336], *p* = 0.218). Emotional trauma was positively correlated with anxiety and depressive disorders and personality disorders (Z*r* = 0.180–0.211, 95% CI = [0.112–0.113, 0.248–0.309], *p*s < .001) but not with stress-related disorders (Z*r* = 0.169, 95% CI = [−0.022,

0.359], p = .062), suicide attempts (Zr = 0.082, 95% CI = [−0.061, 0.224], p = .166), and suicide-related outcomes (Zr = 0.010, 95% CI = [−0.012, 0.032], p = .325). Contextual trauma was only positively correlated with stress-related disorder (Zr = 0.211, 95% CI = [0.127, 0.294], p < .001) but not with anxiety and depressive disorders (Zr = 0.144, 95% CI = [−0.500, 0.787], p = .437), personality disorders (Zr = 0.076, 95% CI = [−0.052, 0.204], p = .224), and suicide attempts (Zr = 0.101, 95% CI = [−0.112, 0.314], p = .277). Mixed trauma was positively associated with all mental disorders (Zr = 0.177–0.284, 95% CI = [0.103–0.191, 0.251–0.377] ps < .001) but not with suicide attempts (Zr = 0.098, 95% CI = [−0.002, 0.197], p = .053) and suicide-related outcomes (Zr = 0.223, 95% CI = [−0.162, 0.607], p = .163).

Publication bias

Publication bias was tested between different types of trauma and the aggregated mental disorders (Appendix E showed the funnel plots). Overall, publication bias was detected between trauma and mental disorders in aggregate (Egger's regression intercept = 0.991, 95% CI = [0.49, 1.49], t = 3.894, p = .0001). The publication bias was also evident for the associations of mental disorders with pre-imprisonment trauma (Egger's regression intercept = 5.35, 95% CI = [2.32, 8.38], t = 3.457, p = .002) and physical trauma (Egger's regression intercept = 1.209, 95% CI = [0.41, 2], t = 2.985, p = .004). Based on the classic fail-safe N test, a minimum of 19,264, 231, and 8,475 studies are required to render the above associations non-significant. Using Duval and Tweedie's trim and fill method to trim 74, 7, and 20 effect sizes of aggregated, pre-imprisonment, and physical trauma respectively, the adjusted overall effect size was relatively unaffected (Adjusted Zr = 0.121, 95% CI = [0.105-0.138], Q = 4617.224).

Quality assessment

The quality of the included 62 studies was rated as good (M = 15.94, SD = 1.90, range

= 11–19) (individual scores were reported in Appendix F). All studies had clear research objectives, used appropriate and justified study designs, took sample from the appropriate populations, used validated instruments to measure the variables of interest, and had clear criteria to determine statistical significance. The results reported were internally consistent, and the limitations were acknowledged. However, almost all studies failed to use power estimation to justify their sample size. Few studies provided adequate information regarding non-respondents (61.29%), and only a few measures were taken to handle and categorize non-respondents (30.65%).

Moderator analyses

Heterogeneity in effect size distribution was indicated by the significant variance on both within-study (36.33% at level 2) and between-study (50.62% at level 3) level, which suggested it necessary to perform moderator analysis to identify the factors contributing to the variation. Based on the 10 moderation models we built, time frame of trauma, type of trauma, and type of mental disorder accounted for the between-study variances. However, other moderators, such as type of assessment method, type of country, sampling method, sample type, gender, age group, and study design did not moderate the associations between trauma and mental disorders (Table 2-4).

Table 2-4 Multilevel moderator analysis

	β_0 (95% CI)	t_0	β_1 (95% CI)	t_1	p	F(df, $df2$)
Model 1: Time of trauma						
Imprisonment trauma (RC)	0.247 (0.177, 0.316)	6.959			<.0001	F(4, 386) = 4.243,
Childhood trauma	0.173 (0.139, 0.208)	9.994	-0.073 (-0.143, -0.004)	-2.066	0.040	p= 0.002
Pre-imprisonment trauma	0.136 (0.066, 0.205)	3.843	-0.111(-0.206, -0.016)	-2.290	0.023	
Post-imprisonment trauma	0.122 -0.127, 0.371)	0.961	-0.125 (-0.383, 0.133)	-0.951	0.342	
Lifetime trauma	0.243 (0.200, 0.285)	11.264	-0.004 (-0.082, 0.0741)	-0.102	0.919	
Model 2: Type of trauma						
Physical trauma (RC)	0.173 (0.133, 0.212)	8.574			<.0001	F(4, 386) = 5.233,
Sexual trauma	0.189 (0.147, 0.232)	8.790	0.019 (-0.022, 0.059)	0.904	0.367	p= 0.0004
Emotional trauma	0.185 (0.139, 0.231)	7.910	0.015 (-0.028, 0.059)	0.695	0.488	
Contextual trauma	0.127 (0.075, 0.178)	4.834	-0.043 (-0.097, 0.012)	-1.545	0.123	
Mixed trauma	0.234 (0.196, 0.272)	12.037	0.064 (0.019, 0.108)	2.792	0.006	
Model 3: Mental disorders outcomes						
Stress-related disorders (RC)	0.261 (0.214, 0.307)	11.014			<.0001	F(4, 386) = 3.995,
Anxiety and depressive disorders	0.203 (0.145, 0.262)	6.786	-0.057 (-0.132, 0.018)	-1.494	0.136	p= 0.004
Personality disorders	0.167 (0.111, 0.222)	5.914	-0.094 (-0.166, -0.022)	-2.558	0.011	
Suicide attempts	0.101 (0.019, 0.184)	2.422	-0.159 (-0.254, -0.065)	-3.315	0.001	
Suicide-related outcomes	0.135 (0.054, 0.215)	3.285	-0.126 (-0.219, -0.033)	-2.654	0.008	
Model 4: Assessment tools						
Clinical diagnosis (RC)	0.155 (0.070, 0.240)	3.594			<.0001	F(1, 389) = 1.191,
Self-report instruments	0.205 (0.171, 0.239)	12.019	0.050 (-0.040, 0.139)	1.091	0.276	p= 0.276

	β_0 (95% CI)	t_0	β_1 (95% CI)	t_1	p	F(*df1*, *df2*)
Model 5: Country Type						
Developed countries (RC)	0.199 (0.166, 0.232)	11.793			<.0001	F(1, 389) = 0.001, p= 0.977
Developing countries	0.197 (0.100, 0.295)	3.969	-0.002 (-0.105, 0.102)	-0.029	0.977	
Model 6: Sampling method						
Random sampling (RC)	0.231 (0.184, 0.278)	9.686			<.0001	F(1, 389) = 3.331, p= 0.069
Convenient sampling	0.188 (0.151, 0.225)	10.075	-0.051 (-0.106, 0.004)	-1.825	0.069	
Model 7: Sample characteristics						
Prisoners (RC)	0.198 (0.166, 0.230)	12.137			<.0001	F(1, 389) = 0.021, p= 0.885
Ex-prisoners	0.206 (0.097, 0.316)	3.710	0.008 (-0.104, 0.121)	0.145	0.885	
Model 8: Age						
Adolescents (RC)	0.157 (0.0002, 0.314)	1.968			0.050	F(2, 388) = 0.177, p= 0.838
Adults	0.202 (0.168, 0.235)	11.958	0.045 (-0.116, 0.205)	0.547	0.585	
Mixed of adults and adolescents	0.183 (0.048, 0.318)	2.656	0.026 (-0.181, 0.233)	0.246	0.806	
Model 9: Sex						
Female Sex (RC)	0.212 (0.172, 0.251)	10.590			<.0001	F(1, 389) = 1.156, p= 0.283
Male Sex	0.192 (0.154, 0.230)	9.927	-0.030 (-0.084, 0.025)	-1.075	0.283	
Model 10: Study design						
Longitudinal (RC)	0.142 (0.009, 0.275)	2.094			0.037	F(1, 389) = 0.736, p= 0.391
Cross-sectional	0.201 (0.169, 0.232)	12.519	0.059 (-0.076, 0.194)	0.858	0.391	

Note. The Fisher's *Zr* between study-wise predictor and outcome variables was the dependent variable in the multilevel moderator models. The moderators were analyzed as categorical covariates as appropriate. β_0 =intercept/mean effect size (r); t_0=difference in mean *r* with zero; β_1 =estimated regression coefficient; t_1= difference in mean *r* with reference category; F(*df1*, *df2*) = omnibus test; (RC) = reference category. Table can be found in Liu, Li, Liang, & Hou (2021).

Among different time frames of trauma, imprisonment trauma (β = 0.247, 95% CI = [0.177, 0.316], $p < .001$) had a greater change in slope relative to childhood trauma and pre-imprisonment trauma. Among the five types of trauma, mixed trauma (β = 0.234, 95% CI = [0.196, 0.272], $p < .01$) had a greater change in slope relative to physical trauma. Also, a greater change in slope was found in stress-related disorders (β = 0.261, 95% CI = [0.214, 0.307], $p < .001$) relative to personality disorders, suicide attempts, and suicide-related outcomes.

Separate moderator analyses were also performed in the subset for males, females, prisoners, and ex-prisoners, which yield similar results. Males were more sensitive to the time sequence of trauma. The trauma–mental disorder association was found to be stronger in imprisonment trauma than in childhood trauma, pre-imprisonment trauma, and lifetime trauma in male samples but not female. However, compared with male prisoners/ex-prisoners, female showed differing associations between forms of trauma and disorders. The trauma–mental disorder association was found to be stronger in mixed trauma relative to physical trauma. Compared with convenient sampling, random sampling had a greater change in slope among females (β = 0.279, 95% CI = [0.200, 0.358], $p < .001$) but not males, and among prisoners (β = 0.236, 95% CI = [0.188, 0.284], $p < .001$) but not ex-prisoners. Tables 2-5 to Table 2-8 showed the results of the separate moderator analyses.

Table 2-5 Multilevel moderator analysis (male)

	β_0 (95% CI)	t_0	β_1 (95% CI)	t_1	p	$F(df1, df2)$
Model 1: Time of trauma						
Imprisonment trauma (RC)	0.345 (0.216, 0.474)	5.285			<.0001	F(3, 120) = 2.988, p= 0.034
Childhood trauma	0.1401 (0.088, 0.193)	5.317	-0.204 (-0.344, -0.065)	-2.898	0.005	
Pre-imprisonment trauma	0.081 (-0.148, 0.311)	0.701	-0.264 (-0.527, -0.0005)	-1.984	0.050	
Post-imprisonment trauma	-	-	-	-	-	
Lifetime trauma	0.162 (0.073, 0.252)	3.583	-0.183 (-0.340, -0.026)	-2.304	0.023	
Model 2: Type of trauma						
Physical trauma (RC)	0.143 (0.088, 0.199)	5.103			<.0001	F(4, 119) = 1.488, p= 0.210
Sexual trauma	0.112 (0.043, 0.181)	3.214	-0.032 (-0.097, 0.034)	-0.951	0.344	
Emotional trauma	0.148 (0.083, 0.213)	4.529	0.004 (-0.055, 0.064)	0.147	0.884	
Contextual trauma	0.274 (0.071, 0.476)	2.668	0.130 (-0.080, 0.340)	1.227	0.222	
Mixed trauma	0.226 (0.151, 0.302)	5.952	0.083 (-0.008, 0.173)	1.810	0.073	
Model 3: Mental disorders outcomes						
Stress-related disorders (RC)	0.187 (0.109, 0.265)	4.745			<.0001	F(4, 119) = 2.326, p= 0.060
Anxiety and depressive disorders	0.242 (0.147, 0.338)	5.023	0.055 (-0.068, 0.179)	0.886	0.377	
Personality disorders	0.170 (0.104, 0.237)	5.051	-0.017 (-0.119, 0.085)	-0.327	0.745	
Suicide attempts	0.008 (-0.151, 0.166)	0.094	-0.180 (-0.357, -0.003)	-2.010	0.047	
Suicide-related outcomes	0.091 (-0.001, 0.183)	1.954	-0.096 (-0.217, 0.024)	-1.582	0.116	
Model 4: Assessment tools						
Clinical diagnosis (RC)	0.107 (-0.040, 0.254)	1.435			0.154	F(1, 122) = 0.806, p= 0.371
Self-report instruments	0.177 (0.126, 0.228)	6.910	0.071 (-0.085, 0.226)	0.898	0.371	

	β_0 (95% CI)	t_0	β_1 (95% CI)	t_1	p	$F(df1, df2)$
Model 5: Country Type						
Developed countries (RC)	0.170 (0.120, 0.221)	6.664			<.0001	F(1, 122) = 0.005, p=0.944
Developing countries	0.164 (0.005, 0.324)	2.038	-0.006 (-0.173, 0.161)	-0.071	0.944	
Model 6: Sampling method						
Random sampling (RC)	0.242 (0.146, 0.338)	4.988			<.0001	F(1, 122) = 2.993, p= 0.086
Convenient sampling	-0.096 (-0.206, 0.014)	-1.730	-0.096 (-0.206, 0.014)	-1.730	0.086	
Model 7: Sample characteristics						
Prisoners (RC)	0.155 (0.110, 0.201)	6.775			<.0001	F(1, 122) = 3.922, p= 0.050
Ex-prisoners	0.338 (0.161, 0.516)	3.782	0.183 (0.0001, 0.366)	1.993	0.049	
Model 8: Age						
Adolescents (RC)	0.146 (-0.082, 0.375)	1.267			0.208	F(2, 121) = 0.040, p= 0.961
Adults	0.173 (0.120, 0.226)	6.497	0.027 (-0.208, 0.261)	0.225	0.822	
Mixed of adults and adolescents	0.156 (-0.018, 0.330)	1.776	0.010 (-0.278, 0.297)	0.068	0.946	
Model 9: Sex						
Female Sex (RC)	-	-	-	-	-	-
Male Sex	-	-	-	-	-	
Model 10: Study design						
Longitudinal (RC)	-	-	-	-	-	-
Cross-sectional	-	-	-	-	-	

Note. Analyses were run in studies which included male participants only. The Fisher's Z*r* between study-wise predictor and outcome variables was the dependent variable in the multilevel moderator models. The moderators were analyzed as categorical covariates as appropriate. β_0 =intercept/mean effect size (r); t_0=difference in mean *r* with zero; β_1 =estimated regression coefficient; t_1= difference in mean *r* with reference category; F(*df1*,*df2*) = omnibus test; (RC) = reference category. Table can be found in Liu, Li, Liang, & Hou (2021).

Table 2-6 Multilevel moderator analysis (female)

	β_0 (95% CI)	t_0	β_1 (95% CI)	t_1	p	$F(df1,df2)$
Model 1: Time of trauma						
Imprisonment trauma (RC)	0.243 (0.141, 0.346)	4.689			<.0001	F(4, 192) = 3.377,
Childhood trauma	0.182 (0.121, 0.242)	5.910	-0.062 (-0.158, 0.035)	-1.263	0.208	p= 0.011
Pre-imprisonment trauma	0.161 (0.076, 0.245)	3.740	-0.083 (-0.204, 0.038)	-1.353	0.178	
Post-imprisonment trauma	0.132 (-0.126, 0.390)	1.008	-0.112 (-0.385, 0.162)	-0.804	0.422	
Lifetime trauma	0.272 (0.209, 0.335)	8.530	0.028 (-0.079, 0.135)	0.522	0.602	
Model 2: Type of trauma						
Physical trauma (RC)	0.171 (0.099, 0.242)	4.718			<.0001	F(4, 192) = 3.272,
Sexual trauma	0.218 (0.150, 0.286)	6.322	0.052 (-0.015, 0.120)	1.542	0.125	p= 0.013
Emotional trauma	0.169 (0.079, 0.259)	3.695	0.008 (-0.080, 0.096)	0.179	0.858	
Contextual trauma	0.155 (0.084, 0.226)	4.304	-0.011 (-0.088, 0.066)	-0.286	0.775	
Mixed trauma	0.252 (0.193, 0.312)	8.344	0.087 (0.013, 0.160)	2.320	0.021	
Model 3: Mental disorders outcomes						
Stress-related disorders (RC)	0.293 (0.215, 0.372)	7.366			<.0001	F(4, 192) = 1.859,
Anxiety and depressive disorders	0.185 (0.089, 0.282)	3.779	-0.108 (-0.233, 0.016)	-1.714	0.088	p= 0.119
Personality disorders	0.159 (0.060, 0.258)	3.169	-0.134 (-0.261, -0.008)	-2.096	0.037	
Suicide attempts	0.108 (-0.054, 0.269)	1.317	-0.186 (-0.365, -0.006)	-2.042	0.043	
Suicide-related outcomes	0.259 (0.080, 0.438)	2.851	-0.035 (-0.230, 0.161)	-0.349	0.728	
Model 4: Assessment tools						
Clinical diagnosis (RC)	0.209 (0.072, 0.345)	3.027			0.003	F(1, 195) = 0.0271,
Self-report instruments	0.221 (0.163, 0.280)	7.457	0.012 (-0.136, 0.160)	0.165	0.869	p = 0.869

	β_0 (95% CI)	t_0	β_1 (95% CI)	t_1	p	$F(df1,df2)$
Model 5: Country Type						
Developed countries (RC)	0.215 (0.160, 0.270)	7.713			<.0001	F(1, 195) = 0.339,
Developing countries	0.279 (0.070, 0.487)	2.633	0.064 (-0.152, 0.280)	0.583	0.561	p= 0.561
Model 6: Sampling method						
Random sampling (RC)	0.279 (0.200, 0.358)	6.953			<.0001	F(1, 195) = 5.496,
Convenient sampling	0.169 (0.093, 0.246)	4.372	-0.110 (-0.202, -0.017)	-2.344	0.020	p= 0.020
Model 7: Sample characteristics						
Prisoners (RC)	0.226 (0.172, 0.279)	8.327			<.0001	F(1, 195) = 1.031,
Ex-prisoners	0.150 (0.006, 0.293)	2.061	-0.076 (-0.223, 0.071)	-1.016	0.311	p= 0.311
Model 8: Age						
Adolescents (RC)	0.139 (-0.045, 0.324)	1.489			0.138	F(2, 194) = 0.403,
Adults	0.227 (0.169, 0.285)	7.760	0.088 (-0.105, 0.281)	0.897	0.371	p= 0.669
Mixed of adults and adolescents	0.217 (-0.030, 0.463)	1.735	0.078 (-0.230, 0.385)	0.497	0.620	
Model 9: Sex						
Female Sex (RC)	-	-	-	-	-	-
Male Sex	-	-	-	-	-	
Model 10: Study design						
Longitudinal (RC)	0.150 (0.006, 0.293)	2.061			0.041	F(1, 195) = 1.031,
Cross-sectional	0.226 (0.172, 0.279)	8.327	0.076 (-0.071, 0.223)	1.016	0.311	p= 0.311

Note. Analyses were run in studies which included female participants only. The Fisher's Zr between study-wise predictor and outcome variables was the dependent variable in the multilevel moderator models. The moderators were analyzed as categorical covariates as appropriate. β_0 =intercept/mean effect size (r); t_0=difference in mean r with zero; β_1 =estimated regression coefficient; t_1= difference in mean r with reference category; F(*df1*,*df2*) = omnibus test; (RC) = reference category. Table can be found in Liu, Li, Liang, & Hou (2021).

Table 2-7 Multilevel moderator analysis (prisoners)

	β_0 (95% CI)	t_0	β_1 (95% CI)	t_1	p	$F(df1,df2)$
Model 1: Time of trauma						
Imprisonment trauma (RC)	0.231 (0.155, 0.308)	5.923			<.0001	F(3, 367) = 4.857,
Childhood trauma	0.172 (0.136, 0.208)	9.439	-0.060 (-0.135, 0.016)	-1.553	0.121	p= 0.003
Pre-imprisonment trauma	0.143 (0.061, 0.225)	3.439	-0.088 (-0.198, 0.022)	-1.578	0.001	
Post-imprisonment trauma	-	-	-	-	-	
Lifetime trauma	0.245 (0.202, 0.289)	11.005	0.014 (-0.070, 0.099)	0.330	0.742	
Model 2: Type of trauma						
Physical trauma (RC)	0.165 (0.124, 0.207)	7.813			<.0001	F(4, 366) = 5.414,
Sexual trauma	0.187 (0.143, 0.231)	8.384	0.024 (-0.018, 0.067)	1.118	0.265	p= 0.0003
Emotional trauma	0.186 (0.138, 0.234)	7.606	0.024 (-0.022, 0.070)	1.027	0.305	
Contextual trauma	0.125 (0.073, 0.178)	4.714	-0.037 (-0.093, 0.019)	-1.296	0.196	
Mixed trauma	0.233 (0.195, 0.272)	12.428	0.071 (0.025, 0.117)	3.011	0.003	
Model 3: Mental disorders outcomes						
Stress-related disorders (RC)	0.256 (0.207, 0.304)	10.455			<.0001	F(4, 366) = 3.658,
Anxiety and depressive disorders	0.216 (0.149, 0.283)	6.346	-0.039 (-0.122, 0.043)	-0.939	0.349	p= 0.006
Personality disorders	0.167 (0.111, 0.222)	5.872	-0.089 (-0.162, -0.016)	-2.383	0.018	
Suicide attempts	0.101 (0.018, 0.184)	2.404	-0.154 (-0.250, -0.058)	-3.163	0.002	
Suicide-related outcomes	0.134 (0.052, 0.216)	3.244	-0.121 (-0.216, -0.027)	-2.520	0.012	
Model 4: Assessment tools						
Clinical diagnosis (RC)	0.163 (0.068, 0.258)	3.371			0.001	F(1, 369) = 0.569,
Self-report instruments	0.201 (0.167, 0.236)	11.517	0.038 (-0.061, 0.137)	0.754	0.451	p= 0.451

	β_0 (95% CI)	t_0	β_1 (95% CI)	t_1	p	$F(df1,df2)$
Model 5: Country Type						
Developed countries (RC)	0.197 (0.163, 0.232)	11.243			<.0001	F(1, 369) = 0.0001,
Developing countries	0.198 (0.100, 0.296)	3.968	0.001 (-0.103, 0.105)	0.012	0.990	p= 0.990
Model 6: Sampling method						
Random sampling (RC)	0.236 (0.188, 0.284)	9.581			<.0001	F(1, 369) = 4.482,
Convenient sampling	0.184 (0.146, 0.221)	9.581	-0.061 (-0.117, -0.004)	-2.117	0.035	p= 0.035
Model 7: Sample characteristics						
Prisoners (RC)	-	-	-	-	-	-
Ex-prisoners	-	-	-	-	-	
Model 8: Age						
Adolescents (RC)	0.157 (-0.001, 0.314)	1.954			0.052	F(2, 368) = 0.163,
Adults	0.200 (0.166, 0.235)	11.416	0.044 (-0.118, 0.205)	0.530	0.597	p= 0.850
Mixed of adults and adolescents	0.183 (0.047, 0.319)	2.636	0.026 (-0.182, 0.235)	0.248	0.804	
Model 9: Sex						
Female Sex (RC)	0.215 (0.175, 0.256)	10.558			<.0001	F(1, 369) = 2.218,
Male Sex	0.186 (0.147, 0.224)	9.449	-0.042 (-0.097, 0.014)	-1.489	0.137	p= 0.137
Model 10: Study design						
Longitudinal (RC)	-	-	-	-	-	-
Cross-sectional	-	-	-	-	-	

Note. Analyses were run in studies which included prisoners only. The Fisher's Z*r* between study-wise predictor and outcome variables was the dependent variable in the multilevel moderator models. The moderators were analyzed as categorical covariates as appropriate. β_0 =intercept/mean effect size (r); t_0=difference in mean *r* with zero; β_1 =estimated regression coefficient; t_1= difference in mean *r* with reference category; F(*df1*,*df2*) = omnibus test; (RC) = reference category. Table can be found in Liu, Li, Liang, & Hou (2021).

Table 2-8 Multilevel moderator analysis (ex-prisoners)

	β_0 (95% CI)	t_0	β_1 (95% CI)	t_1	*p*	*F(df1,df2)*
Model 1: Time of trauma						
Imprisonment trauma (RC)	0.338 (0.209, 0.468)	5.558			<.0001	F(4, 15) = 2.646,
Childhood trauma	0.160 (0.043, 0.276)	2.922	-0.179 (-0.353, -0.004)	-2.181	0.046	*p*= 0.075
Pre-imprisonment trauma	0.091 (-0.025, 0.208)	1.670	-0.247 (-0.421, -0.073)	-3.018	0.009	
Post-imprisonment trauma	0.162 (-0.052, 0.376)	1.615	-0.176 (-0.426, 0.074)	-1.503	0.154	
Lifetime trauma	0.193 (-0.021, 0.407)	1.925	-0.145 (-0.395, 0.105)	-1.239	0.235	
Model 2: Type of trauma						
Physical trauma (RC)	0.262 (0.115, 0.410)	3.762			0.002	F(3, 16) = 0.755,
Sexual trauma	0.238 (0.072, 0.404)	3.038	-0.025 (-0.123, 0.074)	-0.531	0.603	p= 0.536
Emotional trauma	0.199 (0.033, 0.365)	2.540	-0.064 (-0.162, 0.035)	-1.372	0.189	
Contextual trauma	-	-	-	-	-	
Mixed trauma	0.178 (-0.034, 0.389)	1.777	-0.085 (-0.343, 0.174)	-0.695	0.497	
Model 3: Mental disorders outcomes						
Stress-related disorders (RC)	-	-	-	-	-	-
Anxiety and depressive disorders	-	-	-	-	-	-
Personality disorders	-	-	-	-	-	-
Suicide attempts	-	-	-	-	-	-
Suicide-related outcomes	-	-	-	-	-	-
Model 4: Assessment tools						
Clinical diagnosis (RC)	0.126 (-0.059, 0.310)	1.428			0.170	F(1, 18) = 1.811,
Self-report instruments	0.269 (0.144, 0.394)	4.512	0.143 (-0.080, 0.366)	1.346	0.195	p= 0.195

	β_0 (95% CI)	t_0	β_1 (95% CI)	t_1	*p*	*F(df1,df2)*
Model 5: Country Type						
Developed countries (RC)	-	-	-	-	-	-
Developing countries	-	-	-	-	-	-
Model 6: Sampling method						
Random sampling (RC)	0.126 (-0.059, 0.310)	1.428			0.170	F(1, 18) = 1.811,
Convenient sampling	0.269 (0.144, 0.394)	4.512	0.143 (-0.080, 0.366)	1.346	0.195	p= 0.195
Model 7: Sample characteristics						
Prisoners (RC)	-	-	-	-	-	-
Ex-prisoners	-	-	-	-	-	-
Model 8: Age						
Adolescents (RC)	-	-	-	-	-	-
Adults	-	-	-	-	-	-
Mixed of adults and adolescents						
Model 9: Sex						
Female Sex (RC)	-	-	-	-	-	-
Male Sex	-	-	-	-	-	-
Model 10: Study design						
Longitudinal (RC)	-	-	-	-	-	-
Cross-sectional	-	-	-	-	-	-

Note. Analyses were run in studies which included ex-prisoners only. The Fisher's *Zr* between study-wise predictor and outcome variables was the dependent variable in the multilevel moderator models. The moderators were analyzed as categorical covariates as appropriate. β_0 =intercept/mean effect size (r); t_0=difference in mean *r* with zero; β_1 =estimated regression coefficient; t_1= difference in mean *r* with reference category; F(*df1*,*df2*) = omnibus test; (RC) = reference category. Table can be found in Liu, Li, Liang, & Hou (2021).

Mediator analyses

Three types of coping processes/resources were identified after extracting all coping-related variables, namely cognitive coping, emotional coping, and social support Appendix B3 listed measurements of coping. TSSEM was used to test the mediating effects of the three identified types of coping in the association between trauma and mental disorders. In the first step of the TSSEM analyses, the pooled correlation matrices were obtained for each mediation model using random effects modeling. Random effects models were preferred over the fixed-effects models as indicated by the significant Q-statistics for all models (Cheung, 2013). In the second step, the pooled correlation matrices based on the random effects models were used to fit all structural equation modeling (SEM) models. The goodness-of-fit indices were considered adequate (Jak, 2015; Schermelleh-Engel et al., 2003). Tables 2-9 and Table 2-10 presented parameter estimates for the paths of all saturated model with both direct and indirect effects.

Table 2-9 MetaSEM (group by trauma)

					IV to DV			Mediator to DV			IV to Mediator			Indirect effect			
(IV) Trauma	**(MV) Coping variables**	**(DV) Mental disorders**	k	N	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper	
(Time of trauma)																	
Childhood trauma	Social support	Aggregate	52	520	0.056	0.029	0.083	-0.239	-0.267	-0.210	-0.059	-0.111	-0.007	0.014	0.002	0.027	#
		Anxiety/depressive disorders	41	415	0.053	0.024	0.081	-0.250	-0.282	-0.218	-0.026	-0.076	0.024	0.007	-0.006	0.019	
		Personality disorders	5	415	-0.005	-0.132	0.122	-0.291	-0.414	-0.170	-0.318	-0.431	-0.205	0.093	0.049	0.154	*
	Cognitive coping	Aggregate	56	297	0.194	0.155	0.238	-0.326	-0.366	-0.289	0.093	-0.005	0.191	-0.030	-0.067	0.002	
Imprisonment trauma	Social support	Aggregate	7	421	0.195	-0.016	0.405	-0.253	-0.319	-0.186	-0.032	-0.146	0.083	0.008	-0.023	0.037	
		Anxiety/depressive disorders	7	421	0.195	-0.016	0.405	-0.253	-0.319	-0.186	-0.032	-0.146	0.083	0.008	-0.023	0.037	
Lifetime trauma	Social support	Aggregate	4	1428	0.395	0.279	0.511	-0.191	-0.293	-0.087	-0.248	-0.296	-0.200	0.047	0.022	0.075	#
	Emotional coping	Aggregate	13	819	0.256	0.174	0.338	0.072	-0.010	0.154	0.080	0.034	0.125	0.006	-0.001	0.015	
	Emotional coping	Stress-related disorders	13	819	0.256	0.174	0.338	0.072	-0.010	0.154	0.080	0.034	0.125	0.006	-0.001	0.015	
(Interpersonal trauma)																	
Physical trauma	Social support	Aggregate	16	223	0.040	-0.010	0.088	-0.249	-0.300	-0.197	-0.097	-0.197	0.003	0.024	-0.001	0.051	
	Social support	Anxiety and depressive disorders	14	223	0.047	-0.003	0.097	-0.246	-0.302	-0.190	-0.064	-0.163	0.035	0.016	-0.009	0.042	
Sexual trauma	Social support	Aggregate	13	328	0.038	-0.021	0.098	-0.252	-0.305	-0.199	0.016	-0.125	0.157	-0.004	-0.042	0.032	
	Social support	Anxiety and depressive disorders	11	328	0.038	-0.021	0.098	-0.252	-0.305	-0.199	0.016	-0.125	0.157	-0.004	-0.042	0.032	
Emotional trauma	Social support	Aggregate	16	223	0.027	-0.018	0.071	-0.250	-0.302	-0.199	-0.090	-0.188	0.008	0.022	-0.002	0.049	
	Social support	Anxiety and depressive disorders	14	223	0.027	-0.018	0.071	-0.250	-0.302	-0.199	-0.090	-0.188	0.008	0.022	-0.002	0.049	
(Contextual and mixed trauma)																	
Contextual trauma	Social support	Aggregate	8	526	0.190	0.028	0.351	-0.208	-0.266	-0.151	0.008	-0.048	0.065	-0.002	-0.014	0.010	
	Cognitive coping	Aggregate	29	297	0.224	0.179	0.272	-0.326	-0.378	-0.277	0.083	-0.016	0.181	-0.027	-0.065	0.005	
	Emotional coping	Aggregate	8	152	0.161	0.107	0.216	0.126	0.071	0.181	0.040	-0.016	0.096	0.005	-0.002	0.014	
	Emotional coping	Stress-related disorders	8	152	0.161	0.107	0.216	0.126	0.071	0.181	0.040	-0.016	0.096	0.005	-0.002	0.014	

					IV to DV			Mediator to DV			IV to Mediator			Indirect effect		
(IV) Trauma	**(MV) Coping variables**	**(DV) Mental disorders**	k	N	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper
Mixed	Social support	Aggregate	10	1385	0.269	0.142	0.395	-0.245	-0.330	-0.159	-0.084	-0.225	0.057	0.021	-0.016	0.054
	Social support	Anxiety/depressive disorders	6	613	0.250	0.100	0.400	-0.251	-0.371	-0.130	-0.046	-0.195	0.104	0.011	-0.0313	0.051
	Emotional coping	Aggregate	5	819	0.416	0.309	0.522	-0.027	-0.198	0.143	0.160	0.081	0.239	-0.004	-0.036	0.025
		Stress-related disorders	5	819	0.416	0.309	0.522	-0.027	-0.198	0.143	0.160	0.081	0.239	-0.004	-0.036	0.025

Note. k=number of effect size; N=number of participants; *Full mediation; #Partial mediation. Table can be found in Liu, Li, Liang, & Hou (2021).

Table 2-10 MetaSEM (group by mental disorders/symptoms)

			IV to DV			Mediator to DV			IV to Mediator			Indirect effect		
	k	N	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper
Aggregated mental disorders (DV)														
(Mediator)														
Social support	63	2285	-0.270	-0.379	0.567	-0.295	-0.528	0.057	-0.342	-0.549	0.415	0.101	-0.018	0.231
Cognitive coping	58	964	0.206	0.157	0.257	-0.323	-0.363	-0.287	0.069	-0.030	0.168	-0.022	-0.059	0.009
Emotional coping	13	819	0.256	0.174	0.338	0.072	-0.010	0.154	0.080	0.034	0.125	0.006	-0.001	0.015
Anxiety and depressive disorders ((DV)														
(Mediator)														
Social support	50	836	0.090	0.043	0.138	-0.245	-0.275	-0.216	-0.036	-0.082	0.009	0.009	-0.002	0.020
Emotional coping	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cognitive coping	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stress-related disorders (DV)														
(Mediator)														
Social support	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Emotional coping	13	819	0.256	0.174	0.338	0.072	-0.010	0.154	0.080	0.034	0.125	0.006	-0.001	0.015
Cognitive coping	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Personality disorders (DV)														
(Mediator)														
Social support	5	49	-0.005	-0.132	0.122	-0.291	-0.414	-0.170	-0.318	-0.431	-0.205	0.093	0.049	0.154*
Emotional coping	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cognitive coping	-	-	-	-	-	-	-	-	-	-	-	-	-	-

			IV to DV			Mediator to DV			IV to Mediator			Indirect effect		
	k	N	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper	Estimate	Lower	Upper
Suicide attempt														
(Mediator)														
Social support	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cognitive coping	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Emotional coping	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note. Note. k=number of effect size; N=number of participants; *Full mediation; Studies of inadequate sample sizes and/or effect sizes could not be analyzed by MetaSEM were marked as "-" in the tables. Table can be found in Liu, Li, Liang, & Hou (2021).

Childhood and lifetime trauma

Social support partially mediated the positive association between childhood trauma and mental disorders in aggregate (indirect effect: estimate = 0.014, 95% CI = [0.002, 0.027]). The associations between childhood trauma and personality disorders was fully mediated by social support (indirect effect: estimate = 0.093, 95% CI = [0.049, 0.154]). Social support also partially mediated the positive association between lifetime trauma and mental disorders in aggregate (indirect effect: estimate = 0.047, 95% CI = [0.022, 0.075]).

Interpersonal and mixed trauma

Social support did not mediate the positive associations between interpersonal trauma (physical trauma, sexual trauma, and emotional trauma) and mental disorders. The positive associations of mixed trauma, contextual trauma, and mental disorders were also not mediated by social support. In addition, neither emotional coping nor cognitive coping mediated the association between trauma and mental disorder.

Mental disorders

Furthermore, three coping variables were tested for the mediating effects in the associations between trauma in aggregate and each type of mental disorder. Overall, social support did not mediate the positive association between trauma and mental disorders in aggregate. However, social support fully mediated the associations between trauma and personality disorders (indirect effect: estimate = 0.093, 95% CI = [0.049, 0.154]). Neither cognitive coping nor emotional coping mediated the trauma-disorder associations.

Discussion

Main findings

By adopting life-course perspective, the present study is one of the first meta-analysis to identify trauma exposures at varying life stages and examine the relationships between

different types of trauma and different mental disorders in prisoners/ex-prisoners. Overall, this meta-analysis showed that over half of the effect sizes came from studies of childhood trauma (55.05%), whereas trauma occurring before, during, and after imprisonment were underrepresented (12.12%). There has been a similar amount of research on all types of trauma (i.e., physical trauma, sexual trauma, emotional trauma, contextual trauma, and mixed trauma), with slightly more attention paid to mixed trauma. In general, the trauma–disorder association was stronger for imprisonment trauma than for childhood trauma and pre-imprisonment trauma, as well as for mixed trauma than for physical trauma; moreover, stronger association was also found for stress-related disorders relative to personality disorders, suicide attempts, and suicide-related disorders. The associations between childhood trauma with mental disorders in aggregate and personality disorders were mediated by social support. Social support also mediated the association between lifetime trauma and mental disorders in aggregate. Nevertheless, neither cognitive coping nor emotional coping mediated any associations.

Potential moderators in the relationship between trauma and mental health

In line with previous works, our meta-analysis supported that prisoners/ex-prisoners are more likely to suffer from mental disorders following trauma exposure (Bowen et al., 2018). Particularly, the greater effect sizes of mixed trauma, which indicates poly-victimization as represented by the combination of a variety of trauma types, highlights the importance of considering multiple trauma exposure in explaining mental disorders (Kira et al., 2014). Moreover, similarly to the finding of previous meta-analysis which demonstrated that prison victimization can negatively impact mental health, a stronger effect size of imprisonment trauma is found in the association between mental disorders relative to childhood trauma and pre-imprisonment trauma (Listwan et al., 2010; Piper & Berle, 2019). Prison experience is characterized by deprivation of liberty and security, a punitive

penitentiary environment, and even solitary confinement, with 24% of females and 35% of males reporting physical abuse under such a coercive environment (Blitz et al., 2008; Fazel, Hayes, et al., 2016b). This study highlighted the necessity for correctional facilities to be better equipped to assess and intervene victimization inside prison. Trauma was more strongly associated with stress-related disorders than with suicide attempts, and suicide-related outcomes suggested that traumatic experiences are primarily associated with stress-related disorders while suicide attempts/ideation appears to be a secondary product of the association (Blais & Geiser, 2019). The findings also suggested that prisoners and ex-prisoners with stress-related disorders and trauma histories need to be prioritized for screening, risk factor monitoring, intervention, and relapse prevention (Facer-Irwin et al., 2019).

Trauma and mental disorders are not associated differently between developing countries and developing countries. Previous review study on mental health of prison populations focus on low- and middle-income countries (Baranyi et al., 2019). The present meta-analysis adds to previous work by comprehensively analyzing studies from low-, middle-, and high-income countries and considering the distal influence of trauma on mental disorders. The present findings also highlight the need for more trauma-informed psychosocial assessments and interventions, as well as community support to facilitate ex-prisoners in reintegrating into the community.

Equivocal evidence exists in favor of gender differences in the negative mental health impact of trauma. In some studies, sexual abuse was found to have more detrimental effects on female (Barth et al., 2013; Saxena et al., 2016). Additionally, Muller and Kempes (Muller & Kempes, 2016) found that female offenders are likelier than male ones to experience sexual and physical abuse, and they are also likelier to suffer from borderline personality disorder and depression. Nonetheless, other studies showed that trauma does not relate

differently to mental disorders between genders (Freedman et al., 2002; Gallo et al., 2018; Gavranidou & Rosner, 2003; Guina et al., 2019). Based on evidence from the present meta-analysis, prisoners of both genders are equally susceptible to the negative impacts of trauma experienced during childhood, pre-imprisonment, or imprisonment on mental health. Moreover, the assessment tool (clinical diagnosis vs. self-report instrument) did not moderate the association between trauma and mental disorder, indicating the credibility of self-report instruments as cost-effective assessment tools with comparative accuracy as clinical diagnosis.

Underlying mechanisms in the association between trauma and mental health

Previous research showed that in response to specific events, coping can be flexible, and trauma characteristics might influence the type of coping strategies available (Brooks et al., 2019). An in-depth investigation using TSSEM was conducted on the underlying coping mechanisms of the trauma–mental disorder association. Based on eligible studies, all coping strategies were identified and categorized into cognitive coping, emotional coping, and social support (Carver & Connor-Smith, 2010; Taylor & Stanton, 2007). Trauma has long been considered a predisposing factor to psychopathologies. For instance, prolonged childhood exposure to physical, sexual, and emotional trauma is associated with declined social support, which further relates to worse mental health, particularly during times of stress (Cheong et al., 2017; Sheikh et al., 2016).

Social support as the most important coping process for childhood trauma and lifetime trauma

As evidenced in this study, the key coping process for preventing mental disorders in general or personality disorders is social support, especially among prisoners/ex-prisoners who have experienced childhood trauma and lifetime trauma. Within the current meta-analysis, several types of social support for prisoners were identified, which included visits

by children, telephone contacts with children, perceived social support from others, and support from other inmates and family members (Aday & Dye, 2019; Caravaca-Sánchez et al., 2019; Chapman et al., 2005; Hochstetler et al., 2004; Koskinen, 2016; Krammer et al., 2018; Listwan et al., 2010; Maschi et al., 2014; Peltan & Cellucci, 2011; Poehlmann, 2005; Rowan-Szal et al., 2012; Salem et al., 2019; Skarupski et al., 2016). It is not only the event itself that determines individuals' psychological responses to trauma, but also their personal and interpersonal resources that individuals have for dealing with them (Hobfoll, 1989; Lazarus & Folkman, 1984). For example, people who suffer from community violence have higher odds of developing depression and PTSD in the absence of coping skills and social support (Scarpa et al., 2006, 2012). The adverse psychological impact of trauma was ameliorated in those who possessed high levels of social support, suggesting that social support may be a buffer for trauma (Paterline & Petersen, 1999; Wolff & Caravaca Sánchez, 2019). However, social support was not found to mediate the association between interpersonal trauma and mental disorders. This finding indicated that interpersonal trauma may lead to loss in social support – which victims would otherwise normally receive from the perpetrators or witnesses of the trauma (C. Katz & Field, 2020; Meinck et al., 2016), leaving them unable to get quality social support. Notably, social support fully mediated in the association between trauma and personality disorders. This provides evidence that social support can be used to treat a range of personality disorders in prison (Krammer et al., 2018). Therefore, providing social support for prisoners with active or potential personality disorders is crucial.

Cognitive and emotional coping in prison and post-release settings

Trauma–mental disorder association was not found to be mediated by cognitive and emotional coping. Traumatic reactions can cause emotion dysregulation and altered cognitions (i.e., intrusive thoughts and memories, trauma-induced hallucinations or delusions,

or excessive or inappropriate guilt) (Levin & Hanson, 2020). Among prisoners and ex-prisoners, the mental health benefits of cognitive and emotional coping may be compromised by these trauma-induced maladaptive emotional and cognitive dysfunctions. The non-significant results could also be possibly explained by insufficient correlations among eligible studies. For example, there were not adequate correlations between interpersonal trauma and cognitive/emotional coping to run the TSSEM analysis. Instead, only correlations between contextual trauma and cognitive coping and between contextual and mixed trauma and emotional coping were sufficient for the mediation analysis. Considering this, future trauma studies should provide more evidence of cognitive and emotional coping in response to different types of trauma.

Added value of studying trauma and mental disorders among prisoners

For prisoners and ex-prisoners, studying trauma and mental disorders might also have added value in explaining crime. In criminology, general strain theory and pathway theory are two classical theories that relate trauma and mental health problems to crime. General strain theory focuses on strain occurring at the individual level. The term “strain” refers to adverse life events or persistent stressors that impair people’s ability to meet their goals (Agnew & White, 1992). Crime is likely to result from some strains that expose individuals to criminal models of violence perpetrators and family dysfunction. Previous studies have shown that trauma influences violent crime in a positive way (Baron & Forde, 2020). Pathway theory suggests that as a result of trauma, substance abuse may be used as a self-medicating way of treating trauma-induced mental problems, which subsequently lead to the increased criminal behaviors (Gehring, 2018). However, the current meta-analysis cannot examine the nature of associations between trauma, mental disorders, and crime because of insufficient empirical data on recidivism. Future meta-analytical work addresses the association between trauma, mental health, and crime using longitudinal study design is

encouraged.

Limitations

Several limitations should be considered. First, not all criminal populations were included in the current meta-analysis. In order to provide a more focused review and better inform practice in prison settings, people who were on probation, parolees, on remand, detained for non-criminal reasons, in police custody or forensic psychiatric patients were excluded. Second, ex-prisoners were included in our meta-analysis, which might dilute the findings regarding prisoners, although no differences were found between prisoners and ex-prisoners regarding the trauma exposure–mental disorder association. Deficit knowledge regarding post-imprisonment trauma and mental health was further highlighted, and we advocated for more research and support for ex-prisoners in the community. Third, pre-imprisonment trauma was defined as occurring before the current incarceration, and post-imprisonment trauma was defined as occurring after the incarceration. This definition can be blurred: when prisoners have multiple incarceration histories, the pre-imprisonment trauma that took place before the current imprisonment may also be considered post-imprisonment trauma, with reference to the previous imprisonment(s). Fourth, mental disorders were categorized in accordance with the ICD-11 classification. Evaluating the current findings in light of other classification systems, such as the DSM-5 (American Psychiatric Association, 2013), is imperative. Fifth, imprisonment itself could be a trauma, regardless of the adverse events that might occur during detention. Because of the lack of a validated tool for directly assessing imprisonment trauma, the length of imprisonment was used as a proxy measurement of imprisonment as a trauma in this study. Using this approach might be too simplistic and the construct might not be fully operationalized. Sixth, the potential bidirectional relationship between trauma and coping was not tested, even though previous studies suggested that avoidance coping may contribute to subsequent trauma, and problem-

solving coping could reduce trauma exposure (Jenzer et al., 2020; Najdowski & Ullman, 2011). Seventh, the fact that the association between trauma and mental disorder was strongest for prison trauma may be explained by recall bias, with more recent traumas more likely to be reported. Childhood trauma was most measured by retrospective self-report instrument instead of interview, which can be problematic and not accurately reflect traumatic experience because previous meta-analysis suggested that the agreement between prospective and retrospective measures of childhood maltreatment was poor (Baldwin et al., 2019). Eighth, the vast majority of included studies came from high-income countries (91.23%), which may not reflect prisoners and ex-prisoners from LMICs. Finally, only two longitudinal studies (3.23%) were identified among the 62 eligible studies. Even though trauma was considered as distal predictors of mental disorders, it is also possible that the associations are caused by reverse causality and also potential third factors. The central assumption that trauma precedes mental disorders is difficult to verify, especially when lifetime outcomes are assessed. More cohort longitudinal studies should be conducted to test trauma–mental disorder associations as well as the bidirectional relationship between trauma and coping processes.

Chapter 3: Measuring everyday adaptation after imprisonment: The Post-Release Living Inventory for ex-prisoners (PORLI-ex) (Study 2)

Introduction

Globally, more than 10.77 million people are held in penal institution either as pre-trial detainees/remand prisoners or having been convicted and sentenced . (Fair & Walmsley, 2021). In US, more than 650,000 prisoners are released from prison every year, approximately two-thirds of them will likely be rearrested within three years of release (United States Department of Justice, 2022).

The number of people held in penal institutions worldwide has seen a rapid growth of 24% in the past 20 years, reaching 10.74 million in 2018 (Walmsley, 2018). Globally, around 30 million prisoners are released from prisons every year (DeLisi, 2016). On any given day, the USA incarcerates more of its citizens (2·2 million) and at a higher level (700 per 100 000) than any other country (Wildeman & Wang, 2017). Recent population-representative evidence further suggests that as high as one in every 70 citizens has been imprisoned in Australia (Bebbington et al., 2021). Relative to those without prior imprisonment, ex-prisoners showed increased odds of psychosis, schizophrenia, PTSD, substance dependency, ADHD, personality disorders, and suicide attempts, with the odds of common mental disorders (anxiety, depression, obsessive-compulsive disorder [OCD], etc.) nearly doubling than in the general population (Alan et al., 2011; Bebbington et al., 2021; Spittal et al., 2014; Thomas et al., 2016). Indeed, ex-prisoners' transition back into the community could be more complicated than their adaptation to institutional settings, as ex-prisoners face additional challenges of a lack of continued care by community health services, social exclusion, residential instability after release, unemployment, difficulties reestablishing relationships with family, and inconsistent material support (Bebbington et al., 2021; Chang et al., 2015; Fazel, Hayes, et al., 2016a; Fazel & Baillargeon, 2011; Shinkfield & Graffam, 2009; World

Health Organization, 2019). Release can be considered a point of increased risk of poorer adjustment, which demands effective liaison and coordination between prison mental health services and community services (Bebbington et al., 2021).

With an increasing population of ex-prisoners in the community, post-release psychological adaptation could become a significant public health issue that needs to be addressed by more structured research and evidence-based practices (Fazel & Baillargeon, 2011; Walmsley, 2018). However, comprehensive reviews and population-representative evidence of the psychological adaptation of ex-prisoners are scarce (Liu et al., 2021). Difficulty accessing participants and working with the penal system could have further limited prisoner-related research (Watson & Meulen, 2019).

In the sections that follow, the neglected public health concerns of adaptation to life after imprisonment among ex-prisoners will be illustrated. Modifiable daily routines in accordance with World Health Organization's recommendation of a positive lifestyle for the prison population will be discussed, followed by an explication of the dual role of regularizing daily routines for pathways to resilience and desistance, which are the foci of the current scale development. Existing relevant assessments of daily routines among ex-prisoners will be discussed, and knowledge gaps will be identified.

Adaptation to life after imprisonment

Adaptation to life after imprisonment is a neglected public health concern because of the jurisdiction chasm between ministries of health and ministries of justice. Deterred rehabilitation is positively related to subsequent reoffending behaviors and mental health problems (Cnaan et al., 2008; Fazel & Baillargeon, 2011; Ganapathy, 2018). Recidivism ranges from 20% to 59% among ex-prisoners worldwide, with a two-year rate of 20% in Norway (in 2005), 27% in Iceland (in 2005) and Singapore (in 2011), 36% in the US (2005–2010), and 59% in England and Wales (Fazel & Wolf, 2015). Mental health problems are

also more common among ex-prisoners than among the general population (Bebbington et al., 2021). Empirical evidence of the effect of imprisonment on mental health is equivocal. Given the increasing support for the detrimental impact of incarceration on mental health conditions, a recent matched cohort study comparing national detainees and their matched controls found no statistically significant changes in prevalence rates between pre- and post-detention and there was no differences in the levels of change between detainees and controls (Dirkzwager et al., 2021a; Lambie & Randell, 2013; Porter & DeMarco, 2019; Schnittker & John, 2007). Longitudinal evidence shows that the high psychological distress reported during incarceration can persist after release (Thomas et al., 2016). Psychiatric morbidity, especially bipolar disorders, dysthymia, and major depressive disorder, was found to be more closely related to previous incarceration experiences, leading to functional impairment in multiple dimensions (e.g., self-care activities, mobility, cognition, and social functioning) in former prisoners (Schnittker et al., 2012). A systematic review of the mental health of female ex-prisoners revealed that more than two thirds of women with an incarceration history experience psychiatric symptoms of depression, anxiety, PTSD, OCD, or bipolar disorder (Stanton et al., 2016). Many cohort studies on the mental health status of ex-prisoners have focused on self-harm and suicide, which is a significant cause of the mortality of prisoners after release. The suicide rate is consistently high among ex-prisoners compared with the general population across countries (Binswanger et al., 2007; Borschmann et al., 2017; Gan et al., 2021; Haglund et al., 2014; Pratt et al., 2010; Spittal et al., 2014). Their risk of suicide was also found to be three times higher than that of prisoners who are still incarcerated (Borschmann et al., 2017).

Post-release daily routines

Across literature that highlights different aspects of post-release adaptation, the core theme relates to everyday life experience. Indeed, daily routines are the most observable

behaviors that manifest the success of adaptation. Post-release routines can be influenced by the process of prisonization and multiple post-release stressors.

Prisonization refers to the process of being socialized into the inmate subculture, which highlights oppositional values compared with the norms and values outside the prison. (Clemmer, 1940). For example, some behaviors (e.g., physical aggression, exploitation of sexual relations and money, and hostility toward prison staff) that are deemed unacceptable by law-abiding people are honored by the inmate culture (Anderson, 2008). During prisonization, individuals spend considerable time interacting with other inmates whose lives are characterized by criminal behaviors and belief systems (Anderson, 2008). Research has shown that even inmates with only a few criminal characteristics may undergo pervasive behavior and attitude changes that favor a criminal lifestyle (e.g., illegal drug abuse and highly risky sexual behaviors) (Naderi, 2014; Shlosberg et al., 2018; Walters, 2003). Wheeler articulates the classic U-shaped curve of the intensity of prisonization (Wheeler, 1961). Prisonization is less intensive when prisoners first enter prison, as their behaviors are guided by conventional norms; prisonization becomes more intensive when prisoners are immersed into prison life and accept the inmate subculture. However, prisonization gradually becomes less intensive when prisoners are about to be released, which again reflects conventional norms. The influence of a criminal lifestyle on post-release daily living varies. Decker and Pyrooz (Decker & Pyrooz, 2020) replicated the U-shaped curve of prisonization in a random sample of prisoners who were interviewed preceding their release and followed up 10 months later, showing that there is a decline of activism upon reentry to the community. However, other evidence shows that a criminal lifestyle can persist after release, which leads to a vicious cycle of reoffending (Banse et al., 2013; Walters, 2003). Programs targeted at the criminal lifestyles of released prisoners can significantly reduce the likelihood of reoffending (Walters, 2005).

Another important concept related to routine changes during prisonization is total institution, denoting that all daily activities are regularized by central officials, and residents who are isolated from the wider community are treated alike and expected to perform the same institutional routines (Goffman, 1961). Although total institution carries positive value in establishing healthy routines, it keeps prisoners away from society, hampering their adaptation to post-release daily living (Naderi, 2014). World Health Organization (World Health Organization, 2019) recommends and encourages positive lifestyle changes in prisons as a health-promoting initiative, while it also acknowledges that safe custody with strict security regimes makes it difficult to implement mental health care for prisoners. Everyday life during post-release could be regarded as a more optimal point for enhancing health and preventing reoffending (Chandler et al., 2009). However, upon release, prisoners who have habituated to prison rules confront the mismatch between rigid institutional routines and new patterns of life outside prisons, making it difficult for them to adapt to routine social situations and triggering a sense of insecurity and anxiety (Martin, 2018; McKendy & Ricciardelli, 2021). For example, ex-prisoners could experience difficulties in everyday life tasks, ranging from keeping up with the regular time for meals because of the absence of reminders and shopping in different stores to using mobile technology to search for housing and employment and reconnecting with the community (Western et al., 2015).

Apart from the influence of prisonization featured by a criminal lifestyle and total institution, ex-prisoners' daily living can also be influenced by complex post-release stressors. Based on the life course perspective, release can mark a significant role and status transition from imprisonment to post-imprisonment (Hutchison, 2009). Along with this transition is the change from a regularized, supervised, and structured lifestyle to a potentially irregular and unsupervised one, which could be attributable to the absence of a place of residence, material deprivations, inability to dislodge from gangs or criminals, absence of

marketable skills, and demographics, including age, gender, ethnicity, and social class (Ganapathy, 2018). Unstable housing and unemployment/underemployment have been found to be parts of ex-prisoners' unstructured and irregular daily routines (Ganapathy, 2018). The unemployment rate could be as high as 27% in the US and, on average, 12% across European countries (Couloute & Kopf, 2018; Ramakers et al., 2017). It is also likely for unemployed or underemployed ex-prisoners to relapse to drugs and demonstrate chronic physical and mental disorders (Visher et al., 2011).

Daily routines for desistance and resilience

The implications of disrupted daily routines on adaptation could be understood in terms of both desistance and resilience. Desistance refers to the cessation or decrease in the severity of criminal commission or other antisocial behaviors as a dynamic temporal process (Ezell & Cohen, 2012). The risk–need–responsivity (RNR) model suggests three dynamic factors in offenders' rehabilitation: pro-criminal associates, substance abuse, and maladaptive leisure/recreation (Andrews et al., 2011). Pro-criminal associates refer to friends and acquaintances who model, encourage, and support criminal behaviors and thoughts. Constant interaction with these associates in daily life may increase the risk of recidivism (Sutherland et al., 1992). Substance abuse refers to regular alcohol or drug abuse, which interferes with adaptive behaviors and relationships within the contexts of school, work, and family. Maladaptive leisure/recreation refers to activities that lack prosocial pursuits, an absence of participation in prosocial activities, and poor use of leisure time (Andrews et al., 2000). Daily involvement in substance abuse and pro-criminal leisure activities has been found to predict recidivism among ex-prisoners (Andrews et al., 2011; Håkansson & Berglund, 2012; Stahler et al., 2013).

Whereas pathways to desistance are more relevant to criminal or crime-related behaviors in daily life, pathways to resilience can be explained by regular, adaptive daily

routines that characterize most people's lives. Everyday life contains a multitude of routines and interactions with different people in one's social networks. Drive to thrive (DTT) theory states that psychological resilience can be demonstrated overtime through the maintenance of regular daily routines (Hou et al., 2018). Ongoing stress challenges people's daily routines and leads them to focus more on stress as they struggle to cope with. As a consequence of trauma or chronic stress, daily routines will either be disrupted or terminated as individuals are predisposed to an ecology that prohibits them from engaging in activities they are used to. Primary daily routines refer to behaviors that are necessary for maintaining livelihood and biological needs, such as hygiene, sleep, eating, and home maintenance (Oswald & Wahl, 2005; Prüss et al., 2002), whereas secondary daily routines refer to optional behaviors that are dependent upon motivation and preferences, such as exercising, leisure, social activities, and employment (Borodulin et al., 2016; M. Chen & Pang, 2012).

Another theory that suggests regularizing daily routines for mental health is the social zeitgeber model in psychiatry (Aschoff et al., 1971; Van Tienoven et al., 2014; Wever, 1975). The social zeitgeber model assumes that disturbances in circadian rhythms are essential in the pathophysiology of mood disorders, while circadian rhythms are entrained by both physical and social cues (Aschoff et al., 1971; Van Tienoven et al., 2014; Wever, 1975). Social cues, such as bedtime, contact with other persons, having a meal, going out, working, going to school, doing housework, performing volunteer activities, engaging in child or family care, taking an afternoon nap, and doing physical exercises, can keep circadian rhythms synchronized with the 24-hour cycle when humans become increasingly detached from the natural daylight schedule (Aschoff et al., 1971; Van Tienoven et al., 2014; Wever, 1975). They are directly related to the regulation of ordinary daily routines, such as sleeping habits, mealtimes, work, and leisure, which might or might take place alone or within interpersonal interactions (Monk et al., 1990). Disrupted social cues for daily routines may lead to irregular

circadian rhythms and evoke somatic symptoms that relate to higher odds of mood disorders (Aschoff et al., 1971; Van Tienoven et al., 2014; Wever, 1975). Furthermore, changes in social zeitgeber (e.g., sleeping time, mealtime, and time to go to the office) lead to changes in internal biological rhythms, which further induce somatic symptoms and episodes of mood disorders (Ehlers et al., 1993).

Measuring the daily routines of ex-prisoners

The role of regularized daily routines as the underlying mechanism of psychological resilience in response to different external stressors has been evidenced among representative population samples (Hou, Lee, et al., 2021; F. T. T. Lai et al., 2020). However, previous studies have not addressed the behavioral aspects of adaptation among prisoners, not to mention the understudied ex-prisoner population (Filinson, 2016; Liu et al., 2021; Ricciardelli & Memarpour, 2016). Only a few studies have focused on daily functioning among elderly prisoners (Barry et al., 2020) or prisoners with physical or cognitive disabilities (Barry et al., 2017). Prison activities of daily living (PADL) were developed to measure difficulty levels in basic self-care activities of daily living (ADL) and instrumental ADL, which are more complex and require more physical functioning (S. Katz, 1983; B. A. Williams et al., 2006). PADLs highlights that there are unique daily activities that should be considered within prison settings such as: dropping to the floor for alarms, climbing on/off the top bunk, standing for a head count, and getting to the dining hall for meals. These prison-specific ADLs captures the uniqueness of the institutional, social, and physical environments of prisons. PADLs were developed using the elderly female prisoners for measuring disability in activities of daily living specific to prison (Mofina et al., 2022). Previous research showed that PADL disability increased the likelihood of developing depression one year later (OR = 3.41) and suicidal ideation (Barry et al., 2019; Stoliker et al., 2020). PADLs has several limitations: First, the daily activities it measured were limited to prison settings

and did not directly measure daily activities in response to the post-release stressors. Second, PADLs were more appropriate for measuring health needs of the elderly prisoners who had more severe problems of performing daily activities. Similar to ADL measures, those of PADL do not assess behaviors that directly relate to stress adaptation. Therefore, they do not explain how overt behaviors in everyday life might either predispose ex-prisoners to or protect them against poorer mental health and reoffending in the face of stressors.

The present study

The purpose of the current study is to develop a novel self-report instrument, hereafter referred to as the as Post Release Living Inventory for Ex-prisoners (PORLI-ex), to measure key daily routines that are relevant to desistance and mental health among ex-prisoners in the community. First, items were drafted based on two theoretical frameworks, namely, DTT theory and the RNR model, and panel discussions among criminologists, psychologists, social workers, and community workers, as well as a synthesis of previous studies on adaptation to post-imprisonment. Items were tested and further modified based on the item dimensionality revealed in the exploratory factor analysis (EFA) and the panel discussion on the content validity in each domain (Study 2a). Second, confirmatory factor analysis (CFA) was used to establish the factor structure of the scales based on both the results of the EFA and the relevant theoretical framework (Study 2b). Third, the measurement invariance of the PORLI-ex was examined in demographic categories (age, sex, and ethnicity) to ensure the robustness of the constructed measurement model (Study 2c). Fourth, existing self-report instruments were used to validate the subscales to establish convergent, discriminant, criterion-related, and incremental validity (Study 2d). Three independent samples were used with different instruments to reduce the assessment load on the participants. Study 2a was undertaken with the first sample (n = 309), Study 2b with the second sample (n = 394), and

Study 2c with the third sample (n = 574) in conjunction with the second sample to validate the subscale. The characteristics of the three samples are summarized in Table 3-1.

Table 3-1 Demographic characteristics of the three samples

Characteristics	Sample First N (%)	 Second N (%)	 Third N (%)
N	309	394	574
Age group			
<25	26 (8.5)	39 (9.9)	64 (11.1)
25-29	55 (17.8)	73 (18.5)	99 (17.4)
30-34	70 (22.8)	100 (25.4)	151 (26.3)
35-39	63 (20.4)	64 (16.3)	111 (19.3)
40-44	40 (12.9)	46 (11.5)	64 (11.1)
45-49	22 (7.1)	23 (5.8)	40 (6.9)
50-54	14 (4.5)	23 (5.8)	28 (4.8)
55-59	9 (2.8)	13 (3.3)	9 (1.6)
60-64	7 (2.1)	6 (1.7)	1 (0.2)
65-69	-	2 (0.6)	4 (0.8)
70+	-	3 (0.9)	4 (0.8)
Gender			
Male	188 (60.8)	210 (53.3)	281 (49)
Female	114 (36.9)	170 (43.1)	274 (47.7)
Other	7 (2.3)	14 (3.5)	19 (3.3)
Annual income ($)			
0-19,999	61 (19.8)	99 (25.1)	152 (26.5)
20,000-39,999	81 (26.3)	129 (32.7)	183 (31.9)
40,000-59,999	76 (24.7)	76 (19.3)	120 (20.9)
60,000-79,999	42 (13.6)	48 (12.2)	62 (10.8)
80,000-99,999	24 (7.8)	15 (3.8)	26 (4.5)
100,000-119,999	13 (4.2)	15 (3.8)	7 (1.2)
120,000+	6 (1.9)	6 (1.5)	8 (1.4)
Marital status			
Single	144 (46.8)	189 (48)	275 (47.9)
Married	134 (43.5)	165 (41.9)	230 (40.1)
Divorced	27 (8.8)	38 (9.6)	62 (10.8)
Widowed	3 (1)	2 (0.5)	7 (1.2)
Employment status			
Full-time	202 (65.6)	209 (53)	268 (46.7)

Part-time	37 (12)	45 (11.4)	71 (12.4)
Unemployed	33 (10.7)	72 (18.3)	112 (19.5)
Housewife	8 (2.6)	9 (2.3)	18 (3.1)
Retired	6 (1.9)	7 (1.8)	8 (1.4)
Educational attainment			
Some high school or less	5 (1.6)	9 (2.3)	24 (4.2)
High school diploma or equivalent	45 (14.6)	85 (21.6)	142 (24.7)
Some college	80 (26)	128 (32.5)	212 (36.9)
Two-year college diploma	37 (12)	40 (10.2)	65 (11.3)
Four-year college diploma	105 (34.1)	95 (24.1)	90 (15.7)
Graduate degree (Masters, Doctorate)	36 (11.7)	37 (9.4)	41 (7.1)
Race (Non-mutually exclusive)			
Asian	23 (7.5)	14 (3.6)	22 (3.8)
Black/African American	50 (16.2)	64 (16.2)	92 (16)
White/Caucasian	213 (69.2)	279 (70.8)	428 (74.6)
Latinx	4 (1.3)	5 (1.3)	8 (1.4)
Hispanic	25 (8.1)	32 (8.1)	38 (6.6)
Middle Eastern or North African	0	2 (0.5)	4 (0.7)
Multiracial	11 (3.6)	22 (5.6)	20 (3.5)
Other	2 (0.6)	7 (1.8)	4 (0.7)
Violent index offence			
Yes	73 (23.6)	106 (26.9)	123 (21.4)
No	236 (76.4)	288 (73.1)	451 (78.6)
Length of incarceration			
< 6 months	139 (45)	213 (54.1)	294 (51.2)
6-12 months	89 (28.8)	90 (22.8)	124 (21.6)
12-24 months	46 (14.9)	47 (11.9)	97 (16.9)
>24 months	35 (11.3)	44 (11.2)	59 (10.3)
Time since last release			
0-3 months	11 (3.6)	16 (4.1)	30 (5.2)
4-6 months	24 (7.8)	23 (5.8)	29 (5.1)
6-12months	47 (15.2)	41 (10.4)	71 (12.4)
12-18 months	42 (13.6)	48 (12.2)	70 (12.2)
18-24 months	101 (32.7)	119 (30.2)	163 (28.4)
More than 24 months	84 (27.2)	147 (37.3)	211 (36.8)

Alcohol abuse*			
Yes	108 (35)	152 (38.6)	200 (34.8)
No	201 (65)	242 (61.4)	374 (65.2)
Drug abuse*			
Yes	96 (31.1)	168 (42.6)	259 (45.1)
No	213 (68.9)	226 (57.4)	315 (54.9)
Mental disorders*			
Yes	110 (35.6)	167 (42.4)	257 (44.8)
No	199 (64.4)	227 (57.6)	317 (55.2)

Notes: * previous diagnosis of alcohol abuse, drug abuse, or mental disorders before or during incarceration.

Study 2a: Item Development and Exploratory Factor Analysis

A total of 72 original items were drafted to address the daily activities of ex-prisoners in terms of primary and secondary routines (Appendix G and H summarize the drafted items and the theoretical basis). The drafted items were reviewed by an expert panel, in which less relevant items were removed, and wordings were modified and polished through discussion among panel members. The mean scores of the expert ratings are summarized in Appendix I. A pool of 53 draft items were analyzed: institutional routines (4 items), physical activities (3 items), online leisure activities (5 items), socializing with social partners (14 items), maladaptive behaviors (10 items), bad leisure (3 items), religious activities (3 items), work involvement (6 items), and seeking tangible social support (5 items). The instruction read as follows: "We are interested in how regularly you do the following things normally every day. Please rate how **REGULARLY** you have done the following activities every day in the past two weeks." The participants rated each item on an 11-point scale (0 = *not at all regular*, 5 = *moderately regular*, 10 = *very much regular*). The response format was designed based on previously validated self-report instruments that assess the regularity of daily activities (Hou et al., 2019; Hou, Lee, et al., 2021; Monk et al., 2002).

Method

Participants and procedures. This study was conducted using Amazon.com's Mechanical Turk (MTurk) service to collect crowdsourced samples in the US. Previous studies have evidenced the validity, representativeness, and reliability of data derived from MTurk participants (Buhrmester et al., 2011; Casler et al., 2013; Ramsey et al., 2016). Sampling frames of MTurk is based on its labour workforce with a participants pool of more than 500,000 individuals from 190 countries and mostly in US. A comparison study of sampling frame of MTruk and census estimates of national population found that MTurk provided sample demographics that are typically within 10% range of US population

equivalents (Heen et al., 2014). The study was advertised on MTurk as “Post-release daily routines among ex-prisoners” and limited to participants from the US only. The survey consisted of self-reported incarceration history, demographic information, and draft items for the PORLI-ex. Advice on reducing fraud for special populations on MTurk was followed (Kyprianides et al., 2019). First, a pre-screening criterion to constrain each potential respondent to complete the survey just once was set. Second, a separate screener survey was set asking, “Do you have a criminal record (i.e., convicted of a felony) recorded against your name?” and “Have you ever been incarcerated (i.e., spent at least 24 hours in a jail, a prison, or correctional facility)?” (Kyprianides et al., 2019). Only participants who answered yes to both questions were considered eligible and proceeded to participate in this study with a payment of US$1.20. Ineligible participants were directed to terminate the survey. The self-reported method of imprisonment history is broadly used in epidemiological studies (Bebbington et al., 2021; Brewer et al., 2014; Coleman et al., 2021; Kulkarni et al., 2010; Walker et al., 2014; Wang & Green, 2010). Study 2a was conducted among 309 participants (188 males, 114 females, seven others) with a mean age of 35.95 years (*SD* = 11.17, range = 21–64) (Table 3-1). Each MTurk Worker ID was restricted to join only one data collection to avoid multiple participations. The ratio of the sample size to the number of items involved in the factor analysis was more than five (Osborne & Costello, 2004).

Analytic plan. EFA with direct oblimin rotation was performed on 53 draft items after the expert panel discussion. The Kaiser–Meyer–Olkin (KMO) index and Bartlett’s test of sphericity were used to test the factorability of the item correlation matrix (Tabachnick et al., 2007). Communality values revealed a relationship between item variance and the factors. A combination of latent root criteria (eigenvalues > 1.0) and scree plot was used to determine the optimal number of factors. The appropriateness of including an item in the factor was

determined based on inter-factor correlations, inter-item correlations within a factor, and cross-loading.

Results

The KMO index (.916) and Bartlett's test (χ^2 = 12,339.873, *df* = 1,378, $p < .0001$) indicated that the sample size was adequate and that the extracted factors accounted for substantial observed variance. A satisfactory to large percentage of item variance was predicted by the latent factors, as suggested by the communality values (range = .317 to .866). The latent root criterion suggested an 11-factor model (62.530% of the total observed variance). A noticeable difference in slope was observed after the second and fifth eigenvalues, as shown in the scree plot. Three items, "I hang out with companions whom I have known before imprisonment," "I visit my child," and "I go to school," were not loaded on any factors. Another four items, "I visit friends who are law-abiding individuals" (r = .336 to .396), "I talk with community care professionals (e.g., social workers) about my financial/living issues" (r = .392 to .527), "I share my feelings and my recent life with social workers" (r = .355 to .507), and "I do voluntary work in my spare time" (r = .338 to 377), demonstrated similar cross-loadings. The item "I visit my family members" was not loaded on any factor. Subsequent analyses excluded these eight items.

Factor analysis with direct oblimin rotation was performed on the remaining 45 items (Appendix J). A nine-factor model was specified. The KMO index (.911) and Bartlett's test (χ2 = 10300.092, *df* = 990, $p < 0.001$) indicated that the sample size was adequate and that the extracted factors accounted for substantial observed variance. A satisfactory to large proportion of item variance was predicted by the underlying factors, as suggested by the communality values (range = .221 to .886). The latent root criterion suggested a nine-factor model (62.117% of the total observed variance). A noticeable difference in slope was observed after the ninth eigenvalue, as shown in the scree plot. Factor 1, Socializing with Ex-

prisoner Friends, consisted of six items on socializing activities with friends met at the rehabilitation center or during incarceration or visiting those who were still in prison or released drug addicts (31.135%). Factor 2, Active Living, consisted of five items on exercising and being active (9.467%). Factor 3, Online Leisure, consisted of five items on online leisure activities, such as using social media to read news, play online games, or interact with friends (5.059%). Factor 4, Institutional Routines, contained four items that described sustaining personal hygiene, eating/diet/sleep schedule, and exercising, which were practiced during the prior incarceration (3.949%). Factor 5, Maladaptive Behaviors, contained 10 items on gang involvement, substance abuse, prostitution, and gambling (3.773%). Factor 6, Religious Engagement, consisted of three items on religious activities (2.999%). Factor 7, Seeking Professional Support, contained five items on seeking support from community service professionals for resolving physical, housing, work, or financial problems or for following strict parole and probation requirements (2.295%). Factor 8, Work Involvement, contained four items that described work-related behaviors or performance (2.010%). Factor 9, Nonactivity, contained three items that described non-purposive and non-productive behaviors, such as “I lie down and do nothing,” “I do not stay at home alone because it makes me think a lot about my past experiences,” and “I wander around aimlessly” (1.429%). The following validation phases included these 45 items. The factor loadings and the full scale are listed in Appendix J and K.

Study 2b: Confirmatory Factor Analysis

Study 2b tested the factor structure of the 45 items identified in the EFA. The PORLI-ex can be categorized into nine routines. How these routines reflected daily adaptation in post-imprisonment could be understood through the lens of DTT theory. DTT theory assumes that resilience is achieved by sustaining the routines of everyday life. Three core behaviors—consolidation, replacement, and addition—were suggested for sustaining daily routines (Hou,

Liang, et al., 2021). This factorial structure, as stated in the Sustaining Everyday Life Fabrics and Structure (SELFS) model, guided subsequent phases of the validation process (Hou et al., 2018). These three processes are sequential in sustaining everyday life routines and structures. People begin by consolidating existing routines. While they do so, some other routines need to be given up simultaneously. After that, people try to replace the terminated routines with similar alternative routines. They then add new routines to complete their everyday life structures. Consolidation and addition could be proactive or reactive and ongoing procedures that occur during stress adaptation and before and after routine disruption. Replacement is reactive because it occurs after routine disruption and when consolidation does not function for particular routines (Hou et al., 2018).

Nine dimensions identified in Study 2a can fit into each of the second-order factors by closely examining the life changes in the transition from incarceration to post-release in the community. Institutional Routines, Active Living, and Work Involvement are all well-established adaptive routines during imprisonment that should be consolidated during post-release. Institutional routines are a set of existing regularized routines, including personal hygiene, eating/diet/sleep schedule, and exercise, which are strictly scheduled inside the prison (Ricciardelli & Memarpour, 2016). Maladaptive Behaviors and Nonactivity could be understood as maladaptive routines that replace institutional routines. Maladaptive Behaviors consist of a set of daily routines related to delinquency or previous patterns of high-risk behaviors, such as taking drugs, participating in gang activities, gambling, smoking, using sexual services, working as sex workers, and drinking alcohol (Fazel & Baillargeon, 2011; Kinner, 2006). These behaviors are prohibited in prison settings, but upon release from incarceration, ex-prisoners are exposed to environmental cues for practicing them again (Chandler et al., 2009). Nonactivity involves three non-productive and aimless routines: lying down and doing nothing, wandering around aimlessly, and avoiding staying at home. These

three sets of behaviors could be regarded as maladaptive replacements of institutional routines that should be targeted in the rehabilitation progress for ex-prisoners.

According to the SELFS model, some routines are disrupted or terminated, so new ones need to be added to complete the everyday life structure. Four dimensions of routines do not exist in prison settings and are additional to post-release life: Socializing with Ex-prisoner Friends, Online Leisure, Religious Engagement, and Seeking Professional Support. Associated with Online Leisure is the use of the internet or mobile devices, which is prohibited in prison settings, and adaptation to the digital world would be common and serve different functions, such as entertainment and utilization of social services (Western et al., 2015). For Socializing with Ex-prisoner Friends, they may participate in services and activities organized by community support groups or keep in touch with ex-prisoner friends made during imprisonment or who are still drug addicts. Religious Engagement could be restrictive in prison settings, making it difficult for prisoners to receive spiritual and social support from religious groups (Morag & Teman, 2018). Therefore, post-release religious engagement can be considered an additional routine. Seeking Professional Support is typically new, especially for those who were recently released, because they face a range of stressors related to housing, work, financial issues, health issues, and relationships in the transition from incarceration to community life.

Method

Participants and procedures. A total of 394 participants with a self-reported incarceration history (210 males, 170 females, 14 other), aged 35.91 years on average (*SD* = 10.34, range = 19–89), completed the measures and received US$3.00 for their participation in MTurk (see Table 3-1 for the sample's characteristics).

Analytic plan. CFA was conducted using the R package 'lavaan'(Rosseel, 2012). With the use of the diagonal weighted least square estimator, the model with items loaded on

the nine dimensions identified in the EFA and three second-order latent constructs was specified: Consolidation (Institutional Routines, Active Living, Work Involvement), Replacement (Maladaptive Behaviors, Nonactivity), and Addition (Socializing with Ex-prisoner Friends, Online Leisure, Religious Engagement, Seeking Professional Support). For comparison, the alternative model was tested with all nine dimensions loaded on the same second-order construct. Goodness-of-fit was assessed using the root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), comparative fit index (CFI), and Tucker–Lewis index (TLI). The model was accepted if the RMSEA and SRMR ≤ .08 and if the CFI and TLI > .90 (Bentler & Bonett, 1980). Pearson correlation coefficients indicated interrelationships among the subscale scores, and Cronbach's α indicated the internal consistency of each subscale.

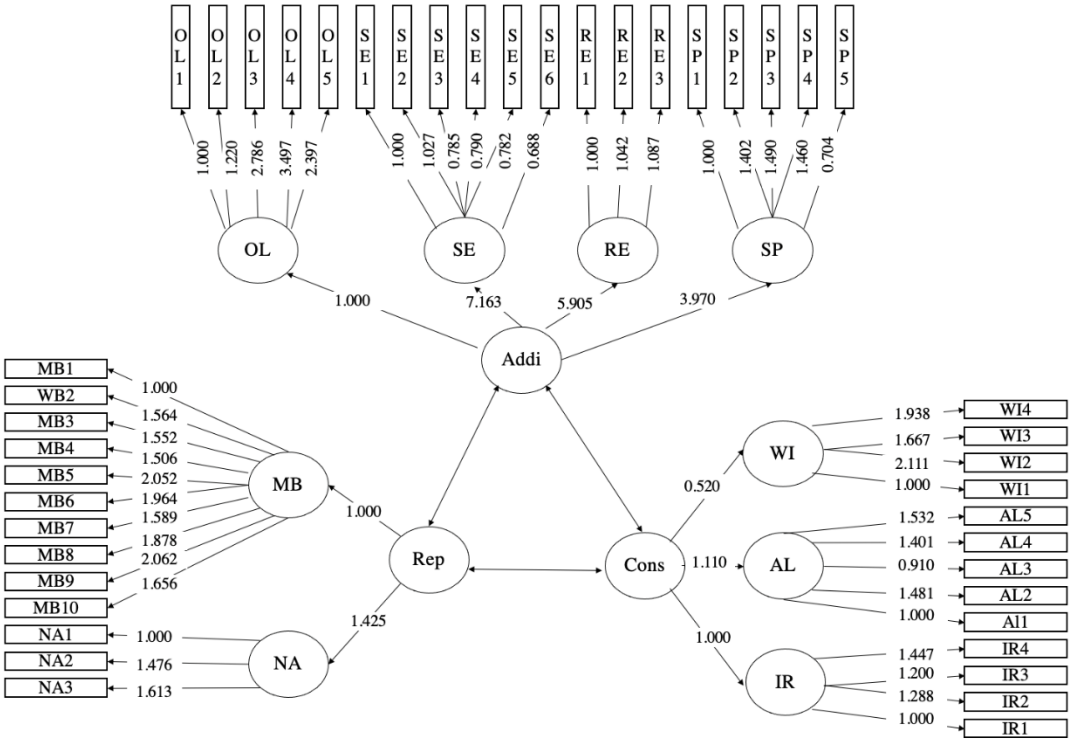
Results

Three second-order latent constructs achieved acceptable goodness-of-fit, χ^2(*df*, *p*-value) = 2491.988 (930, < 0.001), RMSEA = .065 (95% CI [0.062, 0.068]), SRMR = .08, CFI = .923, and TLI = .919, which outperformed the alternative model with one second-order construct, χ^2(*df*, *p*-value) = 23455.031 (990 < 0.001), RMSEA = .077 (95% CI [0.075, 0.080]), SRMR = .094, CFI = .895, and TLI = .888. The results demonstrated significant estimated parameters, and the loadings were reasonably strong. Therefore, the proposed three-construct model derived from the SELFS model was used as the optimal model (shown in Figure 3-1). The estimated parameters of the one-construct model are summarized in Appendix L. The correlations between the average scores of the subscales and their Cronbach's alphas are shown in Table 3-2. All subscales demonstrated good internal consistency (≥. 70).

Table 3-2 Pearson correlation matrix of the average scores of PORLI-ex subscales in Study 2b subscale

Subscale		M	*SD*	Cronbach α	1	2	3	4	5	6	7	8	9	10
1	Socializing with Ex-prisoner Friends	2.033	2.359	0.915	1									
2	Active Living	5.018	2.381	0.843	.387**	1								
3	Online Leisure	6.395	2.128	0.749	.166**	.290**	1							
4	Institutional Routines	5.357	2.822	0.874	.317**	.476**	.146**	1						
5	Religious Engagement	2.436	2.984	0.938	.499**	.444**	.184**	.266**	1					
6	Seeking Professional Support	2.978	2.314	0.786	.536**	.284**	.234**	.272**	.462**	1				
7	Work Involvement	5.041	2.432	0.730	.145**	.410**	.306**	.259**	.218**	.188**	1			
8	Nonactivity	2.833	2.245	0.695	.469**	0.012	.210**	0.096	.250**	.346**	0.004	1		
9	Maladaptive Behaviors	2.087	1.875	0.838	.502**	0.078	.212**	0.095	.192**	.277**	.113*	.547**	1	
10	Total score	5.193	1.041	0.820	.504**	.759**	.428**	.611**	.607**	.566**	.530**	-0.013	-.108*	1

Note. PORLI-ex=Post Release Living Inventory for Ex-prisoners. Maladaptive Behaviors and Nonactivity were reverse coded when calculating total score of PORLI-ex. Correlation is significant at the 0.01 level (2-tailed). Correlation is significant at the 0.05 level (2-tailed).



Notes. IR=Institutional Routines; AL=Active Living; WI=Work Involvement; MB=Maladaptive Behaviors; NA=Nonactivity SE=Socializing with Ex-prisoner Friends; OL=Online Leisure; RE=Religious Engagement; SP=Seeking Professional Support; Cons=Consolidation; Rep=Replacement; Addi=Addition

Figure 3-1 Final model generated from the confirmatory factor analysis with standardized coefficients

Study 2c: Measurement Invariance

Study 2c assessed the measurement invariance of the PORLI-ex across age, gender, and racial groups after the measurement model was established in Study 2b.

Method

Participants and procedures. A total of 574 participants (281 males, 274 females, 19 others) with a mean age of 35.11 years (*SD* = 9.32, range = 17–82) completed the measures on MTurk and were compensated for US$3.00.

Analytic plan. Model invariance was assessed using χ^2 tests to compare models with and without equality constraints on the estimated parameters and with the value changes in the SRMR, CFI, and RMSEA. Models were compared between age groups (17–33 vs. median age of 34 or older), gender (women vs. men), racial groups (non-White or White), length of incarceration (<6 months vs. ≥6 months), and time since last release (<12 months vs ≥12 months). Previous evidence suggested that these variables are potentially related with post-release adaptation in different ways. Age of prisoners were positively related to psychological health and inversely related to risk of reoffending (Piquero et al., 2015; Shinkfield & Graffam, 2010). Post-release adaptation also varied between genders and race, with women and those from ethnic minority groups exhibiting poorer emotional and social adjustment (Lockwood et al., 2015; Pettus-Davis et al., 2018). Longer incarceration was found to be positively associated with poorer mental health (Porter & DeMarco, 2019) and occupational outcomes (Ramakers et al., 2014). Post-release programs were found to increase the employment outcomes in the short term, but the effects diminished with time (Cale et al., 2019). Ex-prisoners' earnings per week were also found to decline with time since release (Graffam & Shinkfield, 2012). Small changes in the SRMR, CFI, and RMSEA indicated model invariance, whereas a significant χ^2 test revealed the potential heterogeneity of the model across groups (F. F. Chen, 2007). To determine model invariance, we used the size of

the change criteria of the SRMR, CFI, and RMSEA in cases of significant χ^2 test results because χ^2 tests are sensitive to sample size and may wrongly reject invariance (F. F. Chen, 2007). The invariance of loadings, intercepts, and means of the model was examined. For testing loading invariance, a change of $\geq$ .010 in the CFI, supplemented by a change of $\geq$ .015 in the RMSEA or a change of $\geq$ .030 in the SRMR indicated non-invariance. Intercept and mean non-invariance was tested by a change of $\geq$.010 in the CFI, a change of $\geq$.015 in the RMSEA, or a change of $\geq$.010 in the SRMR (F. F. Chen, 2007).

Results

Table 3-3 shows that for all three stratifications, the χ^2 test ($p < .001$) and other indicators of model invariance all rejected model invariance. Therefore, changes in the SRMR, CFI, and RMSEA were examined with the equality constraints on loadings, intercepts, and means, all of which were below the thresholds of non-invariance. Model invariance across age, gender, race, length of incarceration, and time since last release was confirmed.

Table 3-3 Tests for measurement invariance in Study 2c

Model	Model $\chi 2$ (*df*)	$\chi 2$ diff. test (df), *p*	SRMR	CFI	RMSEA	ΔSRMR	ΔCFI	ΔRMSEA
Age (17-33 and 34+)								
Configural	4884.8(1860)		0.088	0.794	0.075			
Metric	4939.4(1902)	54.527(42),0.093	0.089	0.793	0.075	0.001	0.001	0.001
Scalar	5041.3(1935)	101.965(33), <.001	0.089	0.789	0.075	0	0.005	0
Means	5091.4(1947)	50.08(12), <.001	0.09	0.786	0.075	0.001	0.003	0
Gender (female and male)								
Configural	4751.7(1860)		0.089	0.801	0.074			
Metric	4839.4(1902)	87.632(42), <.001	0.09	0.798	0.074	0.001	0.003	0
Scalar	5017(1935)	177.656(33), <.001	0.092	0.788	0.075	0.001	0.01	0.001
Means	5070.8(1947)	53.744(12), <.001	0.093	0.785	0.075	0.001	0.003	0
Race (non-white and white)								
Configural	4893.4(1860)		0.088	0.795	0.075			
Metric	4980.7(1902)	87.332(42), <.001	0.090	0.792	0.075	0.001	0.003	0
Scalar	5057.5(1935)	76.818(33), <.001	0.090	0.789	0.075	0	0.003	0
Means	5070.5(1947)	12.967(12),0.371	0.091	0.789	0.075	0.001	0	0
Length of incarceration (<6 months and ≥6 months)								
Configural	4872.9(1860)		0.090	0.791	0.075			
Metric	4935.6(1902)	62.668(42),0.021	0.091	0.789	0.075	0.001	0.001	0.001
Scalar	4976.3(1935)	40.709(33),0.167	0.091	0.789	0.074	0	0.001	0.001
Means	5001(1947)	24.743(12),0.016	0.094	0.788	0.074	0.002	0.001	0

Time since last release (<12 months and ≥12 months								
Configural	4976.2(1860)		0.088	0.784	0.076			
Metric	5064.1(1902)	87.928(42),<.001	0.091	0.781	0.076	0.003	0.003	0
Scalar	5121.1(1935)	57.016(33),0.006	0.091	0.779	0.076	0	0.002	0
Means	5161.2(1947)	40.111(12), <.001	0.095	0.777	0.076	0.004	0.002	0

CFI=comparative fix index; RMSEA=root mean square error of approximation; SRMR=standardized root mean square residual. Configural: testing whether the factor structure is the same across groups; Loadings: testing whether the factor loadings (from items to constructs and from constructs to higher-order constructs) are similar across groups; Intercepts: testing whether model intercepts are also equivalent across groups; Means: testing whether values/means are also equivalent across groups.

Study 2d: Scale Validity

In Study 2d, the convergent validity, discriminant validity, criterion-related validity, and incremental validity of the PORLI-ex were assessed based on correlations with other self-report variables. Theoretically coherent and unrelated variables to the scale were chosen to test the different dimensions of the measurement scale validity of the PORLI-ex.

Method

Participants and procedures. The participants in both Studies 2b and 2c also completed different validation instruments and were included as the validation sample of Study 2d to reduce the survey response burden.

Analytic plan. The convergent validity of the PORLI-ex was measured by zero-order correlations between the total and subscale scores of the PORLI-ex and theoretically related concepts. Scores on the two maladaptive routines, Maladaptive Behaviors and Nonactivity, were reverse coded when calculating the total score, higher scores indicating *less* regular *maladaptive* routines. Validated instruments of everyday life experiences and coping resources included the Lawton Instrumental Activities of Daily Living (IADL) Scale (Lawton & Brody, 1969), the Sustainability of Living Inventory (SOLI) (Hou et al., 2019), the Meaning in Life Questionnaire (Steger et al., 2006), the General Self-Efficacy Scale (Romppel et al., 2013), and the Multidimensional Scale of Perceived Social Support (Zimet et al., 1988). It is hypothesized that the PORLI-ex full scale and subscale scores are positively correlated with ADL, regularity of daily routines, meaning in life, self-efficacy, and perceived social support, except that the correlations are opposite for Maladaptive Behaviors and Nonactivity subscale scores.

Discriminant validity was assessed using the correlations between the PORLI-ex and measures of lifetime trauma. Trauma measures are selected as evidence of discriminant validity because measures of lifetime trauma or significant stressors could be remote and

have a weak relationship with the current evaluation of daily routines (Hou et al., 2018, 2020). Attitudes toward the social and personal costs of punishment could also be unrelated to current daily routines because the cost of punishment is not salient or relevant during post-release (Morenoff & Harding, 2014). A validated measure of potential traumatic events (Life Events Checklist for DSM–5) (Weathers et al., 2013) and measurements of the perceived social and personal costs of punishment (Mulvey et al., 2004; Schubert et al., 2004) were used. It is expected that the measurement of the regularity of routines is weakly correlated or uncorrelated with measures of lifetime trauma and attitudes toward the social and personal costs of crime.

Criterion-related validity was evaluated with the correlations between the PORLI-ex subscales and a commonly used instrument measuring psychological resilience and desistance. Mental health outcomes included anxiety symptoms measured with the seven-item Generalized Anxiety Disorder Scale (Spitzer et al., 2006), depressive symptoms measured with the Patient Health Questionnaire (Kroenke et al., 2001), and PTSD symptoms measured with the abbreviated PTSD Checklist—Civilian Version (Lang & Stein, 2005). Desistance-related outcomes included reoffending, measured with Self-Reported Offending (SRO) (Huizinga et al., 1991); risk of criminal offending, measured with the Hare Psychopathy Checklist Revised (Hare, 2003); risk of violence reoffending in the first and second year, measured with OxRec (Fazel, Chang, et al., 2016); and severity of substance abuse, measured with the 20-item Drug Abuse Screening Test (Yudko et al., 2007). It is expected that the PORLI-ex scores are inversely correlated with psychiatric symptoms and crime or drug-related outcomes.

Finally, incremental validity was assessed using the predictive utility of the PORLI-ex in psychological resilience and desistance after controlling for the effects of other relevant variables. Hierarchical multiple regressions were used to test the correlations of the PORLI-

ex scores with the outcome scores, with the effects of ADL, regularity of daily routines, meaning in life, self-efficacy, and perceived social support controlled for. It is expected that the PORLI-ex scores are correlated with the outcome variables, independent of the effects of the related constructs.

Results

Convergent validity. Table 3-4 summarizes the results for convergent, discriminant, and criterion-related validity. ADL scores were moderately inversely correlated with subscale scores on Maladaptive Behaviors (−.31), Nonactivity (−.35), and Socializing with Ex-prisoner Friends (−.34). Regularity of primary daily routines was positively correlated with Institutional Routines (.22) and Active Living (.22), whereas secondary routines were moderately positively correlated with the PORLI-ex total scores (.32) and subscale scores on Institutional Routines (.23), Active Living (.33), and Work Involvement (.23). Meaning in life was positively correlated with total scores (.28) and subscale scores on Active Living (.25) and Work Involvement (.26). Self-efficacy was positively correlated with subscale scores on Work Involvement (.25). Perceived social support was moderately positively correlated with total scores (.44) and subscale scores on Active Living (.38), Work Involvement (.35), and Online Leisure (.25).

Discriminant validity. The total and subscale scores of the PORLI-ex were weakly or uncorrelated with different measures of traumatic life events (happened, witnessed, or learned about) (−.18 to .11). Scores on the perceived social cost of punishment (−.11) and perceived personal cost of punishment (.12 to .16) were uncorrelated or weakly correlated with the total scores and all subscales of the PORLI-ex.

Criterion-related validity. Subscale scores on Maladaptive Behaviors (.38 to .39) and Nonactivity (.45 to .50) were moderately correlated with higher levels of anxiety symptoms, depressive symptoms, and PTSD symptoms. All crime- or drug-related outcomes were

moderately positively correlated with Maladaptive Behaviors (.29 to .51), Nonactivity (.23 to .46), and Socializing with Ex-prisoner Friends (.21 to .32). Active Living was inversely correlated with depressive symptoms (−.26), whereas Socializing with Ex-prisoner Friends was positively correlated with PTSD symptoms.

Incremental validity. Table 3-5 summarizes the correlations between the PORLI-ex's subscales and outcomes after controlling for the effect of theoretically or conceptually related outcomes, namely, ADL, regularity of daily routines, and coping resources of meaning in life, self-efficacy, and perceived social support. Each related variable was tested one at a time. The scores on Maladaptive Behaviors were positively associated with all symptoms, self-report/risk of reoffending, and severity of substance abuse, controlling for the effects of daily functioning and coping resources. The scores for Active Living were inversely associated with all symptoms, some measures of reoffending, and the severity of substance abuse independent of daily functioning and coping resources, whereas Nonactivity and Seeking Professional Support were positively associated with them. Work Involvement was inversely associated with symptoms independent of regular routines, meaning in life, and self-efficacy, whereas Online Leisure was positively associated with them. Institutional Routines, Socializing with Ex-prisoner Friends, and Religious Engagement were inversely albeit weakly associated with some measures of reoffending and severity of substance abuse, controlling for daily functioning and/or coping resources.

Table 3-4 Pearson correlations between PORLI-ex subscales and other self-reported instruments in Study 2d

Variables	Sample size	Subscales: Institutional Routines	Active Living	Work Involvement	Maladaptive Behaviors	Nonactivity	Socializing with Ex-prisoner Friends	Online Leisure	Religious Engagement	Seeking Professional Support	Total
Convergent validity											
Difficulty in activities of daily living	394	0.018	0.051	.195**	-.306**	-.350**	-.335**	0.019	-0.094	-.153**	0.078
Regularity of daily routines: Primary	968	.224**	.219**	.156**	-0.041	-.074*	0.036	.109**	.103**	0.056	.242**
Regularity of daily routines: Secondary	968	.232**	.327**	.226**	0.014	-0.027	.120**	.168**	.160**	.103**	.319**
Meaning in Life	574	.136**	.252**	.259**	-0.076	-0.071	-0.01	.155**	.118**	.104*	.279**
General Self-Efficacy	574	0.079	.182**	.246**	-0.023	-.115**	-0.037	.099*	0.003	-0.063	.143**
Perceived Social Support	574	.193**	.380**	.350**	-.089*	-.090*	.106*	.246**	.212**	.139**	.437**
Discriminant validity											
Potential traumatic events: happened	968	-.162**	-.164**	-0.04	-0.004	0.003	-.151**	0.018	-.168**	-0.058	-.177**
Potential traumatic events: witnessed	968	-0.021	.064*	0.045	.094**	.112**	0.054	0.023	.069*	0.048	0.014

Potential traumatic events: learned	968	-0.035	-0.015	0.001	0.022	.073*	0.014	0.017	-0.011	0.055	-0.012
Perceived social cost of punishment	394	0.065	0.012	0.089	-0.023	-0.016	-.112*	-0.019	-0.024	0.059	0.021
Perceived personal cost of punishment	394	-0.08	0.015	.117*	0.075	0.019	-0.058	.161**	-0.012	0.094	0.016
Criterion-related validity											
Psychiatric symptoms (Resilience)											
Anxiety symptoms	968	-.065*	-.191**	-.126**	.383**	.452**	.163**	.119**	-0.025	.140**	-.203**
Depressive symptoms	968	-.094**	-.257**	-.188**	.383**	.475**	.174**	.083*	-0.017	.144**	-.247**
PTSD symptoms	968	0.03	-.082*	-.084**	.385**	.501**	.257**	.156**	.076*	.222**	-.074*
Crime or drug related outcomes (Desistance)											
Self-reported offending: violent	968	.088**	.106**	0.026	.396**	.323**	.246**	0.055	.171**	.153**	0.007
Self-reported offending: non-violent	968	0.013	0.035	-0.01	.423**	.292**	.206**	.063*	0.029	.074*	-.101**
Risk of criminal offending	968	0.046	-0.032	-0.051	.508**	.455**	.321**	.109**	.089**	.161**	-.098**
Risk of violence reoffending: 1st year	854	.108**	0.047	-.115**	.300**	.238**	.212**	0.019	0.031	.101**	-0.042
Risk of violence	854	.106**	0.043	-.108**	.292**	.232**	.206**	0.022	0.03	.095**	-0.041

reoffending: 2nd year										
Severity of substance abuse	968	-0.054	-.069*	-0.045	.470**	.301**	.225**	0.022	-0.026	.106**	-.177**

Note. * $p<.05$, ** $p<.0$

Table 3-5 Incremental validity of PORLI-ex subscales in predicting outcomes in Study 2d

Controlled variables	Sample size	Regularity of post-release routines	Anxiety symptoms, β	Depressive symptoms, β	PTSD symptoms, β	Self-reported offending: violent, β	Self-reported offending: non-violent, β	Risk of criminal offending, β	Risk of violence reoffending: 1st year, β	Risk of violence reoffending: 2nd year, β	Severity of substance abuse, β
IADL	394	Institutional Routines	-0.071	-0.054	-0.012	-0.035	-0.057	0.011	0.089	0.086	-0.049
	394	Active Living	-0.149**	-0.269**	-0.113*	0.081	0.022	-0.121*	-0.007	-0.01	-0.114
	394	Work Involvement	-0.067	-0.103*	-0.079	-0.041	-0.023	-0.048	-0.114	-0.103	-0.02
	394	Maladaptive Behaviors	0.254**	0.199**	0.183*	0.272**	0.374**	0.332**	0.236**	0.237**	0.408**
	394	Nonactivity	0.335**	0.316**	0.393**	0.145*	0.085	0.195**	-0.011	-0.015	-0.051
	394	Socializing with Ex-prisoner Friends	-0.065	-0.002	-0.003	0.058	0.069	0.12	0.176*	0.164*	0.186**
	394	Online Leisure	0.052	0.072	0.053	0.009	0.03	0.054	0.012	0.014	0.013
	394	Religious Engagement	-0.045	-0.031	-0.021	0.117*	0.003	0.027	-0.038	-0.039	-0.128*
	394	Seeking Professional Support	0.13*	0.094*	0.145**	-0.089	-0.105	-0.03	-0.102	-0.103	0.006
SOLI: primary	968	Institutional Routines	-0.01	-0.015	0.034	0.01	-0.027	0.029	0.097*	0.097*	-0.067*

	968	Active Living	-0.204**	-0.272**	-0.151**	0.059	0.041	-0.113**	0.032	0.026	-0.067
	968	Work Involvement	-0.084**	-0.127**	-0.089**	-0.029	-0.029	-0.057	-0.156**	-0.145**	-0.026
	968	Maladaptive Behaviors	0.222**	0.205**	0.158**	0.323	0.383**	0.352**	0.233**	0.225**	0.434**
	968	Nonactivity	0.321**	0.339**	0.362**	0.146**	0.096*	0.215**	0.066	0.066	0.056
	968	Socializing with Ex-prisoner Friends	-0.04	-0.009	0.003	-0.049**	-0.007	0.08*	0.059	0.061	0.055
	968	Online Leisure	0.098**	0.081**	0.108**	-0.033	-0.005	0.044	-0.017	-0.013	-0.036
	968	Religious Engagement	-0.051	-0.023	-0.007	0.098**	-0.031	0.006	-0.057	-0.055	-0.096**
	968	Seeking Professional Support	0.102**	0.109**	0.118**	0.012	-0.017	0.007	0.028	0.021	0.056
SOLI: secondary	968	Institutional Routines	-0.013	-0.017	0.029	0.008	-0.03	0.023	0.088*	0.088*	-0.066*
	968	Active Living	-0.2**	-0.268**	-0.15**	0.058	0.041	-0.115**	0.026	0.021	-0.065
	968	Work Involvement	-0.083**	-0.126**	-0.089**	-0.03	-0.029	-0.058	-0.16**	-0.148**	-0.025
	968	Maladaptive Behaviors	0.223**	0.206**	0.159**	0.324**	0.384**	0.353**	0.234**	0.226**	0.434**
	968	Nonactivity	0.322**	0.339**	0.364**	0.147**	0.097**	0.217**	0.07	0.07	0.056
	968	Socializing	-0.039	-0.008	0.005	-0.048	-0.006	0.081**	0.06	0.063	0.055

		with Ex-prisoner Friends									
	968	Online Leisure	0.099**	0.082**	0.107**	-0.033	-0.006	0.042	-0.02	-0.015	-0.035
	968	Religious Engagement	-0.051	-0.023	-0.008	0.098**	-0.032	0.005	-0.058	-0.056	-0.096**
	968	Seeking Professional Support	0.102**	0.109**	0.118**	0.012	-0.017	0.007	0.029	0.021	0.055
Meaning in Life	574	Institutional Routines	0.022	0.002	0.053	0.037	-0.015	0.033	0.083	0.083	-0.086*
	574	Active Living	-0.24**	-0.275**	-0.171**	0.031	0.027	-0.109*	0.051	0.044	-0.059
	574	Work Involvement	-0.081*	-0.13**	-0.086*	-0.028	-0.048	-0.053	-0.189**	-0.177**	-0.047
	574	Maladaptive Behaviors	0.194**	0.202**	0.139**	0.358**	0.388**	0.361**	0.236**	0.22**	0.453**
	574	Nonactivity	0.313**	0.348**	0.349**	0.148**	0.103*	0.224**	0.124*	0.126*	0.124**
	574	Socializing with Ex-prisoner Friends	-0.039	-0.031	-0.002	-0.112*	-0.049	0.041	-0.025	-0.014	-0.021
	574	Online Leisure	0.116**	0.087**	0.135**	-0.061	-0.04	0.038	-0.029	-0.024	-0.064
	574	Religious Engagement	-0.065	-0.021	-0.004	0.071	-0.069	-0.011	-0.067	-0.062	-0.077
	574	Seeking	0.087	0.120**	0.103*	0.072	0.03	0.032	0.125*	0.113*	0.083

		Professional Support									
General Self-Efficacy	574	Institutional Routines	0.021	0.001	0.051	0.038	-0.013	0.03	0.083	0.084	-0.084*
	574	Active Living	-0.247**	-0.279**	-0.18**	0.039	0.043	-0.13**	0.05	0.043	-0.042
	574	Work Involvement	-0.091*	-0.136**	-0.096*	-0.024	-0.04	-0.082*	-0.187**	-0.173**	-0.033
	574	Maladaptive Behaviors	0.192**	0.201**	0.139**	0.354**	0.379**	0.356**	0.242**	0.227**	0.448**
	574	Nonactivity	0.318**	0.351**	0.353**	0.148**	0.104*	0.237**	0.116*	0.117*	0.121**
	574	Socializing with Ex-prisoner Friends	-0.037	-0.03	0.003	-0.119**	-0.064	0.049	-0.019	-0.009	-0.033
	574	Online Leisure	0.113**	0.085*	0.131*	-0.056	-0.03	0.03	-0.032	-0.027	-0.055
	574	Religious Engagement	-0.064	-0.021	-0.006	0.075*	-0.061	-0.01	-0.07	-0.066	-0.072
	574	Seeking Professional Support	0.092*	0.122**	0.105*	0.078*	0.043	0.045	0.116*	0.103*	0.09*
Perceived Social Support	574	Institutional Routines	0.026	0.005	0.055	0.039	-0.012	0.034	0.083	0.083	-0.084*
	574	Active Living	-0.195**	-0.238**	-0.133**	0.048	0.051	-0.098*	0.022	0.015	-0.05

	574	Work Involvement	-0.042	-0.099*	-0.053	-0.014	-0.028	-0.043	-0.218**	-0.206**	-0.039
	574	Maladaptive Behaviors	0.172**	0.184**	0.12**	0.353**	0.381**	0.354**	0.247**	0.231**	0.453**
	574	Nonactivity	0.295**	0.333**	0.333**	0.143**	0.098*	0.218**	0.136*	0.138**	0.124**
	574	Socializing with Ex-prisoner Friends	-0.035	-0.028	0.005	-0.12**	-0.066	0.045	-0.02	-0.009	-0.035
	574	Online Leisure	0.149**	0.114**	0.164**	-0.051	-0.027	0.047	-0.049	-0.043	-0.061
	574	Religious Engagement	-0.045	-0.005	0.013	0.077	-0.062	-0.005	-0.078	-0.073	-0.076
	574	Seeking Professional Support	0.084	0.118**	0.1*	0.075	0.037	0.03	0.121*	0.109*	0.089*

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

Discussion

This study developed and validated the first self-report instrument for measuring the post-release perceived regularity of daily routines for ex-prisoners in community settings. Based on the theoretical framework of DTT theory (Hou et al., 2018) and the RNR model (Andrews et al., 2011) from a psycho-criminogenic perspective, nine dimensions of daily routines were derived with insights from the expert panel. Using three non-repeated crowdsourced samples of ex-prisoners (N = 1,277) in the US community, the EFA first supported a nine-factor structure of post-release daily routines: Institutional Routines, Active Living, Work Involvement, Maladaptive Behaviors, Nonactivity, Socializing with Ex-prisoner Friends, Online Leisure, Religious Engagement, and Seeking Professional Support. CFA further identified three high-order latent factors consistent with consolidation, replacement, and addition of daily routines (Hou, Liang, et al., 2021). Measurement invariance was established by demonstrating comparable model fit across age groups (17–33 vs. median age of 34 or older), gender (female vs. male), and ethnic groups (non-White vs. White). Convergent validity was demonstrated by the moderate correlations of the full and subscale scores of the PORLI-ex with measures of ADL, regularity of daily routines, meaning in life, self-efficacy, and perceived social support. Discriminant validity was shown in the weak or non-significant correlations of the full and subscale scores with lifetime trauma experience and perceived social and personal costs of crime. Criterion-related validity was confirmed by the moderate associations with the scores on anxiety, depressive and PTSD symptoms, and crime/drug-related outcomes. Incremental validity was established with the moderate associations of the total and subscale scores with resilience (mental health) and desistance (crime-related) outcomes independent of the effects of ADL, regularity of daily routines, meaning in life, self-efficacy, and/or perceived social support.

This study was the first to systematically profile both ex-prisoners' adaptive and maladaptive daily routines and investigate their differential values for psychological resilience and desistance from crime. Transition from prison to community as a significant life stressor is very likely accompanied by significant changes in daily routines (Durnescu & Istrate, 2020; Hancock et al., 2018; Kirk, 2012). Prisons provide stable accommodation, regular meals at little or no cost, and scheduled time for sleep and personal hygiene. Study/work, leisure activities, exercise, and social activities can also be part of prison routines. A maladaptive criminal lifestyle that consists of gang activities, criminal behaviors, life-threatening drug overdoses, and so on is normally prohibited inside prison. Therefore, institutionalization can be viewed as a form of behavioral adjustment aligned with a healthy lifestyle. Upon release, the extent to which the healthy lifestyle established in prison is sustained or replaced by high-risk and unstructured daily routines is unclear. In addition, most ex-prisoners are released back into their old neighborhoods and exposed again to their criminal associates (Chamberlain & Wallace, 2016; Jacobs & Skeem, 2021; Kirk, 2012). Whether they will soon return to their criminal lifestyles remains uncertain. A close look at day-to-day life patterns may offer an opportunity to identify behavioral mechanisms for post-release mental health and reoffending.

Evidence of prisonization and a criminal lifestyle in the post-release setting

Regularities of institutional routines, maladaptive behaviors, and socializing with ex-prisoners reflected total institution and criminal lifestyle in post-release setting. Previous evidence of prisonization mainly focuses on inmates during imprisonment, and only a few studies have tested the impact of total institution and a criminal lifestyle on daily routines after release (Decker & Pyrooz, 2020; Martin, 2018; McKendy & Ricciardelli, 2021). High ratings on the regularity of Institutional Routines indicated that ex-prisoners still keep up with institutional routines after release from prison, suggesting the lasting effects of total

institution (Goffman, 1961) on behavioral adjustment and highlighting the importance of establishing a healthy lifestyle inside prison to benefit post-release adjustment. This finding is also in line with previous evidence that ex-prisoners get used to sleeping with noise at prison as an example of how prison routines are inscribed on the body (Martin, 2018; Moran, 2012). Maladaptive Behaviors and Socializing with Ex-prisoner Friends are two types of routines that reflect a criminal lifestyle. These had the lowest ratings on regularity, supporting the U-shaped curve of the intensity of prisonization in which prisonization becomes less intensive when prisoners are about to be released, and they are more guided by conventional norms (Wheeler, 1961). Although substantial evidence shows that the neighborhood disadvantage of being deprived of resources puts ex-prisoners at a higher risk of reoffending through opportunities for socializing with criminal associates (Kirk, 2009; Stahler et al., 2013; Sutherland et al., 1992), our study showed that the majority of ex-prisoners did not regularly take part in maladaptive behaviors and socializing with ex-prisoners compared with other daily routines, and returning to the old lifestyle is not a general phenomenon for ex-prisoners.

Lifestyle intervention for fostering psychological resilience

This study identified protective and risky lifestyles in the PORLI-ex that are associated with psychological resilience. Future interventions targeted at the lifestyle of ex-prisoners are encouraged to foster Active Living habits and modify the problematic routines listed in Maladaptive Behaviors, Nonactivity, and Socializing with Ex-prisoner Friends.

Active Living was found to be a protective lifestyle, supported by its negative correlation with depressive symptoms and positive correlation with meaning in life and perceived social support. This finding is consistent with previous evidence of the protective role of exercise in mental health (Ashdown-Franks et al., 2020; Bell et al., 2019; O'Toole et al., 2018). In addition, Active Living demonstrated a moderate correlation with other dimensions of daily routines, including work involvement, institutional routines, and

religious engagement. This finding indicated that staying active could interact with other essential aspects of life, from engagement at work and keeping regular routines as established at prison to spiritual engagement, and it may jointly contribute to psychological resilience. Considering the high prevalence of depression among ex-prisoners, an active lifestyle should be promoted for ex-prisoners in the community (Fazel & Baillargeon, 2011; Kinner & Young, 2018; Wildeman & Wang, 2017).

Three risky lifestyles that diminished psychological resilience were also identified: Maladaptive Behaviors, Nonactivity, and Socializing with Ex-prisoner Friends. Previous evidence supports the positive association between unhealthy and unstructured lifestyles listed in Maladaptive Behaviors and psychiatric symptoms (Baćak et al., 2021; Lien et al., 2009; Welsh et al., 2017; Widinghoff et al., 2019; Wood & Dennard, 2017). The current study adds to this body of evidence by showing the positive associations between maladaptive daily routines and anxiety symptoms, depressive symptoms, and/or PTSD symptoms in post-release adaptation. The significant positive correlations of Nonactivity with psychiatric symptoms were consistent with previous research findings demonstrating that physical inactivity is a risk factor for different mental disorders, including anxiety and depression (Ashdown-Franks et al., 2020; Hallgren et al., 2018; Y. Huang et al., 2020; Zhai et al., 2015). The positive association between Socializing with Ex-prisoner Friends and PTSD symptoms can possibly be explained by Khantzian's self-medication theory that ex-prisoners seek to obtain drugs from or take drugs with their ex-prisoner friends as a self-medication for alleviating their existing psychiatric conditions (Khantzian, 1997; Weiss et al., 1992).

Lifestyles that hinder desistance from crime

The routines relevant to desistance provide a contextual understanding of reoffending through post-incarceration daily routines. The Maladaptive Behaviors subscale includes a list of high-risk daily routines, some of which are deviant behaviors or closely related to crime

(gang activities, substance abuse, and gambling). The close relationship between gang activities and gang crime had both theoretical and empirical support. Gang members typically come from a low socio-economic status, and social disorganization theory argues that macro-structural factors, such as poverty and neighborhood instability, could explain the frequency of crime in the neighborhood (Breetzke et al., 2021). A recent meta-analysis has also shown a strong link between gang membership and offending (Pyrooz et al., 2016). Substance abuse is another maladaptive routine associated with reoffending. A meta-analysis of risk factors for recidivism in offenders who received community sentences found that substance misuse increases the risk of reoffending by more than twice. Another national cohort study of convicted prisoners in Sweden investigated the psychiatric risk factors for violent reoffending and found that alcohol and drug use disorders have more substantial effects compared with other psychiatric disorders. The severity of gambling is also a significant predictor of increased recidivism risk (April & Weinstock, 2018).

Being physically inactive or engaging in non-productive activities also plays a debilitating role in the pathway to desistance. The positive relationship with crime-related outcomes can be explained by the unstructured lifestyle characterized by excessive spare time as proposed in routine activity theory (Felson & Boba, 2010), which suggests that spare time motivates ex-offenders to look for opportunities to commit crime (Felson & Boba, 2010; Skardhamar & Telle, 2012). Previous evidence on juvenile offenders has shown that “being idle” and “having nothing to do” could be the reasons for criminal behaviors and drug addiction (Gørtz, 2011; Heide, 2021; Jacob & Lefgren, 2003). The PORLI-ex Socializing with Ex-prisoner Friends subscale describes socializing with four types of former prisoners: prisoner friends made during imprisonment, those at the rehabilitation center, those who are still in prison, or drug addicts. The significant positive associations of socializing with ex-prisoners with all crime-related outcomes were consistent with Sutherland’s social learning

theory of crime, which postulates that crime occurs through interactions with others who have favorable attitudes toward crime (Sutherland et al., 1992). This finding is also consistent with the strong link between crime and drugs, as socializing with drug addicts may increase the chance of recreational substance abuse and thus drug-related crime (Yukhnenko et al., 2020).

Feasibility of digitalizing mental health and rehabilitation services

Ex-prisoners were regarded as having a low level of technological sophistication and being one of the most impoverished groups in the digital age (Jewkes & Reisdorf, 2016; McDougall et al., 2017). A recent study of the post-release technology experience of ex-prisoners highlighted that prisoners experience "digital disconnection," which means that their digital skills are not refreshed during imprisonment, so they face substantial barriers to technology upon release (Davis & Ostini, 2019). Nevertheless, our study found that ex-prisoners report the highest rating on the regularities of Online Leisure compared with other routines. The fact that ex-prisoners are likely to have regular daily online activities, such as communicating with friends online, reading digital news, and playing online games, points to the feasibility of digitalizing mental health and rehabilitation services for ex-prisoners (Langat et al., 2020). The positive correlation between online leisure routines and perceived social support in the present study also calls for establishing online support groups for ex-prisoners to help improve their psychological resilience.

Novel behavioral assessments for post-release adaptation

The PORLI-ex was the first behavioral assessment for post-release adaptation. It supplemented the current measurement for daily functioning and routines. Previous studies on the effect of prisonization on post-release daily living mainly relied on ethnographic interviews (Martin, 2018; Western et al., 2015); however, the current scale provided a validated tool for assessing multiple dimensions of everyday life experience upon release. For example, previous studies measured socializing with ex-prisoners as the number of criminal

friends and percentage of time spent with criminal friends (Boduszek et al., 2013; Mills et al., 2004), whereas the PORLI-ex quantified these socializing behaviors as daily routines and measured them in terms of regularity in conjunction with other daily routines.

Furthermore, the PORLI-ex subscales were positively correlated with existing measures of ADL, routines, and coping resources (meaning in life, self-efficacy, and perceived social support). For daily functioning, the IADL Scale measured basic activities, such as the ability to go shopping, prepare food, and housekeeping, which were initially designed for the elderly with physical disabilities (Lawton & Brody, 1969). However, the IADL Scale may not be sensitive to daily routines in response to stress in the general population without physical disabilities. The PORLI-ex included other common dimensions of daily routines that required higher functioning levels and complemented the SOLI as a theory-driven assessment for psychological resilience (Hou et al., 2019). The PORLI-ex Institutional Routines subscale putting the primary routines (personal hygiene, eating, and sleep) into an institutionalized context and measuring the perceived deviance from institutionalized routines. The PORLI-ex Socializing with Ex-prisoner Friends and Maladaptive Behaviors subscales add to the concept of secondary routines (socializing with friends and leisure activities) by specifying features of routines (e.g., criminal associates and unstructured leisure activities) that have been found to predict reoffending (Andrews et al., 2011; Sutherland et al., 1995). Among a handful of studies investigating the coping strategies of ex-prisoners (Kyprianides et al., 2019; Mowen et al., 2020; Souza et al., 2021), the focus was mainly on social support (Liu et al., 2021). The PORLI-ex supplements existing knowledge by assessing different dimensions of daily routines in light of post-release stress.

Limitations

The current study has several limitations. First, it recruited ex-prisoners in the US community, which has the highest incarceration rate in the world. Our sample was also

overrepresented by Caucasians (> 70% across the three samples). Therefore, the findings should be interpreted with caution when applied to ex-prisoners in other countries with low incarceration rates or with low and middle incomes. Second, a cross-sectional design was used instead of an intensive longitudinal design, such as experience sampling, to validate the PORLI-ex. Although the current retrospective method of the regularity of daily routines was cost-effective and found to be valid and reliable across samples, we cannot rule out the possibility that memory bias exists in the participants' responses. We did not test predictive validity using the prospective study design. Study 2a-2d was the initial development and preliminary validation of POLIR-ex. Future research using longitudinal study design to test the association between post-release daily routines and concrete outcomes is encouraged. Third, although growing evidence shows that samples recruited from MTurk are reliable, valid, and representative, and we restricted MTurk Worker ID to allow participation once only, our results could have been affected by participants who own multiple MTurk accounts. Fourth, the self-reported method was used for incarceration history instead of the participants' official conviction statuses. However, self-reported incarceration history has been widely used in epidemiological studies in community settings with large samples (Bebbington et al., 2021; Brewer et al., 2014; Coleman et al., 2021; Kulkarni et al., 2010; Walker et al., 2014; Wang & Green, 2010), and a stand-alone pre-screening question was also set at the beginning to double-check the eligibility of the participants. Fifth, female prisoners comprise only about 10%–15% of the US prison population, and the proportion of women in the present sample (36%) is high. Although the gender proportion was biased, it reflected the fact that female prisoners' growth rate has outpaced that of male prisoners (Walmsley, 2017). Sixth, 27.2% of the sample had been released for more than two years, so the regularities of their daily routines may less reflect the impact of institutional life. Lastly, data collection was conducted amid the COVID-19 pandemic, which could have inevitably impacted the daily

routines of ex-prisoners, similar to the trend in the general population. The interpretation of the current findings should consider COVID-19 and associated infection control measures, such as social distancing and lockdown (Heard, 2020; Lemenager et al., 2021; Sun et al., 2020).

Chapter 4: Psychopathology and resilience among juvenile offenders: Multi-level predictors for longitudinal trajectories (Study 3)

Introduction

Juvenile offenders constitute 5% of the detained population in Western countries (Fazel et al., 2008). On any given day, around 70,000 children under 18 are engaged in the US criminal justice system, among which 53,000 are detained in various correctional facilities (Alcorn, 2014; Fazel et al., 2008). The everyday life of detained youth is characterized by abuse, neglect, insufficient access to stable housing, food, and education opportunities, an insecure family environment, chaotic community conditions, and poor access to health care facilities (Anoshiravani, 2020; Borschmann et al., 2020). These social determinants contribute to a disparity in mental health between juvenile offenders and their non-justice-involved peers, with the former having an increased risk of psychiatric disorders, self-harm, substance abuse, and delinquent behaviors (Anoshiravani, 2020). Psychiatric disorders, if left untreated, can persist during adolescents' transition to adulthood. Despite some previous evidence of the social and structural determinants of mental disorders and delinquency, such as poverty, under-utilized health care services, and trauma exposure (Anoshiravani, 2020; Borschmann et al., 2020; Liu et al., 2021), very little research has been conducted to identify and compare multiple levels of factors that predict mental health among juvenile offenders.

In the sections that follow, an overview of mental health problems among adolescents involved with the criminal justice system will be provided. Heterogeneity of psychological

adaptation following stressful events and prototypical outcome trajectories will be reviewed. Existing trajectory studies of juvenile offenders will then be discussed, and knowledge gaps will be presented.

Mental health of juvenile offenders

Committing a serious crime is a major life event that not only carries numerous costs to society but also puts the offenders in the face of stressful consequences, such as waiting for the sentence, being locked up in jail/detention center, economic burdens of being fined and handling legal costs, broken family relationships, and stigma or discrimination (Day & Koegl, 2019; Lambie & Randell, 2013). Mental health problems are more common among detained juveniles than among their non-detained peers (Borschmann et al., 2020; Dirkzwager et al., 2021b; Heller et al., 2022; Underwood & Washington, 2016). A recent global scoping review of publications between 1980 and 2018 found that the lifetime prevalence of mental disorders ranges from 0% to 95%, with 66.8% of male and 81% of female adolescents in detention diagnosed with at least one mental disorder in the US (Borschmann et al., 2020). A global review showed that the point prevalence, denoting the prevalence measured at a particular time point, of any anxiety disorder ranges from 3.4% to 31.5% for males and from 20.9% to 59.0% for females, while the point prevalence of any depressive disorder ranges from 4.0% to 36.0% for males and from 14.0% to 63.0% for females, suggesting a wide variety of these outcomes (Borschmann et al., 2020). A recent updated meta-analysis of 47 studies comprising 28,033 male and 4,754 female adolescents across 19 countries found that 17.3% of male adolescents and 25.8% of female adolescents have a diagnosis of major depression (Beaudry et al., 2021). More importantly, juvenile offenders' mental health problems usually persist after detention. A 15-year longitudinal cohort study of 1,829 detained youths found that psychiatric disorders persist among 64% of males and 35% of females with previously diagnosed psychiatric disorders (Abram et al.,

2015). This could complicate juvenile offenders' transition from adolescence to adulthood and highlight the importance of studying their long-term psychological adaptation.

Longitudinal patterns of mental health among juvenile offenders

Only a handful of studies have investigated the long-term psychological consequences of committing a crime. In a longitudinal cohort study of 1,216 sentenced adult prisoners that measured the trajectories of psychological distress before prison release and at one, three, and six months after release, five trajectories were identified, with the majority (51%) falling within resilience (i.e., distress consistently below clinical levels) (Thomas et al., 2016). Only person-level factors, namely, mood disorder, anxiety disorder, self-harm, and drug abuse, were tested and found to predict chronicity (i.e., distress consistently above clinical levels) (Thomas et al., 2016). A comprehensive systematic review of longitudinal data found that among three trajectories of offending, namely, adolescence limited, late onset, and life course persistent, adolescence-limited offenders who had criminal behavior only in their teenage years are 1.41 times likelier to experience mental health problems, including depression and anxiety outcomes, relative to non-offenders (Reising et al., 2019).

There is currently a deficit in knowledge about the heterogeneous longitudinal trajectories of psychological adaptation among juvenile offenders, especially those following serious offending (e.g., felony crime). Severity of crime was shown to be highly correlated with having one or more comorbid psychiatric disorders among juvenile offenders in detention centers (Taşkıran et al., 2017). Prospective evidence has shown that serious violent offending is associated with subsequent increased anxiety and depressive symptoms among 503 boys followed up from the age of 7 years to 11–16 years (Jolliffe et al., 2019). Another study of the longitudinal pattern of antisocial behaviors and internalized symptoms found that adolescents who have serious, chronic, and violent patterns of antisocial behaviors also demonstrate more internalized problems (anxiety/depression syndromes) (Sheidow et al.,

2008). One previous study has investigated changes in anxiety, depression, and criminal offending and the risk factors among 1,216 juvenile male offenders in the five years following their first arrest and found that internalized symptoms and offending decrease after the first arrest, followed by a significant increase over the next years (Baker et al., 2022). An important point to note is that all participants were considered homogeneous without identifying individual differences, and a limited range of risk factors, including demographic information, processing type, and self-reported neighborhood quality, was assessed (Baker et al., 2022). Tangential to psychological adaptation was longitudinal evidence of the trajectories of risk factors, as 1,354 serious juvenile offenders who showed a trajectory of stably high exposure to violence were likely to report higher symptoms of anxiety, depression, and PTSD (Baskin & Sommers, 2015). To date, no study has comprehensively tested the predictors of mental health on the person, relationship, and context levels and considered the interrelations among different predictors using a robust statistic method.

Frameworks and models

Relatively little is known about the conceptual and empirical bases of the factors contributing to longitudinal patterns of psychological adaptation among juvenile offenders. The socio-ecological perspective highlights the significance of macro-level contextual factors in understanding psychological adaptation in the face of adversity (Bonanno et al., 2015; Hou et al., 2018; Panter-Brick & Eggerman, 2012). Panter-Brick (2014) further describes the multilevel and dynamic nature of adaptation in which psychological resilience is shaped by the interplay of individuals, family, community, and society at different socio-ecological levels. Contextual factors at the family level include the family belief system, family problem solving, and flexibility (Bonanno et al., 2015). The contextual factors at the community level associated with resilience include the characteristics of the neighborhood, sense of community, and social capital (Bonanno et al., 2015). This perspective is consistent with the

classic conceptual framework on the ecology of human development, which articulates the nested influence ranging from the individual, micro (family, peers, and school) and meso (neighborhood) levels to the macro level (culture and society), with family and peers in the microsystem being highly influential on youth development (Bronfenbrenner, 1979). In sync with the socio-ecological perspective, the developmental assets framework is another theoretical model that emphasizes both internal (e.g., positive values, competencies, and positive identity) and external assets (e.g., contextual and relational features of the socializing system) in preventing adolescents from engaging in high-risk behaviors and strengthening their psychological resilience (Benson et al., 2011).

The present study

This study aims to (1) identify heterogeneous trajectories of probable psychopathology (anxiety and depressive symptoms) and (2) examine a list of predictors on person-, relationship-, and context-levels among juvenile offenders in the seven years after committing serious offences. Four prototypical psychological outcome trajectories have been consistently observed following trauma (Galatzer-Levy et al., 2018). Resilience denotes psychiatric symptoms lower than clinically significant levels over time; recovery denotes nonclinical symptoms recovered from initial clinically significant levels; delayed onset denotes initial nonclinical symptoms that elevate above clinical levels, and chronicity denotes clinically significant symptoms over time (Bonanno et al., 2015; Galatzer-Levy et al., 2018). Conceptual model of multi-level predictors in our prediction model is illustrated in Figure 4-1. Predictors were selected based on previous evidence in trauma studies (Bonanno et al., 2015) and trajectories studies of mental health among juvenile offenders (Baker et al., 2022). Based on the socioecological perspective of resilience (Panter-Brick, 2014), this study examined predictors of outcome trajectories on personal, relationship, and contextual levels in juvenile offenders' life. It is expected that the four trajectories of probable

psychopathology, namely resilience, recovery, delayed onset, and chronicity, will emerge in the current sample of juvenile offenders. It is also expected that the trajectories of outcomes will be predicted by a combination of person-level, relationship-level, and context-level factors.

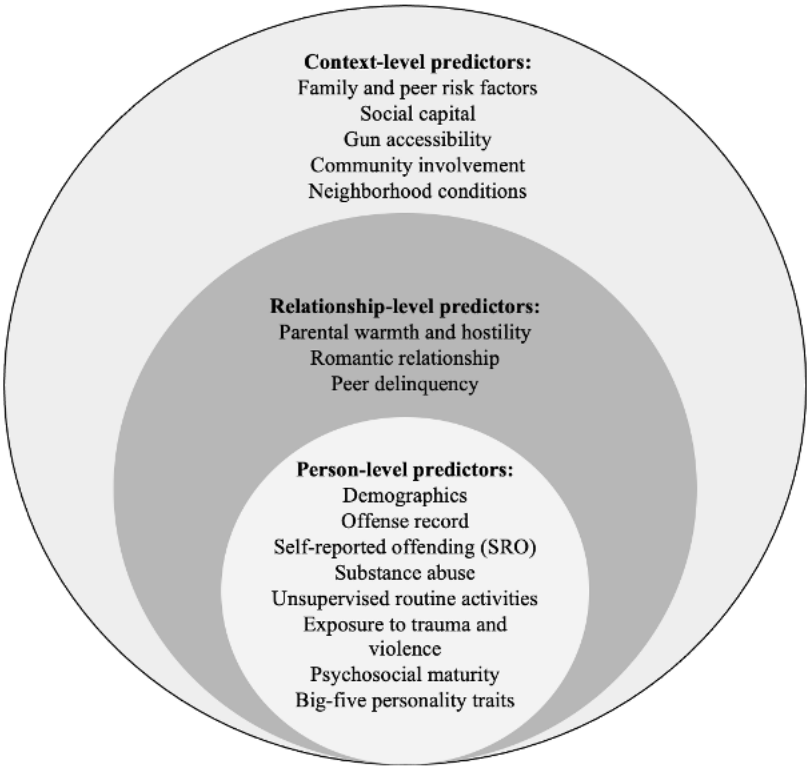


Figure 4-1 Conceptual model of multi-level predictors in LASSO logistic regression model

Note. The statistical modeling is *not* multilevel.

Methods

Participants and procedures

Secondary dataset from the Pathways to Desistance study (Mulvey, 2016) was used. Pathways to Desistance was a multi-site longitudinal study of 1354 juvenile offenders recruited from both juvenile and adult court systems in Maricopa County (Phoenix), Arizona and Philadelphia County, Pennsylvania in US. The participants aged between 14 and 18,

found guilty of serious felony offense, and gave informed consent from parents. The original aims of the study were to identify pathways to desistance and characteristics of juveniles who were out of criminal justice system; to describe the influence of developmental change and social context in pathways to desistance; and to compare the effects of institution and alternative interventions in desistance. The present study focused on juvenile offenders with serious offences but without prior incarceration. The inclusion criteria in the current study were i) no histories of being locked up in any detention center or jail; ii) serious offense that was convicted as felonies; and iii) completed data at least three timepoints across the 11 consecutive interviews. A total of 574 eligible participants were included in the final analysis. The 574 participants aged between 13.82 and 18.29 years (M=16.10, SD=1.08); 82.2% were male. Most of them (38.5%) were black, 31.9% Hispanic, and 24.4% white. Demographics of the participants are summarized in Table 4-1. The baseline interview was conducted between 2000 and 2003. The first six follow-up interviews were scheduled in a six-month interval at six, 12, 18, 24, 30, and 36 months while the remaining four follow-up interviews were scheduled every year at 48, 60, 72 and 84 months. Computer-assisted interview (CAI) technology was used for data collection. Research staff read the instructions to participants who then reported answers by means of CAI technology. Interviews were conducted at the participants' homes, public places, or criminal justice facilities if participants were under supervision. Other details regarding sampling procedures, data collection methodology, and previous publications could be accessed on the study website: https://www.pathwaysstudy.pitt.edu/.

Table 4-1 Demographics of participants at baseline interview (N=574)

	Frequency	Percentage
Gender		
Female	102	17.8
Male	472	82.2
Race		
White	140	24.4
Black	221	38.5
Asian	1	0.2
Native American	9	1.6
Hispanic	183	31.9
Other	20	3.5
In what country were you born		
US	545	94.9
Non-US	29	5.1
Highest grade completed before GED		
6th grade or less	9	1.6
7th grade	35	6.1
8th grade	180	31.4
9th grade	146	25.4
10th grade	131	22.8
11th grade	60	10.5
High school graduate	13	2.3
Most serious adjudicated charge grade		
1st Degree Felony	61	10.6
2nd Degree Felony	98	17.1
3rd Degree Felony	147	25.6
4th Degree Felony	40	7
5th Degree Felony	12	2.1
6th Degree Felony	121	21.1
Felony, Unspecified	95	16.6
Most serious adjudicated charge categories		
Person Crime	267	46.5
Property Crime	153	26.7
Weapons Charge	30	5.2
Drug Charge	76	13.2

Sex Crime	27	4.7
Other	21	3.7
Type of disposition		
Dismissed	11	1.9
Non-incarceration	444	77.4
Incarceration	119	20.7
Court		
Juvenile court	491	85.5

Measures

Two outcome variables and a total of 91 person-level, relationship-level, and context-level predictors mostly assessed at baseline were examined.

Anxiety and depressive symptoms

Subscales in Brief Symptom Inventory (Derogatis, 1983) were used to assess anxiety and depressive symptoms in the past week on a 5-point scale (0=not at all, 4=extremely). Anxiety subscale consisted of six items with the average scores ranging from 0 to 4. A cutoff score of .35 or higher was used to indicate clinically significant anxiety symptoms. Depression subscale consisted of six items with the average scores ranging from 0 to 4. A cutoff score of .28 or higher was used to indicate clinically significant depressive symptoms (Derogatis, 1983). The scores on anxiety and depressive symptoms at baseline and 10 follow-ups were used. Alphas were good across the 11 timepoints (range=.74-.86).

Person-level predictors

Demographics

Participants reported their gender, age at the initial interview, race (White, Black, Asian, Native American, Hispanic, and others), countries that they were born (US vs non-US), education-related variables (e.g., grades completed, number of times suspended etc), employment-related variables (e.g., Money earned per hour), and number of children they had.

Offense record

Four items assessed participants' official record of criminal offense at initial interview. Participants reported their adjudicated charge in terms of serious offense (1= 6th degree felony, 6=1st degree of felony), type of offense (person crime, property crime, weapons crime, drug crime, sex crime, and other crime), type of sentencing (1=dismissed, 2=nonincarcerated – including fines or restitution, probation, nonincarcerated residential

placement, and 3=incarcerated/jail), and court for initial referring petition processing (juvenile or adult court). Participants also reported lifetime number of arrests and age at first arrest.

Self-reported offending (SRO)

The 22-item Self-Reported Offending (SRO) scale was used to capture juvenile's involvement in illegal activities (Huizinga et al., 1991) in the past year. Frequencies of five types of crime committed were calculated: 22 criminal acts, 11 aggressive offenses, 10 income offenses, 19 non-drug offenses, and three non-drug income offenses.

Substance abuse

Modified Substance Use/Abuse Inventory (Chassin et al., 1991) was used to assess the number of times of substance abuse (marijuana, sedatives stimulants, cocaine, opiates, ecstasy, hallucinogens, inhalants, Amyl nitrate, other drugs, alcohol, and cigarette) in the past six months. Lifetime dependency symptoms were reported on a 10-point scale (e.g., have urge to use the substance and cannot stop oneself). Dependency symptoms were indicated by total count of lifetime symptoms attributable to alcohol use and the total count of lifetime symptoms attributable to drug use (range=0-10).

Unsupervised routine activities

Four items from Monitoring the Future Questionnaire (Osgood et al., 1996) were used to measure frequency of unsupervised activities in the absence of authority figures (e.g., How often did you ride in car for fun?) on a five-point Likert scale (1= never, 5=Almost every day). Higher mean scores indicated more frequent involvement in unsupervised activities. Internal consistency was adequate (α=.62).

Exposure to trauma and violence

The Exposure to Violence Inventory (ETV) was used to measure frequency of exposure to 13 traumatic events (Selner-O'Hagan et al., 1998). Six items assessed violence

that participants experienced and seven items assessed violence that they observed. Three summed scores were calculated to reflect participants' exposure to violence as a victim (range=0-6), as a witness (range=0-7), and total scores on both victim and witness (range= 0-13).

Psychosocial maturity

The 30-item Psychosocial Maturity Inventory (PMI) was used to measure psychosocial development in three dimensions (Greenberger et al., 1975): self-reliance (e.g., sense of control initiative), identity (e.g., clarity of self-concept), and work orientation (e.g., standards of competence). Participants rated the items on a four-point scale (1=strongly disagree, 4=strongly agree) with higher scores indicating greater psychosocial maturity. The alpha was .89 in the current administration.

Big-five personality traits (4th/24-month follow-up)

The 120-item NEO-Five Factor Inventory Short Form (NEO-PI-SF) was adopted to measure five subscales of personality, namely neuroticism, extraversion, openness, agreeableness, and conscientiousness at the 4th follow-up (24 months) (Costa & McCrae, 1992). Participants rated each statement on a five-point scale (1=strongly disagree, 5=strongly agree). Cronbach's alphas for the five subscales were acceptable (α=.65-.77).

Relationship-level predictors

Parental warmth and hostility

The 42-item Quality of Parental Relationships Inventory (Conger et al., 1994) was used to assess participants' relationship quality with mothers and fathers, each with 21 items on a four-point scale (1=always, 4=never). Summed scores were calculated for mother warmth, mother hostility, father warmth, and father hostility. Alphas for the four subscales were .92, .85, .94, and .87, respectively.

Romantic relationship

Items from the Quality of Romantic Relationship Inventory (QRI) (Pierce et al., 1997) assessed participant's romantic relationship on a 4-point scale (1=Would not care at all, 4=Would get very upset with me) (Pierce et al., 1997). Tolerance of deviance (2 items) assessed whether partner knew their delinquent behaviors; monitoring (5 items) assessed how much romantic partner monitored the behavior of the participant; and antisocial influence (7 items) assessed whether or not their partners encouraged them to engage in antisocial behaviors. Alphas for tolerance of deviance and monitoring were .67 and .81, respectively. Alpha was not calculated for antisocial influence subscale because it counted the exact number of seven antisocial behaviors that partners encouraged them to engage.

Peer delinquency

Twelve items were adopted to assess friends' antisocial behavior, denoting frequency of friends' engagement in antisocial behaviors, and antisocial influence (7 items), denoting frequency of friends' influence on engagement in antisocial behaviors. Participants rated each item on a 5-point scale (1=None of them; 5=All of them), with higher mean scores indicating greater peer delinquency. Alphas for the two subscales were .91 and .88.

Context-level predictors

Family and peer risk factors

Family risk factors included family members' history of being arrested, jailed or prisoned, or in mental hospital (no/yes), and biological parents' marital status, education level, substance abuse, and history of being arrested or in jail/prison. Peer risk factors were assessed in terms of the number of friends, the count of four closest friends arrested, the count of four closet friends jailed, and the count of closest friends in mental hospital.

Social capital

The Social Capital Inventory assessed participants' connectedness to community on two dimensions (Nagin & Paternoster, 1994). Closure and integration consisted of five items

assessing social integration and three assessing intergenerational closeness on a 4-point scale (1=Never, 4=Often); high scores indicated more social integration. Perceived opportunities for work consisted of five items assessing participants' attitude towards the labor market in the community on a 5-point scale (1=Strongly Agree, 5=Strongly disagree). Scores were reverse coded with higher scores indicating higher perceived opportunities for work. Alphas for the two subscales were .69 and .77.

Gun accessibility

Participants were asked how easy they could purchase guns in their neighborhood on a 5-point scale (1=strongly agree, 5=strongly disagree) and to estimate prices of the two types of guns most carried and used by adolescents, namely handguns (.38 mm) and automatic weapons (9 mm).

Community involvement

The Community Involvement scale assessed participants' involvement in four structured community activities, namely sports teams, scouts, church related groups, and volunteer work. Participants reported whether (no/yes) they have participated in the four activities in their lifetime and in the past six months. Two scores were calculated: lifetime involvement (count of activities independent of recency) and recent involvement (count of activities in the past six months).

Neighborhood conditions

The 21-item Neighborhood Conditions Measure assessed physical environment (12 items; e.g., "Empty beer bottles on the streets or sidewalks") and social environment (9 items; e.g., "Adults fighting or arguing loudly"). Participants rated each item on a 4-point scale (1=never; 4=often). Average scores were calculated for overall condition (Cronbach's alpha= .94), physical environment (Cronbach's alpha= .91), and social environment (Cronbach's alpha= .88).

Analytic plan

First, to identify latent trajectories of probable anxiety and depression, growth mixture modelling (GMM) was performed using Mplus Version 8.2. Random intercept variances were allowed to be freely estimated, and quadratic parameters were nonsignificant and removed to facilitate model convergence in the final models. Akaike information criterion (AIC), sample-size adjusted Bayesian Information Criteria (SSABIC), Entropy, and Bootstrap Likelihood Ratio Test (BLRT) were used to evaluate 1-class to 4-class solutions. Smaller AIC and SSABIC indicated better model fit, and the closer value of entropy to 1 indicated better reliability of class membership. A significant *p* value of BLRT indicated that a k-class model demonstrated a significant increase in the model fit than a k-1-class model (Nylund-Gibson & Choi, 2018). Solution with small classes (<5% of the sample size) could be unstable and hard to replicate and thus were excluded (Nylund-Gibson & Choi, 2018). Final decision was made based on fit statistics, interpretability, and theoretical relevance.

Second, to explore the relative importance of predictors at different levels, least absolute shrinkage and selection operator (LASSO) logistic regression as a form of supervised machine learning was adopted. LASSO applied penalization that shrinked coefficients of less important predictors to exact zero in order to address multicollinearity and model overfitting among a large number of predictors (McNeish, 2015). It is predicted that 1) resilience against all other groups (combined as non-resilience trajectories) and 2) chronicity against all other groups (combined as non-chronicity trajectories) by dichotomizing participants into resilience or non-resilience group and chronicity or non-chronicity group. We dichotomized individuals into two groups because we want to identify predictors for longitudinal stable mental health and predictors of consistent psychopathology. Dataset was split into 80% training and 20% test data. Ten-fold cross-validation with three repetitions was performed to determine the optimal shrinkage parameters (i.e., lambda) for the LASSO

models and mean cross-validation estimates of model performance (Kuhn & Johnson, 2013). Model performance was evaluated by Area under the Receiver Operating Characteristic Curve (AUC): poor discrimination (.50–.69), acceptable discrimination (.70–.79), excellent discrimination (.80–.89), and outstanding discrimination (.90–1.00). The resultant variable importance was visualized by descending ordering the nonzero coefficients of predictors on a scale from 0-100. R Version 4.1.2 (caret, glmnet packages) were used.

Results

Growth mixture modeling

One-class to four-class solutions for both anxiety and depression outcomes were examined with reference to the related model indices (AIC, SSABIC, Entropy, and BLRT) (Table 4-2). AIC and SSABIC gradually decreased for both outcomes, indicating that model fit improved with increased class number. Significant *p* value of BLRTs in the 3-class solution indicated that 3-class solution performed better than 2-class solution. The 4-class solution for anxiety and depressive symptoms both included infrequent classes (less than 5%) which was borderline acceptable/unacceptable. Therefore, three-class solutions were selected for both anxiety and depressive symptoms: stable low symptoms (resilience), consistently high symptoms (chronicity), and initially high but gradually declining symptoms (recovery) (Figure 4-2). Entropy of 3-class solutions for both outcomes was high (> .80) suggesting reliability of the class memberships. Even though both anxiety and depressive symptoms were not normally distributed (Appendix M), the large effect sizes for the three classes (Cohen's d=1.57-6.31) could compensate for the inadvertent effect of non-normal data on class solutions. The class distribution for anxiety symptoms was resilience (75.96%), chronicity (15.16%), and recovery (8.89%). The class distribution for depressive symptoms was similar: resilience (75.78%), chronicity (10.98%), and recovery (13.24%).

Table 4-2 Fit indices for Growth Mixture Models (GMM) for anxiety and depressive symptoms

Class Number	AIC	SSABIC	Entropy	BLRT p	Per. Small
Anxiety symptoms					
1	6815.740	6822.809	1.000	-	-
2	6511.434	6523.214	.857	<.001	14.46%
3	6360.265	6376.758	.819	<.001	8.89%
4	6257.211	6278.416	.779	<.001	2.96%
Depressive symptoms					
1	7884.454	7891.523	1.000	-	-
2	7610.274	7622.055	.667	<.001	18.82%
3	7453.803	7470.296	.842	<.001	10.98%
4	7359.842	7381.047	.832	<.001	4.18%

Note. AIC=Akaike Information Criterion. SSABIC=Sample-size adjusted Bayesian Information Criterion. BLRT = Parametric Bootstrapped likelihood ratio test. Per. Small = Percentage of participants in the smallest group.

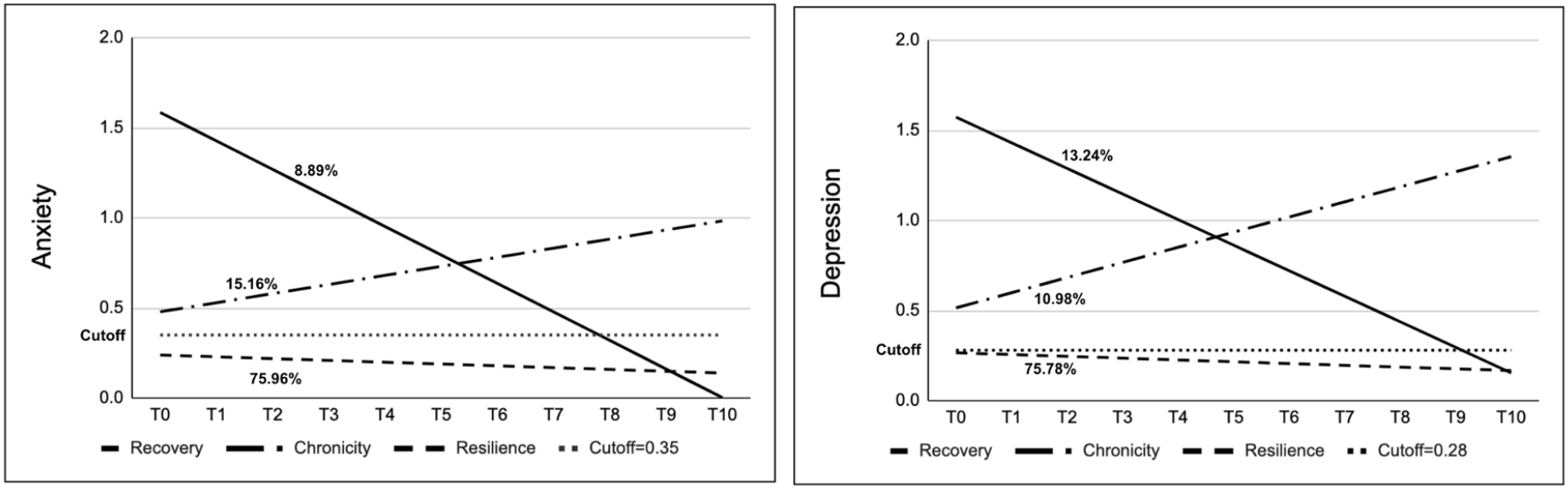


Figure 4-2 Group means for trajectories of anxiety symptoms and depressive symptoms

Note. Reference lines represent cutoff scores for BSI=.35 for anxiety and .28 for depression.

LASSO logistic regression

Four LASSO logistic regression models were performed to identify protective and risk factors of resilience and chronicity among juvenile offenders. Nonzero coefficients of predictors included person-level, relationship-level, and context-level predictors. Plots of variable importance in descending order are visualized in Figure 4-3 and Figure 4-4. Predictors with variable importance less than 10 were omitted. Model performance for the four models was acceptable (.70 ≤AUCs≤.80). Appendix N shows the standardized coefficients of all contributory variables.

Predicting the trajectories of anxiety

Relative to participants in chronicity, those in resilience trajectory were less likely to be high on neuroticism and openness to experience and victims of exposure to violence, and less likely to experience mother's hostility, have children, and encounter peer antisocial behavior and closest friends jailed. Participants in resilience trajectory reported higher work orientation and self-identity than those in chronicity, whereas participants in chronicity trajectory reported higher neuroticism and hallucinogens use in the past six months than those in resilience.

Predicting the trajectories of depression

Relative to participants in chronicity, those in resilience trajectory were also less likely to be in the minority race (other), be with college graduate education level, poor in school performance (i.e., mostly "D"s grade in school), have committed sex crime, be sentenced in adult court, take other drugs in the past six months, and high on neuroticism and openness to experience. They were also less likely to experience parent's hostility and peer's antisocial influence, have a biological father arrested/jailed or remarried, have a biological mother with some college education, and live in a neighborhood with poor physical environment. They were more likely to report committing 4th degree felony higher self-

identity and work orientation, and involvement in community activities. Participants in chronicity trajectory were more likely to report higher neuroticism, taking other drugs in the past six months, and father's remarriage, compared with those in resilience.

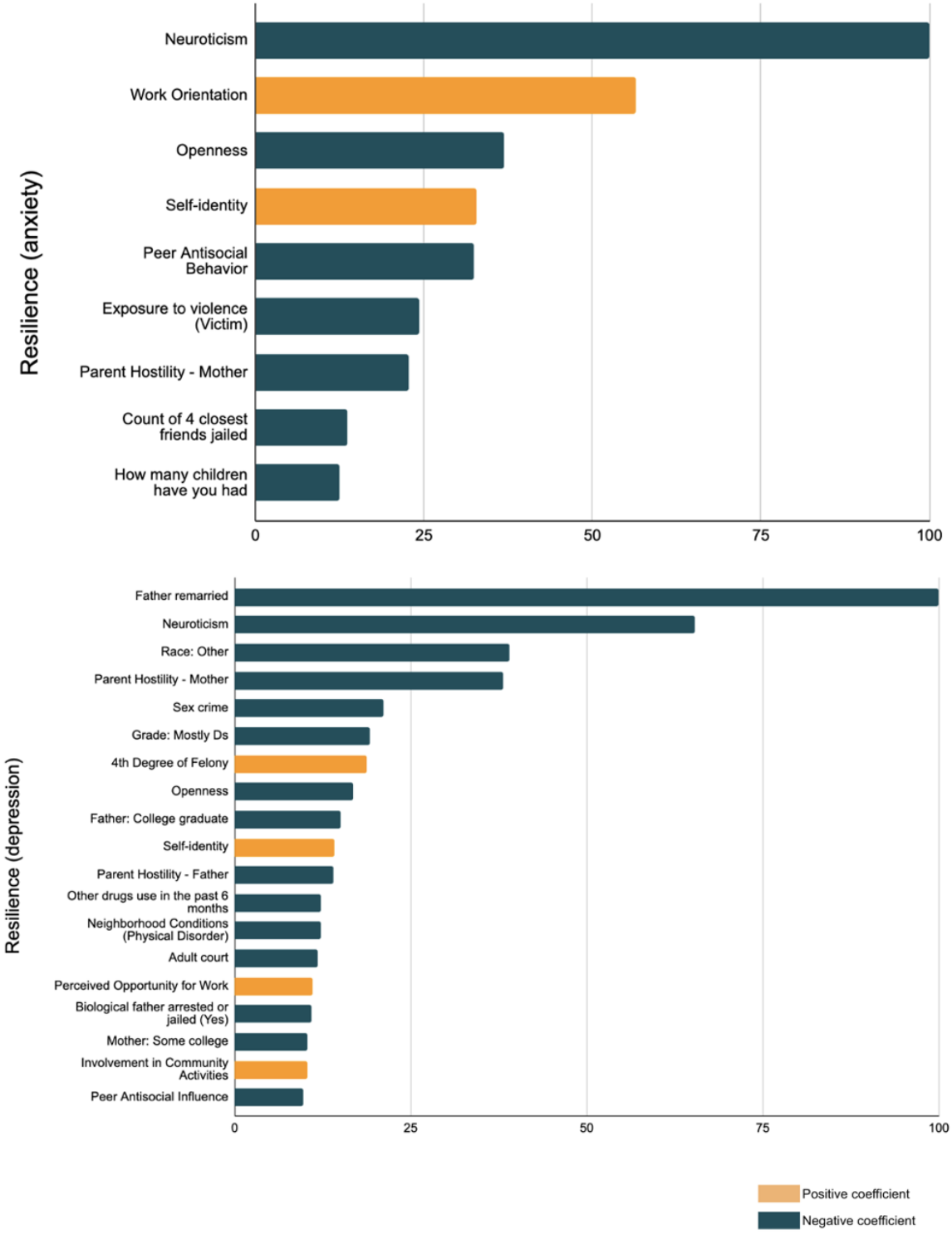


Figure 4-3 Relative importance of variables in the LASSO full models predicting resilience trajectories of probable anxiety (upper) and probable depression (lower).

Note: Variable importance less than 10 were omitted.

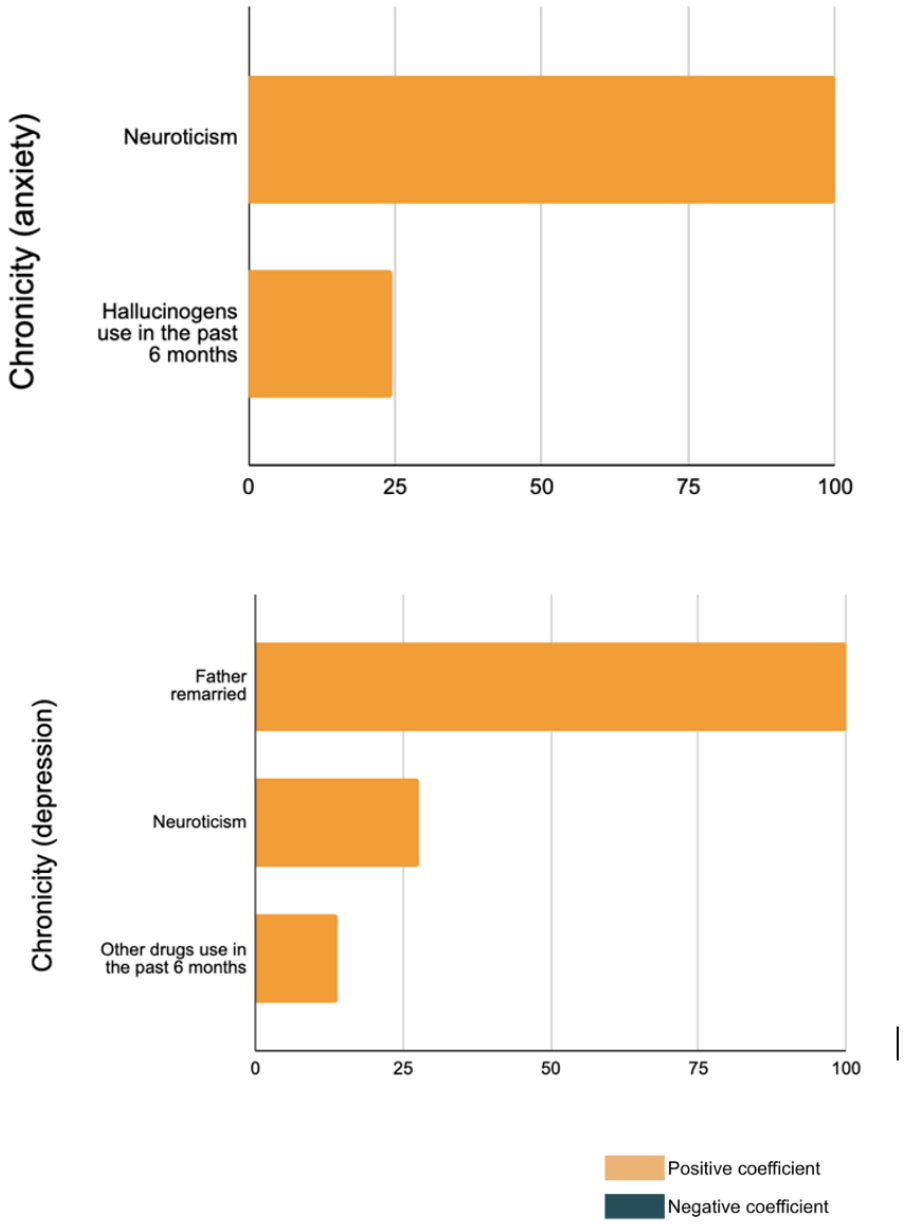


Figure 4-4 Relative importance of variables in the LASSO full models predicting chronicity trajectories of probable anxiety (left) and probable depression (right).

Note: Variable importance less than 10 were omitted.

Discussion

This study aims to identify the longitudinal trajectories of psychopathology and resilience among juvenile offenders with no previous detention histories in the seven years following their first conviction of a serious crime. The trajectories of anxiety and depressive symptoms were identified, and a broad range of predictors at the person, relationship, and context levels was tested in four separate models for resilience and chronicity. Consistent with our expectations and previous findings on the prototypical trajectories following stressful events (Bonanno, 2004; Galatzer-Levy et al., 2018), three trajectories (resilience, chronicity, and recovery) were identified for anxiety and depressive symptoms, in which the majority demonstrated a resilience trajectory (75.78%–75.96%) over the seven years. Predictors across the person, relationship, and context levels were all found to be associated with psychological resilience and chronicity.

This study provided some of the first evidence of the longitudinal trajectories of psychological adaptation among juvenile offenders that can aid in the identification of clinically relevant patterns of psychological distress to following serious offending and the detection of risk factors for chronic mental health problems. The machine learning method of LASSO regression was used, which may address the multitude of interrelated person-, relationship-, and context-level factors that correlate with differential outcome trajectories. This study added to the existing body of knowledge by suggesting caution in interpreting common predictors, such as gender, quality of romantic relationships, and parents' substance abuse and mental illness, with internalized psychopathology among juvenile offenders (Davila, 2008; Foley et al., 2001; La Greca & Harrison, 2005; Manning & Gregoire, 2009; Nivard et al., 2015; Van Droogenbroeck et al., 2018). These demographic predictors could be positively associated with mental health problems concurrently but could have limited associations with the progression of symptoms over time, suggesting that different strategies

could be used to alleviate mental health problems immediately or longitudinally among these young people. It is also found that their percentage of resilience is higher than that of the general population (Galatzer-Levy et al., 2018; Lauterbach & Armour, 2016), consistent with the classic hypothesis that adolescents living in disadvantaged environments are likelier to be resilient (Masten, 2001). Invulnerability or resilience is deemed as unchanged long-term individual characteristics without taking into account developmental progressions, challenges, and variations (Hou et al., 2018; Luthar et al., 2000). Masten proposes the concept of *ordinary magic* to refer to normative psychological functioning, as demonstrated by children and adolescents who have experienced or are experiencing adversity (Masten, 2001; Oades-Sese et al., 2014). This advances previous resilience work by articulating that resilience is attributed to normative adaptation and everyday coping resources made up of the biological and psychological makeup of individuals, intimate social partners, and the community (Masten, 2001; Oades-Sese et al., 2014). According to this perspective, individual, familial, and sociocultural influences could contribute to psychological distress or resilience (Masten, 2001; Masten et al., 1990).

However, some of the juvenile offenders (< 25%) demonstrated either recovery from or a delayed onset of clinically significant anxiety and depressive symptoms over time, suggesting that the chronicity trajectory among these youths could be characterized by mixed features of improving and worsening symptoms across the clinical threshold. This finding could be partially reflected by the nonlinear growth in internalizing symptoms among male adolescents following their first arrest such that the symptoms decreased initially but had a significant upturn over time (Baker et al., 2022). Worsening symptoms following the baseline interview suggested that involvement with the criminal justice system may influence the symptom trajectories (Baker et al., 2022), while the recovery process may occur naturally (Ranøyen et al., 2018). A larger percentage of juveniles in chronicity trajectories of anxiety

(15.16%) than in those of depression (10.98%) replicated previous findings highlighting the hallmark of an elevated risk for anxiety during the period of transition from adolescence to young adulthood (Copeland et al., 2014; Ranøyen et al., 2018).

Previous publications related to Pathways to Desistance Series can be found at: https://www.icpsr.umich.edu/web/NAHDAP/series/260/publications. The value added by this study to the other published findings using the same dataset is that by focusing on serious offenders without previous detention history and convicted as felony crime, the current study controlled the influence of detention/history of serious crime on mental health. Furthermore, it used both supervised and unsupervised machine learning approach to detect trajectories of mental health and multilevel predictors which has not been tested by the previous studies.

Multilevel nature of risk factors

The present findings were consistent with those of Panter-Brick and Eggerman (2012), who stressed the importance of macro context-level factors in explaining psychological resilience in the face of adversity. Across the four LASSO models, person-level predictors had greater explanatory power than relationship- and context-level predictors for predicting the trajectories. The person-level factors that inversely predicted the resilience trajectory of anxiety included neuroticism, openness to experience, being victims of exposure to violence, and having children, whereas neuroticism, openness to experience, poor school performance, minority race (other), having committed sex crimes, being sentenced in adult courts, and taking other drugs in the past six months inversely predicted the resilience trajectory of depression. Neuroticism and hallucinogen use in the past six months were person-level factors that positively correlated with the chronicity trajectory of anxiety, whereas neuroticism and taking other drugs in the past six months positively predicted the chronicity trajectory of depression. Relationship-level factors that inversely predicted the resilience of both anxiety and depression included experiencing parent's hostility and peer

antisocial behaviors. Context-level factors that inversely predicted the resilience trajectory of anxiety included having their closest friends jailed, whereas having a biological father arrested/jailed, being remarried, having a college graduate education level, having a biological mother with some college education, and living in neighborhoods with poor physical environments inversely predicted the resilience trajectory of depression. Father's remarriage predicted the chronicity trajectory of depression. Of note, there are interrelations between relationship- and context-level predictors, so the risk factors in these two levels can facilitate each other, and the significance may not be obvious as person-level predictors. For instance, parent's hostility at the relationship level may closely relate to parents' marital status as family characteristics at the context level; peer antisocial influence may relate to peers' arrested/jailed histories as peer characteristics at the context level. The present findings provided support that these are risk factors working against adaptive adjustment among juvenile offenders that clinicians and prevention programs should target in order to prevent prolonged psychological problems among this population (Wareham & Dembo, 2007).

Multilevel nature of resilience factors

Person-level factors of self-identity (i.e., clarity of self-concept, consideration of life goals, self-esteem, and internalized values), work orientation (i.e., standards of competence, pleasure in work, and general work skills), and perceived opportunities for work positively predicted the resilience trajectory. Committing fourth-degree felony positively predicted the resilience trajectory of depression only. These resilience factors are in line with previous empirical evidence. A study of 639 low-income African American adolescents in Chicago found that high self-esteem is associated with less delinquency, fewer behavioral problems (substance abuse and sexual risk behaviors), greater school engagement, and fewer mental health symptoms, as measured by the Brief Symptom Inventory (Kim et al., 2018). Another longitudinal study of 323 Dutch youths revealed that self-concept clarity and

anxiety/depressive symptoms can reciprocally impact each other over time (Van Dijk et al., 2014). Furthermore, consideration of goals in life (e.g., academic aspirations and expectations) was inversely correlated with subsequent depressive symptoms, as shown in a one-year follow-up study among 3,343 Swedish adolescents at the age of 13 (Almroth et al., 2018). Future rehabilitation programs should thus target establishing self-identity and self-efficacy among juvenile offenders.

The resilience factors of work orientation and perceived opportunity can be explained by the fact that work efficacy and perceived opportunities could motivate juvenile offenders to fulfill their roles as productive and respected members of the community in their adulthood (Schaeffer et al., 2014). Compared with other adolescents in community settings, juvenile offenders tend to have poorer educational achievement and thus inadequate preparation to enter the workforce (Roos, 2006). This finding is consistent with previous evidence showing that career adaptability, denoting competence and adjustment to a career context, predicts lower odds of mental health problems and higher odds of life satisfaction (Ginevra et al., 2018; Xu et al., 2020). Committing a fourth-degree felony as a resilience factor for the trajectory of depression was contrary to our expectation. We did not expect a certain degree of felony to be related to the trajectory. Previous research has supported the bidirectional association between depression and delinquency, in which delinquency is found to be a risk factor for subsequent depression rather than anxiety (Fanti et al., 2019). This evidence may partially support why offense characteristics can predict depression but not anxiety. The present study encourages future research to further elucidate this association.

The context-level factors of involvement in community activities were positively correlated with the resilience trajectory of depression. This finding corroborated previous research results suggesting that volunteer work can contribute to social integration and improve social and psychological resources, which, in turn, alleviate depression symptoms

(Musick & Wilson, 2003). This is also in line with the findings of a longitudinal study of individuals from adolescents to adulthood showing that community engagement predicts later decreases in depressive symptoms (Wray-Lake et al., 2019). This finding provided support for encouraging juveniles to participate in community activities that can benefit their mental health.

Transdiagnostic factors predicting chronic anxiety and depression

From a clinical perspective, neuroticism and substance abuse problems were identified as transdiagnostic factors that predicted chronic probable anxiety and depression among juvenile offenders. Neuroticism was found to be the third most important predictor for anxiety and depression trajectories. This can possibly be explained by the substantial overlapping genetic factors between neuroticism and internalized disorders, as evidenced by a population-based twin study (Hettema et al., 2006) and the overlapping psychopathology symptoms of rumination and worry (Muris et al., 2005). This finding is in keeping with previous meta-analyses showing that, compared with the four other traits in the Five-Factor Model, neuroticism has the strongest correlation with mental disorders, especially internalized ones (Kotov et al., 2010; Malouff et al., 2005). A recent longitudinal study among older adolescents who were high school juniors aged 16.1, on average, further demonstrated that neuroticism predicts the course of general distress in internalized disorders (A. L. Williams et al., 2021). Although the association is evident among the general population, there is scant evidence of a relationship between the personality dimension of neuroticism and the internalized symptoms of anxiety and depression. The present findings strengthen the clinical validity of this personality dimension in forensic settings and highlight the predictive value of personality trait neuroticism in the long-term progression of depression and anxiety during juveniles' transition from adolescents to adults.

Substance abuse is another transdiagnostic factor that predicts chronic anxiety and

depression among juvenile offenders. The strong association between drug abuse, anxiety, and depression was supported by the high prevalence of comorbid illicit drug use disorders with anxiety disorders and major depression relative to other psychiatric conditions (H. M. X. Lai et al., 2015). Specifically, the present findings showed that hallucinogen is related to chronic anxiety, whereas unpopular drugs other than marijuana, sedatives, stimulants, cocaine, opiates, ecstasy, hallucinogens, inhalants, and amyl nitrate are related to chronic depression among serious juvenile offenders. This finding suggests that clinicians should have different targets on substance abuse when treating anxiety and depression in juvenile offenders over time.

Father's remarriage is a diagnosis-specific risk factor for chronic depression. In relation to this finding, it is also found that parental hostility could drive juveniles away from resilience. This suggested that a broken parental relationship, especially indicated by the father's remarriage, might lead to parents' emotion venting, especially anger toward the children, as the possible explanation for children's depressive symptoms. The long-term impact of parental remarriage on children's mental health and parent–child relations is in line with previous evidence (Hetherington, 1993; Hetherington et al., 1989; Noller et al., 2009; O'Gara et al., 2019). The finding on the importance of a father figure replicated that of a previous cohort study of children's depressive symptoms from the age of 16 to 22, demonstrating that later depression is attributed to the father's remarriage but not to the mother's in childhood (Tulisalo & Aro, 2000). From a clinical standpoint, this finding suggested that fostering parent–child relationships for adolescents from father-remarried families should be an essential element for family-based interventions targeted at juvenile offenders.

The current findings could also be regarded as an evidence base for future investigations on the longitudinal patterns of PTSD and their multilevel predictors among

juvenile offenders convicted of serious offenses. The level of severity of an offense has been found to be positively related to traumatic and/or depressive symptomatology, with serious offenders experiencing more intense and distressing symptoms (Gueta et al., 2021; Pink & Gray, 2022; Welfare & Hollin, 2015). A study of intrusive memories among 105 juvenile offenders who were convicted of murder or serious violence found that nearly half (46%) report intrusive memories of their own offenses (Evans et al., 2007). Offense-related shame has further been found to contribute unique variance in predicting levels of intrusive memories among justice-involved male adults committing various types of crimes, suggesting that the more serious an offense, the greater the possibility of experiencing significant psychological distress (Mossière & Marche, 2021).

Limitations

Several limitations should be considered when evaluating the current findings. First, the dataset was collected between 2000 (first baseline interview) to 2010 (last follow up interview), which occurred a decade ago. However, some contextual factors, such as popularity of using hallucinogen and gun accessibility remains essential concerns in US nowadays. A national survey of trends in US hallucinogen use from 2002-2019 showed that since 2002, hallucinogen use in the US has decreased among adolescents but increased in adults (Livne et al., 2022). The finding of hallucinogen use being risk factor for developing chronic anxiety among juvenile offenders should be interpreted with caution by taking the current situation of decreased hallucinogen use among adolescents into account. Second, GMM could have incorrectly identified class numbers because of a non-normal distribution, intercept effect size, and group distribution, although small classes were excluded, and the intercept effect sizes were reasonably large. Third, the current study focused on offenders who were convicted of their first felony because of the positive link between offense severity and mental health problems (Jolliffe et al., 2019; Sheidow et al., 2008; Taşkıran et al., 2017).

The findings might not be generalized to juvenile offenders who committed misdemeanors or to felony convicts who were incarcerated before. Fourth, the participants were not of the same age at baseline, although age was not associated with any trajectories.

Chapter 5: General Discussion and Conclusion

This dissertation investigated mental health of correlational populations focusing on *predictors, mechanisms, and long-term trajectories* in three different contexts: life course perspective of trauma among prisoners and ex-prisoners (study 1), everyday adaptation to post imprisonment among ex-prisoners (study 2), and mental health trajectories following committing serious crime among juvenile offenders (study 3). This chapter will discuss implications and conclusions for these three studies.

Study 1 is one of the first to describe trauma exposure at different life stages and examine the associations between different forms of trauma and different mental disorders in prisoners and ex-prisoners. Overall, this meta-analysis showed that over half of the effect sizes came from studies on childhood trauma (55.05%), whereas trauma occurring before, during, and after imprisonment were underrepresented (12.12%). Previous evidence also contains a handful of studies (k = 130) examining non-specific lifetime trauma and its relationships with different mental disorders. By contrast, a comparable amount of research has been done on all types of trauma, namely, physical trauma, sexual trauma, emotional trauma, contextual trauma, and mixed trauma, with mixed trauma attracting slightly more attention than other types. There was a similar positive association between different types of trauma and anxiety and depressive disorders, stress-related disorders, personality disorders, suicide attempts, and suicide-related disorders. In general, the trauma–mental disorder association was stronger for imprisonment trauma than for childhood trauma and pre-imprisonment trauma, as well as for mixed trauma than for physical trauma; moreover, the association was stronger for stress-related disorders relative to personality disorders, suicide attempts, and suicide-related disorders. Social support mediated the associations of childhood trauma with mental disorders in aggregate and personality disorders. Social support also mediated the association between lifetime trauma and aggregated mental health disorders.

Nevertheless, neither cognitive coping nor emotional coping mediated any trauma–mental disorder association in the current study.

This meta-analysis has practical implications for trauma-informed assessment and interventions in correctional facilities. It carried both front-end (screening) and back-end (treatment) implications for mental health of prisoners. First, treatments, interventions, or programs designed for mental disorders should consider the cumulative effects of multiple trauma history. Second, even though previous studies focused more on childhood trauma and lifetime trauma, imprisonment trauma warrants attention from clinicians, which demonstrated the strongest association with mental disorders relative to other forms of trauma that occurred at different timeframes. Third, previous studies showed equivocal evidence of gender differences in the association between trauma and mental health among prisoners, and the current meta-analytic review found that women and men are equally vulnerable to effect of trauma on the mental health. Therefore, it is necessary to provide assessment and intervention services to male prisoners as well. Fourth, the findings suggest that trauma and mental health self-reporting tools may be accurate measurements comparable to clinical diagnosis tool among correctional populations. Therefore, more cost-effective self-report instruments for screening and intervention purposes are encouraged to be used by clinicians and administrators in prison settings. Last but not least, social support groups (e.g., other inmates, family members) could buffer the effect of histories of childhood and lifetime trauma on mental health, whereas there is also a need to address less efficacious cognitive and emotional coping strategies for improving mental health of the correctional populations.

Study 2 developed and validated the first self-report instrument for measuring post-release perceived regularity of daily routines for ex-prisoners in the community settings. Based on theoretical framework of Drive to Thrive (DTT) theory (Hou et al., 2018) and risk-need-responsivity (RNR) model (Andrews et al., 2011) from psycho-criminogenic

perspective, nine dimensions of daily routines were derived with insights from the expert panel. Using three non-repeated crowdsourced samples of ex-prisoners (N=1,277) in the US community, exploratory factor analysis firstly supported a nine-factor structure of post-release daily routines. Confirmatory factor analysis further identified three high-order latent factors consistent with consolidation, replacement, and addition of daily routines, and measurement invariance was established through age groups, gender, and racial groups. Convergent validity, discriminant validity, and criterion-related validited were confirmed.

PORLI-ex is one of the first self-report instruments for measuring daily routines and their potential roles in psychological resilience and desistance from crime among ex-prisoners. Nine dimensions of ex-prisoners' daily routines were identified, and their differential values in mental health and reoffending were emphasized. Promoting an active lifestyle can benefit ex-prisoners' psychological resilience. The Seeking Professional Support subscale can be used for need assessment among ex-prisoners. Regular involvement in online activities implies opportunities for the digitalization of health services and the development of online supporting programs to facilitate reentry into the community. This study calls for more resources on fostering strengths and psychological resilience through the most basic daily life experiences on top of traditional risk management-based interventions among ex-prisoners. Such evidence-based psychosocial interventions or education programs will have specific benefits for newly released ex-prisoners' immediate adaptation to non-institutional daily life.

Study 3 aims to identify longitudinal trajectories of psychopathology and resilience among juvenile offenders with no previous detention history in the seven years following the first conviction of serious crime. Trajectories of two overlapping internalized symptoms were identified, and a broad range of predictors on personal, relationship, and contextual levels were tested in four separate models for resilience and chronicity. Consistent with expectation

and previous findings of the prototypical trajectories following stressful event (Bonanno, 2004; Galatzer-Levy et al., 2018), three trajectories (resilience, chronicity, and recovery) were identified for anxiety and depressive symptoms, in which the majority demonstrated a resilience trajectory (75.78%-75.96%) over the seven years. A comprehensive profile of psychological adjustment following serious offence among juvenile offenders was further identified. Predictors across personal, relationship, and contextual levels were all found to be associated with psychological resilience and chronicity. Personal-level factors that inversely predicted resilience were race (other), committing sex crime, poor school performance, having more children, being victim of violence, and being neurotic and open. Relationship-level factors that inversely predicted resilience included peer antisocial behaviors, peer antisocial influence, and parental hostility. Contextual-level factors included chaotic neighborhood conditions, father's remarriage, having a biological father arrested or jailed, and having closet friends jailed. Resilience factors were more on personal level that included self-identity, work efficacy, and perceived opportunities for work. Within the chronicity trajectory, neuroticism, hallucinogens use in the past six months, taking other drugs in the past six months, and father's remarriage were positively correlated with class membership.

The mental health needs of juvenile offenders in detention or community programs are always unmet (Chitsabesan & Bailey, 2006; Kessler, 2002). Their mental health problems have been associated with adverse outcomes, such as increased risk of reoffending, behavioral disturbances, substance misuse, risky sexual behaviors, and psychosocial dysfunction in adulthood (Beaudry et al., 2021; Turner et al., 2020). This study provided evidence of the three prototypical trajectories among juveniles and emphasized the importance of considering a holistic picture of risk and resilience factors at the person, relationship, and context levels. Interventions and treatments could be targeted at improving mental health with the ultimate goal of reducing the risk of reoffending and other behavioral

problems among juvenile offenders.

Three empirical studies used multi-methods and fit together to address the mental health problems of correctional populations. Research gaps and limitations in the previous study were addressed in the subsequent study. Study 1 demonstrated that existing evidence of trauma and mental health for correctional populations primarily focuses on prisoners (97.86%) and advocated for more research on ex-prisoners and post-release adaption. This research gap was addressed in Study 2, which adopted four sequential studies to develop and initially validate a novel self-report instrument for measuring everyday adaptation after imprisonment. One major concern in the first two studies is the cross-sectional study design which limited our understanding of the long-term developmental trajectories of mental health. To address this issue, Study 3 drew the secondary dataset from the Pathways to Desistance study, which contains rich and high-quality data on the mental health of juvenile offenders.

Three studies were heavily based on high income counties, especially the US correctional populations. Culture-specific factors to interpret the results should be warrant. US is considered to adopt a more punitive approach to deal with criminal justice issues than other comparable western countries (Nagin et al., 2009). A comparative study of US prison and other countries (Netherlands and Israel) demonstrated significant prison culture differences between three countries, and prisons that created a sense of community can benefit from lower violence and administrative costs (Dervan, 2011). Future studies of prisoners and ex-prisoners residing in different prison culture, low- and middle- income countries are encouraged. In general, three studies carried important implications, suggesting the trauma-informed rehabilitation services for both prisoners and ex-prisoners, which can be understood using the timeframe in Study 1 (Figure 5-1). Seven concrete implications were summarized below:

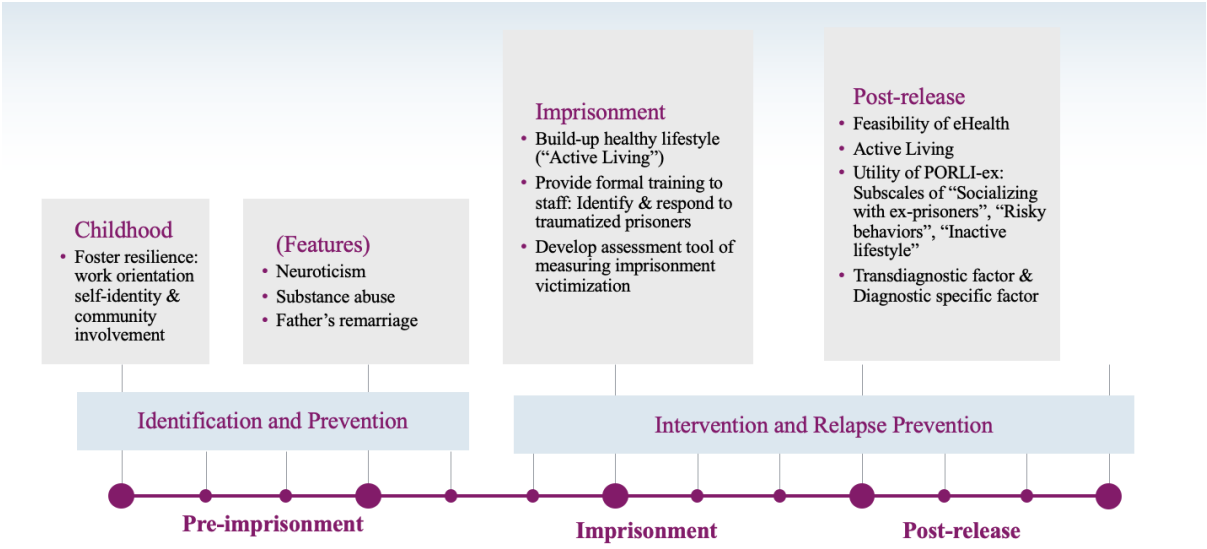


Figure 5-1 General implications for Study 1-3

1. For juvenile offenders and adolescents from disadvantaged environments, it is essential to foster their self-identity, work efficacy, perceived opportunities for work, and community involvement to build their psychological resilience. Clinicians or social workers should especially care about at-risk adolescents who are neuroticism, have substance abuse problems, and experience father's remarriage;

2. High ratings on the regularity of Institutional Routines indicated that ex-prisoners still keep up with institutional routines after release from prison. And this highlights the importance of establishing a healthy lifestyle inside the prison to benefit post-release adjustment, especially active living inside the prison;

3. Furthermore, it is important to provide formal training to prison staff and teach them how to identify trauma that occurred during the imprisonment and respond to the traumatized prisoners;

4. It is also important for clinicians to develop a validated assessment tool for measuring imprisonment victimization;

5. For the post-release rehabilitation service, our study found that ex-prisoners report the

highest rating on the regularities of Online Leisure compared with other routines. This points to the feasibility of digitalizing mental health and rehabilitation services for ex-prisoners;

6. For the utility of PORLI-ex, all dimensions were closely associated with post-incarceration life among ex-prisoners. Some scales (e.g., maladaptive behaviors, inactivity, and socializing with ex-prisoners) strongly correlated with adaptation outcomes. Practitioners may also use the individual dimension of PORLI-ex for predicting post-incarceration outcomes;

7. From a clinical perspective, neuroticism and substance abuse problems were identified as transdiagnostic factors that predicted probable chronic anxiety and depression among juvenile offenders, while father's remarriage is a diagnosis-specific risk factor for chronic depression.

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Appendices

Appendix for Chapter 2 (Study 1)

Appendix A. Notes for the deviation from the Prospero protocol (CRD42020181587)

	Original PROSPERO (CRD42020181587)	Deviation in current manuscripts (Highlighted in green)	Reason for change
1. Exclusion criteria	"Inclusion criteria for this review includes a) they are empirical studies involving inmates' samples from a general prison population or ex-prisoners; (b) with at least one clearly defined quantitative measure for the traumatic experience and mental health outcomes. Studies will be excluded if it does not separate sentenced from remand prisoners in their report, no effect size is reported,	"Inclusion criteria were (1) empirical studies involving convicted prisoners from a general prison population or ex-prisoners; and (2) studies with at least one clearly defined quantitative measure of trauma exposure and mental disorders, respectively. Studies were excluded if they were conducted in prisoners with other sentenced status (pretrial, on remand, on probation, on	We acknowledge that including studies with highly selective samples could inadvertently bias our findings. Therefore, we excluded studies with selective samples of prisoners. We narrow down the scope of our interested population to convicted prisoners only, and excluded prisoners with other sentenced status (pretrial,

	predictor (measurement of traumatic experiences) and/or outcome measures (mental health) was/were absent, measurement tools have not been psychometrically validated, and uses a language other than English."	parole), did not distinguish between sentenced and remand prisoners, did not assess the predictor (i.e., trauma exposure) and/or the outcome (i.e., symptoms and/or diagnoses of mental disorders), included selective samples of prisoners (i.e., participants in treatment program), did not use psychometrically validated quantitative instruments for the study variables, and did not report their studies in English. Studies of prisoners of war, probationers, parolees, forensic psychiatric patients, and people who were detained pretrial, in police custody, or for non-criminal reasons such as immigration centers were not included in the	on remand, on probation, on parole); and 2) prisoners of war, forensic psychiatric patients, in police custody, or for non-criminal reasons such as immigration. The reason is that sentenced prisoners in general stay in prison for longer period of time relative to other types of prisoners under normal circumstances in the West. Focusing on sentenced prisoners can better inform psychoeducation and interventions that are contextualized within prison settings.

		current review."	
2. Tool for quality assessment	"Newcastle-Ottawa Scale will be used by independent two researchers to assess the risk of bias in the included studies."	"Study quality was assessed using the AXIS tool (Downes, Brennan, Williams, & Dean, 2016)."	Newcastle-Ottawa Scale only relates to case-control and cohort designs which is not an appropriate assessment tool for the data from the majority of the current eligible studies that were cross-sectional. Therefore AXIS tool was now used (Downes et al., 2016) which was designed for assessing non-experimental research.
3. Analytic plan for subgroups or subset	"Subgroup analyses will be performed by meta-regression on the basis of type of trauma (interpersonal vs.non-interpersonal), type of mental health disorders (several mental illnesses vs. other mental health problems),	"We applied a multilevel approach to deal with the interdependency of effect sizes and used a three-level meta-analytic model to calculate the aggregated effect sizes and conduct the moderator analyses."	Multiple effect sizes of the same sample were included in the analysis, therefore we used three-level meta-analysis approach instead of meta-regression to address the problem of

	type of population (prisoners vs. former prisoners).”		dependency between effect sizes.

Appendix B1. Measurements of trauma

Abuse Behavior Inventory (ABI)

Administrative Segregation (AS)

Adverse Childhood Experiences (ACE)

Childhood Trauma Questionnaire - 25 items (CTQ-25)

Childhood Trauma Questionnaire - 28 items (CTQ-28)

Childhood Trauma Questionnaire - 34 items (CTQ-34)

Childhood Trauma Questionnaire (CTQ)

Childhood Trauma Questionnaire-Short Form (CTQ-SF)

Clinician-Administered Assessment Interview for Adults

Conflict Tactics Scale (CTS2)

Davidson Trauma Scale (DTS)

Demographics Form 5

Detailed Assessment of Posttraumatic Stress Relative Trauma Exposure (DAPS RTE)

Duration in prison

Family Health History Questionnaire (FHHQ)

Life Event Checklist (LEC-5)

Life Event Checklist (LEC)

Life Events Scale (LES)

Life Stressor Checklist-Revised (LSC-R)

Lifetime Trauma and Victimization History (LTVH)

National Violence Against Women and Men Survey (NVAWMS)

Number of years of imprisonment

Physical and Sexual Abuse scale (PSA)

Posttraumatic Diagnostic Scale (PDS)

Prison Milieu Scale

Prison trauma list

Quickview Social History Questionnaire

Relationship disconnection–trauma index (RDTI)

Severity of Violence Against Women Scale (SVAWS)

Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I -Section on PTSD)

Trauma Content Index (TCI)

Trauma History Questionnaire (THQ)

Traumatic Events Inventory (TEI)

Traumatic Experiences Checklist (TEC)

Traumatic Life Events Questionnaire (TLEQ)

Voiced Diagnostic Interview Schedule for Children (V-DIS)

Appendix B2. Measurement of mental disorders

Anxiety and depressive disorders

Adult Self-Report (ASR)

Alcohol and Drug Use History Questionnaire (ADUHQ)

Beck Anxiety Inventory (BAI)

Beck Depression Inventory-II (BDI-II)

Brief Symptom Inventory (BSI)

Center for Epidemiological Studies Depression Scale Revised (CESD-R)

Center for Epidemiological Studies-Depression Scale (CES–D)

Depression Anxiety Stress Scales (DASS)

HADS-M scale -Hospital Anxiety and Depression Scale -modified by Majkowicz, de Walden-Gałuszko, Chojnacka-Szawłowska

Millon Clinical Multiaxial Inventory-III (MCMI-III)

Mini Neuropsychiatric Interview (MINI)

Symptom Checklist-90-Revised (SCL-90-R)

Disorders specifically associated with stress

Alcohol and Drug Use History Questionnaire (ADUHQ)

Clinician-Administered PTSD Scale (CAPS-DX)

Clinician-Administered PTSD scale (CAPS)

Clinician-Administered PTSD scale for DSM-5 (CAPS-5)

Davidson Trauma Scale (DTS)

Detailed Assessment of Posttraumatic Stress (DAPS)

Impact of Event Scale – Revised (IES-R)

Millon Clinical Multiaxial Inventory-III (MCMI-III)

Posttraumatic Stress Disorder-Checklist version 5 (PCL-5)

PTSD Checklist (PCL)

PTSD Checklist–Civilian version (PCL-C)

Schedule for Affective Disorders and Schizophrenia for School-Age Children—Present and Lifetime version (K-SADS-PL)

Structured Interview for Disorders of Extreme Stress (SIDES)

Trauma Screening Questionnaire (TSQ)

Trauma Symptom Inventory (TSI)

Disorders of personality

Dimensional Assessment of Personality Pathology-Basic Questionnaire (DAPP-BQ)

Minnesota Multiphasic Personality Inventory-2-Restructured Form (MMPI-2-RF)

Multidimensional Personality Questionnaire-Brief Form (MPS)

Personality Diagnostic Questionnaire 4+ (PDQ4+)

Personality Inventory for DSM-5 Brief Form (PID-5-BF)

Psychopathic Personality Inventory (PPI)

Psychopathy Checklist Youth Version (PCL:YV)

Psychopathy Checklist–Revised (PCL-R)

Self-Report Psychopathy Scale-Short Form (SRP-SF)

Structured Clinical Interview for DSM-IV NonPatient Version (SCID-R, NP-V)

Symptom Checklist-90-Revised (SCL-90-R)

Suicide attempts/ Suicide related outcomes

Addiction Severity Index (ASI)

EPQ (the 68th item)

Eysenck Personality Questionnaire (EPQ)

Lifetime Parasuicide Count-2 (LPC-2)

Millon Clinical Multiaxial Inventory-III (MCMI-III)

Mini Neuropsychiatric Interview (MINI)

Mini-International Neuropsychiatric Interview-Plus (MINI-Plus)

Self-report history of self-cutting

Self-report history of self-harm

Self-report history of self-injuries

Self-report history of suicidal behaviors

Self-report history of suicide attempts

Structured Clinical Interview for DSM-IV NonPatient Version (SCID-R, NP-V)

Suicide Behaviors Questionnaire-Revised (SBQ-R)

Voiced Index of Self-injurious Actions (VISA)

Other ICD-11 psychiatric conditions (not included in the analysis)

Addiction Severity Index (ASI)

Alcohol and Drug Use History Questionnaire

Alcohol Use Disorders Identification Test (AUDIT)

Brief Psychiatric Rating Scale (BPRS)

Brief Symptom Inventory (BSI)

Clinical interview for self-harm history

Dissociative Experiences Scale–II (DES-II)

Eating Disorder Inventory (EDI-2)

Millon Clinical Multiaxial Inventory-III (MCMI-III)

Mini Neuropsychiatric Interview (MINI)

Mini Neuropsychiatric Interview for Children and Adolescents (MINI-KID)

Mini-International Neuropsychiatric Interview-Plus (MINI-Plus)

Structured Clinical Interview for DSM-IV Axis I&II Disorders (SCID I&II)

Substance Abuse Module (SAM)

Symptom Checklist-90-Revised (SCL-90-R)

Tilburg frailty indicator (TFI)

Trauma Symptom Inventory (TSI)

Trauma Symptoms Checklist (TSC-40)

Voiced Index of Self-injurious Actions (VISA)

World Health Organization Composite International Diagnostic Interview (WHO CIDI)

Appendix B3. Measurements of coping

Cognitive coping

Coping Resources Inventory (CRI)

Daily Spiritual Experiences Scale (DSES)

Reasons for Living Scale (RLS)

Emotional coping

Emotion Regulation Questionnaire (ERQ)

COPE Inventory

Social support

Coping Resources Inventory (CRI)

Social Support Inventory (SSI)

COPE Inventory

Appendix C1. Summary of other psychiatric conditions that were not included in the analysis

First author (Year)	*N*	Country of origin	Male%	Mean age	Sample	Trauma measures	Category: Trauma time	Category: Trauma type	Mental disorders measures	Specific mental disorders/symptoms
Akyüz (2007)	108	Turkey	100%	36.40	Prisoners	CANQ	Childhood	Physical Sexual Emotional Mixed	DES	Dissociative symptoms
Altintas (2018)	200	Turkey	50%	NA	Prisoners	CTQ-28	Childhood	Physical Sexual Emotional Mixed	DES-II	Dissociative symptoms
Bielas (2016)	130	Switzerland	100%	16.84	Prisoners	MCSI	Childhood	Mixed	MINI-KID	ADHD Substance abuse disorder Disruptive behavior disorder
Capuzzi (2020)	141	Italy	100%	36.70	Prisoners	CTQ	Childhood	Physical Sexual Emotional	Brief Psychiatric Rating Scale (BPRS)	Psychotic syptoms
Chadick (2018)	24	U.S.	100%	31.99	Prisoners	Time in segregation (months)	Imprisonment	Mixed	MCMI-III	Somatoform Substance abuse disorder Thought disorder Delusional disorder syndromes
Chen (2016)	110	Israel	55%	33.91	Prisoners	CTQ	Childhood	Physical Sexual Emotional	ASI	Substance abuse disorder Eating disorder
Chen (2018)	62	Israel	0%	39.21	Prisoners	CTQ	Childhood	Sexual Emotional Mixed	EDI-2	Eating disorder

DeCou (2016)	186	U.S.	0%	33.47	Prisoners	SVAWS THQ	Pre-imprisonment Lifetime	Mixed	DES-II	Dissociative symptoms
Driessen (2006)	139	Germany	55%	34	Prisoners	CTQ	Childhood	Mixed	SCID I&II	Psychosis Substance abuse disorder
Green (2016)	464	U.S.	0	35	Prisoners	CIDI (Criterion A), LSC-R,Turner and associates' adversity scale. NVAWMS, LAES	Lifetime	Physical Contextual	WHO CIDI	Substance abuse disorder
Gunter (2012)	320	U.S.	83%	31.14	Prisoners	LEC	Lifetime	Mixed	MINI-Plus	ADHD Psychosis
Howard (2017b)	89	UK	0%	34.52	Prisoners	CTQ	Childhood	Mixed	DES-II	Dissociative symptoms
Kang (2014)	189	U.S.	100%	17.03	Prisoners	CTQ	Childhood	Mixed	TSC–40	Trauma symptoms
Kennedy (2013)	159	U.S.	0%	33.70	Prisoners	CTQ	Childhood	Physical Sexual Mixed	MINI	Psychosis
Krammer (2018)	49	Switzerland	100%	40.10	Prisoners	ACE	Childhood	Physical Sexual Emotional Mixed	SCL-90-R	Somatoform Obsessive-compulsiveness Psychosis
Listwan (2010)	1616	U.S.	100%	34.52	Ex-prisoners	Coercion Scale	Imprisonment	Mixed	TSC-40	Trauma symptoms
Lynch (2012)	102	U.S.	0%	32.52	Prisoners	SVAWS	Pre-imprisonment	Mixed	BSI	Substance abuse disorder
Roe-Sepowitz (2007)	192	U.S.	0%	35.68	Prisoners	CMIS	Childhood	Physical	TSI	Dissociative symptoms
Tripodi (2019)	230	U.S.	0%	33.70	Ex-prisoners	ABI CTQ	Childhood Pre-imprisonment	Physical Sexual Emotional	MINI SAM	Substance abuse disorder Psychosis
Yitayih (2019)	329	Ethiopia	93%	26	Prisoners	LEC	Lifetime	Mixed	AUDIT	Substance abuse disorder

Notes: ABI -Abuse Behavior Inventory, ACE -Adverse Childhood Experiences, ASI -Addiction Severity Index, AUDIT -Alcohol Use Disorders Identification Test, BPRS -Brief Psychiatric Rating Scale, BPRS -Brief Psychiatric Rating Scale, BSI -Brief Symptom Inventory, CANQ -Childhood Abuse and Neglect Questionnaire, CIDI -Composite International Diagnostic Interview, CMIS -Child Maltreatment Interview Schedule CMIS -Child Maltreatment Interview Schedule, Coercion Scale, CTQ -Childhood Trauma Questionnaire, CTQ-28 -Childhood Trauma Questionnaire (28 items), DES -Dissociative Experiences Scale, DES-II -Dissociative Experiences Scale (DES-II), EDI-2 -Eating Disorder Inventory-2, LAES -Lifetime Adverse Event Scale, LEC-Life Event Checklist, LSC-R -Life Stressor Checklist-Revised MCMI-III -Millon Clinical Multiaxial Inventory-III, MCSI -Multidimensional Clinical Screening Inventory for delinquent juveniles, MINI -Mini Neuropsychiatric Interview, MINI-KID -Mini Neuropsychiatric Interview for Children and Adolescents, MINI-Plus -Mini-International Neuropsychiatric Interview-Plus, NVAWMS -National Violence Against Women and Men Survey, SAM -Substance Abuse Module, SCID I&II -Structured Clinical Interview for DSM-IV Axis I&II Disorders, SCL-90-R -Symptom Checklist-90-Revised, SVAWS -Severity of Violence Against Women Scale, THQ -Trauma History Questionnaire, Time in segregation (months), TSC-40-Trauma Symptoms Checklist, TSI -Trauma Symptom Inventory, Turner and associates' adversity scale, "WHO CIDI -World Health Organization Composite International Diagnostic Interview.

Appendix C2. Summary of the characteristics of included studies

First author (Year)	*N*	*k*	*Country of origin*	*Male%*	*Mean age*	Sample	Study Design	Trauma measure	Category: Trauma time	Category: Trauma type	Mental health measures	Category: Mental disorders/symptoms	Specific outcomes
Aday (2018)	327	2	US	0%	55.48	Prisoners	Cross-sectional	Times served(years) Prison Milieu Scale	Imprisonment	Contextual	BSI	Anxiety and depressive disorders	NA
Blonigen (2012)	226	3	U.S.	0	31.9	Prisoners	Cross-sectional	LEC& Institution file	Lifetime	Mixed	PCL-R PCL-C MPS	Disorders Specifically Associated With Stress Disorders of Personality	NA
Boland (2020)	180	20	U.S.	63.30%	31.64	Prisoners	Cross-sectional	FHHQ	Childhood	Physical Emotional Sexual Contextual	PID-5-BF	Disorders of Personality	NA
Briere (2016)	96	2	Canada	65.60%	34.3	Prisoners	Cross-sectional	DAPSRTE	Lifetime	Sexual Mixed	DAPS	Disorders Specifically Associated With Stress	NA
# Caravaca-Sánchez (2019)	174	6	Spain	0%	37.6	Prisoners	Cross-sectional	ACEs	Childhood	Physical Emotional Sexual	DASS	Anxiety and depressive disorders	NA
# Caravaca-Sánchez (2021)	174	18	Spain	0%	37.6	Prisoners	Cross-sectional	LTVH ACEs Prison trauma list	Childhood Imprisonment	Physical Emotional Sexual	TSQ DASS	Anxiety and depressive disorders Disorders Specifically Associated With Stress	NA
# Carli (2010)	1265	15	Italy	100%	39.61	Prisoners	Cross-sectional	CTQ	Childhood	Physical Sexual Emotional	MINI, EPQ (the 68th item)	NA	Suicide attempts Suicide-

													related outcomes
#	Carli (2011)	1555	5	Italy	100%	39.5	Prisoners	Cross-sectional	CTQ-34	Childhood	Physical Sexual Emotional	History of self harm	NA	Suicide-related outcomes
	Chadick (2018)	48	5	U.S.	100%	33.2	Prisoners	Cross-sectional	AS	Imprisonment	Mixed	MCMI-III	Anxiety and depressive disorder Disorders Specifically Associated With Stress	NA
	Chapman (2005)	105	6	U.S.	0%	33.9	Prisoners	Cross-sectional	CTQ DemographicsForm5	Childhood	Sexual Contextual Mixed	LPC-2	NA	Suicide attempts
	Chen L. (2017)	1705	14	China	61%	NA	Prisoners	Cross-sectional	CTQ-28 Duration in prison	Childhood Imprisonment	Physical Sexual Emotional Mixed	BDI-II BAI	Anxiety and depressive disorder	NA
	Chen G. (2017)	46	4	Israel	0%	34.82	Prisoners	Cross-sectional	CTQ	Childhood	Physical Sexual Emotional	ASI	NA	Suicide attempts
	Chen G. (2020)	290	4	Israel	78%	38.22	Prisoners	Cross-sectional	CTQ-28 CTS2 DemographicsForm8	Childhood	Contextual Mixed	History of suicidal behaviours	NA	Suicide attempts
	Cima (2008)	47	22	Netherlands	100%	30.4	Prisoners	Cross-sectional	CTQ-25	Childhood	Physical Sexual Emotional Mixed	PPI	Disorders of Personality	NA
	Clements-Nolle (2009)	247	2	U.S.	0%	34	Prisoners	Cross-sectional	CTQ-28	Childhood	Mixed	SBQ-R	NA	Suicide attempts
	Giarratano (2020)	497	1	U.S.	61%	31.64	Prisoners	Cross-sectional	TEI	Childhood	Mixed	SIDES	Disorders Specifically Associated With Stress	NA

#	Gottfried (2016)	212	42	U.S.	0%	34	Prisoners	Cross-sectional	PSA	Lifetime	Mixed	MMPI-2-RF	Disorders of Personality	NA
#	Gottfried (2019)	215	24	U.S.	0%	33.89	Prisoners	Cross-sectional	Quick view Social History Questionnaire	Childhood	Contextual	MMPI-2-RF	Disorders of Personality	NA
	Guthrie (1998)	100	1	U.S.	100.00 %	37.9	Prisoners	Cross-sectional	Clinician-Administered PTSD Scale(CAPS-DX)	Lifetime	Mixed	Clinician-Administered PTSD Scale (CAPS-DX)	Disorders Specifically Associated With Stress	NA
	Harner (2015)	387	5	U.S.	0%	38	Prisoners	Cross-sectional	PDS	Lifetime Childhood	Physical Sexual	PDS	Disorders Specifically Associated With Stress	NA
#	Howard (2017a)	89	2	UK	0%	34.52	Prisoners	Cross-sectional	CTQ	Childhood	Mixed	PCL-C	Disorders Specifically Associated With Stress	NA
#	Howard (2017b)	89	1	UK	0%	34.52	Prisoners	Cross-sectional	CTQ	Childhood	Mixed	PCL-C	Disorders Specifically Associated With Stress	NA
#	Huang (2006)	471	32	China	0%	31.6	Prisoners	Cross-sectional	TLEQ (Chinese version)	Lifetime	Physical Sexual Contextual Mixed	CAPS	Disorders Specifically Associated With Stress	NA
#	Huang (2008)	471	1	China	0%	31.6	Prisoners	Cross-sectional	TLEQ	Lifetime	Sexual	CAPS	Disorders Specifically Associated With Stress	NA
	Jones (2020)	349	1	U.S.	0%	36	Prisoners	Cross-sectional	ACE	Childhood	Mixed	PCL-C	Disorders Specifically Associated With Stress	NA
#	Karatzias (2018)	89	3	UK	0%	34.5	Prisoners	Cross-sectional	LEC	Lifetime	Mixed	PCL-5	Disorders Specifically	NA

													Associated With Stress	
	Kimonis (2011)	373	2	U.S.	100%	16.43	Prisoners	Cross-sectional	LES	Lifetime	Physical	K-SADS-PL	Disorders Specifically Associated With Stress	NA
	Komarovskaya (2011)	125	8	U.S.	100%	36.78	Prisoners	Cross-sectional	THQ	Lifetime	Physical Sexual Mixed	IES-R	Disorders Specifically Associated With Stress	NA
	Konecky (2019)	152	12	U.S.	0%	37	Prisoners	Cross-sectional	THQ	Lifetime	Contextual Mixed	CAPS-5	Disorders Specifically Associated With Stress	NA
	Koskinen (2016)	667	1	U.S.	94%	NA	Prisoners	Cross-sectional	LSC-R	Lifetime	Mixed	PCL-C	Disorders Specifically Associated With Stress	NA
	Krammer (2017)	49	20	Switzerland	100%	40.1	Prisoners	Cross-sectional	ACE	Childhood	Physical Sexual Emotional Mixed	SCL-90-R	Anxiety and depressive disorders Disorders of Personality	NA
	Krischer (2008)	89 96	10	Germany	0% 100%	17.32 17.92	Prisoners	Cross-sectional	CTQ	Childhood	Physical Sexual Emotional	PCL:YV	Disorders of Personality	NA
	Lanes (2009)	264	1	U.S.	100%	NA	Prisoners	Cross-sectional	CTQ	Childhood	Mixed	History of self-injuries	NA	Suicide-related outcomes
#	Lynch (2012)	102	6	U.S.	0%	32.52	Prisoners	Cross-sectional	SVAWS	Pre-imprisonment	Mixed	ADUHQ BSI CESD-R PCL-C	Anxiety and depressive disorders Disorders Specifically Associated With Stress	NA

#	Lynch (2017)	59	4	U.S.	0%	34	Ex-prisoners	Longitudinal	THQ	Lifetime Post-imprisonment	Mixed	CES-D PCL-C	Anxiety and depressive disorders Stress-related disorders	NA
#	Maschi (2011)	334	1	U.S.	100%	60.83	Prisoners	Cross-sectional	LSC-R	Lifetime	Mixed	PCL-C	Disorders Specifically Associated With Stress	NA
#	Maschi (2014)	677	1	U.S.	100%	61	Prisoners	Cross-sectional	LSC-R	Lifetime	Mixed	PCL-C	Disorders Specifically Associated With Stress	NA
	Matsumoto (2005)	796	1	Japan	100%	23.7	Prisoners	Cross-sectional	LEC	Lifetime	Physical	History of self-cutting	NA	Suicide related outcomes
	McReynolds (2011)	220	2	U.S.	0%	16	Prisoners	Cross-sectional	V-DISC	Lifetime	Physical Sexual	VISA	NA	Suicide related outcomes
	Moeller (2003)	102	1	Swiss	100%	21.3	Prisoners	Cross-sectional	SCID-1	Lifetime	Mixed	PCL-R	Disorders of Personality	NA
	Öğülmüş (2020)	329	1	Turkey	100%	36.19	Prisoners	Cross-sectional	LEC	Lifetime	Mixed	PCL-5	Disorders Specifically Associated With Stress	NA
	Payne (2008)	26	1	UK	100%	33.8	Prisoners	Cross-sectional	THQ	Lifetime	Mixed	IES-R	Disorders Specifically Associated With Stress	NA
	Pedrogo (2019)	1179	1	Puerto Rico	NA	NA	Prisoners	Cross-sectional	DTS	Lifetime	Mixed	DTS	Disorders Specifically Associated With Stress	NA
	Poehlmann (2005)	94	2	U.S.	0%	28.33	Prisoners	Cross-sectional	RDTI	Lifetime	Mixed	CES-D	Anxiety and depressive disorders	NA

#	Roy (2014)	1537	6	Italy	100%	39.6	Prisoners	Cross-sectional	CTQ	Childhood	Physical Sexual Emotional Mixed	History of suicide attempt	NA	Suicide attempts
#	Sarchiapone (2009a)	1117	3	Italy	100%	39.5	Prisoners	Cross-sectional	CTQ	Childhood	Emotional Mixed	MINI & EPQ	NA	Suicide attempts Suicide-related outcomes
#	Sarchiapone (2009b)	903	1	Italy	100%	40.18	Prisoners	Cross-sectional	CTQ	Childhood	Mixed	MINI	NA	Suicide-related outcomes
	Schappell (2016)	100	4	U.S.	100%	38.33	Ex-prisoners	Cross-sectional	NVAWMS	Imprisonment	Physical	ASR PCL	Anxiety and depressive disorders Disorders Specifically Associated With Stress	NA
	Schimmenti (2015)	78	4	Italy	100%	43.32	Prisoners	Cross-sectional	TEC	Childhood	Physical Sexual Emotional Mixed	PCL-R	Disorders of Personality	NA
	Sevecke (2016)	171 170	8	Germany	0% 100%	17.54 17.75	Prisoners	Cross-sectional	CTQ	Childhood	Physical Sexual	PCL:YV DAPP-BQ	Disorders of Personality	NA
	Skarupski (2016)	192	4	U.S.	100%	41.8	Prisoners	Cross-sectional	ACE	Childhood	Contextual Mixed	CESD-R	Anxiety and depressive disorders	NA
	Smith (2020)	180	1	U.S.	0%	35.49	Prisoners	Cross-sectional	TCI	Lifetime	Mixed	TSI	Disorders Specifically Associated With Stress	NA
	Sygit-Kowalkowska (2017)	46	1	Poland	0%	35.95	Prisoners	Cross-sectional	Number of years of imprisonment	Imprisonment	Mixed	HADS-M	Anxiety and depressive disorder	NA

	Taşören (2017)	43	1	Turkey	100%	19.14	Prisoners	Cross-sectional	CTQ	Childhood	Mixed	History of self-harm	NA	Suicide-related outcomes
#	Tripodi (2013)	125	3	U.S.	0%	34.3	Prisoners	Cross-sectional	CTQ	Childhood	Physical Sexual Mixed	ASI	NA	Suicide attempts
#	Tripodi (2014)	125	2	U.S.	0%	34.3	Prisoners	Cross-sectional	CTQ	Childhood	Physical Sexual	ASI	NA	Suicide attempts
#	Tripodi (2019)	230	12	U.S.	0%	33.7	Ex-prisoners	Longitudinal	ABI CTQ	Childhood Pre-imprisonment	Physical Sexual Emotional	MINI SAM	Anxiety and depressive disorders	NA
	Willemsen (2012)	81	2	Belgium	100%	39.8	Prisoners	Cross-sectional	SCID-I	Pre-imprisonment	Mixed	SCID-I PCL-R	Disorders Specifically Associated With Stress Disorders of Personality	NA
	Wolff (2014)	592	7	U.S.	100%	42.7	Prisoners	Cross-sectional	THQ	Lifetime	Physical Sexual	PCL-C	Disorders Specifically Associated With Stress	NA
	Woodfield (2016)	101	3	UK	100%	33.01	Prisoners	Cross-sectional	LEC-5	Lifetime	Mixed	PCL-5 SRP-SF	Disorders Specifically Associated With Stress Disorders of Personality	NA
	Zhang (2018)	1001	15	China	100%	30.86	Prisoners	Cross-sectional	CTQ-SF	Childhood	Physical Sexual Emotional	PDQ-4	Disorders of Personality	NA
	Zlotnick (1999)	85	2	U.S.	0	31	Prisoners	Cross-sectional	Clinician-Administered Assessment Interview for Adults	Childhood	Mixed	SCID-R/NP-V	Disorders of Personality	Structured Clinical Interview for DSM-IV, Non-

Notes: k, number of effect sizes, *N*, total sample size; # indicates overlapping populations in multiple publications: (1) Caravaca-Sánchez(2019); Caravaca-Sánchez (2021); (2) Carli (2010); Carli (2011); Sarchiapone (2009a); Sarchiapone (2009b); Roy (2014); (3) Gottfried (2016); Gottfried (2019); (4) Howard (2017a); Howard (2017b); Karatzias (2018); (5) Huang (2006); Huang (2008); (6)Maschi (2011); Maschi (2014); (7) Tripodi (2013); Tripodi (2014); Tripodi (2019); (8) Lynch(2012); Lynch (2017). ABI -Abuse Behavior Inventory, ACE -Adverse Childhood Experiences, ADUHQ -Alcohol and Drug Use History Questionnaire, AS -Administrative Segregation, ASI -Addiction Severity Index, ASR -Adult Self-Report, BAI -Beck Anxiety Inventory, BDI-II -Beck Depression Inventory-II, BSI -Brief Symptom Inventory, CAPS -Clinician-administered PTSD scale, CAPS-5-Clinician-Administered PTSD scale for DSM-5, CES–D -Center for Epidemiological Studies-Depression Scale, CESD-R -Center for Epidemiological Studies Depression Scale Revised, CTQ -Childhood Trauma Questionnaire, CTQ-25 -Childhood Trauma Questionnaire (25 items), CTQ-28 -Childhood Trauma Questionnaire (28 items), CTQ-34 -Childhood Trauma Questionnaire (34 items), CTQ-SF -Childhood Trauma Questionnaire-Short Form, CTS2 -Conflict Tactics Scale, DAPP-BQ -Dimensional Assessment of Personality Pathology-Basic Questionnaire, DAPS -Detailed Assessment of Posttraumatic Stress, DAPS RTE -Detailed Assessment of Posttraumatic Stress Relative Trauma Exposure, DASS-Depression Anxiety Stress Scales, DTS -Davidson Trauma Scale, EPQ -Eysenck Personality Questionnaire, FHHQ -Family Health History Questionnaire, HADS-M scale -Hospital Anxiety and Depression Scale -modified by Majkowicz, de Walden-Gałuszko, Chojnacka-Szawłowska, IES-R -Impact of Event Scale – Revised, K-SADS-PL -Schedule for Affective Disorders and Schizophrenia for School-Age Children—Present and Lifetime version, LEC-Life Event Checklist, LEC-5-Life Event Checklist for DSM-5, LES -Life Events Scale, LPC-2 -The Lifetime Parasuicide Count-2, LSC-R -Life Stressor Checklist-Revised, LTVH -Lifetime Trauma and Victimization History, MCMI-III -Millon Clinical Multiaxial Inventory-III, MINI -Mini Neuropsychiatric Interview, MMPI-2-RF -Minnesota Multiphasic Personality Inventory-2-Restructured Form, MPS -Multidimensional Personality Questionnaire-Brief Form, NVAWMS -National Violence Against Women and Men Survey, PCL -PTSD Checklist, PCL:YV -Psychopathy Checklist Youth Version, PCL-5-Posttraumatic Stress Disorder-Checklist version 5, PCL-C -PTSD Checklist–Civilian version, PCL-R -Psychopathy Checklist–Revised, PDQ4+-Personality Diagnostic Questionnaire 4+, PDS -Posttraumatic Diagnostic Scale, PID-5-BF -Personality Inventory for DSM-5 Brief Form, PPI -Psychopathic Personality Inventory, PSA -Physical and Sexual Abuse scale, RDTI -Relationship disconnection–trauma index, SAM -Substance Abuse Module, SBQ-R -Suicidal Behaviors Questionnaire-Revised, SCID-I -Structured Clinical Interview for DSM-IV Axis I Disorders, SCID-R, NP-V -Structured Clinical Interview for DSM-IV NonPatient Version, SCL-90-R -Symptom Checklist-90-Revised, SIDES -

Structured Interview for Disorders of Extreme Stress, SRP-SF -Self-Report Psychopathy Scale-Short Form, SVAWS -Severity of Violence Against Women Scale, TCI -Trauma Content Index, TEC -Traumatic Experiences Checklist, TEI -Traumatic Events Inventory, THQ -Trauma History Questionnaire, TLEQ -Traumatic Life Events Questionnaire, TSI -Trauma Symptom Inventory, TSQ -Trauma Screening Questionnaire, V-DISC -Voiced Diagnostic Interview Schedule for Children, VISA -Voiced Index of Self-injurious Actions.

Appendix D. Reference list of eligible studies

Aday, R. H., & Dye, M. H. (2019). Examining predictors of depression among older incarcerated women. *Women and Criminal Justice*, *29*(1), 32–51. https://doi.org/10.1080/08974454.2018.1443870

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Appendix E. Funnel plots

Figure E.1. Begg's Funnel plots of the pooled effect sizes between overall trauma and mental disorders.

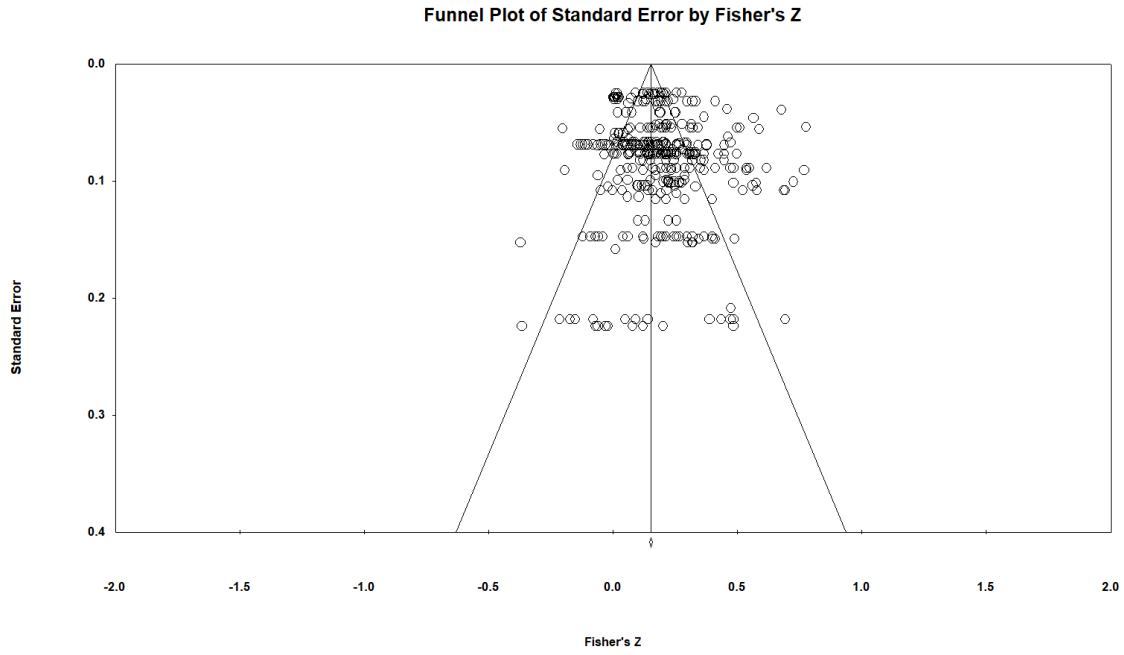


Figure E.2. Begg's Funnel plots of the pooled effect sizes between childhood trauma and mental disorders.

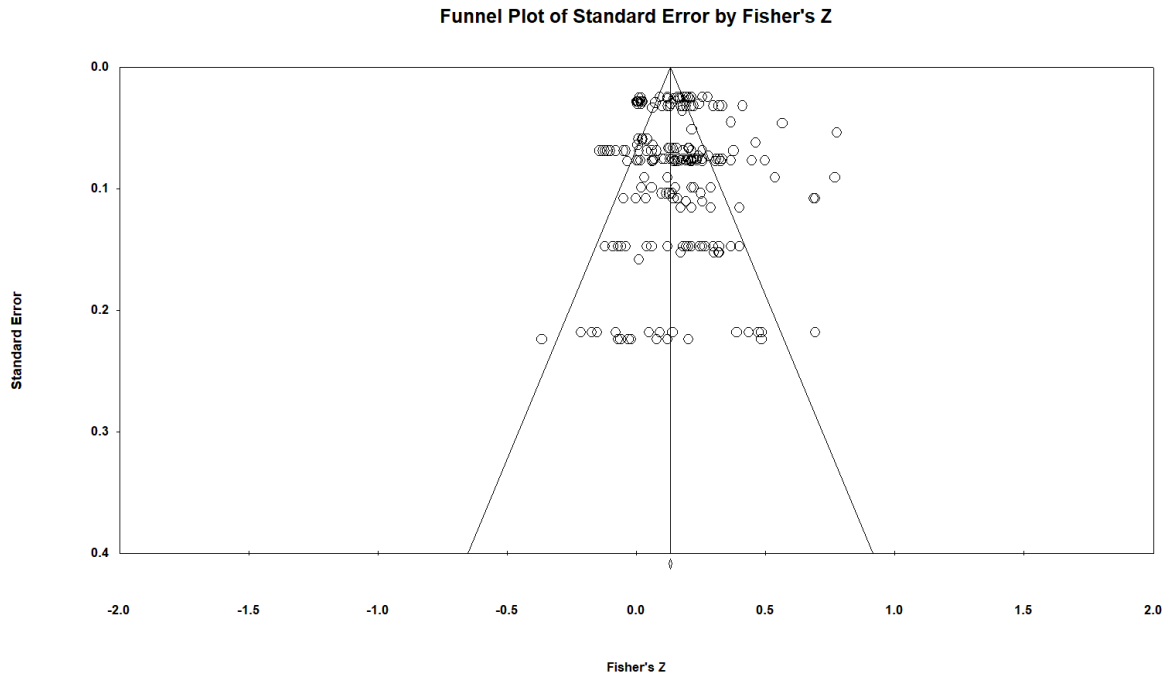


Figure E.3. Begg's Funnel plots of the pooled effect sizes between pre-imprisonment trauma and mental disorders.

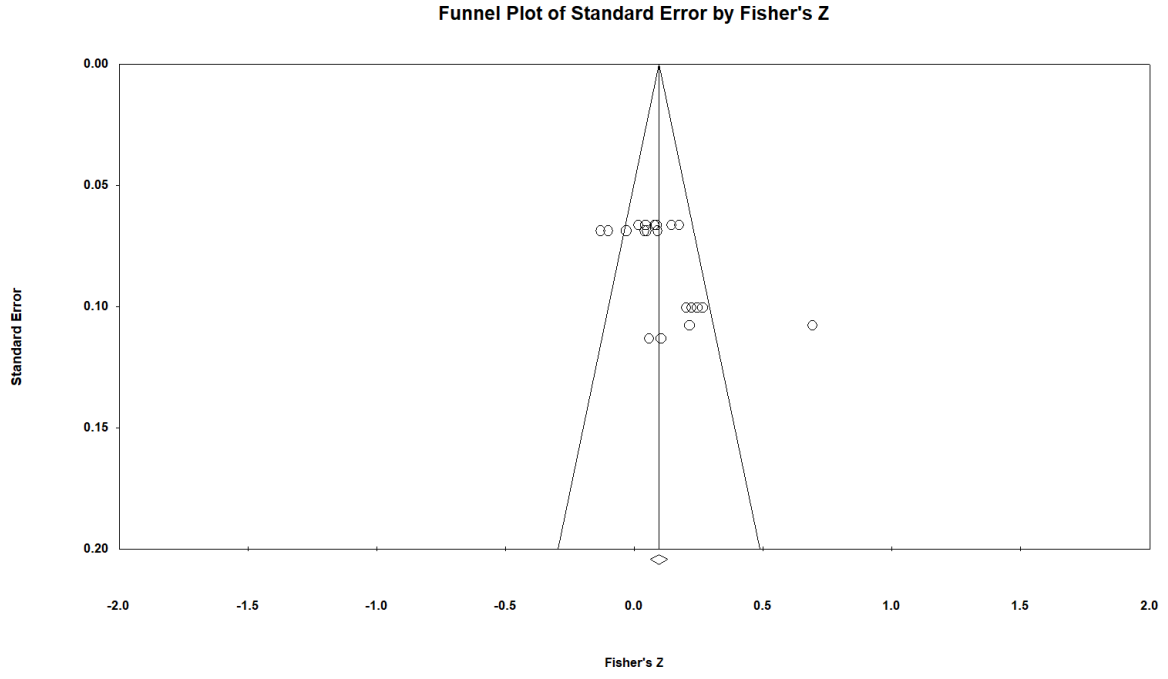


Figure E.4. Begg's Funnel plots of the pooled effect sizes between imprisonment trauma and

mental disorders.

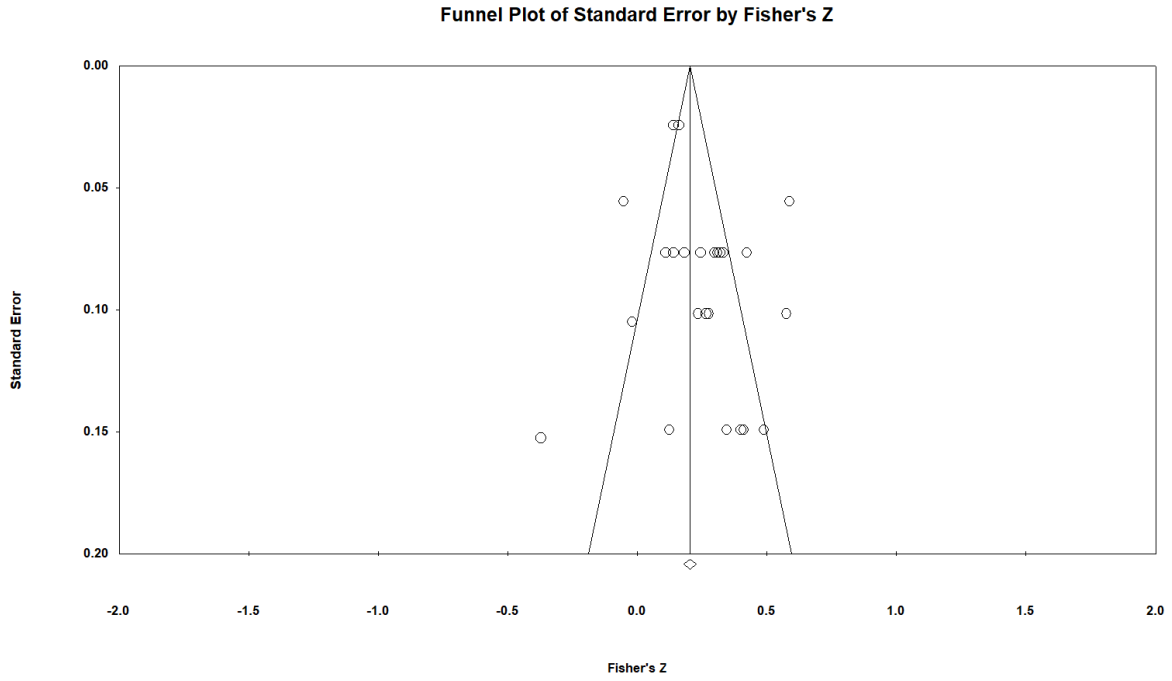


Figure E.5. Begg's Funnel plots of the pooled effect sizes between lifetime trauma and mental disorders.

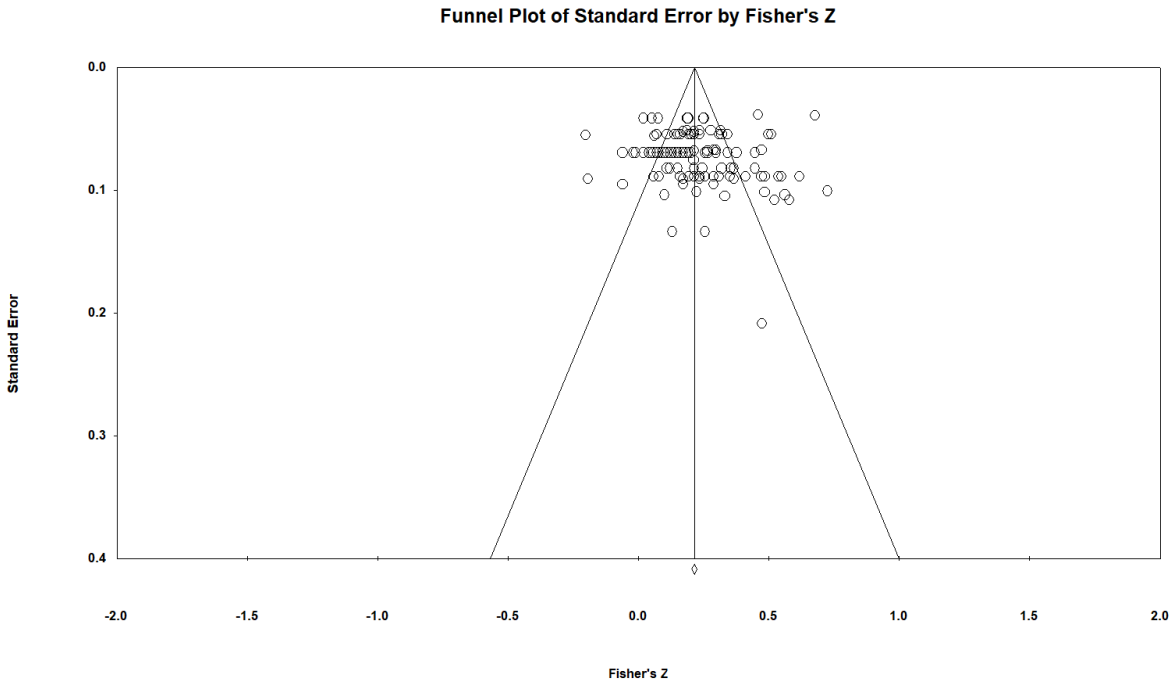


Figure E.6. Begg's Funnel plots of the pooled effect sizes between physical trauma and mental disorders.

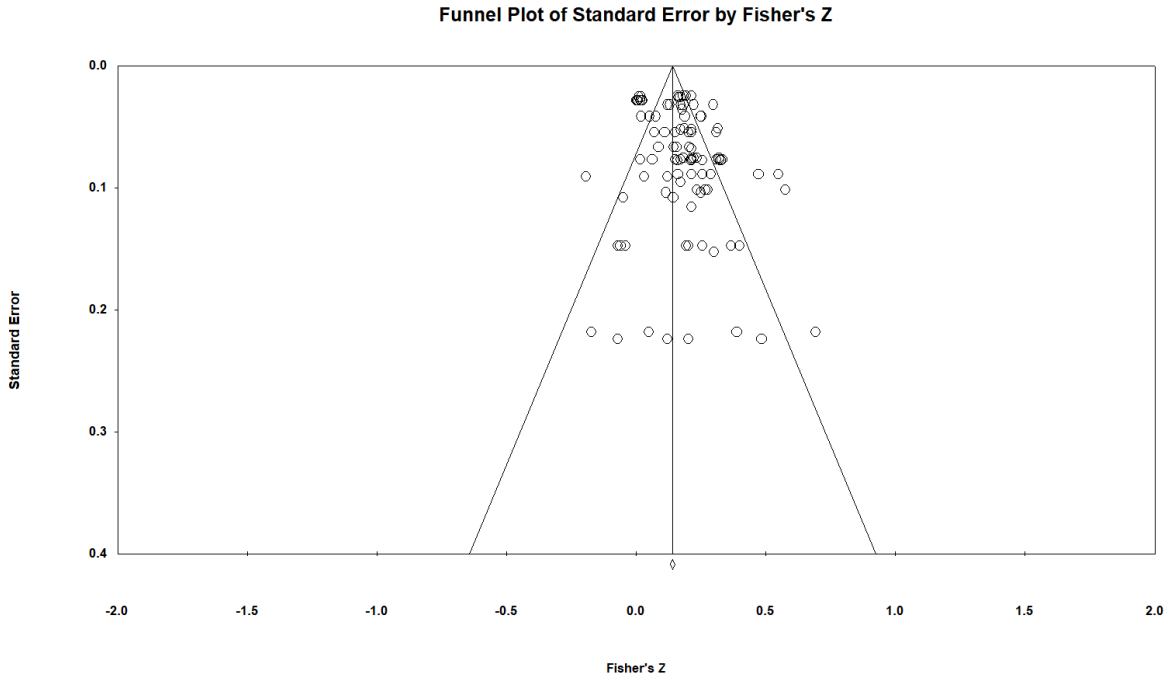


Figure E.7. Begg's Funnel plots of the pooled effect sizes between sexual trauma and mental disorders.

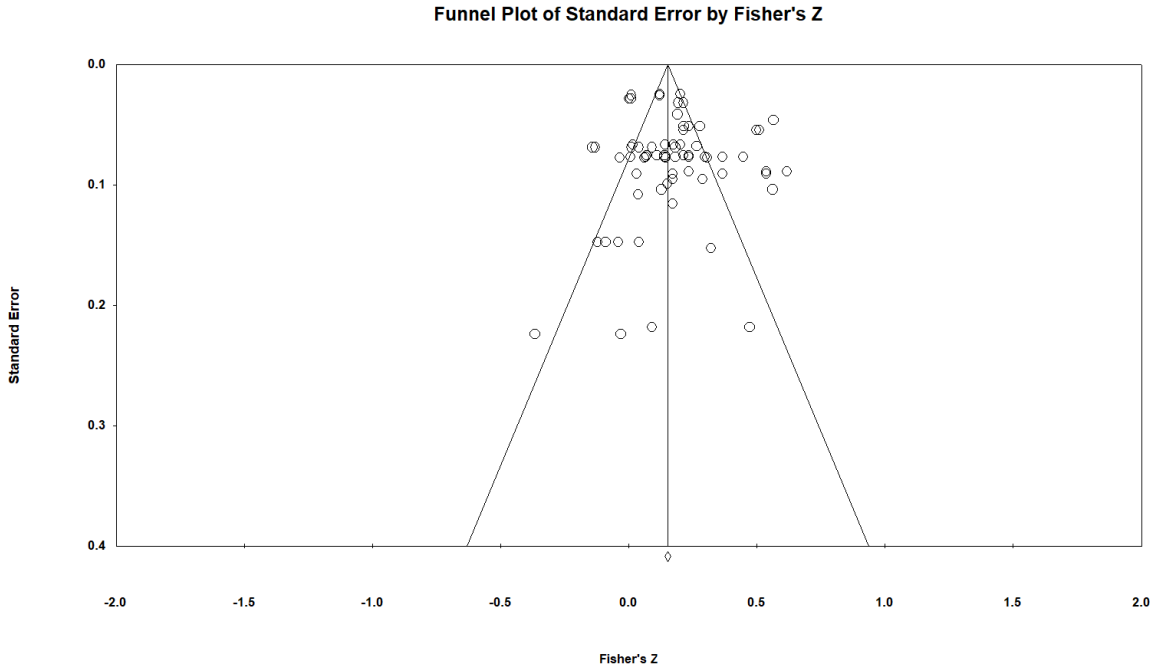


Figure E.8. Begg's Funnel plots of the pooled effect sizes between emotional trauma and mental disorders.

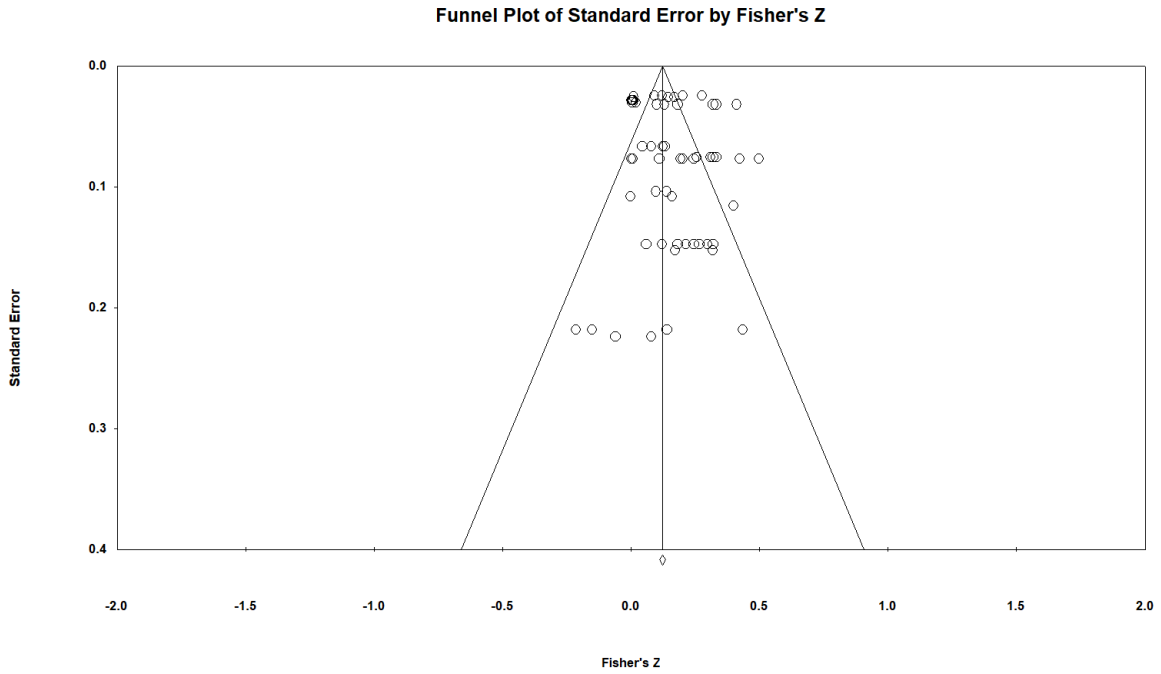


Figure E.9. Begg's Funnel plots of the pooled effect sizes between contextual trauma and mental disorders.

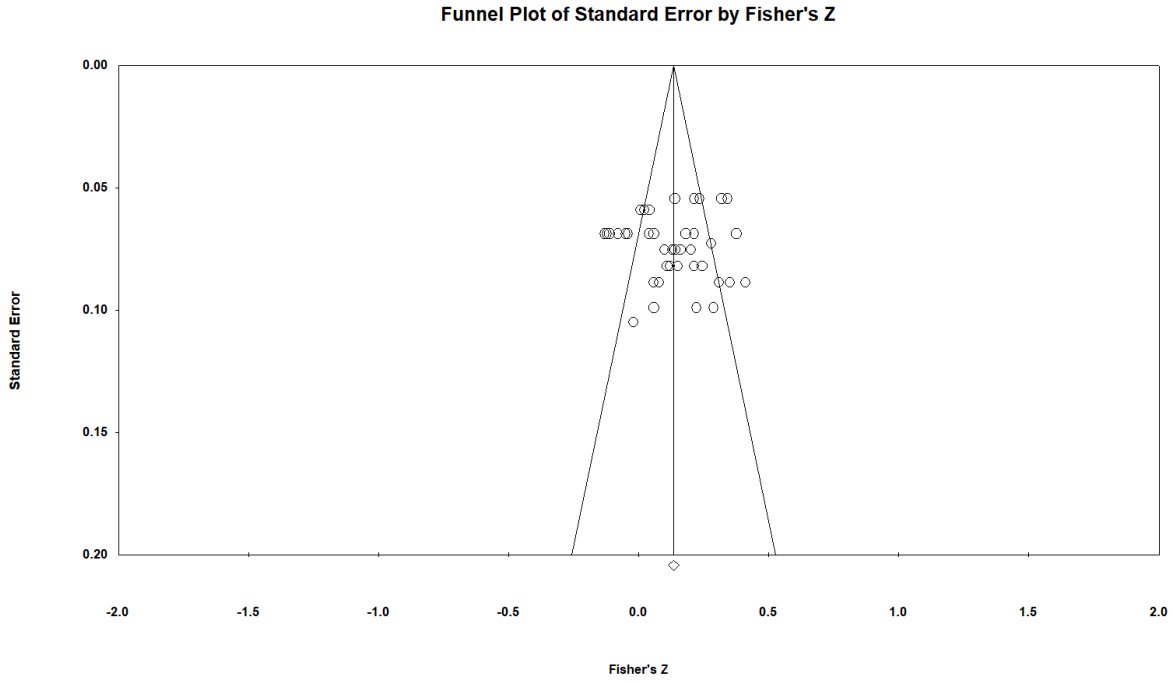
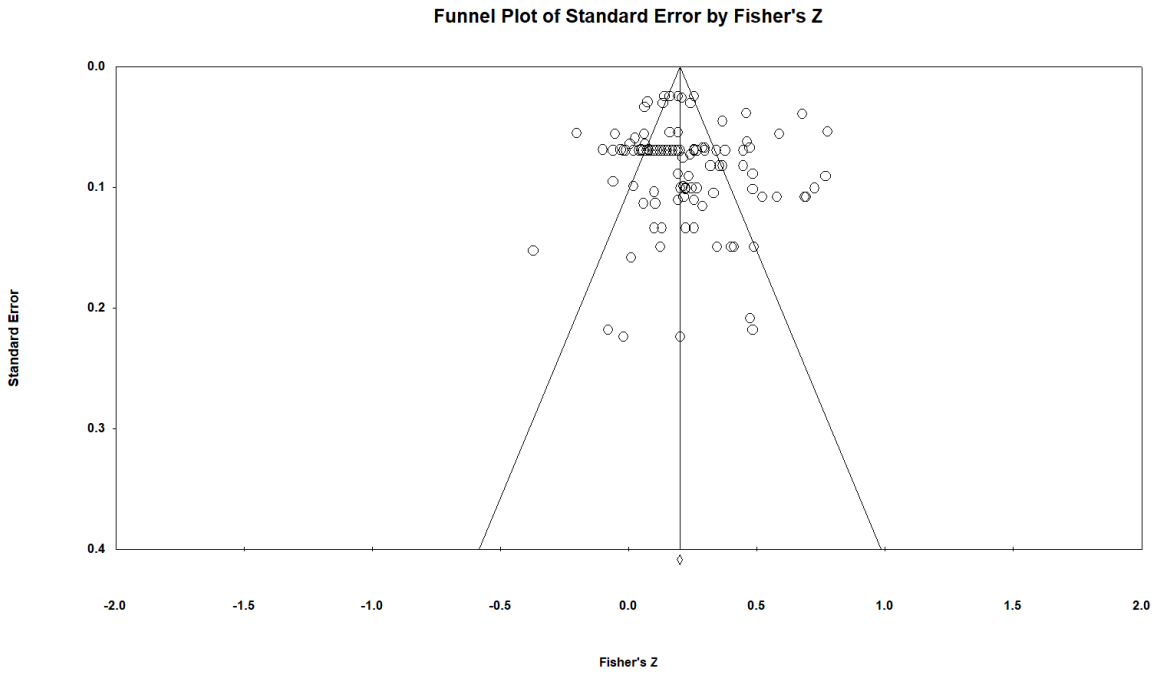


Figure E.10. Begg's Funnel plots of the pooled effect sizes between mixed trauma and mental disorders.



Appendix F. Quality assessment

Author	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total score
Aday(2018)	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N/A	Y	17
Blonigen(2012)	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N/A	16
Boland(2020)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N/A	14
Briere(2016)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N/A	N/A	13
Caravaca-Sánchez(2019)	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N/A	Y	16
Caravaca-Sánchez(2021)	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N/A	Y	16
Carli(2010)	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	18
Carli(2011)	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	18
Chadick(2018)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	15
Chapman(2005)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N/A	Y	14
Chen G.(2017)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N/A	Y	14
Chen G.(2020)	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	16
Chen L.(2017)	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	17
Cima(2008)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	15
Clements-Nolle(2009)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	19
Giarratano(2020)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	19

Gottfried(2016)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N/A	Y	18
Gottfried(2019)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N/A	Y	18
Guthrie(1998)	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N/A	Y	17
Harner(2015)	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	18
Howard(2017a)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N/A	Y	15
Howard(2017b)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N/A	Y	15
Huang(2006)	Y	Y	N	Y	Y	Y	N/A	Y	Y	Y	Y	Y	Y	N/A	Y	Y	Y	Y	Y	N/A	Y	16
Huang(2008)	Y	Y	N	Y	Y	Y	N/A	Y	Y	Y	Y	Y	Y	N/A	Y	Y	Y	Y	Y	N/A	Y	16
Jones(2020)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	N/A	N/A	16
Karatzias(2018)	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N/A	Y	17
Kimonis(2011)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N/A	Y	15
Komarovskaya(2011)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N/A	Y	18
Konecky(2019)	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N/A	Y	17
Koskinen(2016)	Y	Y	N	Y	Y	N	N/A	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	17
Krammer(2018)	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N/A	Y	17
Krischer(2008)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N/A	Y	14
Lanes(2009)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	N	N/A	N/A	12	
Lynch(2012)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	15	
Lynch(2017)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	15	
Maschi(2011)	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	17	
Maschi(2014)	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	17	
Matsumoto(2005)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N/A	Y	14	

McReynolds(2011)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	N/A	13
Moeller(2003)	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	N	N/A	N/A	13
Öğülmüş(2020)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N/A	Y	14
Payne(2008)	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N/A	Y	16
Pedrogo(2019)	Y	Y	N	N	Y	Y	N	Y	Y	Y	Y	N	Y	N	Y	Y	Y	Y	Y	Y	15
Poehlmann(2005)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	16
Roy(2014)	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	18
Sarchiapone(2009a)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N/A	Y	16
Sarchiapone(2009b)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N/A	Y	16
Schappell(2016)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N/A	Y	14
Schimmenti(2015)	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	18
Sevecke(2016)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	16
Skarupski(2016)	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N/A	Y	15
Smith(2020)	Y	N/A	N	Y	Y	N	N	Y	Y	Y	N	Y	N	N	Y	Y	Y	N	N/A	Y	11
Sygit-Kowalkowska(2017)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	15
Taşören(2017)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	N/A	N/A	13
Tripodi(2013)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	19
Tripodi(2014)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	19
Tripodi(2019)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	19
Willemsen(2012)	Y	Y	N	N	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N/A	13
Wolff(2014)	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	19

Woodfield(2016)	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	17
Zhang(2018)	Y	Y	N	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	16
Zlotnick(1999)	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N/A	N/A	16

Notes. Items of AXIS; N = No (0); Y = Yes(1).

Introduction

1 Were the aims/objectives of the study clear?

Methods

2 Was the study design appropriate for the stated aim(s)?

3 Was the sample size justified?

4 Was the target/reference population clearly defined? (Is it clear who the research was about?)

5 Was the sample frame taken from an appropriate population base so that it closely represented the target/reference population under investigation?

6 Was the selection process likely to select subjects/participants that were representative of the target/reference population under investigation?

7 Were measures undertaken to address and categorise non-responders?

8 Were the risk factor and outcome variables measured appropriate to the aims of the study?

9 Were the risk factor and outcome variables measured correctly using instruments/ measurements that had been trialled, piloted or published previously?

10 Is it clear what was used to determined statistical significance and/or precision estimates? (e.g., p values, CIs)

11 Were the methods (including statistical methods) sufficiently described to enable them to be repeated?

Results

12 Were the basic data adequately described?

13 Does the response rate raise concerns about non-response bias?

14 If appropriate, was information about non-responders described?

15 Were the results internally consistent?

16 Were the results for the analyses described in the methods, presented?

Discussion

17 Were the authors' discussions and conclusions justified by the results?

18 Were the limitations of the study discussed?

Other

19 Were there any funding sources or conflicts of interest that may affect the authors' interpretation of the results?

20 Was ethical approval or consent of participants attained?

Appendix for Chapter 3 (Study 2)

Appendix G. Drafted 53 items based on the frameworks

	Draft items (N=53)	Drive to Thrive (DTT) theory (Pathway to resilience)	Risk-need-responsivity (RNR) model (Pathway to desistance)
1.	I keep up with the institutional routines on personal hygiene.	Primary routines - hygiene	Structured behaviors
2.	I keep up with the institutional routines on eating/diet.	Primary routines - eating/diet	Structured behaviors
3.	I keep up with the institutional routines on sleep schedules.	Primary routines - sleep	Structured behaviors
4.	I keep up with the institutional routines on exercise.	Primary routines - exercise	Structured behaviors
5.	I go out and keep active when I am free.	Secondary routines - leisure (physical)	Structured behaviors
6.	In my leisure time, I engage in sports and exercises such as running, jogging, etc.	Secondary routines - leisure (physical)	Structured behaviors
7.	In my leisure time, I engage in light exercises, such as walking, cleaning, chores, or similar activities.	Secondary routines - leisure (physical)	Structured behaviors

8. I use my phone for online leisure activities.	Secondary routines - leisure (online)	Structured behaviors
9. I use computer for online leisure activities.	Secondary routines - leisure (online)	Structured behaviors
10. I spend time on social media (Facebook, WhatsApp, Instagram, YouTube, etc) to interact with friends.	Secondary routines - leisure (online)	Structured behaviors
11. I spend time on social media (Facebook, WhatsApp, Instagram, YouTube, etc) to learn about news.	Secondary routines - leisure (online)	Structured behaviors
12. I play online games.	Secondary routines - leisure (online)	Structured behaviors
13. I go out and get together with my friends or colleagues.	Secondary routines - leisure (social)	Structured behaviors
14. I go out and get together with companions that I made at rehabilitation center(s).	Secondary routines - leisure (social)	Structured behaviors
15. I go out and get close to the nature with my colleagues or friends.	Secondary routines - leisure (social)	Structured behaviors
16. I go out and get close to the nature with companions that I made at rehabilitation center(s).	Secondary routines - leisure (social)	Structured behaviors

17. I smoke.	Unstructured behaviors	Poor use of leisure time/High risky behaviors
18. I drink.	Unstructured behaviors	Alcohol misuse
19. I take drugs.	Unstructured behaviors	Drug misuse
20. I buy sexual service.	Unstructured behaviors	Poor use of leisure time/High risky behaviors
21. I seek for sexual partner online.	Unstructured behaviors	Poor use of leisure time/High risky behaviors
22. I watch pornography.	Unstructured behaviors	Poor use of leisure time/High risky behaviors
23. I work as sexual worker.	Unstructured behaviors	Poor use of leisure time/High risky behaviors
24. I participate in gang activities.	Unstructured behaviors	Poor use of leisure time/High risky behaviors

25. I gamble.	Unstructured behaviors	Poor use of leisure time/High risky behaviors
26. I stay at home for taking drugs and go out only for a purpose.	Unstructured behaviors	Poor use of leisure time/High risky behaviors
27. I lie down and do nothing.	Unstructured behaviors	Poor use of leisure time/High risky behaviors
28. I do not stay at home alone because it makes me think a lot about my past experiences.	Unstructured behaviors	Poor use of leisure time/High risky behaviors
29. I wander around aimlessly.	Unstructured behaviors	Poor use of leisure time/High risky behaviors
30. I hang out with companions that I have known before the imprisonment.	Secondary routines -social	Pro-criminal associates
31. I hang out with companions that I made during the imprisonment.	Secondary routines -social	Pro-criminal associates
32. I hang out with companions that I made at	Secondary routines -social	Pro-criminal associates

rehabilitationcenter(s).		
33. I write or visit companions who are still inside the prison.	Secondary routines -social	Pro-criminal associates
34. I visit companions who are drug addicts.	Secondary routines -social	Pro-criminal associates
35. I visit my family members.	Secondary routines -social	Family relationship
36. I visit my child.	Secondary routines -social	Family relationship
37. I visit friends who are law-abiding individuals.	Secondary routines -social	Structured behaviors
38. I talk with social workers about my financial/living issues.	Secondary routines -social	Structured behaviors
39. I share my feelings and my recent life with social workers.	Secondary routines -social	Structured behaviors
40. I go to religious organizations.	Secondary routines -social	Structured behaviors
41. I get along with friends that I met in religious activities.	Secondary routines -social	Structured behaviors
42. I take some voluntary work in religious organizations.	Secondary routines -social	Structured behaviors
43. I deal with job duties on my own.	Secondary routines - Work/School	School/Work
44. I spend time interacting with people at work.	Secondary routines - Work/School	School/Work
45. I do manual labour (cleaning, moving, etc.).	Secondary routines - Work/School	School/Work

46. I do skilled work (delivery services, driver, etc.).	Secondary routines - Work/School	School/Work
47. I go to school.	Secondary routines - Work/School	School/Work
48. I do voluntary work in my spare time.	Secondary routines - Work/School	School/Work
49. I seek professional services for my physical health issues.	Helping seeking behaviors in community settings	Helping seeking behaviors in community settings
50. I seek social services/help from social workers, community, friends, or family for my financial problems.	Helping seeking behaviors in community settings	Helping seeking behaviors in community settings
51. I seek social services/help from social workers, community, friends, or family for helping me find a job.	Helping seeking behaviors in community settings	Helping seeking behaviors in community settings
52. I seek social services/help from social workers, community, friends, or family for my housing problems.	Helping seeking behaviors in community settings	Helping seeking behaviors in community settings
53. I follow strict parole and probation requirements.	Helping seeking behaviors in community settings	Helping seeking behaviors in community settings

* Note: Four necessary primary routines were reflected in items measuring the structured institutional routines, including personal hygiene, eating/diet, sleep, and exercise. Four domains of secondary routines, including socializing with friends, leisure activities, work/study

involvement, and exercising, were drafted. Specifically, we developed items measuring socializing with both antisocial associates and law-abiding individuals whom they made outside their criminal circles. For leisure activities, we developed items measuring both structured leisure activities and non-structured recreational activities indicating poor use of leisure times or high risky health-related behaviors. Work/study involvement and exercise were reflected in items measuring participation in different work/study and physical activities. Items were also drafted to measure behaviors related to substance abuse and family relationships, which are considered as two important domains of daily routines that are related to desistance as suggested in the RNR model. In addition to daily routines reflected in DTT theory and the RNR model, some items also measured the help-seeking behaviors of ex-prisoners who face different types of daily stressors after release, such as housing, financial, employment, and relationship.

Appendix H. Theoretical basis for Post Release Living Inventory for Ex-prisoners (PORLI-ex)

Theoretical basis		**Drive to Thrive (DTT) theory (Pathway to resilience)**	**Risk-need-responsivity (RNR) model (Pathway to desistance)**	**Post-Release Living Inventory for ex-prisoners (PORLI-ex)**
Dimensions "Institutional routines"	Primary routines	• Hygiene		1.Institutional routines
		• Eating		
		• Sleep		
		• Home time		
"Non-institutional routines"	Secondary routines	• Socializing with friends	• Antisocial Associates	2. Socializing with Ex-prisoner Friends
		• Leisure activities: structured leisure activities	• Leisure/Recreation: poor use of leisure time	3. Online Leisure 4. Religious Engagement 5. Nonactivity

	• Work/study involvement	• Education/Employment	6. Work Involvement
	• Exercising		7. Active Living
		• Substance Abuse - alcohol, drug	8. Maladaptive Behaviors
		• Family/Marital Circumstance	
			9. Seeking Professional Support

Appendix I. Detailed process of the expert discussion, background of each expert, and mean scores of expert ratings

Process of expert discussion

First, drafted items based on RNR model and Drive to Thrive (DTT) theory were reviewed by an expert panel consisting of two psychologists, one criminologist, and three social workers and community workers. Experts were asked to rate

"Please rate how **RELEVANT** you do the following items is to the post-release daily routines of the ex-prisoners?". Experts rated each item on an 11-point scale (0=*Not at all relevant*, 5=*Moderately relevant*, 10=*Very much relevant*). The experts were also asked to add any additional items that were not shown on the list. Less relevant items were removed, and wordings were modified and polished through discussion among panel members.

Background of each expert invited

Two psychologists: WKH & HL

WKH has conducted programmatic research investigating psychological resilience in everyday life. The previous projects have led to publications in high-impact international refereed journals.

Hou, W. K.*, Lai, F. T. T., Ben-Ezra, M., & Goodwin, R. (2020). Regularizing daily routines for mental health during and after the COVID-19 pandemic. Journal of Global Health, 10(2), 020315.

Hou, W. K.*, Lai, F. T. T., Hougen, C., Hall, B. J., & Hobfoll, S. E. (2019). Measuring everyday processes and mechanisms of stress resilience: Development and initial validation of the Sustainability of Living Inventory (SOLI). Psychological Assessment, 31, 715-729.

Hou, W.K.*, & Bonanno, G.A. (2018). Emotions in everyday life during social movements: Prospective predictions of mental health. Journal of Counseling Psychology, 65, 120-131.

WKH & HL have also amassed a track record of impactful research outputs on public mental health. The research has contributed to a thorough understanding on the adaptation processes and mechanisms of populations undergoing major life stressors.

Hou, W. K.*, Hall, B. J., Liang, L., Li, T. W., **Liu, H**., & Galea, S. (2021). Probable depression and suicidal ideation in Hong Kong amid massive civil unrest. Annals of Epidemiology, 54, 45-51.

Hou, W. K.*, Lee, T. M. C., Liang, L., Li, T. W., **Liu, H**., Ettman, C. K., & Galea, S. (2021). Civil unrest, COVID-19 stressors, anxiety, and depression in the acute phase of the pandemic in Hong Kong. Social Psychiatry and Psychiatric Epidemiology.

Criminologist: KL

Mr. KL is the Research & Development Manager of The Society of Rehabilitation and Crime Prevention (SRACP) in Hong Kong SAR, China. He has a track record of impactful local research on post-release daily living among ex-prisoners in Hong Kong. The research has contributed to the annual research bulletin (Sracpology) that disseminates local knowledge on crime prevention and rehabilitation of marginalized persons in Hong Kong.

Lau, K. L., Chan, S. M., Mok, Y. C., & Mok Y. L., (2017). Facts and Myths: ICE use in Heroin Abusers. In HKCSS (Ed.), The 10th Mainland, Hong Kong and Macau Conference on Prevention of Drug Abuse 2017 Publications (pp. 107-112). Hong Kong: The Hong Kong Council of Social Service.

Lau, K. L. & Mok Y. C. (2016). LS/CMI & Study on Leisure and Recreation among ex-offenders in Hong Kong. In Y. Zhang & B. Zhao (Ed.), Crime Prevention, Social Rehabilitation and Correction Experience, Strategy and Prospect International Conference Publications (pp. 186-195). Xi'an, China: China Prison Association.

Social workers: YCM, RL, CL

YCM is the Supervisor of The Society of Rehabilitation and Crime Prevention (SRACP) in Hong Kong SAR, China. She has been working in the field of offender rehabilitation for ten years. She has completed both Bachelor degree of Social Work and Postgraduate Diploma in Psychology at the Chinese University of Hong Kong. Miss Mok obtained LS/CMI Master Trainer from Multi-Health System from Canada in 2010. She has provided internal training to the SRACP staff in recent years.

RL and **CL** are registered social workers in Hong Kong and had years of working experiences with ex-prisoners at The Society of Rehabilitation and Crime Prevention (SRACP) in Hong Kong.

Mean scores of expert ratings

Initial drafted items (N=72)	Mean (Range: 0-10)	Deleted after the expert rating
1. I keep up with the institutional routines on personal hygiene.	3.5	
2. I keep up with the institutional routines on eating/diet.	2.5	
3. I keep up with the institutional routines on sleep schedules.	2.5	
4. I keep up with the institutional routines on exercise.	1.75	
5. I go out and keep active when I am free.	5.5	
6. I work out during free time using public facilities.	2.25	Deleted
7. In my leisure time, I engage in sports and exercises such as running and jogging on my own.	2.5	
8. In my leisure time, I engage in sports and exercises such as soccer, table tennis, or alike with other people.	2.5	Deleted
9. In my leisure time, I engage in light exercises, such as walking, cleaning, or similar activities.	4	
10. I use my phone for online leisure activities.	8.75	
11. I use computer for online leisure activities.	5	
12. I spend time on social media (Facebook, WhatsApp, YouTube, etc) to interact with friends	6.5	
13. I spend time on social media (Facebook, WhatsApp, YouTube, etc) to learn the news.	6.75	
14. I play online games.	7.75	
15. I go out and get together with my friends or co-workers.	5.75	
16. I go out and get together with my family.	4.25	Deleted
17. I go out and get together with companions made at the rehabilitation center(s) (e.g., SRACP).	5.25	

18. I go shopping/window shopping with my friends or co-workers.	3.75	Deleted
19. I go shopping/window shopping with my family.	2.75	Deleted
20. I go shopping/window shopping with companions made at the rehabilitation center(s) (e.g., SRACP).	3	Deleted
21. I go out and get close to nature with my friends or co-workers.	3.5	
22. I go out and get close to nature with my family.	3	Deleted
23. I go out and get close to nature with companions made at the rehabilitation center(s) (e.g., SRACP).	3.25	
24. In my leisure time, I take part in indoor activities that are not physical.	5.75	Deleted
25. I spend my spare time watching TV or listening to radio.	8	Deleted
26. I listen to music quietly.	4.75	Deleted
27. I do meditation.	2	Deleted
28. I read at home.	2.5	Deleted
29. I visit art galleries and museums.	2.5	Deleted
30. I smoke to relieve my stress.	8.75	
31. I drink to relieve my stress.	8	
32. I take drugs to relieve my stress.	8	
33. I consume sexual service.	6.75	
34. I seek for sexual partner online.	5.25	
35. I watch pornography.	7	
36. I work as sexual worker.	3.25	
37. I participate in gang activities.	5.5	
38. I gamble.	7.25	

39. I stay at home for taking drugs and go out only for a purpose.	7	
40. I lie down and do nothing	6.75	
41. I do not stay at home alone because it makes me think a lot about my past experiences.	5.5	
42. I wander around aimlessly	7	
43. I hang out with my companions whom I have known before the imprisonment.	6	
44. I hang out with my companions made during the imprisonment.	4.75	
45. I hang out with my companions whom I have known at SRACP center.	5	
46. I hang out with my companions whom I have known outside SRACP center.	4.75	Deleted
47. I write to my companions who are still inside the prison.	4	
48. I visit inmates who are still serving their sentences.	4.25	Deleted
49. I visit inmates who have been released from prison.	4	Deleted
50. I visit my companions who are drug addicts.	5.25	
51. I visit my family members.	4.5	
52. I visit my child.	4	
53. I visit my friends who are law-abiding individuals.	4.75	
54. I talk with my social workers about my financial/living issues.	8	
55. I share my feelings and my recent life with my social worker.	6.75	
56. I read religious books.	3.25	Deleted
57. I go to religious organizations.	4.25	
58. I get along with my friends I met in religious activities.	4.25	

59. I take some voluntary work in a religious organizations.	4	
60. I deal with my job duties on my own.	5.25	
61. I spend time interacting with people in my work.	4.75	
62. I do manual labour (cleaning, moving, etc.).	8.5	
63. I do skills-required work (delivery services, driver, etc.).	6.5	
64. I go to school.	2.25	
65. I do voluntary work in my spare time.	3.75	
66. I seek professional services for my psychiatric conditions.	3	Deleted
67. I seek professional services for my physical health issues.	4.5	
68. I seek social services for my financial problems.	9	
69. I seek social services for helping me to find a job.	8	
70. I seek social services for my housing problems.	8.25	
71. I follow strict parole and probation requirements.	7.5	
72. I keep pets.	2.5	Deleted

Appendix J. Factorial structure of the 45 draft items in Study 2a

	Factor								
	1	2	3	4	5	6	7	8	9
Factor 1 "Socializing with Ex-prisoner Friends"									
I hang out with companions that I made during the imprisonment.	**0.614**								
I hang out with companions that I made at rehabilitation center(s).	**0.588**								
I go out and get close to the nature with companions that I made at rehabilitation center(s).	**0.552**						0.316		
I go out and get together with companions that I made at rehabilitation center(s).	**0.542**								
I write or visit companions who are still inside the prison.	**0.507**								
I visit companions who are drug addicts.	**0.481**				0.387				
Factor 2 "Active Living"									
I go out and keep active when I am free.		**0.754**							
In my leisure time, I engage in sports and exercises such as running, jogging, etc.		**0.736**							
In my leisure time, I engage in light exercises, such as walking, cleaning, chores, or similar activities.		**0.638**							
I go out and get close to the nature with my colleagues or friends.		**0.528**							
I go out and get together with my friends or colleagues.		**0.505**							
Factor 3 "Online Leisure"									

I spend time on social media (Facebook, WhatsApp, Instagram, YouTube, etc.) to interact with friends.		**0.75**		
I use my phone for online leisure activities.		**0.696**		
I spend time on social media (Facebook, WhatsApp, Instagram, YouTube, etc.) to learn about news.		**0.667**		
I play online games.		**0.538**		
I use computer for online leisure activities.		**0.435**		
Factor 4 "Institutional Routines"				
I keep up with the institutional routines on eating/diet.			**0.869**	
I keep up with the institutional routines on sleep schedules.			**0.76**	
I keep up with the institutional routines on personal hygiene.			**0.73**	
I keep up with the institutional routines on exercise.	0.347		**0.654**	
Factor 5 "Maladaptive Behaviors"				
I stay at home for taking drugs and go out only for a purpose.				**0.84**
I take drugs.				**0.819**
I buy sexual service.				**0.741**
I seek for sexual partner online.				**0.687**
I work as sexual worker.				**0.631**
I participate in gang activities.				**0.618**
I gamble.				**0.601**
I smoke.				**0.502**

I watch pornography.	**0.498**			
I drink.	**0.459**			
Factor 6 "Religious Engagement"				
I go to religious organizations.		**0.963**		
I get along with friends that I met in religious activities.		**0.936**		
I take some voluntary work in religious organizations.		**0.744**		
Factor 7 "Seeking Professional Support"				
I seek social services/help from social workers, community, friends, or family for my financial problems.			**0.909**	
I seek social services/help from social workers, community, friends, or family for my housing problems.			**0.816**	
I seek social services/help from social workers, community, friends, or family for helping me find a job.			**0.753**	
I seek professional services for my physical health issues.			**0.617**	
I follow strict parole and probation requirements.			**0.414**	
Factor 8 "Work Involvement"				
I deal with job duties on my own.				**0.727**
I spend time interacting with people at work.				**0.694**
I do skilled work (delivery services, driver, etc.).				**0.431**
I do manual labor (cleaning, moving, etc.).				**0.339**

Factor 9 "Nonactivity"			
I wander around aimlessly.		0.33	**0.377**
I do not stay at home alone because it makes me think a lot about my past experiences.			**0.336**
I lie down and do nothing.	0.318		**0.325**

Appendix K. Full scale of PORLI-ex

Post Release Living Inventory for Ex-prisoners (PORLI-ex)

The scale asked about how regularly you do the following things normally every day.
Please rate how **REGULARLY** you do the following activities every day in the **past two weeks**.

Please rate each item on an 11-point scale
(0=*Not at all regular*, 5=*Moderately regular*, 10=*Very much regular*).

Socializing with Ex-prisoner Friends											
1. I hang out with companions that I made during the imprisonment.	0	1	2	3	4	5	6	7	8	9	10
2. I hang out with companions that I made at rehabilitation center(s).	0	1	2	3	4	5	6	7	8	9	10
3. I go out and get close to the nature with companions that I made at rehabilitation center(s).	0	1	2	3	4	5	6	7	8	9	10
4. I go out and get together with companions that I made at rehabilitation center(s).	0	1	2	3	4	5	6	7	8	9	10
5. I write or visit companions who are still inside the prison.	0	1	2	3	4	5	6	7	8	9	10
6. I visit companions who are drug addicts.	0	1	2	3	4	5	6	7	8	9	10
Active Living											
7. I go out and keep active when I am free.	0	1	2	3	4	5	6	7	8	9	10
8. In my leisure time, I engage in sports and exercises such as running, jogging, etc.	0	1	2	3	4	5	6	7	8	9	10
9. In my leisure time, I engage in light exercises, such as walking, cleaning, chores, or similar activities.	0	1	2	3	4	5	6	7	8	9	10
10. I go out and get close to the nature with my colleagues or friends.	0	1	2	3	4	5	6	7	8	9	10
11. I go out and get together with my friends or colleagues.	0	1	2	3	4	5	6	7	8	9	10
Online Leisure											

12. I spend time on social media (Facebook, WhatsApp, Instagram, YouTube, etc) to interact with friends.	0	1	2	3	4	5	6	7	8	9	10
13. I use my phone for online leisure activities.	0	1	2	3	4	5	6	7	8	9	10
14. I spend time on social media (Facebook, WhatsApp, Instagram, YouTube, etc) to learn about news.	0	1	2	3	4	5	6	7	8	9	10
15. I play online games.	0	1	2	3	4	5	6	7	8	9	10
16. I use computer for online leisure activities.	0	1	2	3	4	5	6	7	8	9	10
Institutional Routines											
17. I keep up with the institutional routines on eating/diet.	0	1	2	3	4	5	6	7	8	9	10
18. I keep up with the institutional routines on sleep schedules.	0	1	2	3	4	5	6	7	8	9	10
19. I keep up with the institutional routines on personal hygiene.	0	1	2	3	4	5	6	7	8	9	10
20. I keep up with the institutional routines on exercise.	0	1	2	3	4	5	6	7	8	9	10
Maladaptive Behaviors											
21. I stay at home for taking drugs and go out only for a purpose.	0	1	2	3	4	5	6	7	8	9	10
22. I take drugs.	0	1	2	3	4	5	6	7	8	9	10
23. I buy sexual service.	0	1	2	3	4	5	6	7	8	9	10
24. I seek for sexual partner online.	0	1	2	3	4	5	6	7	8	9	10
25. I work as sexual worker.	0	1	2	3	4	5	6	7	8	9	10
26. I participate in gang activities.	0	1	2	3	4	5	6	7	8	9	10
27. I gamble.	0	1	2	3	4	5	6	7	8	9	10
28. I smoke.	0	1	2	3	4	5	6	7	8	9	10
29. I watch pornography.	0	1	2	3	4	5	6	7	8	9	10
30. I drink.	0	1	2	3	4	5	6	7	8	9	10
Religious Engagement	0	1	2	3	4	5	6	7	8	9	10
31. I go to religious organizations.	0	1	2	3	4	5	6	7	8	9	10
32. I get along with friends that I met in religious activities.	0	1	2	3	4	5	6	7	8	9	10
33. I take some voluntary work in religious organizations.	0	1	2	3	4	5	6	7	8	9	10

Seeking Professional Support											
34. I seek social services/help from social workers, community, friends, or family for my financial problems.	0	1	2	3	4	5	6	7	8	9	10
35. I seek social services/help from social workers, community, friends, or family for my housing problems.	0	1	2	3	4	5	6	7	8	9	10
36. I seek social services/help from social workers, community, friends, or family for helping me find a job.	0	1	2	3	4	5	6	7	8	9	10
37. I seek professional services for my physical health issues.	0	1	2	3	4	5	6	7	8	9	10
38. I follow strict parole and probation requirements.	0	1	2	3	4	5	6	7	8	9	10
Work Involvement											
39. I deal with job duties on my own.	0	1	2	3	4	5	6	7	8	9	10
40. I spend time interacting with people at work.	0	1	2	3	4	5	6	7	8	9	10
41. I do skilled work (delivery services, driver, etc.).	0	1	2	3	4	5	6	7	8	9	10
42. I do manual labor (cleaning, moving, etc.).	0	1	2	3	4	5	6	7	8	9	10
Nonactivity	0	1	2	3	4	5	6	7	8	9	10
43. I wander around aimlessly.	0	1	2	3	4	5	6	7	8	9	10
44. I do not stay at home alone because it makes me think a lot about my past experiences.	0	1	2	3	4	5	6	7	8	9	10
45. I lie down and do nothing.	0	1	2	3	4	5	6	7	8	9	10

Appendix L. Standardized Estimates of Alternative Model with Only One Second-Order Construct

Domain	Item	Estimate	SE	*z-value*	*p*
Factor 1: Institutional Routines	Institutional_routines1	1.000	2.047	0.629	
	Institutional_routines2	1.363	0.077	17.700	<.001
	Institutional_routines3	1.258	0.072	17.512	<.001
	Institutional_routines4	1.508	0.084	17.972	<.001
Factor 2: Active Living	Active_liv1	1.000	1.536	0.505	
	Active_liv2	1.583	0.093	17.046	<.001
	Active_liv3	0.933	0.061	15.225	<.001
	Active_liv4	1.613	0.091	17.673	<.001
	Active_liv5	1.773	0.100	17.779	<.001
Factor 3: Work Involvement	Work1	1.000	0.952	0.304	
	Work2	2.357	0.271	8.707	<.001
	Work3	2.233	0.260	8.606	<.001
	Work4	2.546	0.295	8.632	<.001
Factor 4: Maladaptive Behaviors	Maladaptive_beh1	1.000	0.925	0.229	
	Maladaptive_beh2	1.675	0.166	10.066	<.001
	Maladaptive_beh3	1.529	0.159	9.636	<.001
	Maladaptive_beh4	1.538	0.151	10.216	<.001
	Maladaptive_beh5	2.170	0.206	10.508	<.001
	Maladaptive_beh6	2.099	0.202	10.400	<.001
	Maladaptive_beh7	1.621	0.158	10.289	<.001

	Maladaptive_beh8	1.960	0.188	10.429	<.001
	Maladaptive_beh9	2.198	0.210	10.453	<.001
	Maladaptive_beh10	1.606	0.165	9.753	<.001
Factor 5: Nonactivity	Nonactivity1	1.000	1.272	0.430	
	Nonactivity2	1.713	0.126	13.611	<.001
	Nonactivity3	1.654	0.124	13.327	<.001
Factor 6: Socializing with Ex-prisoner Friends	Socializing_ex1	1.000	2.681	0.865	
	Socializing_ex2	1.028	0.037	27.947	<.001
	Socializing_ex3	0.779	0.029	26.811	<.001
	Socializing_ex4	0.785	0.029	27.258	<.001
	Socializing_ex5	0.776	0.030	26.174	<.001
	Socializing_ex6	0.678	0.029	23.090	<.001
Factor 7: Online Leisure	Online_leisure1	1.000	0.818	0.314	
	Online_leisure2	1.228	0.155	7.909	<.001
	Online_leisure3	2.814	0.295	9.529	<.001
	Online_leisure4	3.525	0.362	9.744	<.001
	Online_leisure5	2.403	0.262	9.165	<.001
Factor 8: Religious Engagement	Religious1	1.000	2.772	0.879	
	Religious2	1.042	0.044	23.668	<.001
	Religious3	1.083	0.045	24.141	<.001
Factor 9: Seeking Professional Support	Seeking_supp1	1.000	1.726	0.556	
	Seeking_supp2	1.400	0.068	20.482	<.001
	Seeking_supp3	1.484	0.071	20.838	<.001

	Seeking_supp4	1.455	0.071	20.565	<.001
	Seeking_supp5	0.711	0.052	13.741	<.001
Second-order construct	**First-order construct**				
Dimension of post-release routines	Factor 7: Online Leisure	1.000	0.397	0.397	
	Factor 1: Institutional Routines	2.817	0.304	9.282	<.001
	Factor 2: Active Living	2.784	0.303	9.203	<.001
	Factor 3: Work Involvement	1.145	0.164	6.987	<.001
	Factor 4: Maladaptive Behaviors	1.543	0.203	7.588	<.001
	Factor 5: Nonactivity	2.433	0.284	8.572	<.001
	Factor 6: Socializing with Ex-prisoner Friends	6.887	0.696	9.890	<.001
	Factor 8: Religious Engagement	5.708	0.583	9.784	<.001
	Factor 9: Seeking Professional Support	3.808	0.401	9.492	<.001

Appendix for Chapter 4 (Study 3)

Appendix M. Levels of skewness and kurtosis of outcome variables in each wave

Outcome	Skewness	Kurtosis
T0_Anxiety	2.18	4.94
T1_Anxiety	2.54	8.39
T2_Anxiety	2.45	7.71
T3_Anxiety	2.30	6.58
T4_Anxiety	2.43	7.56
T5_Anxiety	2.94	12.35
T6_Anxiety	2.73	8.46
T7_Anxiety	2.85	11.87
T8_Anxiety	2.49	6.84
T9_Anxiety	2.69	8.75
T10_Anxiety	2.40	6.35
T0_Depression	1.98	3.89
T1_Depression	2.10	4.73
T2_Depression	2.05	4.06
T3_Depression	2.15	4.93
T4_Depression	2.07	4.67
T5_Depression	2.44	7.48
T6_Depression	2.43	6.41
T7_Depression	2.12	4.63
T8_Depression	2.33	5.44
T9_Depression	2.19	4.86
T10_Depression	2.21	5.09

Note. T0 = Baseline, T1=Time1 follow up, T2=Time2 follow up, T3=Time3 follow up, T4=Time4 follow up, T5=Time5 follow up, T6=Time6 follow up, T7=Time7 follow up, T8=Time8 follow up, T9=Time9 follow up, T10=Time10 follow up.

Appendix N Standardized coefficients for all nonzero predictors in LASSO Logistic Regression

Predictors (measured at baseline)	Predicting Resilience		Predicting chronicity	
	Anxiety	Depression	Anxiety	Depression
Person-level predictors (Demographics)				
Gender (Reference: Male)				
Female	-	-	-	-
Age at initial interview	-	-	-	-
Race (Reference: White)				
Black	-	-	-	-
Asian	-	-	-	-
Native American	-	-	-	-
Hispanic	-	-	-	-
Other	-	-0.712	-	-
In what country were you born (Reference: US)				
Outside US	-	-	-	-
Highest grade completed before GED (Reference: High school graduate)				
High grade (9th-11th grade)	-	-	-	-
Low grade (6th grade or less-8th grade)	-	-	-	-
What were grades like in school (Reference: Mostly As)	-	-	-	-
About half As and half Bs	-	-	-	-
Mostly Bs	-	-	-	-
About half Bs and half Cs	-	-	-	-
Mostly Cs	-	-	-	-
About half Cs and half Ds	-	-	-	-
Mostly Ds	-	-0.349	-	-
Mostly below Ds	-	-	-	-
How many times suspended	-	-0.007	-	-
How many times expelled	-	-0.018	-	-
Money earned per hour	-	-0.008	-	-
How many children have you had	-0.054	-0.049	-	-
(Offense record)				
Court for Initial Referring (Reference: Juvenile court)				
Adult court	-	-0.216	-	-
Degree of felony (Reference: 6th Degree of Felony)				
5th Degree of Felony	-	-	-	-
4th Degree of Felony	-	0.342	-	-
3rd Degree of Felony	-	-	-	-

2nd Degree of Felony	-	-	-	-
1st Degree of Felony	-	-	-	-
Offense type (Reference: Person crime)				
Property crime	-	-	-	-
Weapon crime	-	-	-	-
Drug crime	-	-	-	-
Sex crime	-	-	-	-
Other crime	-	-0.386	-	-
Type of sentencing (Reference: dismissed)				
Nonincarcerated (fines or restitution, probation, nonincarcerated residential placement)	-	-	-	-
Incarcerated / Jail	-	-	-	-
Official record: Age first time arrested	-	-	-	-
Official record: Number times arrested in lifetime	-	-	-	-
(Self-reported offending)				
Self-reporting offending: Frequency of Offending Past Year	-	-	-	-
Self-reporting offending: Aggressive Offending Frequency in Past Year	-	-	-	-
Self-reporting offending: Income Offending Frequency in Past Year	-	-	-	-
Self-reporting offending: Frequency of Offending Past Year- No Drug	-	-	-	-
Self-reporting offending: Income Offending Frequency in Past Year - No Drug	-	-	-	-
(Substance abuse)				
Marijuana use in the past 6 months	-	-	-	-
Sedatives use in the past 6 months	-	-	-	-
Stimulants use in the past 6 months	-	-	-	-
Cocaine use in the past 6 months	-	-	-	-
Opiates use in the past 6 months	-	0.083	-	-
Ecstasy use in the past 6 months	-	-	-	-
Hallucinogens use in the past 6 months	-	-	0.061	-
Inhalants use in the past 6 months	-	-	-	-
Amyl nitrate use in the past 6 months	-	0.161	-	-
Other drugs use in the past 6 months	-	-0.224	-	0.155
Alcohol use in the past 6 months	-	-	-	-
Cigarette use in the past 6 months	-0.001	-	-	-
Lifetime alcohol dependence symptoms	-	-	-	-
Past 6 months alcohol dependence symptoms	-	-0.064	-	-
Lifetime drugs dependence symptoms	-0.002	-	-	-
Past 6 months drugs dependence symptoms	-	-0.023	-	0.049
(Unsupervised routine activities)				
Routine: How often ride in car for fun	-	0.136	-	-
Routine: How often get w/friends informally	-	-	-	-
Routine: How often go to parties	-	-	-	-

Routine: How often go out for fun typical week	-	-	-	-
Routine: Unsupervised Routine Activities	-	-	-	-
(Exposure to trauma and violence)				
Exposure to violence (Witness)	-	-	-	-
Exposure to violence (Victim)	-0.106	-0.119	-	-
Exposure to violence (Witness & Victim)	-	-	-	-
(Psychosocial maturity)				
Psychosocial Maturity inventory (Overall)	-	-	-	-
Work Orientation	0.245	-	-	0.101
Self-reliance	-	-	-	-
Self-identity	0.143	0.259	-	-
Neuroticism	-0.434	-1.191	0.248	0.31
(Big-five personality traits)				
Extraversion	-	-	-	-
Openness	-0.16	-0.306	-	-
Agreeableness	-	-	-	-
Conscientiousness	-	-	-	-
Relationship-level predictors				-
(Parental warmth and hostility)				
Parent Warmth - Mother	-	-	-	-
Parent Hostility - Mother	-0.099	-0.695	-	0.103
Parent Warmth - Father	-	-0.023	-	-
Parent Hostility - Father	-	-0.255	-	-
(Romantic relationship)				
Quality of Relationship - Monitoring	-	-0.028	-	-
Quality of Relationship - Deviance	-	-0.113	-	-
Quality of Relationship - Antisocial Influence	-	-	-	-
(Peer delinquency)				
Peer Antisocial Behavior	-0.141	-0.051	-	-
Peer Antisocial Influence	-	-0.179	-	-
Context-level predictors				-
(Family risk factors)				
Bioparents marital status (Reference: never married to each other)				
Separated from each other	-	-0.02	-	-
Divorced from each other	-	-	-	-
Married to each other	-	-	-	-
Widowed from each other	-	0.145	-	-
Mother remarried	-	-	-	-
Father remarried	-	-1.824	-	1.121
Both remarried	-	-	-	-
Both deceased	-	0.021	-	-
Anyone in your family ever been arrested (Yes)	-	-	-	-
Anyone in family been in jail or prison (Yes)	-	-	-	-

Any family members ever been in mental hospital (Yes)	-	-	-	-
Mother was an alcoholic in past	-	-	-	-
Mother had drug problem in past	-	-	-	-
Father was an alcoholic in past	-	-0.035	-	-
Father had a drug problem in past	-	-	-	-
Biological father arrested or jailed (Yes)	-	-0.199	-	-
Biological mother arrested or jailed (Yes)	-	-	-	-
Biological father has been in mental hospital (Yes)	-	-	-	-
Biological mother has been in mental hospital (Yes)	-	-	-	-
Mother education level (Reference: graduate school)				
College graduate	-	0.127	-	-
Some college/grad of 2-yr college .	-	-0.189	-	-
High school diploma	-	-	-	-
Some high school	-	-	-	-
Grade school or less	-	-	-	-
Father education level (Reference: graduate school)				
College graduate	-	-0.276	-	-
Some college/grad of 2-yr college .	-	-	-	-
High school diploma	-	-	-	-
Some high school	-	-	-	-
Grade school or less	-	-	-	-
(Peer risk factors)				
Number of close friends (truncated to 4)	-	-	-	-
Count of 4 closest friends arrested	-	-	-	-
Count of 4 closest friends jailed	-0.06	-0.075	-	-
Count of 4 closest friends in mental hospital	-	-	-	-
(Social capital)				
Social capital: Closure and Integration	-	0.003	-	-
Social capital: Perceived Opportunity for Work	-	0.202	-	-
(Gun accessibility)				
Gun Access: Person wants to buy a gun he she can	-	-0.09	-	-
Gun Access: How much to buy a 9mm gun	-	-	-	-
Gun Access: How much to buy a 38mm gun	-	-0.001	-	-
(Community involvement)				
Involvement in Community Activities - Ever	-	-	-	-
Involvement in Community Activities - past 6 months	-	0.188	-	-
(Neighborhood conditions)				
Neighbourhood Conditions (Total)	-	-	-	-
Neighbourhood Conditions (Physical Disorder)	-	-0.222	-	-

Neighbourhood Conditions (Social Disorder)	-	-	-	-

Note. All predictors were measured at baseline except measurement for personality (measured at T4 follow up).

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