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ADOLESCENT PSYCHOPATHIC TRAITS: SLEEP, SOCIAL RELATIONSHIPS AND PARENTAL BEHAVIORS AS RISK AND PROTECTIVE FACTORS

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DOCTORAL DISSERTATION

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ABSTRACT

Psychopathy is a personality disorder characterized by affective, interpersonal, behavioral and antisocial features, with a developmental trajectory in which the first signs can be detected early in life. A growing body of psychopathy literature is focusing on risk factors which may be genetic, neurobiological and environmental. The factors that promote positive outcomes are instead neglected, although such protective factors may foster prosocial healthy behavior in children and adolescents. They may at best prevent the development of persistent psychopathic personality despite genetic, neurobiological or environmental risk factors.

This study project, consisting of Studies I–IV, investigated adolescent self-reported psychopathic traits and their associations with sleep, peers, romantic partners and parental warmth and hostility. Its aims can be divided into four main goals. The first was to investigate the role of psychopathic features in the associations between qualitative and quantitative aspects of sleep and delinquent behavior among Finnish adolescents. Second, the study project examined how self-reported severe sleep problems related to scores on a self-reported psychopathy scale and its subfactors among Finnish adolescents. The third goal was to identify the possible predictive roles of peer and romantic relationships in total psychopathic traits, as well as their three subdomains among serious adolescent offenders. Finally, the project aimed to study psychopathic traits of juvenile delinquents and their perceptions of parental warmth and hostility, and offending over time.

Studies I–II investigated the associations of sleep, psychopathic features and delinquency of Finnish adolescents. The relationship between sleep problems, including both qualitative and quantitative aspects, and delinquent behavior involving property and violent criminality, while controlling for adolescents' psychopathic features and parental supervision at bedtime were explored in Study I. Respectively, Study II examined whether severe sleep problems, in terms of frequent and persistent qualitative sleep problems and continuous short sleep, were related to psychopathic traits and its subdimensions of impulsivity, narcissism and callous-unemotional traits. The data were drawn from a Finnish Self-Report Delinquency Study with population-based sample of 4,855 Finnish adolescents (mean age 15.3 years, 51% females). Sleep was evaluated through questions on the frequency and persistence of sleep problems and the amount of sleep on school and weekend nights. Psychopathic features were measured using the Antisocial Process Screening Device-Self Report (APSD-SR), and delinquency was evaluated via self-reports.

In statistical analyses, sleep-related variables acted as predictors for both property crime and violent crime after controlling for psychopathic features and parental supervision at bedtime in negative binomial regressions. Further,

factorial analysis of variance (ANOVA) was conducted to compare the main effects of sleep quality and sleep quantity, and to examine the interaction effect between frequent and persistent sleep problems and continuous short sleep and gender in the APSD-SR total score. A multivariate analysis of variance (MANOVA) was also used to identify any associations between sleep variables and the APSD-SR subscale scores of adolescent boys and girls. The results of Study I suggested that both sleep problems and an insufficient amount of sleep were associated with property crime and violent behavior, and that the relationship was not explained by gender, degree of parental supervision at bedtime or co-occurring psychopathic features. In Study II, higher APSD-SR measure scores were associated with severe sleep problems. In conclusion, severe sleep quality and quantity problems among adolescents may be associated with psychopathic traits, i.e. a lack of behavioral control and prosocial behavior, narcissism and callous-unemotional traits, but cause and effect cannot be distinguished. Sleep difficulties and an insufficient amount of sleep associate with adolescents' delinquent behavior.

To better understand potential causal associations, Studies III-IV tested the effects of within-individual changes on psychopathic traits over time. The within-individual method adjusts for all confounding factors that do not change within individuals, thereby taking into account all time-invariant, between-individual differences. Data were derived from repeated measurements of 1,354 offending adolescents (14.3% females; 40.1% black) in the Pathways to Desistance longitudinal study, from which ten follow-ups for 6.5 years were used in Study III and seven follow-ups for 4.5 years in Study IV. Analyses were adjusted for age, gender, ethnicity, self-reported offending and living facilities or contact with parental figures. The results of Study III showed that romantic and peer relationships of high quality were associated with lower psychopathic traits, whereas antisocial behavior and antisocial influence in interpersonal relationships were related to higher psychopathic traits. Within-individual analysis indicated that time-invariant individual characteristics did not confound these associations. Further, those with no romantic relationships had lower mean levels of psychopathic traits than those in relationships of low quality. Study IV indicated that maternal warmth associated negatively with psychopathic traits and offending among adolescent delinquents. Paternal warmth protected from psychopathic traits but not from delinquency, and both maternal and paternal hostility linked positively to psychopathic traits and offending. To conclude, peers and romantic partners can act as factors that either protect against or are risks for psychopathic features, depending on the quality and antisocial activities of the relationships. Social relationships should be taken into account in treatment and intervention programs targeted toward adolescents with psychopathic behaviors. Reducing affiliations with delinquent peers and partners may prove beneficial for both adolescents with psychopathic traits and the individuals involved with them. Parenting quality matters in adolescence, such that

parental behaviors may either amplify or attenuate adolescent psychopathic traits and delinquency based on the warmth and hostility of the relationship.

Keywords: Psychopathic traits, Adolescence, Juvenile delinquency, Sleep problems, Romantic relationships, Friendships, Parental warmth, Parental hostility, Protective factors

FINNISH SUMMARY

Psykopatia on persoonallisuushäiriö, jolle on tunnusomaista affektiiviset, interpersonaaliset ja käyttäytymiseen liittyvät antisosiaaliset piirteet. Psykopatian ensimmäiset merkit voidaan havaita jo varhaisvuosina, jolloin puhutaan psykopatiapiirteistä, psykopaattisista käyttäytymistavoista, riskeistä psykopatian kehittymiselle tai psykopatialle tyypillisestä tunnekylmyydestä. Valtaosa psykopatiakirjallisuudesta on keskittynyt tunnistamaan riskitekijöitä, joiden tiedetään olevan geneettisiä, neurobiologisia ja ympäristöstä aiheutuvia. Psykopatialta suojaavia tekijöitä on tunnistettu huomattavasti vähemmän, vaikka niiden avulla voitaisiin edistää lasten ja nuorten terveyttä sekä prososiaalista käyttäytymistä ja ehkäistä nuorta psykopaattisen persoonallisuuden kehittymiseltä genetiikasta, neurobiologiasta tai ympäristötekijöistä johtuvasta alttiudesta huolimatta.

Tämä väitöskirjatyö koostuu tutkimuksista I – IV. Niissä tarkasteltiin nuorten itsensä raportoimien psykopatiapiirteiden yhteyksiä univaikeuksiin ja unen pituuteen, ystävyys- ja seurustelusuhteisiin sekä vanhemmuuden lämpöön ja vihamielisyyteen. Väitöskirjatyön tavoitteet voidaan jakaa neljään päätavoitteeseen. Ensimmäisessä osajulkaisussa tutkittiin suomalaisten nuorten psykopatiapiirteitä suhteessa unen laadullisiin ja määrällisiin vaikeuksiin sekä rikoskäyttäytymiseen. Toisessa osatutkimuksessa pyrittiin selvittämään, millaisia yhteyksiä nuorten vakavilla, toistuvilla ja pitkäkestoisilla univaikeuksilla sekä vähäisellä unimäärällä on psykopatiapiirteiden tasoon huomioiden psykopatiapiirteet kokonaiskäsitteenä ja alaskaalojensa mukaan. Väitöskirjatyön kolmantena tavoitteena oli tunnistaa ystävyys- ja seurustelusuhteiden mahdollisia vaikutuksia psykopatiapiirteiden tasoon rikollisaineistoa hyödyntäen. Viimeiseksi väitöskirjatyö pyrki selvittämään, millaisia vaikutuksia vanhemmuuden lämmöllä ja vihamielisyydellä on nuorisorikollisten itse raportoimiin psykopatiapiirteisiin ja rikoskäyttäytymiseen.

Tutkimuksissa I – II tarkasteltiin nuorten unen, psykopaattisten piirteiden ja rikollisuuden välisiä yhteyksiä suomalaisilla nuorilla. Yhteydet unen laadullisten ja määrällisten ongelmien sekä omaisuus- ja väkivaltarikollisuuden välillä olivat tarkastelun alla tutkimuksessa I, jossa kontrolloitiin nuorten psykopatiapiirteet ja vanhempien valvonta lapsen nukkumaanmenoajoista. Tutkimuksessa II arvioitiin vakavien, toistuvien ja pitkäkestoisten univaikeuksien ja jatkuvan univajeen yhteyksiä nuorten psykopatiapiirteisiin ja sen alaskaaloihin impulsiivisuuteen, narsismiin ja tunnekylmyyteen. Aineisto saatiin vuoden 2012 Nuorisorikollisuuskyselystä, joka on väestöpohjainen otos 4855 suomalaisnuoresta (keski-ikä 15,3 vuotta; 51 % tyttöjä). Unta tutkittiin univaikeuksien frekvenssiin ja pitkäkestoisuuteen sekä unen määrään liittyvillä kysymyksillä. Psykopatiapiirteitä arvioitiin

Antisocial Process Screening Device-Self Report (APSD-SR) -mittarilla, rikollisuuden arviointi perustui niin ikään itseraportointimenetelmään.

Tilastolliset analyysit toteutettiin siten, että ennustavina muuttujina toimivat unen laadulliset ja määrälliset ongelmat sekä sukupuoli ja ennustettavina omaisuus- ja väkivaltarikollisuus. Negatiivisissa binomiregressioanalyyseissa kontrolloitiin Nuorten psykopatiapiirteet ja vanhempien valvonta nukkumaanmenoajoista. Varianssianalyysi (ANOVA) ajettiin unen laadun ja määrän päävaikutusten vertailemiseksi sekä vakavien uniongelmien, jatkuvan unen vähäisyyden ja sukupuolen välisten interaktioiden tarkastelemiseksi suhteessa psykopatiamittariin. Monen muuttujan varianssianalyysia (MANOVA) käytettiin myös tunnistamaan mahdolliset assosiaatiot unimuuttujien sekä poikien ja tyttöjen APSD-SR-mittarin alaskaalojen välillä. Tutkimuksen I tulokset viittasivat siihen, että sekä unihäiriöt että riittämätön unen määrä liittyivät omaisuusrikollisuuteen ja väkivaltaiseen käyttäytymiseen eikä tämä yhteys selittynyt sukupuolella, vanhempien valvonnalla nukkumaanmenoajoista tai samanaikaisesti esiintyvillä psykopatiapiirteillä. Tutkimuksessa II korkeat pisteet APSD-SR-mittarissa liittyivät vakaviin unihäiriöihin. Yhteenvetona voidaan todeta, että nuorten itseraportoimilla vakavilla laadullisilla ja määrällisillä uniongelmilla on yhteyksiä itseraportoituihin psykopatiapiirteisiin, kuten käyttäytymisen hallinnan ja prososiaalisen käyttäytymisen puutteeseen, narsistisiin piirteisiin ja tunnekylmään käytökseen. Tämän tutkimuksen perusteella ei kuitenkaan voida erottaa syy-seuraussuhdetta. Univaikeudet ja riittämätön unen määrä vaikuttavat linkittyvän nuorten rikolliseen käyttäytymiseen.

Syyn ja seurauksen ymmärtämiseksi tutkimuksissa III-IV testattiin yksilön sisäisten muutosten vaikutuksia psykopaattisiin ominaisuuksiin pitkittäisaineistoa hyödyntäen. Yksilön sisäistä vaihtelua tarkasteleva menetelmä ottaa huomioon kaikki ne tekijät, jotka ovat ajan suhteen invariantteja. Aineistona käytettiin Pathways to Desistance -tutkimusdataa, joka koostui 1354 nuorisorikollisesta (14,3 % naisia; 40,1 % mustia). Pitkittäisaineisto on kerätty seitsemän vuoden aikana alkuhaastattelun lisäksi kymmenellä eri mittauskerralla, joista tutkimuksessa III käytettiin kaikkia kymmentä seurantakertaa kuuden ja puolen vuoden ajalta. Tutkimukseen IV poimittiin vastaukset seitsemältä mittauskerralta neljän ja puolen vuoden ajanjaksolta. Analyyseja mukautettiin iän, sukupuolen, etnisen alkuperän, asumisolosuhteiden tai vanhemman yhteydenpidon suhteen. Tutkimuksen III tulokset osoittivat, että hyvälaatuisiksi arvioidut seurustelu- ja ystävyyssuhteet olivat yhteydessä matalampiin psykopatiapiirteisiin, kun taas antisosiaalinen käyttäytyminen ja antisosiaaliset vaikutteet liittyivät korkeampaan piirteiden tasoon. Yksilöiden sisäinen vaihtelu analyyseissa osoitti sen, etteivät ajallisesti invariantit tekijät vaikuttaneet löydökseen. Matalammat psykopatiapiirteet havaittiin niillä nuorilla, jotka eivät olleet seurustelusuhteessa, verrattuna huonolaatuisessa suhteessa oleviin nuoriin. Ystävät ja seurustelukumppanit voivat joko suojata nuorta psykopaattisilta ominaisuuksilta tai olla riskeinä niille riippuen suhteiden laadusta ja

antisosiaalisista piirteistä. Tutkimus IV osoitti, että äidin lämminhenkisyys korreloi negatiivisesti nuoren psykopatiapiirteisiin ja rikoskäyttäytymiseen; isän lämminhenkisyys suojasi nuorta psykopaattisilta ominaisuuksilta, mutta ei rikollisuudelta. Sekä äidin että isän vihamielisyys liittyivät korkeampiin psykopatiapiirteisiin ja rikollisuuteen. Yhteenvetona voidaan todeta, että sosiaaliset suhteet tulisi ottaa huomioon psykopaattisen käyttäytymisen omaaville nuorille suunnatuissa hoito- ja interventio-ohjelmissa. Etääntyminen rikollisuutta sisältävistä interpersonaalisista suhteista voi osoittautua hyödylliseksi nuorille, joilla on psykopaattisia piirteitä, ja heidän kanssaan tekemisissä oleville ihmisille. Vanhemmuuden laadulla vaikuttaisi olevan merkitystä nuoruusiässä niin, että vanhempien käyttäytyminen voi toimia joko suojaavana tai riskitekijänä nuorten psykopaattisille piirteille ja rikoskäyttäytymiselle riippuen suhteen lämminhenkisyydestä ja vihamielisyydestä.

Avainsanat: Psykopatiapiirteet, nuoruusikä, nuorisorikollisuus, univaikeudet, seurustelusuhde, ystävyyssuhde, vanhempien lämminhenkisyys, vanhempien vihamielisyys, suojaavat tekijät

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CONTENTS

LIST OF ORIGINAL PUBLICATIONS

I Backman, H., Laajasalo, T., Saukkonen, S., Salmi, V., Kivivuori, J., & Aronen, E. T. (2015). Are qualitative and quantitative sleep problems associated with delinquency when controlling for psychopathic features and parental supervision?. Journal of Sleep Research, 24(5), 543-548.

II Backman, H., Laajasalo, T., Saukkonen, S., Salmi, V., Jokela, M., & Aronen, E. T. (2016). Severe Sleep Problems and Psychopathic Features: A Study of Finnish Adolescents. Journal of Child and Adolescent Behavior, 4(301), 2.

III Backman, H., Laajasalo, T., Jokela, M., & Aronen, E. T. (2018). Interpersonal relationships as protective and risk factors for psychopathy: a follow-up study in adolescent offenders. Journal of Youth and Adolescence, 47(5), 1022-1036.

IV Backman, H., Laajasalo, T., Jokela, M., & Aronen, E. T. (2021). Parental warmth and hostility and the development of psychopathic behaviors: A longitudinal study of young offenders. Journal of Child and Family Studies, 30(4), 955-965.

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ABBREVIATIONS

ANCOVA	Analysis of covariance
APA	American Psychiatric Association
APSD	Antisocial Process Screening Device
APSD-SR	Antisocial Process Screening Device – Self-Report
ASPD	Antisocial personality disorder
CU	Callous-unemotional
DSM-5	Diagnostic and Statistical Manual of Mental Disorders, 5th revision
FSRD-12	Finnish Self-Report Delinquency Study 2012
ICU	Inventory of Callous Unemotional Traits
M	Mean
MANOVA	Multivariate analysis of variance
PCL	Psychopathy Checklist
PCL-R	Psychopathy Checklist—Revised
PCL-YV	Psychopathy Checklist: Youth Version
SD	Standard deviation
SDSC	Sleep Disturbance Scale for Children
SRO	Self-Reported Offending
SSR	Sleep Self-Report
YPI	Youth Psychopathic traits Inventory

1 INTRODUCTION

Psychopathy can be viewed as a multidimensional construct comprising a variety of interpersonal, affective and behavioral features (Hare and Neumann, 2008). Although it is a personality disorder of adults, in the past 30 years the direction of psychopathy research has diverted downward to children and adolescents, in an attempt to profoundly understand the developmental paths of the disorder (Forth et al., 1990; Frick, 2009). The study of child and adolescent psychopathic traits uses varying terminology, as psychopathy refers only to adults with a fixed personality (Petrila and Skeem, 2003; Vitacco and Vincent, 2006). Some pioneering researchers in this topic prefer to use terms "developmental risk for psychopathy", "psychopathic traits" (Viding and McCrory, 2018), "antisocial and callous-unemotional behavior" (Waller et al., 2013) or "callous-unemotional traits" (Frick et al., 2014b). Even "psychopathic-like features" have been used in order to emphasize the malleability of the traits in early ages (Saukkonen, 2015). In studies of children and adolescents with psychopathic traits, the focus has been mostly on callous-unemotional features that closely resemble the affective dimension of psychopathy in the construct of adult samples (Frick et al., 2014b; Hare and Neumann, 2008). However, studying affective features with other dimensions linked to youth psychopathic traits has been proved fruitful as well (Salekin et al., 2018b; Salihovic and Stattin, 2016).

Understanding the developmental routes to psychopathic personality is significant because psychopathy is a profound burden to society in terms of public health, research and practice in correctional psychology, psychiatry and criminal systems, though it affects less than 2% of the general population (Coid et al., 2009; Reidy et al., 2015; Reidy et al., 2017). As with adults, a relationship between psychopathic features and delinquency has been systematically found among adolescents (Asscher et al., 2011; Virtanen et al., 2020), which makes youth psychopathic traits a cardinal risk factor for severe, persistent and early onset violence (Reidy et al., 2015).

Compared to typically developing youth, those with psychopathic traits show more impairments in emotional and empathy processing, decision-making and reward-punishment contingencies (Blair, 2013; Viding and McCrory, 2018). Within a developmental context, the signs of risks for psychopathy can be traced back to the early years of life, and the latest findings expose the predisposing heritable and neurocognitive factors that contribute to the disorder (Blair, 2013; Viding et al., 2005; Waller et al., 2016). Recently, genetic, neurocognitive and contextual risk factors have been explored intensively, perhaps even more than the compensatory, protective and preventive factors that may buffer levels of psychopathic features. This thesis investigates and discusses associated factors, both risk-causing and protective variables of psychopathic traits in adolescents by taking a developmental

approach to the disorder. Specifically, the factors studied in this thesis are adolescent sleep, peer and romantic relationships and parental warmth and hostility. The data are derived from big data sets, comprised of both community and forensic samples.

Adolescents' sleep problems, in terms of quality and quantity, are surprisingly common throughout the world (Gradisar et al., 2011; National Sleep Foundation, 2013). Inadequate sleep associates with juvenile delinquency (Clinkinbeard et al., 2011; Short and Weber, 2018), aggression and impulsivity (El-Sheikh et al., 2019; Kamphuis et al., 2012), and deficits in emotion (Palmer and Alfano, 2018). However, the lack of studies on sleep and psychopathy is astounding, as sleep could be critical in the context of prevention of youth psychopathic behavior and juvenile delinquency.

Given that peers and romantic partners may be of great significance to adolescents (Hall-Lande et al., 2007; Zimmer-Gembeck, 2002; Hill et al., 2007), the social environment should be considered a potential area for intervention to reduce psychopathic characteristics. Antisocial friends may increase delinquency among psychopathic youths (Muñoz et al., 2008; Tatar et al., 2016) and a deviant partner may promote delinquency persistence (Haynie et al., 2005; Simons et al., 2002). Some preliminary findings also show that friendships and romantic relationships may have protective effects against delinquency and psychopathic traits (Barry et al., 2008; Rhule-Louie and McMahon, 2007; Zedaker and Bouffard, 2017). However, previous studies have not assessed the quality of these relationships. Notably, the causes and effects have rarely been investigated at the within-individual level to control for confounding individual factors.

There are preliminary findings that parental behaviors may have an impact on psychopathic traits even in adolescence, as it is robustly indicated that certain parenting factors shape psychopathic behaviors in children (see Hawes et al., 2014; Waller et al., 2013 for reviews). Harsh and coercive parenting has been linked to elevated conduct problems (Pasalich et al., 2011; Viding et al., 2009), childhood callous-unemotional traits and psychopathic behaviors (Barker et al., 2011; Larsson et al., 2008), and later psychopathic features (Lynam et al., 2008), whereas parental involvement and positive reinforcement associate with reduced psychopathic traits over time (Hawes et al., 2011; Pardini et al., 2007). Parental warmth in childhood may prevent from later callous-unemotional traits (Barker et al., 2011; Goulter et al., 2019), and continuous warmth matter even in adolescence by associating with lower rates of psychopathic behavior (Buck, 2015; Pasalich et al., 2011; Ray, 2018). Adolescents' reports of maternal warmth and involvement associate with levels of callous-unemotional traits (Bisby et al., 2017; Kimonis et al., 2013).

In Finland, two academic dissertations have previously focused on adolescent psychopathic traits. The first was published in 2015 (Saukkonen, 2015) and the second in 2017 (Oshukova, 2017). Saukkonen (2015) investigated both a patient group of children and a community sample of adolescents with disruptive behavior and psychopathic-like features. She

studied the cognitive, psychosocial and personality-related characteristics of the children and adolescents, and assessed the psychometric properties of one of the psychopathy measures among community adolescents. Oshukova (2017) used community, psychiatric out-patient and forensic psychiatric data to explore the self-assessment tools of psychopathic traits, gender and culture-related differences, externalizing and internalizing psychopathology, and limited prosocial emotions.

Given the serious nature of psychopathy, many scientists and practitioners worldwide are motivated to understand how psychopathy develops, how neurobiological and environmental factors interact with each other, how the traits could be prevented, how to recognize the early signs of risks, how to protect the youth at risk for developing psychopathy, and how to treat youth with elevated psychopathic traits and behaviors. Although studying psychopathic youth is reasoned and distinguishing psychopathic youth from other youth is theoretically possible, studying humans with this kind of a sensitive topic is not straightforward or undisputed. However, researchers are engaged in systematic research using pioneering quantitative and neuroimaging methods, large twin datasets and genetically informative designs. In the coming decades, the literature of psychopathy will likely grow enormously and expose different developmental trajectories, risk and protective factors, treatment and prevention mechanisms, and genetic and neurocognitive contributions to the development of psychopathy. This is what we all hope for.

2 REVIEW OF LITERATURE

2.1 OVERVIEW OF PSYCHOPATHY

2.1.1 BACKGROUND OF PSYCHOPATHY RESEARCH

Psychopathy is one of the most studied personality disorders. In 50 years, the number of publications on psychopathy has increased enormously, from less than 15 per year in the 1960s to more than 250 per year in the 2010s (Hare, 2013), and to over a thousand peer-refereed publications in 2018. Although *psychopathic personality* was first introduced in the late 1800s, American psychiatrist Hervey Cleckley (1941) was the first scholar to systematically delineate the principal features of psychopathy and has strongly influenced empirical investigations of the disorder. In terms of psychopathic research coming to fruition, Cleckley and psychologist Robert D. Hare encouraged one another to understand psychopathy more deeply through comprehensive interchanges in the 1970s, which generated debate and burgeoning interest (Lilienfeld et al., 2018). Accordingly, the increased theory and research on psychopathy owes much to the development of the metric Psychopathy Checklist (PCL; Hare, 1985) and its successor, the Psychopathy Checklist – Revised (PCL-R; Hare, 2003). These measures are based on Cleckley's clinical description and the insights reported in his book called *Mask of Sanity: An Attempt to Clarify Some Issues about the So-Called Psychopathic Personality* (Cleckey, 1941), which is considered a seminal work in psychopathic research and continues to influence scholars and clinicians in a myriad of ways (Lilienfeld et al., 2018). The PCL-R, along with many versions of these measures for youth and community samples, is the most extensively validated psychopathy measure and has been used in thousands of studies.

Psychopathy can be differentiated from other personality disorders on the basis of interpersonal, affective, and behavioral features, encompassing a lack of empathy, callousness and shallow affect, lack of remorse, manipulativeness, grandiosity, superficial charm, impulsivity, irresponsibility, and a persistent violation of social norms (Cleckley, 1941; Hare and Neumann, 2008). The definition is strongly based on the PCL-R measure, covering an interpersonal-affective domain that encompasses core traits such as callousness and manipulativeness, and an antisocial domain that entails disinhibition and chronic antisocial behavior. Some investigators view antisocial behavior as more of a downstream correlate of psychopathy than a central component of the syndrome (Skeem et al., 2011), whereas others claim that affective and interpersonal features are intimately tied to antisocial behavior and influence one another over the course of development (Hare and Neumann, 2010).

2.1.2 PSYCHOPATHY IN COMMUNITY AND FORENSIC SETTINGS

Although psychopathy is highly prevalent among prisoners, with rates varying widely from 7% to over 30% (Coid et al., 2009; Hare, 1996; Hart and Hare, 1997), and over 90% of adult male psychopaths in the United States are in prison or on parole or probation (Kiehl and Hoffman, 2011), Cleckley stated already in 1941 that these personalities are found not only in forensic settings but also in the community. Psychopathy affects approximately 0.5–2% of the general population, although this prevalence is an approximation, as studies have limitations (Coid et al., 2009; Reidy et al., 2017). The question of "law-abiding" psychopaths is ambiguous. Hare (2013, p. vii) assumes that psychopathic individuals have an understanding of right and wrong and are accountable for their actions, but that "they choose which rules to follow or to ignore, based on their own self-interest, a calculating appraisal of the circumstances, and a lack of concern for the feelings or welfare of others." These law-abiding psychopaths (also called "successful", "white-collar" or "prosocial"), people who display the core features of psychopathy while being non-convicted, have recently gained interest among scholars (Lilienfeld et al., 2015). The atypical manifestation of psychopathic personality can be seen as a mitigation of behavioral acts by protective factors (Lilienfeld et al., 2015), which are still fairly unknown, but might buffer psychopathic individuals against criminal outcomes. Without breaking the law, these individuals may still cause social harm to other people by lying, manipulating and acting without regard (Skeem et al., 2011).

As mentioned earlier, psychopathy is indeed commonly found in forensic settings and is "arguably the single most important clinical construct in the criminal justice system" (Hare, 1998, p. 189). According to estimations, psychopathic adults are responsible for an excessive proportion of crimes committed, and they are much more likely to violently recidivate and become imprisoned than non-psychopathic offenders (Hare, 1996; Kiehl and Hoffman, 2011; Porter et al., 2009). Further, psychopathic traits among adults and adolescents are a risk factor for violence of greater frequency, severity and persistency across the community and psychiatric populations (Hare, 1996; Leistico et al., 2008; Reidy et al., 2017). Psychopathy is likely the most expensive mental health disorder to societies, through its direct financial consequences, including public costs, victim services, criminal prosecutions, incarceration and post-release monitoring, and through the indirect emotional and psychological damage it causes (e.g. Reidy et al., 2015). These severe consequences and costs to societies are a reason to try to understand the development of psychopathic features and to enhance the prevention of psychopathy.

2.1.3 PSYCHOPATHY AND ANTISOCIAL PERSONALITY DISORDER

The Diagnostic and Statistical Manual of Mental Disorders (DSM-5) of the American Psychiatric Association (2013) has no specific diagnostic category

for psychopathy. It recognizes a related diagnostic entity called Antisocial personality disorder (ASPD), which lists a life-long pattern of antisocial behavior, including aggression, repeated fights or assaults, traits of impulsivity and irresponsibility, and violation of social norms and laws. To be diagnosed with ASPD, an individual must be at least 18; have displayed conduct disorder before the age of 15; and have a disregard for and have been involved in the violation of others since the age of 15. However, the cut-off point of the age of 18 might make more sense in legal settings than from the psychological perspective, as youths aged under 18 also commit major crimes without being classified as having ASPD (Lykken, 2006/2018). In the case of children and adolescents, conduct disorder can be considered as a precursor of ASPD (Frick et al., 2014b; Loeber et al., 2002).

ASPD and psychopathy, as defined by the Psychopathy Checklist Revised (PCL-R; Hare, 2003), are often mistakenly thought to be largely or entirely synonymous, although they are not interchangeable and correlate only moderately (De Brito and Hodgins, 2009; Kosson et al., 2006). Most incarcerated offenders present with ASPD, while only one-third of adult offenders with a diagnosis of ASPD meet the criteria for psychopathy (Coid and Ullrich, 2010; Hare and Neumann, 2009; Kosson et al., 2016). In contrast, most psychopathic offenders also meet the criteria for ASPD (Hare and Neumann, 2009), creating a more severe form and a greater risk of violence on the same continuum (Coid and Ullrich, 2010). Thus, using a dimensional approach, psychopathy and ASPD can be considered the same disorder, or ASPD could be treated as a hypernym of diverse symptoms and etiology including psychopaths (Lykken, 2006/2018). The main difference between psychopathy and ASPD appears to lie in psychopathic individuals' distinctive form of processing emotions (De Brito and Hodgins, 2009; Kosson et al., 2006). More precisely, these emotional processing impairments are an absence of guilt and concern for their actions or for others' feelings, and a low tendency to show loyalty unless it is in their own interest (Hare and Neumann, 2008; Viding and McCrory, 2018). It is also known that many psychopathic features are associated with certain brain regions and functions which differ from those of the majority of other antisocial people (Coid and Ullrich, 2010).

Diagnostic manuals parse individuals into taxons. Controversy over the extent to which psychopathy is distributed as a dimension or category in nature is ongoing. Based on taxometric analyses, which demand valid indicators that discriminate between the hypothetical taxon and other groups, there seems to be more evidence of dimensionality than taxonicity in psychopathy among adults (Edens et al., 2006) and adolescents (Edens et al., 2011). For example, Woodmass and O'Connor (2018) studied the opposite sides of psychopathy and reported that most psychopathy measures showed normal distributions. A growing data of community samples also give strength to the dimensionality by indicating the presence of psychopathic traits with different degrees in the general population (Andershed et al. 2002; Coid et al. 2009; Laajasalo et al., 2014). These findings, in sum, indicate that it may be

better to view psychopathic personality traits as existing on a continuum and to study individuals in terms of the level of these traits rather than in terms of different classes (Hare and Neumann, 2008).

2.2 PSYCHOPATHIC TRAITS IN CHILDHOOD AND ADOLESCENCE

2.2.1 CONCEPTUALIZATION OF YOUTH PSYCHOPATHY

The notion of youth psychopathy can be traced back to the middle of the last century (Bowlby, 1951; Cleckley, 1941). However, a strong scientific interest in the study of psychopathy among children and adolescents was not really born until the 1990s, when Forth, Hart and Hare (1990) published their substantial work *Assessment of psychopathy in male young offenders*, and since then juvenile psychopathy has become a highly studied topic (Salekin et al., 2018a).

A tremendous growth in publications in three decades provides an illustrative example of the increased interest in understanding the development of psychopathy. According to many scholars, psychopathy can be viewed as following a developmental trajectory with strong genetic influences and environmental bases (Anderson and Kiehl, 2014; Frick and Ray, 2015; Moore et al., 2019). As professor Viding (2018) has pointed out, psychopathic personality disorder does not emerge on one's 18th birthday, neither is anybody born a psychopath, but some children are at a higher risk than others of developing psychopathy later in their lives (Viding, 2018). Studying psychopathy among younger people may, for example, enhance our understanding of the routes and precursors of adult psychopathy and severe antisocial behavior, uncover other etiological issues, elucidate the causes of youth violence, and advance prevention and treatment methods.

Extending the concept of psychopathy downward to children and adolescents has not been straightforward however. A considerable amount of debate on applying psychopathy to youth has stemmed from empirical issues, ecological validity concerns and ethical appropriateness (Rubio et al., 2014; Salekin and Lynam, 2010). For example, Vitacco and Vincent (2006) have discussed the negative connotations of psychopathy with adolescents with behavioral problems. A number of characteristics associated with adult psychopathy, for example impulsivity and stimulus-seeking, to some extent delineate the normal fluctuations in the emotional, psychosocial, and behavioral immaturity of youth, which usually improve with time and guidance (Edens et al., 2001; Lochman et al., 2010; Petrila and Skeem, 2003). Some juveniles, without any risks of later psychopathic personality, may even engage in considerable delinquent behavior limited to adolescence, which makes studying the causes of persistent and psychopathic criminality through antisocial youths and their point in the life course difficult (Moffit, 1993/2017). As these features are age-inappropriate markers of psychopathy among

adolescents, clinicians may run the risk of misinterpreting normative and transient traits as antisocial or psychopathic (Cauffman et al., 2016; Lochman et al., 2010; Salekin and Frick, 2005). Such labels may influence how a youth is viewed and responds to treatment (Boccaccini et al., 2008). The etiological concerns have also been debated in legal and policymaking settings, as psychopathic traits may be viewed as neurocognitive abnormalities of juvenile delinquents, which in turn can be used as a justification for either shorter or longer sentences (Skeem et al., 2011).

To conclude, as psychopathy and associated antisocial behaviors are not yet fixed before adulthood and as such labeling might do considerable harm to younger people, the concept of "psychopath" has traditionally only been applied to adults (Petrila and Skeem, 2003; Vitacco and Vincent, 2006). Accordingly, preferable terms to use when talking about findings relating to children and adolescents could be "psychopathic traits" (e.g. Frick et al., 2014b), "developmental risk for psychopathy" (e.g. Viding and McCrory, 2018), "psychopathic behavior" (e.g. Hare, 2013), or "psychopathic-like features" (e.g. Saukkonen, 2015) depending on the study question and design.

2.2.2 MEASUREMENT OF PSYCHOPATHIC TRAITS IN ADOLESCENTS

Psychopathic personality traits can be assessed using many measures originally targeted at adults, or using youth versions for children and adolescents. Adapting adult assessment tools and creating new measures for youths has been inevitable, because the measurement tools used to measure psychopathy in adults are inappropriate for use with younger people (Edens et al., 2001). For example, some of the items delineating adult psychopathy might measure age-appropriate markers in adolescence without distinguishing psychopathic youths from their peers.

The Antisocial Process Screening Device (APSD; Frick and Hare, 2001), the Youth Psychopathic Traits Inventory (YPI; Andershed et al., 2002), and the Inventory of Callous Unemotional Traits (ICU; Frick, 2004) all have a self-report version to be used with youths. First, the APSD (Frick and Hare, 2001) is targeted at children and adolescents and is based on the Psychopathy Checklist-Revised (PCL-R) (Hare, 2003). The metric has optional versions for parents and teachers, and a 20-item self-report directed at youths, rated on a three-point Likert scale. This questionnaire supports a three-factor structure indexing narcissism, impulsivity and callous-unemotional traits (Laajasalo et al., 2014). Second, the YPI (Andershed et al., 2002) contains 50 items to which participants respond on a four-point Likert scale, ranging from 0 (does not apply at all) to 3 (applies very well). This is made up of three factors: Grandiose-manipulative, callous-unemotional, impulsive-irresponsible, and organized into ten subscales with five items in each subscale. Finally, the ICU (Frick, 2004) was designed to assess CU traits via parent-, teacher-, and youth self-reports. It was developed and expanded from the APSD (Frick and Hare, 2001), and has three subscales – callousness, uncaring, and unemotional. The

items are rated on a four-point Likert-type scale. A clinical assessment system is also under development (Frick, 2013), and is explicitly tied to the ICU.

2.2.3 CALLOUS-UNEMOTIONAL TRAITS

With children and adolescents, the terms psychopathic traits, callous-unemotional (CU) traits and limited prosocial emotions are sometimes used interchangeably, albeit the two latter concepts refer mainly to the affective dimension of psychopathy (Viding and Kimonis, 2018). Although CU traits are separate from the other factors of psychopathy, they correlate substantially with global measures of psychopathy and guide research of developmental psychopathy (Frick and Ray, 2015).

CU traits have been widely studied in both community, clinical and forensic samples, because they are considered the most reliable and distinctive extension of psychopathy into youth, are seen as exemplifying the core features of psychopathy and delineating a specific subgroup of antisocial, aggressive, conduct disordered or delinquent youths (Frick, 2009; Frick and Ray, 2015). CU behaviors such as low empathy and guilt, uncaring about others, low emotional responsivity, and deficits in affective empathy can be distinguished as early as in toddlerhood (Waller and Hyde, 2018), and has been linked to heritable temperament dimensions of fearlessness and low affiliative behavior (Waller et al., 2016).

Children and adolescents with CU traits seem insensitive to sanctions, show little concern for the feelings of others and neglect affiliative needs and goals (Frick et al., 2014a; Viding and McCrory, 2012). They endorse more deviant values such as accepting aggression as a means for obtaining goals, emphasize dominance, blame and take revenge in social situations, and underestimate the likelihood of punishment (Frick et al., 2014b). Further, different biological, cognitive, emotional and social markers are shown among youths with elevated levels of CU traits than among other antisocial youths (Frick and Marsee, 2018; Frick and Ray, 2015).

Some years ago, the psychopathic features of children and adolescents were added to the conduct disorder diagnosis in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders, through a specifier, “limited prosocial emotions” (DSM-5; American Psychiatric Association, 2013). To qualify for this specifier, an individual must have persistently exhibited at least two of the features over at least 12 months, and in one or more relationships and settings. The specifier reflects the principal emotional deficits underlying psychopathy, comprising the core symptoms that have been used to delineate CU characteristics in youth: the absence of remorse or guilt, a lack of empathy, unconcern about performance and shallow emotion (Salekin et al., 2018a; Viding and Kimonis, 2018). The inclusion of this specifier was preceded by a vast number of studies indicating that CU traits designate a subgroup of youths with severe conduct problems (Frick and Ray, 2015; Frick et al., 2014b).

The inclusion of the specifier to the diagnostic manual has raised debate on how to measure CU traits appropriately in youth, and whether the three-factor model of the ICU measure consisting of callous, uncaring and unemotional dimensions is valid (Essau et al., 2006; Frick and Marsee, 2018). The unemotional component in particular has evoked discussion, as youths with high levels of CU traits tend to show more deficits in emotional response than devoid emotional expressions (Hawes et al., 2014; Kimonis et al., 2016). These youths may exhibit intense anger, and a subgroup also has high levels of anxiety problems (Kimonis et al., 2012). Accordingly, the clinical use of this specifier needs reconciliation and discourse about the terminology. Viding (2018) has hinted that callous-unemotional traits could be called callous-uncaring traits, and Waller et al. (2017b) prefer to use the term callous-unemotional behavior instead of CU traits to emphasize the externalizing aspect of the early features.

2.2.4 MULTIDIMENSIONALITY OF PSYCHOPATHIC TRAITS

It is worth noting that the relationship between CU traits and antisocial behavioral problems is asymmetrical, as most youths with high levels of CU traits also exhibit severe conduct problems, whereas youths with high levels of behavioral problems display only moderately high levels of CU traits, reflecting similar connections to those found between adult psychopathy and ASPD (Fontaine et al., 2011; Hart and Hare, 1997). Although CU traits distinguish a specific subgroup of youths with conduct problems (Frick and Ray, 2015), it seems to be the combination of CU traits and impulsive-antisocial behavior that designates the most antisocial group of youths with severe, chronic and proactive violent behavior (Frick et al., 2014a; Hawes et al., 2017; Viding et al., 2012). Accordingly, youths comprising both affective-interpersonal traits and impulsive-antisocial features may be comparable to adults who present with psychopathy (Frick and Ray, 2015; Viding and McCrory, 2012).

In spite of the solid arguments for the importance of CU traits in searching for the pathways to psychopathy (Frick and Ray, 2015), not only the behavioral but also the interpersonal facet along with affective features have become the subject of considerable debate among scholars. Some scholars claim that the study of psychopathy among youths should not be restricted to affective dysfunction, because examining the broader construct of psychopathy might help the prediction of negative outcomes and enhance etiological knowledge, clinical care, dimension interactions and measurement precision (Salekin, 2016; Salekin et al., 2018b). For example, Somma et al. (2018) found that the three-factor model of psychopathy helps predict youth self-reported delinquency better than the separate factors, and Feilhauer and Cima (2013) wrote in their recent review that narcissistic and impulsive features might help identify different psychopathic profiles among adolescents. Gillen et al. (2018) also report that all three dimensions play a role in the association with

emotional intelligence and empathic concern. Bergstrøm and Farrington (2018) discuss interesting clusters of those scoring high in two specific dimensions and compare them to those with only high levels of CU traits. They state that a combination of psychopathic traits predicts the strongest antisocial and life outcomes such as offences, fighting, drug abuse and drinking problems. Based on current studies, the answer to the recently raised question of "Are CU traits enough?" (Salekin et al., 2018b) may be that investigation of the broader, multidimensional concept of psychopathy in youth samples is warranted. To conclude, the study question and design determine ultimately which dimensions to study.

2.2.5 PRIMARY AND SECONDARY PSYCHOPATHY

A growing body of research is recognizing a great heterogeneity within the etiology of psychopathy, including the identification of two variants: primary and secondary psychopathy. The distinction dates back to Karpman (1941), who suggested that primary psychopathy was the consequence of an inherent deficit, whereas secondary psychopathy was more an acquired disturbance in emotional functioning as a result of environmental adversity. Later, Lykken (1957) considered individuals who met most of the Cleckley criteria primary psychopaths and others secondary psychopaths, calling them sociopaths (Lykken, 2006/2018). The subtyping of psychopathic individuals as primary and secondary variants has generated much research, and the distinction has grown in the past ten years, with empirical studies showing a consistency not only with adult psychopathy but also with youth psychopathic traits (Kimonis et al., 2012; Vaughn et al., 2009). In respect of prevalence, a higher proportion of youths present with the primary profile than the secondary subtype (Craig and Moretti, 2018; Fanti et al., 2013; R. E. Kahn et al., 2013).

To better understand these two variants, research has shifted to examine affective regulation as being a necessary condition for adaptive social and moral development, which in turn influences the development of psychopathic traits (Blair, 2013; Craig and Moretti, 2018; Thompson and Newton, 2010). Skeem et al. (2011) claims that the variants differ in emotional stability and the secondary variant has an acquired emotional disturbance that may be changed through treatment. Also, the risk and protective factors may affect the variants differently.

Evidence from other studies suggests that the primary variant is characterized by low to average anxiety levels and general poverty of emotional expression in contrast to the secondary group, which is more likely to exhibit higher levels of anxiety and psychological distress (Craig and Moretti, 2018; Kimonis et al., 2012; Vaughn et al., 2009). Craig and Moretti (2018) also reported that the profile of primary CU features might be marked by affect dysregulation and affect suppression, referring to underarousal of affect. On the other hand, secondary variants typically have a history of maltreatment or traumatic exposure with internalizing symptoms (R. E. Kahn et al., 2013;

Kimonis et al., 2017) showing an overaroused disposition (Craig and Moretti, 2018). In a recent study, Kimonis and colleagues (2017) reported preliminary findings of reduced startle reactivity, referring to reduced amygdala activation especially with the primary subtype, after investigating differences in emotional processing between the variants. To conclude, if youths with psychopathic traits can be separated into subgroups that differ in their emotional reactivity, this should be noticed in etiological hypotheses, prevention methods and treatment development (Skeem et al., 2011).

2.2.6 PSYCHOPATHY AND JUVENILE DELINQUENCY

Youths with psychopathic traits are more likely to violate social norms and engage in the justice system than other adolescents (Kimonis et al., 2016; Reidy et al., 2017; Vitacco and Salekin, 2013), and a link between adolescent delinquency and psychopathic features has consistently been found (Asscher et al., 2011; Virtanen et al., 2020). For example, Vaughn et al. (2014) indicated that less than 5% of adolescents were responsible for almost one third of the most severe violent crimes. Although they did not measure psychopathic features among this minority, Reidy et al. (2017) proposed that psychopathy might be a considerable contributory factor in these crimes. Also, in a recent study using a large, prospective sample of Swedish twins, Virtanen et al. (2020) found that late childhood psychopathic traits may be a risk factor for subsequent delinquency even without co-occuring conduct problems. Scholars emphasize caution when evaluating psychopathic traits among juvenile delinquents in the legal context, because they should not be the reason for conviction (Vitacco and Salekin, 2013) or a justifier for shorter or longer sentences (Skeem et al., 2011). Cauffman and colleagues (2016) also warn against basing legal decisions on psychopathy, because assessing these by using cut-off scores risks false positive errors.

The division of violence types is important because proactive aggression, often termed premeditated or instrumental, tends to be a less common, goal-oriented and more severe form of violence, whereas reactive aggression is an impulsive emotional response to provocation (Cornell et al., 1996; Hecht et al., 2016; Reidy et al., 2011). Psychopathy is linked to both types of aggression (Blais et al., 2014), and diverse forms of offences (Kiehl and Hoffman, 2011). Traditionally, studies have demonstrated that psychopathic traits are more closely tied to proactive violence than to reactive violence, among both adults and adolescents (Cornell et al., 1996; Hecht et al., 2016; Reidy et al., 2011), but the associations may vary between the factors of interpersonal, affective and behavioral (Blais et al., 2014). Poor impulse control may cause reactive forms of aggression or violence, but affective deficits make it relatively easy to engage in aggression and violence that is more premeditated and instrumental in nature (Cornell et al., 1996; Hare and Neumann, 2009; Kimonis et al., 2016). For example, in a study by Hecht et al. (2016), psychopathy associated more

strongly with proactive aggression, explaining 15–21% of the variance, compared to reactive aggression, which only explained 5%.

2.3 DEVELOPMENTAL APPROACH TO PSYCHOPATHY

The development of psychopathy is seen as a dynamic process and has multiple pathways of various contributing factors (Frick et al., 2014a; Frick and Viding, 2009), though psychopathy has a neurobiological basis (Moore et al., 2019; Waller and Hyde, 2018) and can be seen as a neuropsychiatric disorder (Anderson and Kiehl, 2014). Early identification of the risk and protective factors is considered essential for improving our understanding of the causal mechanisms that underlie adult psychopathy as most psychopathic adults are likely to have manifested similar traits in childhood and adolescence and become involved in antisocial acts at an early age (Frick and Marsee, 2018; Hawes et al., 2017).

The trajectories of psychopathy may vary as the same developmental outcome can generate through different paths, or as an opposite, the same risk factors can have several developmental outcomes (Frick and Viding, 2009). Based on a cognitive neuroscience approach, cognitive impairments (Blair, 2013) or emotional deficits (Anderson and Kiehl, 2014) may disrupt the normal development of empathy, conscience and socialization and generate antisocial and aggressive behavior (Blair, 2013) or create callous and unemotional features (Frick et al., 2014a; Waller and Hyde, 2018). Also, decreased response to typical socialization, based on empathy, sanctions and motivation, may strengthen the risk that a normal prosocial development goes awry (Viding and McCrory, 2018; Waller and Hyde, 2018). Figure 1 illustrates the developmental course of psychopathy with risks and negative outcomes, as well as the significance of environmental or individual protective factors at an early stage for avoiding psychopathic personality disorder and long-term criminality. The following sections introduce the potential risk and protective factors for psychopathy, but first, the stability and change of the psychopathic traits are presented.

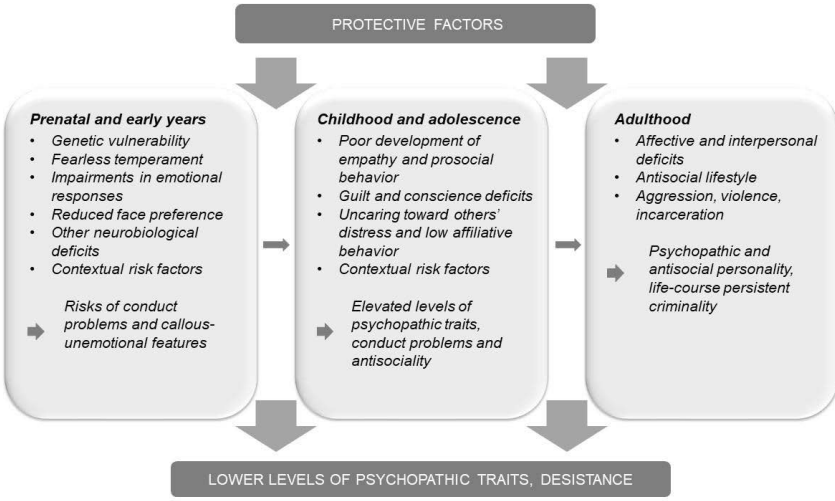

Figure 1 Developmental model of heritable, neurocognitive and environmental risk factors, and contextual protective factors accounting for psychopathy and antisocial behavior (adapted and modified from Waller et al., 2016)

2.3.1 STABILITY AND CHANGE OF PSYCHOPATHIC TRAITS

Many studies have reported moderate degrees of stability in psychopathic features across childhood and adolescence (Fanti et al., 2017; Fontaine et al., 2010; Frick et al., 2003; Frick et al., 2014a; Lynam et al., 2009) and from adolescence into adulthood (Frick et al., 2014a; Lynam et al., 2007; 2008; Pardini and Loeber, 2008). The mean level of psychopathic traits may decrease slightly between late adolescence and early adulthood (Pardini and Loeber, 2008; Salihovic et al., 2014). For example, Cauffman et al. (2016) reported a weak mean-level stability in youth CU traits over a two-year period, as about only two-thirds of the youths who scored high in the psychopathic measure scored lower at the end of the measurement period. The same study investigated stability in adulthood and found a stronger stability, which points to a malleability in these traits during adolescence. Lynam and colleagues' (2007) study also gives strength to the malleability and decreasing tendency, as they reported that less than one-fifth of the youths with high levels of psychopathic traits at the age of 13 remained psychopathic at the age of 24. Respectively, over 90% of the boys who scored low in psychopathy at the age of 13 remained below the disorder criteria at the age of 24 (Lynam et al., 2007). Further, in Frick and colleagues' (2003) study, the trajectory was more linear for those initially low on CU traits than for those with initially high levels of CU traits, indicating a decreasing trend. Approximately two-thirds of the youths remained steadily low at the initial level and in all follow-up assessments (Frick et al., 2003).

In addition to these studies, a number of others have also used mean-level or rank-order estimates that focus on the relative ordering or average changes of psychopathic traits over time, and to date only a handful of studies have examined the stability of psychopathic traits on an individual level. Individual-level analysis reveals the intra-individual sources of change and adjusts for all the time-invariant confounding factors, which may create false correlations, because repeated measures are nested within individuals in longitudinal data (Curran and Bauer, 2011). In addition to the paucity of within-individual investigations, studies examining the longitudinal development of psychopathic traits also have a number of other shortages. First, many of these studies have used theoretical cut-off points to define groups (e.g. Cauffman et al., 2016; Frick et al., 2004; Lynam et al., 2007); second, only a few of them have focused on the shape of possible CU trajectories (e.g. Lynam et al., 2009; Pardini and Loeber, 2008); and third, the proportions of children of different developmental trajectories have not been systematically reported (e.g. Frick et al., 2003; Lynam et al., 2007).

The few findings of studies concentrating on the stability of psychopathic traits on an individual level have demonstrated within-person diversity in individual trajectories across childhood and adolescence (Byrd et al., 2018; Frick et al., 2003; Fontaine et al., 2010; Hawes et al., 2017; 2018; Pardini and Loeber, 2008; Salihovic et al., 2014). Pardini and Loeber (2008) reported individual differences in CU traits from mid-adolescence to adulthood, and the trajectories showed a mild mean-level decrease. As regards more detailed trajectories of stability and change, studies of within-individual methods have started to recognize the shape of trajectories and the proportions of youths by identifying four different courses of the levels of CU traits from childhood to adolescence: “Stable high” with a relative density of 4–14%, “decreasing” with a relative density of 10–17%, “increasing” with a relative density of 10–23%, “stable low” with a relative density of 49–70% (Byrd et al., 2018; Fontaine et al., 2010; Hawes et al., 2017; 2018). For example, Byrd et al. (2018) studied male youths annually at the ages of 7 to 15, and classified two-thirds as having low or moderate levels of interpersonal callousness over the period. In contrast, the youths in the early-onset and chronic trajectory group showed more conduct problems, fearlessness, emotional abuse and neglect. Fontaine et al. (2010) also found that most of the children aged 7 to 12 followed the stable low trajectory and much fewer followed the stable high trajectory. The children with high levels of CU traits over the study period were highly likely to also display high levels of conduct problems. Finally, the study of Hawes et al. (2018) of 7- to 16-year-old boys found a substantial malleability in the developmental course of psychopathic traits, and this change across time had important implications for following outcomes in adulthood.

Overall, the studies of stability and changes in psychopathic traits yield that the majority of youths follow a stable-low trajectory, whereas fairly equal proportions of youths follow increasing and decreasing trajectories. The stable high trajectory seems to characterize the smallest group of youths

proportionally, which is good news in general. However, only a few of the studies have explored change within individuals.

2.3.2 ASSOCIATED FACTORS OF PSYCHOPATHY

In order to comprehend the developmental course of psychopathy, researchers are motivated not only to understand the continuities and discontinuities across its development, but also to identify the factors – the risks and protective variables – that affect the levels of psychopathic traits. Accordingly, factors that influence stability and change might play a key role in defining the critical targets of prevention and intervention (Frick et al., 2014a), as the findings suggest that not all youths with psychopathic traits become psychopathic criminals. Neurocognitive and genetically informative studies have found evidence of the risks of psychopathy (Viding and McCrory, 2012). However, little is still known about the systems through which the factors work, and the influence of the early social and contextual factors of the trajectories of psychopathic traits remain largely unidentified (Byrd et al., 2018).

2.3.2.1 Neurocognitive findings

Over the last 10 years, our understanding of the neurobiology of psychopathic traits has progressed enormously. Many studies of the structural and functional neural correlates of psychopathic personality traits have reported similar findings among both adults and adolescents and children (Blair, 2013; Viding and McCrory, 2012). Stemming from the neural impairments reported in neuroimaging studies, psychopathic traits have been associated with impairments in emotional responses, decision-making, and social cognition, which affect the formation of moral judgments in particular (Blair, 2013; Viding and McCrory, 2018). Psychopathic youths fail to recognize and react to affective stimuli by showing deficits in empathy and guilt, and low emotional responsiveness to distress and pain cues (Blair, 2013; 2018; Viding et al., 2012). Furthermore, they seem to have reduced sensitivity to visual and vocal expressions and body postures of fear, sadness and pain, and even happiness (Blair, 2013; Dawel et al., 2012; Marsh and Blair, 2008; Muñoz, 2009), although normal recognition of anger and disgust has been reported (Dawel et al., 2012; Marsh and Blair, 2008). These deficits in sensitivity to visual expressions might be caused by abnormal attention to socially relevant cues and reduced face preference, i.e. poor attention to the eye region of the face (Bedford et al., 2015; Dadds et al., 2006; 2014). For example, Hodsoll et al. (2014) found that boys aged 8 to 16 with high levels of CU traits were less distracted and rewarded by happy faces than other children. The finding indicates that these facial expressions may not capture their attention as effectively as they catch the attention of other youths.

Studies have shown that psychopathic youth have intact abilities in cognitive empathy, whereas the affective empathy may be impaired (Blair, 2013). However, recent research has advanced the notion indicating that psychopathic individuals, both adults and adolescents, may have a tendency to decide whether to consider minds and mental stages of others or not (Drayton et al., 2018; Roberts et al., 2020). Likely, they tend to do it when it benefits themselves or helps them to manipulate others, but they ignore to orient to other persons perspectives if they find it irrelevant.

Some cognitive differences have been linked to psychopathic traits, for example, poor verbal cognitive ability (Fontaine et al., 2011), low self-regulation and executive dysfunction (Fanti et al., 2017), and lower educational performance (DeLisi et al., 2011; Fanti et al., 2017). Regarding decision-making, adolescents high in psychopathic traits tend to care less about negative consequences or conflicts and are more likely to dominate or harm others to achieve their own goals (Blair, 2013). Cognitive impairments in reinforcement learning, deficits in linking reward and punishment to stimuli, and making prediction errors are likely to cause disadvantageous decisions and their recurrence (Blair, 2013; Viding and McCrory, 2012). Moreover, as mentioned earlier, neuroimaging studies have documented alterations in social cognition, in moral reasoning and judgement (Blair, 2013; Marsh et al., 2011), and preliminary findings regarding social affiliation and reduced neural responses to laughter (O'Nions et al., 2017; Viding and McCrory, 2019). These deficits might result in atypical and poor affiliative bonds and emotional resonance abilities, which result in impaired socialization demands.

In terms of structural and functional MRI findings, the main brain regions implicated in psychopathic traits among youths are the amygdala, the caudate as a part of the striatum, the ventromedial and dorsomedial prefrontal cortex, the anterior insula and the anterior cingulate cortex (Blair, 2013; 2018; Viding and McCrory, 2012). Moreover, alterations in grey matter volume (Caldwell et al., 2019), reduced cortical thickness (Wallace et al., 2014), a higher microstructural integrity of white matter, and a lower global brain volume reflecting macro- and microstructural differences among children with high levels of CU traits (Bolhuis et al., 2019) have been documented. Associations between CU traits and grey matter volume may even vary between CU trait subcomponents.

An interesting finding concerns the amygdala and the moderation of prior trauma, as both Kimonis et al. (2017) and Meffert et al. (2018) have reported that youths with high CU traits and low trauma exposure show less amygdala responsiveness than youths with high CU traits and a trauma history (Kimonis et al., 2017; Meffert et al., 2018). These findings also link to the primary and secondary variants of psychopathy and warrant further study.

2.3.2.2 Genetically informative studies

Genetics play a vital etiological role in psychopathy, although no genes directly regulate it, as Viding (2018) states that a genetic predisposition sets the window but not the outcome for its development. Studies among children and adolescents have reported that heritable factors have a moderate to high influence on psychopathy or CU traits, and that genetic influences account for 36% to 67% of this variation (Moore et al., 2019; Viding and McCrory, 2012). Interestingly, the risk alleles for psychopathy do not entirely overlap with those for conduct disorder or antisocial personality disorder, which appear to be influenced more by contextual factors (Viding et al., 2005; Viding and McCrory, 2018). Based on recent knowledge, genetically determined serotonin and oxytocin systems might create a risk of psychopathy (Moore et al., 2019).

A large body of research has linked differences in temperament to psychopathic features. CU traits are often related to lower levels of fear and anxiety (Blair, 2013; Frick et al., 2014a; Waller et al., 2016). Temperamental traits of fearlessness and low interpersonal emotional sensitivity have been linked to problems in the normal development of empathy, guilt and conscience (Barker et al., 2011; Kochanska, 1997; Thompson and Newton, 2010). A unique prospective study by Barker et al. (2011) examined the topic using a large population-based sample and reported that a fearless temperament at the age of two preceded CU traits at the age of 13. Waller et al. (2016) found that the biological mother's fearlessness and affiliative behavior predicted an adopted child's CU behaviors over a nine-month period in toddlerhood. Another study by Waller and colleagues (2017a) found that psychopathic behaviors in late childhood were predicted indirectly by the interaction of child fearless temperament and low positive parenting. These results hint at heritable temperament pathways with environmental effects to psychopathic traits, although they warrant more longitudinal research to better untangle the developmental course.

2.3.2.3 Individual and contextual risk and protective factors

Genetic predisposition influences the development of psychopathic traits, but the outcome also depends on environmental context, which in turn, may be influenced by genetics (Viding and McCrory, 2018; Waller et al., 2017b). The scope of interest of many previous studies has been in the environmental or individual risks of developing psychopathy rather than in factors promoting a positive outcome. This shortcoming has been noticed among the scholars: "Perhaps one of the most glaring gaps in the psychopathy literature is the lack of knowledge regarding protective factors" (Reidy et al., 2015, p. 129); "more research is needed to discover protective factors that might decrease the likelihood of psychopathy in individuals who are at risk" (Farrington and Bergstrøm, 2018, p. 355).

Protective factors can be same factors as risks, depending on their positivity or negativity representing opposite ends of the same continuum (Fanti et al., 2017; Bergstrøm and Farrington, 2018). As mentioned, most studies of psychopathy have focused on the negative extremes indicating the risk factors (Salekin and Lochman, 2008). Parental behaviors may be the most studied contributing factor for psychopathy, while it is also a good example of covering both risks and protection. Accordingly, both negative and positive parenting have been found to associate with psychopathic traits of children and adolescents (Hawes et al., 2014; Waller et al., 2013). In addition, delinquent peers and partners may contribute the levels of psychopathic traits (Frick et al., 2014b; Golmaryami et al., 2021), and sleep may have effects on antisocial behavior (Short and Weber, 2018). These themes will be introduced later.

Few risk factors for psychopathy have been identified. It is known that childhood maltreatment may alter the neurobiology of the brain and contribute to the development of psychopathy (McCrory et al., 2017; Kimonis et al., 2017). Also, inattention and low self-esteem (Fanti, 2013), high levels of chaos in the home (Fisher and Brown, 2018; Fontaine et al., 2011), low socioeconomic status (Fontaine et al., 2011; Lynam et al., 2007), and neighborhood impoverishment (Waller et al., 2015) might relate to the development of psychopathic traits. In terms of prenatal factors, maternal psychopathology may associate with child CU traits (Barker et al., 2011). Although some of individual or environmental risks to be linked with psychopathic traits among children and adolescents are known, the causality and underlying mechanisms remain uncertain, and gene–environment correlations are difficult to disentangle (Waller et al., 2017b).

A handful of findings address protective factors for psychopathy or variables associated with low psychopathic traits among youths, and most of these have been detected using community samples. They are listed in Table 1, from which all intervention studies have been left out. The most commonly detected protective factor against psychopathy seems to be positive parenting (e.g. Frick et al., 2003; Pardini and Loeber, 2008), specifically parental warmth (e.g. Barker et al., 2011; Clark and Frick, 2018; Pardini et al., 2007), and positive reinforcement (Hyde et al., 2016; Waller et al., 2016). Family socioeconomic status (Frick et al., 2003; Lynam et al., 2007), prosocial peers (Barry et al., 2008; Fanti et al., 2017), a school friend (Muñoz et al., 2008), bonds with school (Baroncelli and Ciucci, 2020), and a positive classroom climate (Fisher and Brown, 2018) have also been found to have some weakening impact on the levels of psychopathic traits. In addition to contextual protection, a few individual factors, such as motivation to change (Salekin et al., 2010) and intact mentalization (Taubner et al., 2013), may also favorably affect the psychopathic traits of adolescents. Finally, a method through which examining protective factors can be examined is the successful psychopathy concept. For example, Lilienfeld et al. (2015) proposed that protective factors among law-abiding psychopaths might lie in intact executive functioning or intelligence. Similarly, Gao and Raine (2010) propose that the

absence of cognitive deficiency and structural or functional abnormality among successful psychopaths might refer to protective factors against psychopathy. These need to be studied in the future.

Table 1. *Potential protective factors associated with psychopathic traits*

Study	Sample	Key methods	Target traits or behaviors	Protective factors found
Barker et al., 2011	N = 6673; 50,46% male; age = 13; population-based sample	Longitudinal study with time points at age 2-4 and 13; mother-reports	CU traits	Warm parenting
Baroncelli and Ciucci, 2020	N = 301; 48.17% male; mn age = 12.96; community sample	Longitudinal study of 2 time points; time frame of 6 months; self-reports	CU traits	Bonds with school and social preference
Barry et al., 2008	N = 80; 56.3% male; mn age = 10.66 in initial assessment; community sample	Longitudinal study for 2 years; parent, teacher, peer, and self-reports	CU traits	Better social functioning and prosocial peer relationships
Buck, 2015	N = 957; age = 54 months - 15 years; community sample	Longitudinal study of 5 time points; observation and self-reports	CU traits	Maternal sensitivity
Clark and Frick, 2018	N = 92; 61% male; mn age = 6.2; community sample	Cross-sectional study; caregiver and teacher reports	CU traits	Positive parenting, parental warmth
Chinchilla and Kosson, 2016	N = 214; 85.5% male; mn age = 15.37; forensic sample	Cross-sectional study; self-reports	Conduct problems of youth with low/medium levels of psychopathic traits	Parental warmth
Fanti and Centifanti, 2014	N = 1736; 46.6% male; age = 7-12; community sample	Two time points with 1 year time frame; parent-reports	Conduct problems of children with CU traits	High parental involvement, lower parental distress
Fanti et al., 2017	N = 1200; 46.6% male; mn age = 9.38; community sample	Longitudinal study for 2 years; parent, teacher, and self-reports	CU traits	School connectedness, peer social support, and positive relationships from different contexts
Fisher and Brown, 2018	N = 390; 49.5% male; mn age = 8.06-15.05; community sample	Longitudinal study for 3 years; parent, teacher, and self-reports, observation	Psychopathic traits	Positive classroom climate
Frick et al., 2003	N = 1136; 47% male; mn age = 10.65 in initial assessment; community sample	Longitudinal study for 4 years; parent, teacher, and self-reports	Psychopathic traits	Socioeconomic status, quality of parenting

Hawes et al., 2011	N = 1008; 52.6% male; mn age = 6.5; community sample	Longitudinal study with time-frame of 12 months; parent-reports	CU traits	Positive parenting, parental involvement
Henry et al., 2018	N = 662; age = 7-12 years; community sample	Longitudinal study for 5 years; mother and teacher reports	Heritability of CU traits	Warm/rewarding parenting
Hyde et al., 2016; Waller et al., 2016	N = 561; 57,2% male; age = 9-27 months; community sample	Longitudinal study for 18 months; adoptive and biological mother reports, observation	CU traits	Positive parenting, parental reinforcement
Goulter et al., 2019	N = 753; 58% male; age = 5-25 years; community sample	Longitudinal study with time points in kindergarten, grades 1-2, 6-7, and at age 25; parental and self-reports	CU traits	Parental warmth
Muñoz et al., 2008	N = 667; age = 12-15 years; community sample	Longitudinal study for 4 years; peer and self-reports	Delinquency of youth with psychopathic traits	At least one school friend
Pardini et al., 2007	N = 120; 59.2% male; mn age = 10.66 in initial assessment; as part of a larger investigation of a school-based prevention program for at-risk youth	Longitudinal study for 1 year; parent, teacher, and self-reports	CU traits and antisocial behavior	Parental warmth and involvement
Pardini and Loeber, 2008	N = 247; 100% male; mn age = 13.9-17.9; community sample	Longitudinal study for 4 years; caregiver and teacher reports, interview	CU traits	Parenting practices
Pasalich et al., 2011	N = 95; 100% male; age = 4-12; clinical sample	Cross-sectional study; observation	Conduct problems of youth with CU traits	Parental warmth
Ray, 2018	N = 1354; 86.4% male; mn age = 16.04; forensic sample	Longitudinal study for 7 years; self-reports	Psychopathic traits	Parental warmth, being female
Ray et al., 2017	N = 1216; 100% male; mn age = 15.29; forensic sample	Longitudinal study for 12 months; self-reports	Offending of youth with CU traits	Parental warmth and parental monitoring
Salekin et al., 2010	N = 140; 66% male; mn age = 15.25; forensic sample	Longitudinal and prospective study; records and self-reports	Violent offending of youth with psychopathic traits	Motivation to change
Salihovic et al., 2012	N = 875; 53% male; age = 13-15 in initial assessment; community sample	Longitudinal study for 4 years; self-reports	Psychopathic traits	Positive parental behavior

Taubner et al., 2013	N = 104; 56.7% male; mn age = 16.4; community sample	Cross-sectional study; self-report and interview	Expression of aggression of youth with psychopathic traits	Intact mentalization
Waller et al., 2018	N = 454; 51.5% male; age = 6-11 years; community sample	Cross-sectional study; parent-reports	CU traits	Parental warmth

2.4 PSYCHOPATHIC TRAITS AND ADOLESCENT SLEEP

Sleep difficulties and sleep deprivation are a chronic problem among youths worldwide (Gradisar et al., 2011; National Sleep Foundation, 2013). According to systematic reviews and meta-analyses, many adolescents do not obtain adequate nocturnal sleep (Bartel et al., 2015; Crowley et al., 2007; Gradisar et al., 2011), especially on school-nights, which cascades into a persistent pattern of week-day sleep deprivation (Carskadon et al., 2004; Gradisar et al., 2011). Accordingly, adolescent sleep quantity is apt to fluctuate, with week-night sleep being shorter than weekend sleep (Gradisar et al., 2011). Eight to ten hours of sleep per night is optimal for adolescents, whereas less than eight hours of sleep is insufficient, and causes sleep loss (Carskadon, 2011; Hirshkowitz et al., 2015; Short et al., 2018). Typical sleep problems among youths are insomnia-like symptoms, i.e. insufficient sleep in terms of both quality and quantity, including difficulty maintaining sleep, early morning awakening and unrefreshing sleep (Gradisar et al., 2011; Roberts et al., 2009).

From late childhood to young adulthood, sleep onset and wake-up times typically delay causing sleep deprivation among adolescents (Carskadon, 2011; Carskadon et al., 2004). These and other alterations in sleep across adolescence are a normal part of development due to underlying changes in brain structure and organization (Colrain and Baker, 2011) and hormonal changes, such as melatonin being released later (Carskadon, 2011). Accordingly, delayed sleep onset seems to be related to biological, psychological and socio-cultural changes, for example certain parts of the homeostatic system change, resulting in later bedtimes among older adolescents (Carskadon et al., 2004). In a study by Sadeh et al. (2009), delayed sleep onset and other changes in adolescent sleep-wake patterns predicted more pubertal development across time, suggesting that alterations in sleep may be inevitable before pubertal bodily changes. Although the reduced amount of sleep in adolescence has long been recognized, the need for a long sleep during adolescence remains (Carskadon, 2011).

Many internal and external factors have been found to associate with poor sleep among children and adolescents (Bartel et al., 2015; Shochat et al., 2014). For example, sleep disturbances are related to emotional regulation problems (Brand et al., 2015; Palmer and Alfano, 2017), to behavioral problems (Aronen

et al., 2014; Roberts et al., 2008; 2009; Shochat et al., 2014), and to aggression or violence (Hildenbrand et al., 2013; Kamphuis et al., 2012; Short and Weber, 2018). In a meta-analysis conducted by Gradisar et al. (2011), approximately 40% of the surveys reported at least one sleep parameter that was indicative of problems in adolescents' general functioning. In sum, many adolescents suffer from inadequate sleep, which negatively affects their daytime performance and social environment.

2.4.1 SLEEP, BEHAVIORAL PROBLEMS AND DELINQUENCY

Several studies have found a link between juvenile delinquency and sleep problems (Catrett and Gaultney, 2009), insufficient amount of sleep (Clinkinbeard et al., 2011; Hildenbrand et al., 2013; Meldrum et al., 2015; Peach and Gaultney, 2013), or both (El-Sheikh et al., 2019; Meijer et al., 2010). A meta-analysis of 26 studies including over 570 000 participants showed a non-linear relationship between sleep duration and risk-taking behavior, with both short and long sleep durations being related to increased risk-taking among adolescents (Short and Weber, 2018). This risk-taking included violent or delinquent behavior, drug or alcohol use, smoking, sexual risk-taking, risk-taking related to transport or road safety, gambling and trait risk-taking.

The direction of the effect remains unknown, since most studies of sleep and risk-taking, specifically adolescent delinquency and violence, have been cross-sectional. Kamphuis et al. (2012) suggested that sleep predisposes to aggression and violence. Raine and Venables (2017) also conducted a longitudinal investigation of the causality of sleep in criminality and found that adolescent sleepiness predicted later antisocial behavior and criminality. The study was first conducted among 101 schoolchildren aged 14 to 16, and measuring their daytime sleepiness and antisocial behavior, found them to correlate. The same participants were then examined at the age of 29. Seventeen of the 101 adults were found to have criminal records, and these scored higher on the sleepiness scale than their counterparts (Raine and Venables, 2017). Another interesting finding is the association between an evening-type chronotype and externalizing behavior among young people (Schlarb et al., 2014). The review found these links in 13 studies and discussed their mediating factors, defined as altered personality traits or poor sleep, for example. It made an assumption that chronotype precedes poor sleep, which leads to externalizing behaviors.

Recent findings suggest that instead of a one-way causality there may be bidirectional effects between sleep and behavioral problems. A review among adults showed that sleep deprivation preceded aggression and that aggressive behavior induced alterations in sleep parameters (Pires et al., 2018). A similar finding has been announced among adolescents in a longitudinal study indicating that links between poor sleep and impulsive behavior are bidirectional which poses a possibility for a negative cycle over time (Bauducco et al., 2019).

It is widely recognized that sleep problems are associated with emotional dysregulation and diminished emotional control among children and adolescents (Baum et al., 2014; Gregory and Sadeh, 2016; Palmer and Alfano, 2017). However, what is not known is that why sleep deprivation is associated with emotional disturbances and how sufficient sleep protects against dysfunction. The effect of emotions on sleep problems might be two-way, as emotions may arise as a result of poor sleep or they may alter sleep as an underlying regulatory system (M. Kahn et al., 2013; Palmer and Alfano, 2017). In addition, negative emotional states such as increased irritability and hostility are related to both sleep loss and violence (Ireland and Culpin, 2006). Insufficient sleep produces more negative emotions (Palmer and Alfano, 2017), which plausibly cause poor impulse control and weakened behavioral response inhibition (Killgore et al., 2008). There are individual differences, as some people are more susceptible to losing control over their emotions as a result of sleep deprivation than others (Kamphuis et al., 2012).

Inadequate sleep might increase risk-taking through its harmful impact on the brain regions accountable for decision-making (Killgore et al., 2008; Short and Weber, 2018); specifically, poor sleep has shown to adversely affect decision-making by raising the expectation of gains and reducing the observed likelihood of loss following risky decisions (Venkatraman et al., 2007). Thus, insufficient sleep links to emotional and cognitive impairments, which are both related to poor impulse control and decision-making at least partly through irritability, which in turn increases the likelihood of violent encounters and delinquency (Clinkinbeard et al., 2011; Ireland and Culpin, 2006; Meldrum et al., 2015).

2.4.2 ASSOCIATIONS BETWEEN SLEEP AND PSYCHOPATHIC TRAITS

Studies of sleep and psychopathic traits are scarce, even though poor sleep associates with impulsivity (Ireland and Culpin, 2006; Kamphuis et al., 2012; Short and Weber, 2018), affective features (Baum et al., 2014; Palmer and Alfano, 2018) and narcissism (Sabouri et al., 2016), which link to psychopathic traits' subdomains. Although the association between altered sleep and psychopathy was proposed already by Hare in the 1970s (Hare, 1970), only a handful of studies have looked at sleep and psychopathy, all of which have been conducted among adults (Akram et al., 2017; Denis et al., 2017; Harty et al., 2010; Jonason et al., 2013; Sabouri et al., 2016; Salley et al., 1980). The results of these studies are controversial. A general population study investigating Dark Triad traits (i.e., narcissism, psychopathy, and Machiavellianism) found positive associations between psychopathy and insomnia-type sleep disturbances (Akram et al., 2017; Sabouri et al., 2016), and between psychopathy and an evening-type orientation (Jonason et al., 2013), which in turn has been linked to poor sleep, an irregular sleep-wake schedule, and shorter sleep length on week nights (Mateo et al., 2012;

Giannotti et al., 2002). In contrast, two other studies failed to find associations between sleep and psychopathy (Harty et al., 2010; Salley et al., 1980). Denis et al. (2017) investigated the relationships between CU traits and sleep quality including sleep duration. Using different methods (i.e. questionnaire measures and actigraphic data), the research group found either no relationships or better sleep quality to be related to CU traits, which is in line with Gregory and Sadeh's (2016) suggestion regarding children with conduct problems. They predicted sleep problems to be more characteristic of those who do not have limited prosocial emotions with conduct problems than of those with a conduct disorder and CU traits (Gregory and Sadeh, 2016). Further, Lindberg et al. (2008) reported that the sleep duration of adolescents with a conduct disorder were slightly longer, whereas the percentage amount of different sleep stages was more similar to that among adolescents with no history of antisocial behavior than to that of their peers.

The neuropsychological deficits of persons with altered sleep resemble those found among individuals with psychopathic features. Both may exhibit diminished fear reactivity in fear-conditioning experiments (Dawel et al., 2012; Marsh et al., 2011), altered risk-related judgments favoring unrealistic expectations of gains, that lead to underestimating the consequences of losses (Killgore, 2013; Venkatraman et al., 2007), and reduced empathy toward others and a poor ability to delay gratification (Killgore et al., 2008; Palmer and Alfano, 2017). Moreover, sleep deprivation detrimentally affects the capacity to understand the emotions of others as well as one's own (Killgore et al., 2008) and to recognize facial emotions (Pallesen et al., 2004). Neuroimaging studies signal similar findings among sleep deprived individuals and those with psychopathic traits. Accordingly, sleep deprivation associates with alterations in the normal functional activity of impulse control, reinforcement learning, risky decision-making, and emotional processing, namely in the prefrontal cortex, the amygdala, and the striatum, among both adults and adolescents (Gregory and Sadeh, 2016; Palmer and Alfano, 2017; Short and Weber, 2018). Impairments in these areas are also thought to underlie many of the core symptoms of psychopathy (Anderson and Kiehl, 2014; Blair, 2013; Viding and McCrory, 2018). Considering the similarities between sleep problems and psychopathy on the cognitive, behavioral and neural level, the lack of research on associations between sleep and adolescent psychopathic traits is surprising.

2.5 PSYCHOPATHIC TRAITS AND SOCIAL RELATIONSHIPS IN ADOLESCENCE

2.5.1 PEER RELATIONSHIPS

The adolescent social environment may be a potential area for intervention to reduce psychopathic characteristics and their related antisocial behavior. The

quality of peer relationships in particular should be scrutinized in terms of prevention (Fanti et al., 2017; Frick et al., 2014a). Close, meaningful connections with friends is one of the best indicators of an adolescent's psychological wellbeing, and the quality of friendships influences self-concept, identity and behavior in adolescence (Hall-Lande et al., 2007).

Studies have shown that a prosocial peer group may prevent later antisocial acts (Hemphill et al., 2015; Shepherd et al., 2016), whereas affiliating with antisocial peers is likely to increase psychopathic traits (Lynam et al., 2008). The influence of peer relationship problems might affect the stability of CU traits by keeping them on a high level (Fontaine et al., 2011). On the other hand, having no friends may also have adverse effects on the individual, as social isolation can act as a risk factor for developing psychopathic features (Lynam et al., 2007) or other psychological health problems (Hall-Lande et al., 2007). According to Barry et al. (2008), social competence may moderate the levels of psychopathic traits over time, indicating a protective role. That is, being positively considered by peers may relate to decreased psychopathy on the affective and behavioral levels. Further, having at least one school friend may weaken delinquent acts of youths with high levels of psychopathic traits (Muñoz et al., 2008), and positive peer support and strong commitment to school appear to have protective effects against CU traits (Fanti et al. 2017). There are few longitudinal studies investigating the protective effects of peer factors among children and adolescents that have failed to find a significant impact of prosocial peers and prosocial activities (Kimonis et al., 2004; Pardini and Loeber, 2008), of positive friendship quality (Kokkinos et al., 2016), and of low levels of peer delinquency (Lynam et al., 2008) on the reduction of psychopathic-like traits.

Despite the preliminary findings, little is still known about how the prosocial impact of friends might affect the levels of psychopathic traits among adolescents. Much-needed longitudinal investigations involving the protective roles of social relationships against psychopathic traits would enable testing for causal associations. Within-individual analyses of repeated measurements would more precisely determine whether changes in risk factors are associated with corresponding changes in psychopathy.

2.5.1.1 Friendship quality

Studies investigating friendship quality and psychopathic traits are scarce, as Frick et al. (2014a, p. 27) highlight: "Very little work has focused on -- the quality of their [youths with CU traits] peer relationships." What research has shown is that psychopathic traits among children and adolescents have been associated with some negative outcomes in peer relationships, indicating poor quality of these friendships. These adverse effects are, for example, peer problems and conflicts (Fontaine et al., 2011; Kokkinos et al., 2016; Muñoz et al., 2008), low peer support and stability (Fanti, 2013; Fanti et al., 2017; Muñoz et al., 2008), greater impairment in peer relationships (Essau et al.,

2006), bullying and peer victimization (Fanti, 2013; Fontaine et al., 2018), and a pattern of inferior peer functioning such as less social competence and quality (Haas et al., 2018). In a recent study, Miron and colleagues (2020) indicated that CU traits related to lower friendship quality and the effect was reciprocal. CU traits associated with weakening of friendship quality over time and the quality predicted higher levels of CU traits at the same time. However, psychopathic youths seem to have close friends (Kimonis et al., 2004), they report having as many friends as other youth, and they are capable of forming friendships although the quality may be poor and unstable (Muñoz et al., 2008).

A preliminary study of laughter contagion (O'Nions et al., 2017) is interesting in terms the friendships of adolescents with psychopathic features, as it suggested a neural basis for poor social affiliation. Adolescents with elevated psychopathic traits may show reduced neural responses to laughter, causing a diminished desire to join in when they hear the laughter of others, and a reduced likelihood of pleasing and affiliating with others to form social relationships (O'Nions et al., 2017). This needs to be taken into account in studies of psychopathic youth and their peer relationships.

Given that psychopathic traits are marked by a lack of prosocial emotions and empathy (Haas et al., 2018; Pardini, 2011), forming a peer relationship on the basis of enjoyment of prosocial interaction or concern for others' well-being becomes less likely. In addition, adolescents with elevated CU traits are considered prone to engaging in short-term peer relationships to use people for their own personal gain (Muñoz et al., 2008), having no desire to develop meaningful relationships with others (Pardini, 2011) and not caring about other people's suffering (Frick et al., 2014a). Adolescents with elevated CU traits declare adverse social goals such as dominance, revenge and forced respect over conflict avoidance (Pardini, 2011). Children with CU traits might use unfavorable methods to make others reveal personal information and are thus likely to form friendships with children with low self-esteem (Van Zalk and Van Zalk, 2015). In contrast, a study by Haas et al. (2018) reported different results that suggested that children with elevated CU traits may care about their close peer relationships and want to have friendships of good quality. The preteens in the study also showed no self-desired exclusivity of their close friends, which infers that they were not prone to using peers for their own gain (Haas et al., 2018). However, this study used only self-report for measuring friendships and past work has indicated that youths with elevated CU traits may underestimate the quality of their friendships in relation to how they are perceived by their peers (Muñoz et al., 2008). In addition, social preference – indicating how liked the classmates are – associated negatively with CU traits in a recent study of Baroncelli and Ciucci (2020). To conclude, results of friendship quality and psychopathic traits are contradictory and insufficient.

2.5.1.2 Delinquency in peer relationships

Generally, current findings suggest that avoiding delinquent peers and favoring prosocial friends have benefits in terms of reducing psychopathic behaviors (Barry et al., 2008; Fanti et al., 2017; Muñoz et al., 2008). Youths with high levels of psychopathic traits tend to have delinquent friends (Kimonis et al., 2004; Lynam et al., 2008), and are more likely to engage in delinquent acts with peers than alone (Goldweber et al., 2014; Muñoz et al. 2008; Thornton et al., 2015). Moreover, adolescents with elevated CU traits typically lead the planning and conducting of group crimes (Thornton et al., 2015). Tatar et al. (2016) predicate that the influence of delinquent friends is more prone to lead to offences among youths with high levels of psychopathic traits than among those with low levels of these traits. Also Bryson et al. (2020) indicated that peer delinquency mediated the relationship between psychopathic traits and offending, whereas Kerr et al. (2012) found that peer delinquency only had a low influence on delinquent children with CU traits. However, they also reported a reverse effect by showing that the delinquent acts of children with high CU traits seemed to strongly influence their friends' delinquency (Kerr et al., 2012). Good news is that offending and association with delinquent peers seems to decline in late adolescence and early adulthood (Bryson et al., 2020).

2.5.2 ROMANTIC RELATIONSHIPS AND PSYCHOPATHY

Many youth start dating and form romantic relationships when they enter adolescence and early adulthood (Zimmer-Gembeck, 2002). As psychopathic traits influence friendships, they are also expected to have an impact on other social relationships. The links between romantic relationships and psychopathic traits during adolescence remain obscure due to a lack of empirical research, but some data on psychopathic adults and their mating strategies do exist. For example, CU traits of adults associated with physical aggression towards a partner, a dominant interpersonal style, and reduced romantic relationship satisfaction in a novel study (Golmaryami et al., 2021). This study critizizes the few previous studies of romantic relationship and psychopathy by making a difference between general antisocial tendencies and CU traits. Majority of research has focused on antisocial behavior and romantic relantipships rather than in psychopathic traits.

2.5.2.1 Romantic relationship quality

Psychopathic individuals seem to favor short-term dating over long-term relationships (Jonason et al., 2011; 2012; Schimmenti et al., 2014), and avoid romantic attachment (Brewer et al., 2018). For example, Jonason et al. (2012) found in a community sample that psychopathic traits associated positively with a desire for low-commitment relationships and other short-term mating

behavior, and negatively with serious romantic relationships. In a study of romantic preferences (Watts et al., 2019), relative attraction to one's partner's psychopathic traits was most obvious at first glance and for dating, although low on average. This finding is in line with that of Jonason et al. (2015), that females show a greater interest in males with low levels of psychopathic traits for long-term relationships. In addition, some evidence supports assortative mating, in that psychopathic individuals mate selectively with others who share similar characteristics (Jonason et al., 2011; Watts et al., 2019). Individuals who report the most attraction are those characterized with psychopathic features themselves (Jonason et al., 2011; 2015).

Some studies have suggested that psychopathic adults engage in behaviors that cause problems in long-term romantic relationships (Jonason et al., 2012; Jones and Weiser, 2014), and report relationship dissatisfaction and couple distress (Savard et al. 2006; 2011); decreased feelings of commitment, intimacy, and passion toward their romantic partner (Ali and Chamorro-Premuzic, 2010); and poor experiences within romantic relationships (Jonason et al., 2013). Further, psychopathy has been linked to infidelity among both men and women (Brewer et al., 2015; Jones and Weiser, 2014). Finally, although psychopaths consider their romantic relationships to be poor and their subjective well-being inferior, in terms of happiness, satisfaction and positive affect (Love and Holder, 2014), romantic relationship quality may mediate the links between psychopathy and subjective well-being (Love and Holder, 2016).

2.5.2.2 Delinquency in romantic relationships

Despite a great deal of research, controversies still exist as to whether romantic relationships amplify or attenuate a partner's delinquency. Much research indicates that a deviant partner promotes delinquency persistence (e.g., Haynie et al., 2005; Monahan et al., 2014; Simons et al., 2002), and the promoting mechanism is typically examined in the context of "behavior contagion" which refers to a reciprocal influence of problem behavior among intimate partners (Rhule-Louie and McMahon, 2007). This contagion effect for antisocial acts may be valid in the short term (Monahan et al., 2014), or throughout the relationship (Haynie et al., 2005). Eklund et al. (2010) assert that although romantic partners may enhance pre-existing delinquency, they do not cause subsequent offending, and that the impact is more pronounced in early adolescence than later in life.

There is little doubt that romantic relationships may also play a protective role against delinquency, especially in relationships of high quality (Rhule-Louie and McMahon, 2007; Zedaker and Bouffard, 2017) with strong attachment (Maume et al., 2005; Sampson and Laub, 1995; Warr, 1998), support and engagement (Kansky et al., 2019). For example, two quite recent studies have indicated that the higher the quality of a romantic relationship, the less adolescents or young adults report their problem behavior, such as

offences (Zedaker and Bouffard, 2017), or aggressive and intrusive acts (Kansky et al., 2019). It appears that high-quality relationships may deter individuals from problem behavior through psychosocial processes (Larson et al., 2016). These mechanisms might arise via attachment as a consequence of a social bond with a partner (Sampson and Laub, 1995; Sampson et al., 2006), through social control or emotional support of the spouse (Wyse et al., 2014), avoidance of harming the relationship (Haynie et al., 2005), extensive support and connection in conflict situations (Kansky et al., 2019), or distancing oneself from delinquent friends (Warr, 1998).

2.6 PARENTING AND PSYCHOPATHIC TRAITS

2.6.1 PARENTING IN ADOLESCENCE

The majority of studies in parenting and psychopathic traits has been conducted in children. In adolescence, significant changes occur in biological, social, and cognitive development, identity development, friendship, and family relationships (Hill et al., 2007). Adolescence is a unique period of development, characterized by a strong desire for independence and, on the other hand, the need for social support (Hall-Lande et al., 2007). Some theorists have argued that as young people become independent, begin to build their own identity, and spend more time with peers, the influence of parents would become non-existent (Hill et al., 2007).

It is now known that parents can still influence a young person's development. Researchers have moved away from traditional assumptions that parents and peers would be competitors to each other in relation to their influence on the adolescent (Brown and Bakken, 2011; Hall-Lande et al., 2007). Instead, research concentrates on what kind of connections there are between parents and peers and how do they affect each other. Both peers and parents seem to be important for attachment needs in adolescence, but they do not replace parental attachments with peer attachments (Brown and Bakken, 2011). However, parental support and supervision have been found to decrease from early adolescence to middle youth and remain stable thereafter (Hill et al., 2007; Mastrotheodoros et al., 2019). It should also be noted that while the time young people spend with parents decreases and the time they spend with peers increases, parents can still act as a buffer against adolescent psychological problems (Hall-Lande et al., 2007; Hill et al., 2007). Mastrotheodoros et al. (2019) showed that parenting has an effect over the ages 13 to 18, although they also showed that young people's perceptions of parenting differ from those of parents, especially in early adolescence. The perceptions may change with age, and the whole relationship between parent and child seems to be a changeable and continuous process. Parenting behaviors may thus have different effects as the child matures (Salihovic et al., 2012). Parental interventions for conduct problems have proven important

not only in early childhood but also later (Gardner et al., 2019), while interventions may be various in different ages.

2.6.2 PARENTAL RISKS FOR PSYCHOPATHIC TRAITS

The family context has been in the scope of interest in studies of psychopathic traits and their etiological issues. Certain parenting practises have been found to affect conduct problems and CU traits. Studies have proved that parental behaviors such as harsh parenting and a lack of parental warmth may increase the CU traits among children and adolescents (Barker et al., 2011; Frick et al., 2003; Waller et al., 2013). Low warmth in parenting appears to associate with elevated CU traits, whereas harsh and coercive discipline is more likely to associate with conduct problems and normal levels of CU traits (Frick et al., 2014b; Pasalich et al., 2011). Psychopathic youth are characterized by reward-seeking tendencies, insensitivity to punishments, and a fearless temperament which may cause unresponsiveness to parental harsh punishment (Byrd et al., 2014). This may cause parents distress by which parents become less consistent in their parenting and show decreasing parental involvement over time (Fanti and Centifanti, 2014). Thus, child- and parent-driven effects seem to function reciprocally, as children with psychopathic features elicit different reactions in parents compared to normally developed children (Hawes et al., 2011; Viding and McCrory, 2018).

Parents and their offspring may both have psychopathic traits, which may also contribute to the development of an insecure attachment relationship or a poor child-parent relationship. The link between negative parenting and psychopathic traits may be due to an evocative gene-environment correlation which means that genetically influential phenotypes such as psychopathic traits in young people elicit negative responses from their parents (Henry et al., 2018; Hyde et al., 2016). Given the neurological changes in children with CU traits due to genetic factors or early negative experiences, there may be a particular challenge in parenthood causing a distorted relationship between the child and the parent (Van der Zouwen et al., 2018).

Contemporary research on parent-child attachment and its associations to psychopathic traits is still scarce. A meta-analysis based on 12 studies reported that insecure attachment to a caregiver was positively related to psychopathic traits, especially to CU traits (Van der Zouwen et al., 2018). Seven of the studies in the meta-analysis were conducted among adolescents, males were over-represented, and the effect was found only in clinical and justice settings. Also, parental attachments may impact behaviors in adolescence through peer and romantic relationships although the connections in early and mid-adolescence remain modest and variable (Brown and Bakken, 2011).

2.6.3 PARENTING AS A PROTECTIVE FACTOR FOR PSYCHOPATHIC TRAITS

The development of psychopathic traits can be contributed by parental risks, such as low parental warmth, insecure attachment or maltreatment. Fortunately, a positive relationship to a parent with warmth and support may have a protective effect for psychopathic traits and behaviors linked to these traits. Especially, a warm and positive parenting in early years associates with lower CU traits in childhood, and this has been indicated in cross-sectional (Clark and Frick, 2018; Pasalich et al., 2011; Waller et al., 2018) and longitudinal studies (Barker et al., 2011; Frick et al., 2003; Hawes et al., 2011; Pardini et al., 2007).

Some of the studies of associations between warm parenting and adolescent psychopathic traits have been conducted by assessing the parenthood in early childhood and psychopathic traits in adolescence (Buck et al., 2015; Goulter et al., 2019). For example, Goulter et al. (2019) examined how CU traits assessed in the grade 7 were related to parental warmth at ages 5 to 7, and found that warmth was associated with lower CU traits, which in turn were related to a reduction in antisocial behavior in adulthood. In a similar way Buck (2015) studied maternal sensitivity – composed of supportive presence, respect for autonomy, and reversed hostility – by observing mother-child interaction at 54 months, first, third, and fifth grades, but also in adolescence. Psychopathic traits were assessed at age 15. The associations differed by sex as maternal sensitivity protected boys with poor inhibitory control for psychopathic traits in adolescence and secure attachment associated with a reduced likelihood of psychopathic traits in females (Buck, 2015). Longitudinal studies of parental practices assessed in adolescent years are scarce. Salihovic et al. (2012) found that community adolescents who perceived their parents as warm and understanding showed decreases in psychopathic traits over a year. In regard of juvenile delinquents, self-reported parental warmth may associate with lower CU traits (Ray, 2018), and with fewer conduct problems for adolescents with low to medium levels of psychopathic traits (Chinchilla and Kosson, 2016). The study of Chinchilla and Kosson (2016) was cross-sectional.

New results from adoption and twin studies give preliminary findings that warm parental practices targeting at the right time might weaken the risk of genetic predisposition for psychopathic traits (Henry et al., 2018; Hyde et al., 2016). In the study of Hyde et al. (2016), a strong positive reinforcement by adoptive mothers effectively buffered hereditary risk by attenuating the effect of antisocial behavior of the biological mother on subsequent callous-unemotional behaviors. The results emphasize the adaptability of early callous-unemotional behaviors. These results support the view that children with a fearless temperament can better internalize empathy and develop conscience if they have a positive relationship with their parents that involves positive affect and warmth (Kochanska, 1997).

3 AIMS OF THE STUDY

The aim of the study project was to explore psychopathic traits among adolescents and their relation to self-reported sleep, social relationships and parental behaviors. Sleep quality, as problems and disturbances during night, and sleep quantity, as sleep duration at night, were both scrutinized. We investigated whether peer and romantic relationships act as risk or protective factors for psychopathic traits over a 6.5-year period of time. Also, the links between parental warmth and hostility and psychopathic traits and self-reported offending were studied with longitudinal data.

The study project had four main objectives:

1. To investigate the role of psychopathic features for the associations between qualitative and quantitative aspects of sleep and delinquent behavior, both property and violent crimes, among Finnish adolescents. (I)

2. To examine how the self-reported frequent and persistent sleep problems and continuous short sleep on week and weekend nights associate with scores on a self-reported psychopathy scale and its subfactors, which are impulsivity, narcissism and callous-unemotional traits, among Finnish adolescents. (II)

3. To identify the possible predictive roles of peer and romantic relationships on psychopathic traits as well as its three domains among serious adolescent offenders. (III)

4. To test whether adolescent parental warmth and hostility predict changes in psychopathic traits and self-reported offending in a high-risk sample of delinquent adolescents of 14 to 19 years old. (IV)

4 METHOD

4.1 PARTICIPANTS

4.1.1 COMMUNITY DATA OF FINNISH ADOLESCENTS

The data in this study come from 4855 ninth-grade students [mean age 15.3 years, standard deviation (SD) = 0.55] from the Finnish Self-Report Delinquency Study (FSRD-2012). FSRD is a series of nationally representative self-report surveys of juvenile delinquency covering a wide range of delinquent behaviors and a set of individual and family-level background factors. The data were collected by the Institute of Criminology and Legal Policy (formerly National Research Institute of Legal Policy), the survey procedure and the study sample are described in detail elsewhere (Kivivuori and Bernburg, 2011; Laajasalo et al., 2014).

The survey was conducted randomly in 51 municipal comprehensive schools in spring 2012, with classification criteria of geographical area and community residential density. All ninth-grade students were asked to participate and complete the study questionnaire, finally 79.7% (n=4855) of the students completed the questionnaire of the targeted pupils (n=6089). The reasons for nonresponse were absence for personal reasons (e.g. illness, athletic meets, special needs education, family vacation, or truancy), and in some cases a poor net connection in schools, occurring randomly nationwide. Of the sample, 50.9% were female, 97.5% were of Finnish origin, and 66.5% came from a nuclear family. In respect to family constellation and living conditions, Statistics Finland assured that the sample represented the general population of 15-16-year-old adolescents in Finland. The survey was completed anonymously via computer during a regular class supervised by a teacher who had been briefed about the required practices. According to the regulations of the Finnish Advisory Board on Research Integrity, formal consent from the parents was not required for this study.

4.1.2 PATHWAYS TO DESISTANCE DATASET

Participants were from the Pathways to Desistance study (Mulvey, 2004), which is a longitudinal study of 1354 serious youth offenders transitioning from adolescence to young adulthood from Maricopa County (metropolitan Phoenix), Arizona, and Philadelphia County, Pennsylvania. The enrolled youth were between the ages of 14 and 17 at the time they committed the crime, and were adjudicated delinquent or found guilty of a serious offense, predominantly felonies. Each study participant was followed for a period of seven years during the years of 2000 to 2010. After the baseline interview,

there were 10 follow-up interviews every six months for the first three years postconviction, annually thereafter for seven years in total. At the baseline, the Pathways to Desistance study collected a plethora of information divided into six domains: background characteristics, indicators of individual, psychosocial development and attitudes, family context, personal relationships, and community context. Due to the comprehensive nature and length of the interview, it was broken into two sessions while follow-up interviews were conducted in one 2-hour session. Windows of opportunity for follow-up interviews were given to the interviewers to ensure equal measurement periods for all participants. Sample retention rate was high (mean = 90% of the full sample) at each follow-up interviews. Most of these interviews were conducted in the participant's home or, for those participants in institutional placement, in a private room within the facility, via a computer-assisted interviewing in which a computer screen was visible to both the interviewer and participant. The interviewers' obligation to maintain confidentiality was informed to the participants. The procedures were reviewed and approved by the Institutional Review Boards of the participating universities. Complete details related to recruitment, description of the full sample, and the study methodology are found elsewhere (Mulvey, 2004).

Study III focused on the 10 follow-up interviews over a period of 6.5 years with a total sample of 11,965 person-observations of 1,354 persons (1,170 males and 184 females). The mean age was 18.9 years (standard deviation (SD) = 2.45) ranging from 14 to 26 over the follow-up points. A total of 13,540 person-observations would have been contributed if all the participants of the Pathways to Desistance study had participated in all the assessment waves. Accordingly, 11.6% of all potential person-observations were missing. Respectively, Study IV used eight follow-ups over 4.5 years with 7,135 person-observations of 1,354 persons. The age range was 14 to 19 years with a mean age of 17.6 years (standard deviation (SD) = 0.01). The data include a diverse racial and ethnic mix of offenders, the majority (40.1%) identified their ethnicity group as Black, 34.0–34.3% as Hispanic, and one fifth of the sample (20.9–21.4%) as White. The remaining 4.4–4.7% of participants indicated multiple ethnicities. 24.7% of all potential person-observations were missing due to various reasons (e.g., participant missed the interview, did not fill-in the measure, too few answers for computation, refusal). Overall, the sample retention was high, approximately 90% of the full sample in both studies.

4.2 MEASURES

4.2.1 ITEMS FROM THE FINNISH SELF-REPORT DELINQUENCY SURVEY

Psychopathic traits

Psychopathy was measured via the Antisocial Personality Screening Device – Self-Report (APSD-SR; Frick and Hare, 2001), based on the Psychopathy Checklist-Revised (PCL-R; Hare, 2003). It comprises 20 items (Table 2) scored on a three-point scale (0 = not at all true, 1 = sometimes true, 2 = definitely true) with a higher score representing a higher level of the trait. The items reflect impulsive behavior, narcissistic features, and callous-unemotional traits without referring to a specific period of time. The total score and the subscale scores are obtained by adding the respective items, the total score for the APSD-SR reflecting psychopathic features. A three-factor model was found to fit the data from Finnish adolescents the best, consistent with several earlier studies of the instrument in other populations, a more detailed description of the factor analyses is given elsewhere (Laajasalo et al., 2014).

Table 2. *The items of the Antisocial Process Screening Device - Self Report (APSD-SR) (Frick and Hare, 2001). The items on the APSD are copyright protected and are reproduced with permission of author.*

Item number	Item description
1	Blames others for mistakes
2	Engages in illegal activities
3	Concerned about schoolwork [Reverse coded]
4	Acts without thinking
5	Shallow emotions
6	Lies easily and skillfully
7	Keeps promises [Reverse coded]
8	Brags about accomplishments
9	Gets bored easily
10	Uses or cons others
11	Teases other people
12	Feels bad or guilty [Reverse coded]
13	Risky and dangerous behaviors
14	Charming in insincere ways
15	Becomes angry when corrected
16	Think he/she is more important
17	Does not plan ahead
18	Concerned about feelings of others [Reverse coded]
19	Does not show emotions
20	Keeps same friends

Sleep

In the FSRD-12 survey, sleep problems were evaluated with four sleep questions adapted and modified from Sleep Self-Report (SSR) (Owens et al., 2000) and Sleep Disturbance Scale for Children (SDSC) (Bruni et al., 1996). Two of the questions assessed the frequency and duration of adolescents' sleep problems, and two other sleep amount on school and weekend nights reflecting qualitative and quantitative aspects of these problems. The items were rated on a Likert-type scale. Of the original items, two dichotomous sleep variables were formed to indicate sleep quality and sleep quantity. Respondents who reported having sleep problems "3–5 nights per week" or "every or almost every night" and for "1–2 years" or "over 2 years" were classified as having frequent (3 or more times per week) and persistent (persisting for 1 year or more) sleep problems. Accordingly, all the other respondents were treated as not having frequent and persistent sleep problems. Likewise, respondents who reported sleeping continuously "5–7 hours" and/or "less than 5 hours" were categorized as having continuous short sleep duration (less than 7 hours) on both school and weekend nights. Respondents who reported longer sleep durations, belonged to a group not having continuous short sleep. These two dichotomized sleep-related variables, based on previous studies using comparable items (e.g. Roberts et al., 2008), were used in statistical analysis to predict delinquent behavior. The original sleep items and the dichotomous redefined items are presented in Table 3.

Delinquency

For all offences, respondent was asked to indicate the number of times engaging in the particular behavior over the last year. A scale measuring involvement in property offences was formed by adding up the number of the following six offences committed during the past 12 months: 'graffiti', 'shoplifting', 'stealing from school', 'motor vehicle theft', 'other theft' and 'breaking and entering'. In a similar vein, the variable regarding involvement in violent offences was formed by adding up the number of the two following offences reported by the respondent: 'fighting' and 'beating up somebody'. The greatest possible number of each offences was set at 25 per person per item in the statistical analysis. The range of property offences was 0–150 and of violent offences 0–50 with means 1.10 (SD = 8.37) for the number of property offences and 0.28 (SD = 3.26) for the number of violent offences. In the past 12 months, 56.3% of all participants had not engaged in either crime, 59.1% had not engaged in any property crime, 87.2% had not engaged in any violent crime.

Table 3. *Sleep items (1.−4.) used in the Finnish Self-Report Delinquency Study (FSRD-12), and combinations of the original items (5.−6.).*

1. Do you think you have trouble sleeping?
1 No sleep problems
2 Less than once a week
3 1−2 nights a week
4 3−5 nights a week
5 Every or almost every night
2. If you do, how long have you had troubles sleeping?
1 No sleep problems
2 Less than 4 weeks
3 1−6 months
4 6−12 months
5 1−2 years
6 Over 2 years
3. How many hours of sleep do you get on school nights?
1 9−11 hours
2 8−9 hours
3 7−8 hours
4 5−7 hours
5 less than 5 hours
4. How many hours of sleep do you get on weekend nights?
1 9−11 hours
2 8−9 hours
3 7−8 hours
4 5−7 hours
5 less than 5 hours
5. Adolescent reports having trouble sleeping 3 to 5 times per week for one or more years.
1 No
2 Yes
6. Adolescent reports sleeping less than 7 hours on school and weekend nights.
1 No
2 Yes

Parental supervision

In Study I, parental supervision regarding sleep behaviors was measured with one statement: 'My parents supervise that I go to bed on time'. Answers were given on a five-point Likert scale (from 1 = never to 5 = always). In the FSRD-12 survey, the parental supervision item was one part of family and home section.

4.2.2 MEASURES DRAWN FROM THE PATHWAYS TO DESISTANCE DATA

Psychopathic traits

The Youth Psychopathic Traits Inventory (YPI; Andershed et al., 2002) is a 50-item, 10-scale self-report each containing five questions. The YPI focuses on core features of psychopathic personality with subscales Dishonest Charm, Grandiosity, Lying, Manipulation, Remorselessness, Callousness, Unemotionality, Impulsiveness, Irresponsibility, and Thrill Seeking. The subscales map onto the three domains of psychopathy: affective (Callous-Unemotional), interpersonal (Grandiose-Manipulative), and behavioral (Impulsive-Irresponsible). Responses are given on a four-point Likert scale in order to rate the degree to which the individual statements or items apply to them (1 = does not apply at all; 2 = does not apply well; 3 = applies fairly well; 4 = applies very well). The YPI frames psychopathic traits in the items as neutral or pleasing to minimize the influence of social desirability on responses. The measure is developed for youth ages 12 and older, and the test takes approximately 15 min to complete. In the Pathways to Desistance study, the YPI was run every 6 months for 2.5 years, and annually thereafter for 6.5 years in total. For the domains, the correlations were calculated and found to be strong (range, $r = 0.59–0.67$, $p < 0.001$). The internal consistency for the YPI total score and the domain scores was good (range, $\alpha = 0.73–0.94$), and the intraclass correlation of the YPI scores (ICC = 0.27) refers to slight stability of the psychopathic traits over time in the data.

Romantic relationships

In the Study III, two different scales were targeted to measure romantic relationships: romantic relationship quality and partner's antisocial influence. The Quality of Romantic Relationships inventory (Pierce et al., 1997) was adapted in the Study III in order to evaluate the support, conflict, and depth of the adolescent's romantic relationships. In general, the measure reflects participant's subjective rating of his/her romantic relationship and is categorized into the level of quality which demonstrates satisfaction, love, closeness and interpersonal support in the relationship. The relationship quality was assessed using two dimensions, i.e. nine items, and responses were given on a four- or five-point Likert scale. Scores of the items were summed into one continuous variable, with higher scores indicating a relationship of higher quality. More specifically, seven of the items considered exclusively the quality of the relationship and two items tolerance of deviance reflecting the qualitative aspects of the relationship (Table 4).

A variable measuring a partner's antisocial influence, a subjective rating of the partner's suggestions regarding antisocial acts, was comprised seven items based on antisocial influence section of the Peer Delinquent Behavior measure. The items began with "Has [Main Romantic Partner] suggested…" and followed by a question regarding antisocial behavior (e.g., "…that you

should sell drugs/steal something/hit or beat someone up?"). The summing of the responses to dichotomous (yes/no) questions yielded one sum variable reflecting stronger antisocial influence. The variables measuring romantic relationships were labeled as "Romantic relationship quality" and "Partner's antisocial influence" for the analyses. The internal consistency of the inventory was good across the follow-up time points (range, $\alpha = 0.73–0.94$).

Table 4. *Romantic relationship quality items and response categories used in Study III*

1. How often is [Name] there for you when you need him/her? [Reverse coded]	
1	All of the time
2	Most of the time
3	Sometimes
4	Not very often
5	Never
2. In general, how happy are you with your relationship? [Reverse coded]	
1	Very happy
2	Happy
3	Neither happy nor unhappy
4	Unhappy
5	Very unhappy
3. Compared to your friends' relationships, how good is yours? [Reverse coded]	
1	Much better
2	Better
3	About as good
4	Worse
5	Much worse
4. How often do you wish you hadn't gotten into this relationship?	
1	All of the time
2	Most of the time
3	Sometimes
4	Not very often
5	Never
5. How is your relationship with [Name] compared to what you thought it would be? [Reverse coded]	
1	Much better
2	Better
3	About as good
4	Worse
5	Much worse
6. How much do you love [Name]? [Reverse coded]	
1	Very often
2	A lot
3	Somewhat
4	Not very much
5	Not at all

7. How many problems are there in your relationship?
   1 Very many
   2 Many
   3 Some
   4 A few
   5 None
8. If you used drugs, what would [Name]'s reaction be?
   1 Would not care at all
   2 Would be bothered, but would not say anything to me about it
   3 Would be bothered and would talk to me about it
   4 Would get very upset with me
9. If you were involved in an illegal activity, what would [Name]'s reaction be?
   1 Would not care at all
   2 Would be bothered, but would not say anything to me about it
   3 Would be bothered and would talk to me about it
   4 Would get very upset with me

Peer relationships

In Study III, three dimensions were used to measure peer relationships: friendship quality, antisocial behavior and antisocial influence. Based on the Quality of Relationships Inventory (Pierce et al., 1997), the items on the Friendship Quality scale reflect the respondent's subjective rating of closeness and support offered. Ten items include questions: "How much can you count on the people for help with a problem?"; "How close do you think you will be to these people in 10 years?"). Participants average the rating across their five closest friends on a 4-point Likert scale ranging (1 = not at all; 2 = a little; 3 = quite a bit; 4 = very much). A mean of the ten items was computed, higher scores indicating better quality. The measure was found to have good internal consistency at the follow-up time points (range, $\alpha = 0.80–0.82$).

Peer Delinquent Behavior measure is a subset of items used by the Rochester Youth Study (Thornberry et al., 1994). It reflects the degree of antisocial activity among a peer group with 12 items characterizing antisocial behavior (e.g., "During the recall period, how many of your friends have sold drugs?") and seven other items measuring antisocial influence (e.g. "During the recall period, how many of your friends have suggested…"). Participants were asked to respond on a 5-point Likert scale (1 = none of them; 2 = very few of them; 3 = some of them; 4 = most of them; 5 = all of them). To build a variable reflecting peer delinquency, the items of antisocial behavior and antisocial influence were summed up as lower scores indicating less peer delinquency, i.e. antisocial behavior and antisocial influence of peers. At the follow-up measures, the internal consistency was within acceptable range (range, $\alpha = 0.87–0.94$). The peer variables are called "Friendship quality" and "Peer delinquency" in this paper.

Parental warmth and hostility

The parental warmth and hostility measure based on the Quality of Parental Inventory (Conger et al., 1994) assesses the affective tone of the parent-adolescent relationship via adolescent self-report. Items measure maternal and paternal warmth and hostility separately with 9 items of warmth and 12 items of hostility with 21 items in total for both parents (Table 5). Responses were asked on a 4-point Likert scale (1 = Always, 2 = Often, 3 = Sometimes, 4 = Never). Higher scores indicate a more supportive and nurturing parental relationship on the warmth scale and higher scores on the hostility scale indicated a more hostile relationship. The subscales for mother, farther, warmth and hostility were used separately, and notably, the parent could be biological or any primary caregiver who was responsible for raising the adolescent. The internal consistency for the parental subscales were high (range, $\alpha = 0.80–0.95$).

Table 5. *Maternal warmth and hostility items used in Study IV (similar items for fathers)*

		How often your mother:
W	1.	Helps you to do something important?
H	2.	Gets angry at you?
W	3.	Lets you know she cares?
H	4.	Got so mad she broke/threw things?
W	5.	Listens your point of view?
H	6.	Shouts because she was mad at you?
W	7.	Acts supportive toward you?
H	8.	Threats to hurt you physically?
H	9.	Criticizes your ideas?
W	10.	Acts loving toward you?
H	11.	Pushes/grabs/hits/shoves you?
W	12.	Has good laugh with you?
H	13.	Argues with you when disagreed?
H	14.	Slaps or hits you with her hands?
W	15.	Lets you know that she appreciates you/your ideas?
H	16.	Strikes you with object?
H	17.	Bosses you around?
H	18.	Throws things at you?
W	19.	Says she loves you?
H	20.	Insults/swears at you?
W	21.	Understands the way you feel?

Note. H = hostility; W = warmth

Offending
Questions of offending via self-report measured adolescent's account of involvement in antisocial and illegal activities at each time point over 6.5 years. The scale assesses offending with 24 items regarding aggressive and income offending, or both. In Studies III-IV, the measure was coded dichotomously (0 = no acts; 1 = at least one act) to indicate any or no offending (aggressive or income-based) in the recall period of 6 or 12 months depending on the follow-up point. The interest was specifically in whether or not the young person committed crimes during the recall period.

Covariates
Regarding time-invariant control variables of Study III, gender, ethnicity and year of birth were used because they are unchanging with time. The year of birth was calculated manually by subtracting the age of the participant from the year of the baseline interview. Interview information was recorded as part of the data collection process for each study wave, which enabled to use a dichotomized variable of interview location (1 = jail or detention; 0 = other) as a covariate to indicate the living facility during the recall period, and to control for the accessibility of social connections. In addition, a dichotomized measure for romantic relationships (0 = no relationship; 1 = has/had a relationship during the recall period) was included to control for the relationship status in the analyses of peer variables. In Study IV, gender and ethnicity were constant, whereas study waves and age varied across time. Also, contact with the parental figure was controlled in the analyses in order to indicate whether the respondent was in contact with the figure across the recall period (1 = participant in community and biological parent living in the location, 2 = participant in community and step/adoptive parent living in the location, 3 = participant in community and no parental figure living in the location, 4 = participant in institution and in contact with parent, 5 = participant in institution and no contact with parent).

4.3 STATISTICAL ANALYSES

To investigate the relationship between sleep and delinquency in Study I, negative binomial regression analyses were conducted. Parental supervision and psychopathic features were controlled. Negative binomial analysis was used, as variables reflecting property crime and violent crime (dependent variables) were not distributed normally and the variance was greater than the mean in both delinquency variables. In addition, bivariate correlations were performed between the dichotomized sleep related variables, delinquency and the APSD-SR total score. In the regression analyses, the target groups were sleep quality and quantity problems, so that adolescents having no sleep difficulties comprised the reference groups.

In Study II, descriptive analyses using Chi-square tests were conducted to assess the prevalence of qualitative and quantitative sleep problems among boys and girls. Also, point-biseral correlations were calculated to assess the correlations between sleep items and APSD-SR scores. The associations between sleep variables and psychopathic traits were examined by conducting a factorial analysis of variance (ANOVA) and a multivariate analysis of variance (MANOVA). These analyses were conducted to compare the main effects of sleep quality and sleep quantity and to examine interaction effect between frequent and persistent sleep problems and continuous short sleep with gender on APSD-SR total score and subscale scores (impulsivity, narcissism and callous-unemotional). To investigate the two-way interaction effects of sleep among boys and girls separately, multiple two-way ANOVAs were run for both gender groups on APSD-SR total score and subscale scores. Multicollinearity problems were not detected, as subscales correlated only moderately with each other. Assumption of normal distribution for the APSD-SR total and subscale scores and the homogeneity of variances for each combination of the groups of the independent variables (sleep quality, sleep quantity and gender) were valid.

In Studies I–II, the statistical analyses were conducted with IBM SPSS statistics (version 21, SPSS Inc., Chicago, USA). The Appropriate sample weights were used to ensure that the sample was representative for Finnish adolescent population (Laajasalo et al., 2014).

Data analyses were performed using Stata, version 13.1 in Study III and version 15.1 in Study IV (Stata Corp. LP, College Station, Texas, USA) statistical software. By reason of a longitudinal nature of the Pathways to Desistance data, multilevel regression analyses were performed to detect the effects of peer and romantic relationships on psychopathy over time. In the analyses, the level 1 fixed-effects regressions were the main focus to ensure that unobserved characteristics of the individuals were taken into account and biased variation was removed (see Curran and Bauer, 2011). The within-individual analysis shows individual growth rates and variation around the individual's mean level of the exposure across all person-observations. If the within-individual association was statistically nonsignificant but the corresponding between-individual association significant, the difference between these coefficients was tested via the Wald test (Carlin et al., 2005). There were 11,965 person-observations of 1,354 persons in Study III and correspondingly 7,135 person-observations of 1,354 persons in Study IV, since the cross-sectional time-series data from multiple study waves were pooled into a single dataset. Notably, adolescents 20 years or older were omitted from the data used in Study IV, because the parental warmth and hostility items were only filled in by those under 20 years of age. Descriptive statistics, mean scores and pairwise correlation coefficients for variables were calculated.

In Study III, nine models of multilevel regressions regarding the associations between social relationship variables and psychopathic traits were conducted. A detailed description of the models is presented in Table 2

in the detached research article (Backman et al., 2018). Both time-invariant covariates, such as gender, ethnicity, year of birth or age, and time-varying variables, such as relationship status, self-reported offending, study wave and interview location were adjusted for the analyses. Analyses for the romantic relationship and peer variables were conducted separately with interaction term for gender, and these time-varying independent variables were concurrently assessed at each study wave with the psychopathy inventory and three subdimension. To highlight the potential causal effects (i.e., variables measured one study wave before the psychopathy measure, rather than concurrently with the outcome), the independent variables were lagged to the previously reported measurement time compared with the dependent variable. Also, inclusion of a backward-lagged dependent variable was conducted to control for the previous YPI scores. The impact of peer delinquency on the associations of romantic relationships and psychopathy was tested to exclude a possible mediation effect. The associations were even tested so that the backward-lagged YPI was made an independent variable and peer and romantic relationships as dependents to uncover the causes and effects more precisely. In the final stage, analysis-of-variance (ANOVA) was conducted to estimate, whether the means of the psychopathic traits were equal among the five groups based on the romantic relationship quality (low, moderately low, moderately high, or high), and status (no romantic relationship).

In Study IV, associations between parental behaviors and adolescent self-reported psychopathic traits were tested in five stages. Adolescent self-reported maternal and paternal warmth and hostility acted as independent variables, and self-reported psychopathic traits were the dependent variable. Interaction terms of parental warmth and hostility with the age of the adolescent were added into the analyses, with age centered at its mean value. Time-invariant covariates included gender and ethnicity, whereas time-varying covariates were the contact with parental figures, age of the subject, self-reported offending, and study wave. In the next stage, logistic regressions were calculated to predict self-reported offending based on parental warmth and hostility and the analyses were adjusted for psychopathic traits. In order to examine the direction of effects, psychopathic traits were tested as an independent variable and forward-lagged parental warmth and hostility as dependent variables.

5 RESULTS

5.1 PSYCHOPATHIC TRAITS, SLEEP AND DELINQUENCY

Regression analyses were conducted to investigate the associations between sleep, psychopathy and delinquency among Finnish adolescents. Table 6 shows the main findings of Study I: a significant relationship between sleep and delinquency was found despite the inclusion of psychopathy as a control variable. Parental supervision was also controlled constantly. The regression coefficients and effect sizes reflect the significant associations of both qualitative and quantitative sleep problems to both property and violent crime with and without co-occuring psychopathic traits.

Table 6. *Regression coefficients of gender, sleep variables and parental supervision parameter for property crime and violent crime (adapted and modified from Backman et al., 2015).*

Variable	Property crime		Violent crime	
	B (SE)	*Exp (B)*	*B (SE)*	*Exp (B)*
Gender (male)	0.82*** (0.05)	2.26	2.24*** (0.11)	9.47
Qualitative sleep problems[a]	0.99*** (0.08)	2.69	1.49*** (0.11)	4.45
Insufficient sleep amount[b]	1.59*** (0.09)	4.88	1.70*** (0.12)	5.45
Control variables:				
Parental supervision	-0.15*** (0.02)	0.86	-0.28*** (0.01)	0.76
Psychopathic features[c]	0.15*** (0.00)	1.17	0.12*** (0.03)	1.12

B = The beta value indicates how strongly independent variables influence dependent variables. Values in parentheses are standard errors. Exp(B) = factor change in odds for unit increase in variable.

* p < .05; ** p < .01; *** p < .001

[a] Sleep problems at least three times per week for at least one year

[b] Less than 7 hours of sleep on both school and weekend nights

[c] Total APSD-SR score

In terms of bivariate correlations, significant positive relationships between sleep (quality and quantity) and crime (property and violent) were found. Also, psychopathic traits correlated positively with sleep problems, insufficient amount of sleep and both types of delinquency, and the links were statistically significant. Parental supervision had a significant negative relationship to crimes, psychopathic features and to poor sleep indicating that the more parents monitored the bedtimes, the less adolescents reported delinquency, psychopathic traits and sleep problems, and the more they reported sleep. Further, a positive correlation of gender to insufficient sleep amount and a negative one to qualitative sleep problems mirror that boys were more likely to report quantitative sleep problems compared to girls whereas girls had more qualitative sleep problems than boys (see also Figure 2).

Study II concentrated on the prevalence of sleep problems in more detail and indicated, that most of the adolescents reported having no severe sleep problems regarding frequent and persistent sleep problems (95.0%) or continuous short sleep duration (96.8%), whereas 5% of the adolescents suffered from severe qualitative sleep problems (i.e. having trouble sleeping 3 to 5 times per week for 1 or more years) and 3.2% from insufficient sleep amount (i.e. sleeping less than 7 hours on both school and weekend nights) (Figure 2). Compared to boys, girls reported more sleep problems (5.9%), whereas boys were more sleep deprived (4.0%) than girls.

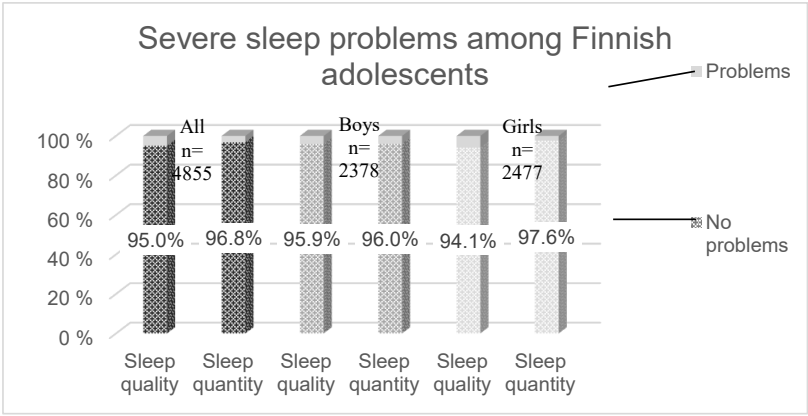

Figure 2 Prevalence of severe sleep quality problems (having trouble sleeping 3 to 5 times per week for 1 or more years) and sleep quantity problems (sleeping less than 7 hours on both school and weekend nights) among boys and girls (n=4855).

A factorial analysis of variance was conducted on the influence of three independent variables (sleep quality, sleep quantity, gender) including two levels (yes, no) or groups (boys, girls) on the APSD total score. Girls having

both qualitative and quantitative sleep problems scored highest on the APSD-SR scale (M = 21.91, SD = 12.31) compared to boys (M = 16.96, SD = 7.56) and those having either qualitative or quantitative sleep problems. Numerical details are shown elsewhere (Table 3 in the detached research article, Backman et al., 2016).

Table 7. *The main effects and the three-way interaction between frequent and persistent sleep problems, continuous short sleep on all week, and gender on psychopathic, impulsive, narcissistic and callous-unemotional traits among adolescents (adapted and modified from Backman et al., 2016).*

	APSD-SR		Impulsivity		Narcissism		CU traits	
	F(1, 5472)	*ηp2*	*F*(1, 5472)	*ηp2*	*F*(1, 5472)	*ηp2*	*F*(1, 5472)	*ηp2*
Sleep quality	39.58***	0,007	20.57***	0.004	27.50***	0.005	9.09**	0.002
Sleep quantity	57.38***	0,01	19.83***	0.004	30.77***	0.006	41.23***	0.007
Gender	0.22	0	5.61*	0.001	0.49	0	35.89***	0.007

Note. Results are from ANOVA and MANOVA; ASPD-SR = Antisocial Process Screening Device- Self Report; CU traits = Callous-unemotional traits

ηp2 = Partial Eta squared statistics indicating effect sizes; *p < .05; **p < .01; ***p < .001.

Severe sleep problems in terms of persistency, frequency and sleep amount associated significantly with psychopathic traits and its sub-dimensions: impulsivity, narcissism and CU traits in the multivariate analyses (Table 7). However, the significance of the association was little bit slighter for sleep quality and CU traits than for other sleep and subdimension variables. Although the main effects for gender were non-significant, a significant three-way interaction between the sleep variables and gender was found, reflecting that a two-way interaction between variables of sleep quality and quantity varied across boys and girls. Accordingly, the two-way analyses of variances showed a significant interaction effects among girls on APSD-SR scale (Figure 2) yielding an F ratio of $F(1, 2783)=7.91$, $p<0.01$, and on narcissism scale ($F(1, 2783)=13.00$, $p<0.001$). Among boys, the two-way interaction effect was significant on impulsivity scale ($F(1, 2689)=11.76$, $p<0.01$). Results for boys and girls are shown in Figure 3 in terms of psychopathy total score.

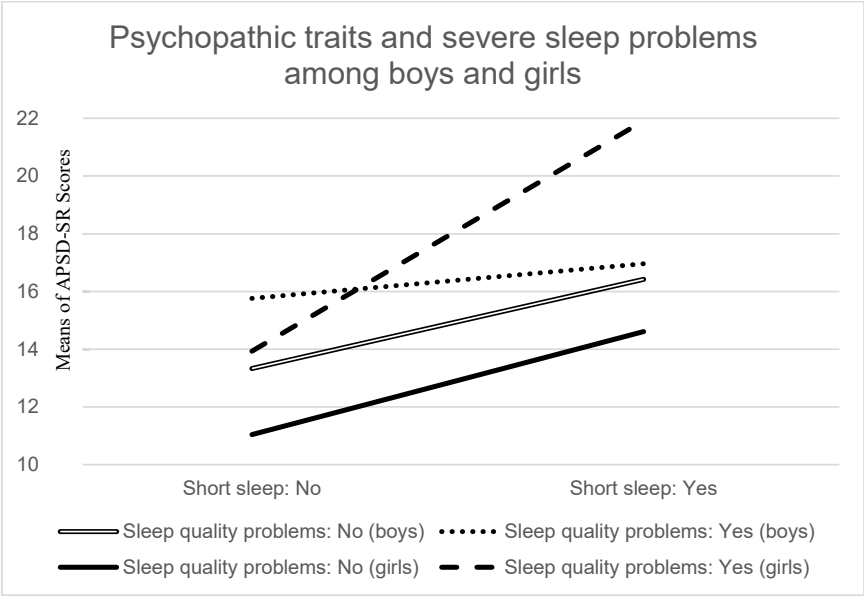

Figure 3 Cell means and interaction effects of frequent and persistent sleep problems and continuous short sleep on school and weekend nights among boys and girls for APSD-SR total scores indicating the level of psychopathic traits. For boys $F(1, 2689)=2.03$, $p>0.05$; For girls $F(1, 2783)=7.91$, $p<0.01$.

5.2 PSYCHOPATHIC TRAITS AND SOCIAL RELATIONSHIPS

Regarding the descriptive statistics in Study III, more than half of the participants reported committing a crime at some point during the follow-up time of 6.5 years, and about one-quarter had been interviewed in a jail or detention center at least once over the Pathways to desistance study period. More than half of the sample declared that they were in a romantic relationship at some point of the 6.5 years of time. In terms of mean values, for the YPI total score it was 102.85 (SD = 23.42; range 21–197), for the romantic relationship quality 7.38 (SD = 1.19; range 1–8), and for partner's antisocial influence 1.25 (SD = 0.74; range 1–8). Regarding peer factors, the mean scores were 3.32 (SD = 0.50; range 1–4) for the friendship quality variable, and 4.31 (SD = 2.77; range 1–9) for peer delinquency with lower scores demonstrating less delinquency. The standard deviations for within-individual associations were lower than for the between-person associations in all the variables expressing peer and romantic relationships.

In respect of pairwise correlations, significant but low correlations were found for psychopathic traits (i.e. YPI total scores) and romantic relationship quality ($r = -0.18$, $p < 0.001$), psychopathic traits and partner's antisocial

influence ($r = 0.15$, $p < 0.001$), and psychopathic traits and friendship quality ($r = -0.16$, $p < 0.001$), and a moderate correlation for psychopathic traits and peer delinquency ($r = 0.38$, $p < 0.001$). A positive correlation for psychopathic traits was found with the dichotomous self-reported offending with a modest coefficient ($r = 0.29$, $p < 0.001$). Neither age nor gender were significantly related to the quality of romantic relationships, although gender and partner's antisocial influence showed a low positive correlation ($r = 0.08$, $p < 0.001$), indicating that females experience more antisocial influence from their partners than males. In contrast, females reported less delinquency among their peers and more friendships of better quality compared to men. Being in a romantic relationship was more common among men than women, and males committed more offenses than females, according to the correlation matrix.

Table 8 shows the within-individual changes conducted via multilevel regression analyses in all of the models from 1 to 9. Both the quality of romantic relationships and the friendship quality had main effects on psychopathic traits ($p < 0.001$) after controlling for age, gender, ethnicity, relationship status (in the peer analyses), self-reported offending, study wave and interview location (models 1 and 2), indicating that high-quality interpersonal relationships were associated with lower psychopathic traits in the within-individual regressions. Partner's antisocial influence and peer delinquency, in contrast, increased the level of psychopathic traits ($p < 0.001$). These results are demonstrated in Figure 4. The quality of romantic relationships and friendships, and partner's antisocial influence and peer delinquency were associated with psychopathy's sub-domains as well except for friendship quality on impulsivity-irresponsibility dimension. This within-individual association indicated statistical non-significance ($p = 0.49$), while the corresponding between-individual coefficient was significant ($p < 0.001$).

Interaction terms of gender and romantic relationship factors or gender and peer factors (models 3 and 4) were included in the multilevel regressions. These analyses showed stronger associations among females concerning social relationships and psychopathy, but the interaction for gender was statistically significant only for peer delinquency ($p < 0.001$). The between-individual interaction terms produced equivalent results in terms of statistical significance. The within-individual associations between backward-lagged romantic relationship variables and psychopathy were not statistically significant ($p = 0.097$; $p = 0.150$), nevertheless, in between-individual analyses, the associations showed significance ($p < 0.001$). The differences for the within-individual and between-individual regression coefficients demonstrated significance (Wald test, $p < 0.001$), reflecting that romantic relationships could not predict psychopathic traits across a recall period of 6–12 months within individuals. The results of the peer variable models remained unchanged when explanatory factors were used in a backward-lagged fashion (model 6).

Table 8. *Regression coefficients of independent variables and covariates for psychopathy (adapted and modified from Backman et al., 2018).*

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
	β *(SE)*	β *(SE)*	β *(SE)*	β *(SE)*	β *(SE)*	β *(SE)*	β *(SE)*	β *(SE)*	β *(SE)*
Variables									
RRQ	-1.13*** (0.21)		-0.99*** (0.24)				-1.21*** (0.22)		-0.91*** (0.21)
PAI	1.33*** (0.32)		1.21** (0.39)				1.14*** (0.34)		0.95** (0.32)
FQ		-1.43*** (0.42)		-1.33** (0.45)				1.29*** (0.09)	
PD		1.34*** (0.08)		1.24*** (0.9)				-1.20*** (0.45)	1.35*** (0.11)
Interaction terms									
RRQ x G			-0.55 (0.50)						
PAI x G			0.26 (0.69)						
FQ x G				-0.84 (1.27)					
PD x G				0.85*** (0.25)					
Backward-lagged variables									
RRQ					-0.37 (0.22)				
PAI					0.49 (0.34)				
FQ						-1.07* (0.45)			
PD						0.36*** (0.08)			
YPI							0.04** (0.01)	0.05*** (0.01)	
Covariates									
Age	-0.17 (0.47)	-0.20 (0.36)	-1.70 (0.47)	-0.18 (0.35)	0.14 (0.52)	-0.67 (0.39)	-0.63 (0.52)	-0.39 (0.40)	-0.59 (0.46)
Study wave	-1.08** (0.34)	-0.80** (0.26)	-1.08** (0.34)	-0.81*** (0.26)	-1.20** (0.41)	-0.49 (0.30)	-0.64 (0.41)	-0.56 (0.30)	-0.69* (0.34)
SRO	4.04*** (0.53)	3.04*** (0.41)	4.05*** (0.53)	3.02*** (0.41)	4.63*** (0.55)	4.56*** (0.41)	4.14*** (0.55)	2.92*** (0.44)	2.49*** (0.54)
Interview location	0.32 (0.73)	-0.40 (0.55)	0.32 (0.73)	-0.36 (0.55)	-0.30 (0.78)	-0.87 (0.56)	0.15 (0.78)	-0.65 (0.59)	0.46 (0.73)
Relationship status		-1.9 (0.39)		-0.16 (0.39)		0.27 (0.41)		-0.03 (0.42)	

Abbreviations: RRQ = Romantic relationship quality; PAI = Partner's antisocial influence; FQ = Friendship quality; PD = Peer delinquency; SD = standard deviation; SRO = Self-Reported Offending; YPI = Youth Psychopathic Traits Inventory total score

Values are B-coefficients for within-individual regressions

*p < .05; **p < .01; ***p < .001

Inclusion of backward-lagged psychopathy as a covariate weakened the associations slightly without invalidating the statistical significance and similarly, peer delinquency did not change the effect of romantic relationship quality or partner's antisocial influence on psychopathic traits (models 7–9). Regarding causality in reverse, the backward-lagged psychopathy scores did not predict interpersonal relationships at a statistically significant level, except for peer delinquency ($p < 0.001$).

Finally, findings showed (Figure 5) that those having no romantic relationship had lower mean levels of psychopathic traits ($M = 103.56$, $SD = 23.09$) than those rating their relationship quality as low ($M = 108.34$, $SD = 23.12$) or moderately low ($M = 104.15$, $SD = 22.74$). The lowest mean levels of psychopathic traits were seen from those classifying their romantic relationship quality as high ($M = 96.62$, $SD = 23.59$). The ANOVA showed significant differences between the groups, yielding an F ratio of $F(4, 11{,}947) = 61.29$, $p < 0.001$.

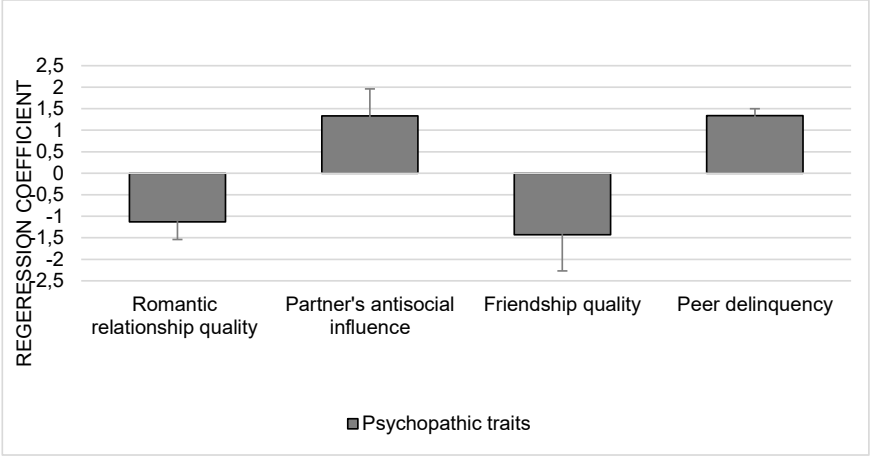

Figure 4 Both the quality of romantic relationships and friendships had negative main effects on psychopathic traits whereas partner's antisocial influence and peer delinquency increased the level of psychopathic traits. Error bars are 95% confidence intervals. N=up to 11,965 person-observations from 1,354 individuals (adapted and modified from Backman et al., 2018).

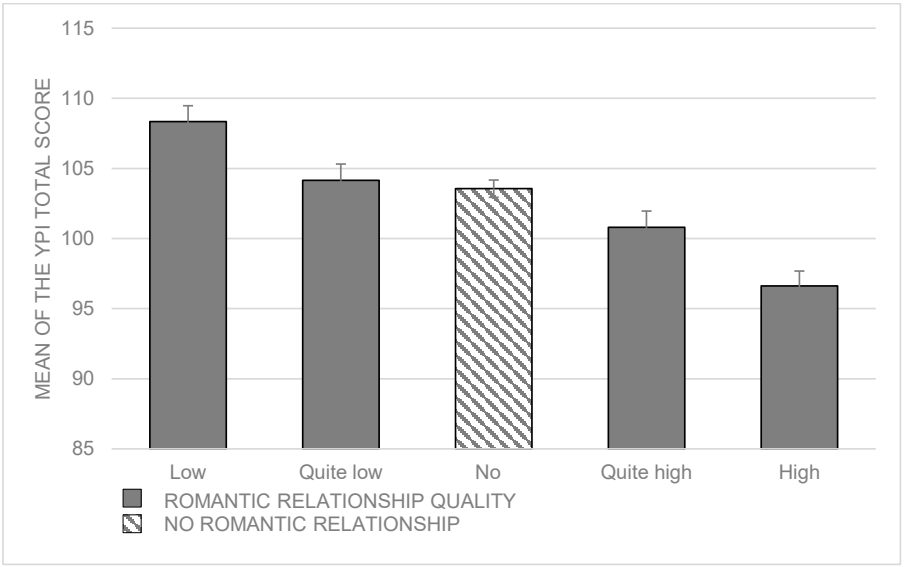

Figure 5 The better the quality of a romantic relationship was, the lower the respondent scored on the psychopathic measure on average. Those having no romantic relationship had lower mean levels of psychopathic traits than those having relationships of a low quality. Error bars are 95% confidence intervals. Mean differences statistically significant $F(4, 11947) = 61.29$, $p < 0.001$ (adapted and modified from Backman et al., 2018).

5.3 PSYCHOPATHIC TRAITS AND PARENTING BEHAVIORS

In terms of descriptive statistics in Study IV, most of the person observations were male (85.83%), and the Black ethnicity was overrepresented (40.10%). Little bit more than a half of the person-observations (52.52%) desisted from criminal activity, and 64.56% spent their time in the community instead of institutions. Most of those living in the community (62.24%) had a biological mother living in the same location, but only about one fifth (21.24%) reported having a biological father living with them. The mean score for the YPI total score was quite high ($M = 104.87$; $SD = 0.28$) compared to general population, and males scored higher than females in the meter. The parental variables ranged from 1 to 4 with means scores of 2.74–3.12 ($SD = 0.01–0.02$) for parental warmth and 1.32–1.42 ($SD = 0.01$) for parental hostility. Descriptive statistics are presented in Table 1 in the detached research article (Backman et al., 2021).

The main results of Study IV are shown in Figure 6. Maternal and paternal warmth had main effects on psychopathic traits ($p < 0.001$) in fixed-effects models after controlling for the contact with parental figures, participant's age, self-reported offending, study wave and time-invariant factors. The negative effect indicated that the more supportive and nurturing the parent, the smaller

the scores in the psychopathic meter YPI. Parental hostility showed significant associations with self-reported psychopathic traits in both fixed-effects models ($p < 0.01$), whereas the effect was positive reflecting higher scores in the YPI when the parent was rated as more hostile. The age of the adolescent did not moderate the associations between parental warmth and hostility and psychopathic traits, and age did not have a main effect on psychopathic traits. In terms of offending, maternal warmth was associated with lower, whereas maternal and paternal hostility were associated with higher odds of having committed crimes during the recall period. The association of paternal warmth was not found in the fixed-effect regression. When further adjusted for psychopathic traits, the significance of these relations remained the same. Lastly, there were no time-lagged associations between psychopathic traits and parental warmth and hostility in the fixed-effects models.

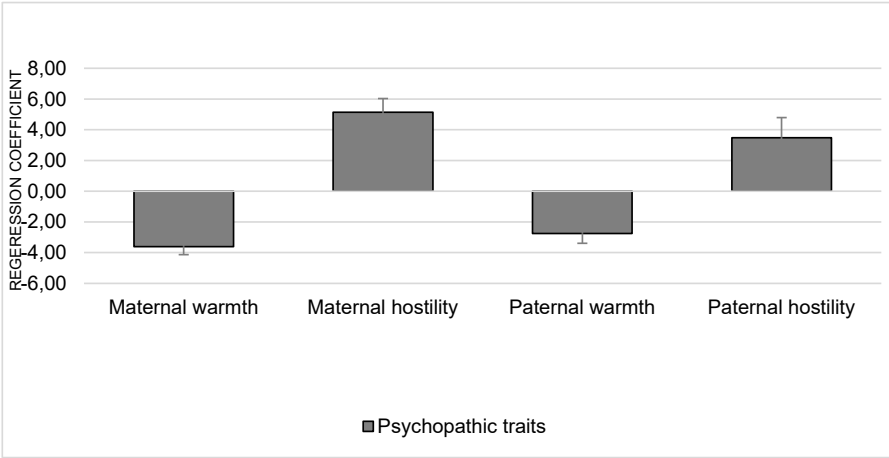

Figure 6 Maternal and paternal warmth had main effects on adolescent self-reported psychopathic traits and the regression coefficients were negative, whereas the associations between maternal and paternal hostility to psychopathic traits were positive. Error bars are 95% confidence intervals. N=up to 7,135 person-observations from 1,354 individuals.

6 DISCUSSION

6.1 ASSOCIATIONS BETWEEN SLEEP, PSYCHOPATHY AND DELINQUENCY

Sleep was found to associate with psychopathic traits and delinquency in a large, representative community sample of Finnish adolescents that was used in Studies I and II. Sleep quality and quantity problems were significantly related to psychopathic traits and delinquency after controlling for co-occurring psychopathic features. These studies were among the first to test the relations between sleep and psychopathy among adolescents. Study I was novel in controlling for psychopathic traits while investigating links between sleep and juvenile delinquency. The studies also measured both types of sleep problems (qualitative and quantitative), and Study I investigated delinquency in more detail, including violent and property offence forms, than previous studies on this subject. Finally, they explored psychopathic features and their subdomains, i.e. impulsivity, narcissism and CU traits, among adolescents with frequent, persistent sleep difficulties and continuous short sleep duration (Study II).

The results of Study II underpin the findings of Akram et al. (2017) and Sabouri et al. (2016), who also reported significant associations between sleep problems and psychopathy. However, the previous studies were conducted among adults, and they focused on insomnia symptoms, including difficulty initiating and maintaining sleep and awakening too early. The study of Jonason et al. (2013) found a relationship between psychopathy and sleeping chronotype, indicating a propensity to go to sleep early or late in the evening and to wake up early or late. Among psychopathic individuals, the more common orientation may be eveningness, which is in turn linked among adolescents to poor sleep, shorter sleep length on school nights (Mateo et al., 2012; Giannotti et al., 2002) and impulsivity (Schlarb et al., 2014). Two other earlier studies of sleep and psychopathy (Harty et al., 2010; Salley et al., 1980) reported no associations between psychopathy and sleep problems. However, these studies had considerable limitations as Salley et al.'s study (1980) assessed psychopathy using a projective personality test, and Harty et al.'s study (2010) examined a mostly male adult sample from a correctional institute.

Interestingly, Denis et al. (2017) studied sleep quality and quantity among two adult samples and found that CU traits were not related to sleep problems assessed using the Pittsburg Sleep Quality Index with 18 items (Buysse et al., 1989). Moreover, actigraphy measurement in the same study indicated that CU traits might even relate to better sleep quality. There are substantial differences between Study II and the study by Denis et al. (2017), not only in terms of the results: The main difference between these two studies might lie

in the targeted participants, as Denis et al. (2017) studied adults aged 18 to 27 and 18 to 66, whereas Study II examined adolescents aged 15 to 16. A systematic review and meta-analysis of sleep and risk-taking (Short and Weber, 2018) ascertains several reasons as to why the results of studies of adults may not apply to adolescents. They arise from different biological, psychological and socio-cultural factors. For example, adolescents' need for sleep is greater than that of adults, they have a different psychosocial environment, and they are exposed to risk-taking and poor decision-making due to behavioral and brain immaturity (Carskadon, 2011; Edens et al., 2001; Hirshkowitz et al., 2015). Another possible reason for the differences between the findings of Study II and that of Denis et al. (2017) concerns psychopathic traits. Denis et al. (2017) focused only on CU traits over the broader psychopathy concept, whereas Study II utilized the whole construct of psychopathy along the subdimensions. In Study II, the main effects of sleep problems on CU traits were significant, but the effects of qualitative sleep problems were smaller for CU traits than for other subdomains, i.e. impulsivity and narcissism. Further, research suggests that psychopathic-like behavior is more common among adolescents than adults; these traits show more change and malleability in adolescence, and on a mean-level, they tend to decrease from adolescence to adulthood (Cauffman et al., 2016; Moffit, 1993/2017; Pardini and Loeber, 2008; Salihovic et al., 2014). Compared to adults, the levels of these traits might thus be more susceptible to increasing in adolescence as a consequence of sleep problems, or alternatively, adolescent-limited psychopathic traits may affect sleep differently in adolescence than in adulthood. Finally, the two studies operationalized the sleep problems differently, as Study II defined the most severe problems as persistent, frequent and continuous inadequate sleep in terms of quality and quantity. The Pittsburg Sleep Quality Index (Buysse et al., 1989) on the other hand, investigates sleep problems over the previous month, and uses actigraphy as an objective method to assess sleep patterns and efficiency. In the future, it would be fruitful to test whether the relationships between sleep problems and psychopathic traits depend on a) the age of the participants; b) the persistency and frequency of sleep problems, i.e. the severity level of the problems; c) the assessment method, such as self-reports or objective monitors; or c) the operationalization of psychopathic traits.

The question of the primary and secondary variants of psychopathy and levels of anxiety should be scrutinized in terms of the associations between sleep and psychopathy. Given that sleep difficulties are related to increases in anxiety symptoms (M. Kahn et al., 2013; Sabouri et al., 2016; Waller et al., 2016) and a secondary variant shows pronounced anxiety in comparison to a primary variant displaying low levels of anxiety (R. E. Kahn et al., 2013; Kimonis et al., 2012; Vaugh et al., 2009), the associations between sleep and psychopathic traits might be moderated by either the levels of anxiety or by the two psychopathy variants. Denis et al. (2017) discussed a possible protective role of low levels of emotional reactivity and anxiety in terms of

sleep among those who had CU traits. It could respectively be assumed that higher levels of anxiety and overarousal of affect in secondary psychopaths (Kimonis et al., 2012; 2017) might instead create a risk of sleep problems. The notion of the different effects on primary and secondary variants is important, and based on the findings of Studies I–II, remains obscure.

A few underlying mechanisms have been proposed to explain the links between sleep, psychopathy and delinquency. As causation cannot be established from cross-sectional studies, the direction of the effect is unknown. The impact of third variables; not only overlapping the constructs, but also impacting, partly mediating or moderating the associations, should be investigated. The proposed confounding factors for the links between sleep, psychopathy and delinquency are demonstrated in Figure 7. Emotions play a central role in inadequate sleep, psychopathic and specifically callous-unemotional traits, as well as in violent acts. First, it has been widely indicated that insufficient sleep is linked to the experience of negative emotions; decreases in positive emotions; alterations in understanding, expressing and modifying emotions (Baum et al., 2014; Gregory and Sadeh, 2016; M. Kahn et al., 2013; Palmer and Alfano, 2017); and impairments in recognizing facial expressions (Pallesen et al., 2004). Second, psychopathic traits are associated with low emotional responsiveness to others' distress (Blair, 2013) and poor emotional recognition (Dawel et al., 2012; Marsh and Blair, 2008). CU traits reflect limited prosocial emotions, and callous, uncaring and unemotional components (Essau et al., 2006). Finally, violent acts have shown to be accompanied by poor emotion regulation and negative affect such as irritability, hostility and aggression (Ireland and Culpin, 2006; Kamphuis et al., 2012), as the same brain areas account for failures of emotion regulation and increased propensity for impulsive aggression and violence (Davidson et al., 2000). Emotional deficits may mirror alterations in the amygdala's activity, which have been reported in sleep (e.g. Yoo et al., 2007), aggression (Blair, 2018; Davidson, 2000), and psychopathy studies (Blair, 2013; Viding and McCrory, 2012).

Sleep-deprived individuals appear to be both more self-focused and less empathic than when fully rested (Killgore et al., 2008). Emotional empathy in particular seems to decrease with sleep deprivation (Guadagni et al., 2014), and emotional empathic impairments are also widely indicated among psychopathic individuals (Blair, 2018; Viding and McCrory, 2018). Links between empathy and delinquency are reported less, although a lack of guilt and empathy are proposed to underlie conduct problems and antisocial behavior through different causal pathways (Frick and Viding, 2009). In addition to emotional and empathic impairments, potential third factors that could explain the associations between sleep, psychopathy and delinquency might be, for example, impulsivity and poor impulse control (Hare and Neumann, 2008; Peach and Gaultney, 2013), low self-control (Meldrum et al., 2015), eveningness chronotype (Mateo et al., 2012; Giannotti et al., 2002; Jonason et al., 2013; Schlarb et al., 2014), contextual factors such as parenting

that contributes to poor adolescent behavior in terms of antisocial acts (Clinkinbeard et al., 2011), amount of sleep, or simply a genetical vulnerability to CU traits (e.g. Clark and Frick, 2018; Frick et al., 2003).

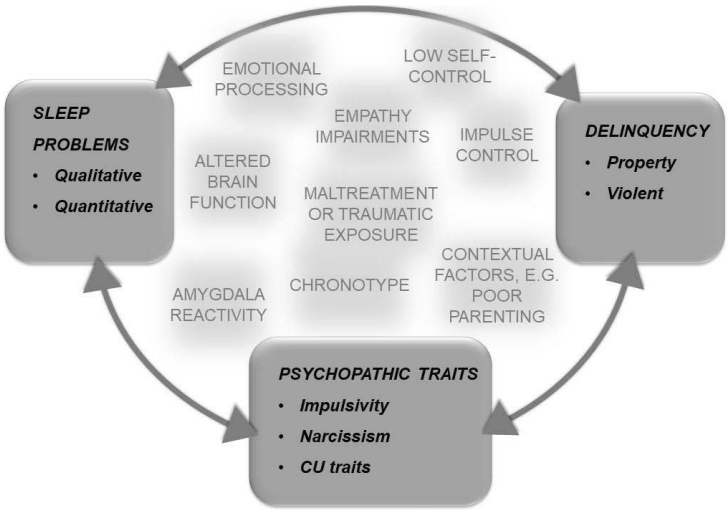

Figure 7 The literature shows associations between sleep problems and delinquency, between sleep problems and psychopathic traits, and between delinquency and psychopathic traits. Several mechanisms may account for these associations: causes and consequences may be intertwined or bidirectional, and other confounding factors may have an impact on all these associations.

Study I indicated an independent relationship between sleep and delinquency regardless of parental supervision at bedtime, although the frequency of parental supervision from never to always correlated negatively with crimes, psychopathic traits and poor sleep, indicating that parental supervision may play a minimal role in the inter-relationships between these variables. The non-significant effect is surprising, considering the vast literature indicating positive effects of parental practices on psychopathic behaviors (e.g. Waller et al., 2013). What was noteworthy in Study I was that parenting was measured narrowly using a self-report method to explore parental set bedtimes without controlling for other parental variables, such as parental warmth or involvement, which have shown to have an impact on psychopathic traits (Henry et al., 2018; Hyde et al., 2016). In future, it would be beneficial to test the effects of parental practices in more detail in the same study of adolescent sleep quality and quantity, on the levels of psychopathic traits and on delinquent acts.

The neurobiological mechanisms that explain the potential relationship between sleep, psychopathy and delinquency are unknown, although some brain areas (e.g. the prefrontal lobe and amygdala) have been identified as

being linked to all of these factors (Blair, 2013; Palmer and Alfano, 2017; Short and Weber, 2018). Previous neuroimaging studies give strength to the notion that sleep problems may impact risk-taking behavior through failure to inhibit risky decisions and preference of greater reward-seeking (Short and Weber, 2018; Venkatraman et al., 2007), and this may happen via different effects on the brain, for example, by attenuating the reactivity of specific regions (Short and Weber, 2018). Poor sleep may impair prefrontal cortical functioning, thus weakening the inhibition of aggressive impulses (Kamphuis et al., 2012). Although neurocognitive issues are beyond the scope of this study project, there is little doubt that neuroimaging studies would more diversely shed light on the relations between sleep, psychopathy and delinquency.

Several limitations must be addressed regarding Studies I–II. First is the lack of objective measures, as sleep, psychopathy and crimes were all assessed by subjective measures, that is, self-reports. The operationalization of sleep problems also varies between studies, making comparisons difficult. Future studies should use objective meters (e.g. actigraphy or polysomnography) of sleep and measures of psychopathy and delinquency that do not rely solely on self-report. These methods would also yield sleep patterns or neurocognitive differences among sleep deprived psychopathic individuals. Second, the cross-sectional study design does not allow for causality interpretations, nor control for time-invariant or other confounding factors. Longitudinal studies with appropriate methods would expose the developmental courses and relationships between cause and effect. Third, the findings of Studies I and II may not be generalizable to adults or younger children, because the sample was homogeneous with regard to age. Finally, the relationships between sleep and different types of delinquent acts and the different facets of the psychopathy construct need further study, as only the APSD-SR total score was used as a measure of psychopathy in Study I. It would be especially fruitful to assess, whether the results are linked to primary and secondary psychopathy variants.

6.2 SOCIAL RELATIONSHIPS AS RISK AND PROTECTIVE FACTORS FOR PSYCHOPATHIC TRAITS

Study III examined whether peer and romantic relationships predict the level of psychopathic traits among offending adolescents over six and a half years. The associations were detected via within-individual analyses of ten repeated measurements, providing evidence of potentially causal associations between friendships, romantic relationships and psychopathic traits, regardless of age, gender, ethnicity, self-reported offences and living facilities. The findings showed that both romantic partners and peers can have either protective or harmful associations with psychopathic traits, depending on the quality of the relationship in terms of satisfaction, closeness and supportiveness; and on the

level of antisocial behavior and influence. On a scale of low to high, the quality of both romantic relationships and friendships correlated negatively with psychopathic traits, although notably, psychopathic traits were the lowest among those with romantic relationships of high quality and highest among those in the lowest quality intimate relationships. For those not in a relationship, they were in between the two ends of the scale. It could thus be argued that it is better not to have a romantic relationship than to have one of low quality. Partners' antisocial influence and peer delinquency increased the risk of psychopathy, suggesting that the more antisocial activities the adolescent experiences in social relationships, the higher the scores in psychopathic measures.

Study III focused on relationship quality rather than relationship status because previous studies have overlooked quality (Frick et al., 2014a; Rhule-Louie and McMahon, 2007; Zedaker and Bouffard, 2017). In terms of romantic relationships, the results pointed out that quality matters more than the relationship status itself, which is in line with previous findings (Monahan et al., 2014; Wyse et al., 2014; Zedaker and Bouffard, 2017). With respect to friendships, the findings of Study III support the previous work on peers' protective roles against psychopathic traits (Barry et al., 2008; Fanti et al., 2017) and disagree with studies which state that affiliating with prosocial peers does not affect psychopathic-like traits (Kimonis et al., 2004; Lynam et al., 2008; Pardini and Loeber, 2008). However, there are several ways in which to measure the quality of friendships and prosocial friendships. Naturally, a friendship subjectively rated as being of high quality is not necessarily the same as a prosocial friendship, which makes it difficult to compare Study III with past studies. Study III did not reveal the intentions and lengths of the friendships, peers' ratings of the relationships, nor quality in terms of details such as persistency or frequency of conflicts. Further research is needed to establish whether psychopathic youths have adverse social goals in friendships, a low desire to develop meaningful relationships, or merely short-term friendships, even if they rate their friendships' quality as high.

The antisocial influence of partners and peers increased the risk of psychopathy, suggesting that the more antisocial activities the adolescent experiences in their interpersonal relationships, the higher they score in psychopathic measures. These results support previous studies on peers (Lynam et al., 2008; Muñoz et al., 2008; Tatar et al., 2016) and romantic partners (Eklund et al., 2010; Haynie et al., 2005; Monahan et al., 2014; Simons et al., 2002). However, these earlier studies have explored the mean-level effects of peers across time, and antisocial peers have not been found to be a risk factor for antisocial behavior within the same individual across time (Farrington et al., 2002; Hemphill et al., 2015; Pardini and Loeber, 2008). Study III discovered however, that peer delinquency also associated with psychopathy within individuals, demonstrating that changes in peer delinquency can produce changes in psychopathic traits at a person level. The reasons for these discrepant findings may stem from the operationalization of

the variables, as both the antisocial behavior and antisocial influence of peers were included in Study III, in contrast to the previous studies which concentrated on only the behavioral facet.

Romantic relationships may only have an impact in terms of quality or antisociality on psychopathy in the short-term because the backward-lagged variables of romantic relationships showed no within-individual effects on psychopathic traits. It is noteworthy that the participants' reports included their experiences of intimate relationships retrospectively over the entire recall period of 6–12 months, regardless of their current relationship status, whereas the psychopathy measure requested that participants rate the items generally, without concentrating on a specific recall period. In addition, the previous psychopathic scores were controlled in order to stress the latest levels and remove the risk of reverse causal effects. The results indicate immediate and short-term effects on psychopathic traits, supporting the findings of Larson et al. (2016) concerning how romantic relationships have acute effects on criminality. In contrast, friendship quality and peer delinquency appeared to have both immediate and long-lasting impacts on psychopathic traits, possibly up to 12–24 months.

The underlying mechanisms of high-quality relationships that protect against psychopathy are unknown. These mechanisms may be similar to those proposed for desistance from delinquency, such as a strong bond to a romantic partner (Haynie et al. 2005; Zedaker and Bouffard 2017) or social support from a partner (Sampson et al. 2006; Wyse et al. 2014). It is also important to consider other potential third factors for positive effects of social relationships on psychopathy, such as motivation to change (Salekin et al., 2010) or increased subjective well-being (Love and Holder, 2016). Moreover, the issue of primary and secondary psychopathy may also be relevant, as the effects of couple distress (Savard et al., 2006) or relationship intimacy (Ali and Chamorro-Premuzic, 2010) on primary and secondary psychopaths have shown to be different.

The findings need to be viewed cautiously in light of the study limitations. First, the dataset comprised a high-risk sample of serious offending adolescents. Generalizing these results to non-criminal samples should be done with caution. The effects of peers and romantic partners on adolescents without a criminal conviction may be different, and future studies should consider this. Second, all the constructs were assessed using self-report indicators. Future research should gather reports from alternative informants for a more objective understanding in order to avoid bias, as psychopathic individuals may misinterpret the quality of their relationships (Muñoz et al., 2008) or overestimate and erroneously characterize the nature of their friendships (Goldweber et al., 2014). Finally, as marital and dating relationships may have different impacts, future studies should differentiate these (Larson et al., 2016).

6.3 PARENTAL BEHAVIORS AS RISK AND PROTECTIVE FACTORS FOR PSYCHOPATHIC TRAITS

Study IV studied parental warmth and hostility and their effects on psychopathic traits among offending adolescents over four and a half years with eight repeated assessments. Within-individual analyses were used in order to show causal associations between parenting, delinquency and psychopathic traits, regardless of age, gender, ethnicity, and whether the juvenile contacted the parent. The findings showed that maternal warmth associated negatively with psychopathic traits and offending, and paternal warmth protected from psychopathic traits but not from delinquency. The more supportive and nurturing the relationship, the less psychopathic traits were reported. In contrast, maternal and paternal hostility linked positively to psychopathic features showing that parent's hostility, angry coerciveness, and antisocial behavior toward the adolescent may strengthen the levels of psychopathic traits. The statistical method allows to suggest a causal association between parental behaviors to psychopathic traits and offending indicating that parenting may lower the risk of psychopathy and further delinquency in adolescence.

In Study IV, parental warmth and hostility were not explained by adolescent psychopathic traits, although the bidirectional effects of parents and childhood psychopathic traits have been found repeatedly (Hawes et al., 2011; Larsson et al., 2008). Typically children are the ones to spend more time with their parents than adolescents, and after childhood, parental supervision (Henry et al., 2018) and warmth (Mastroheodoros et al., 2019) decreases in parent-child relationships. From middle adolescence onwards, adolescents develop more independently, but the warmth they experience towards their parents does not decrease (Hill et al., 2007; Mastroheodoros et al., 2019). The parent-child relationship reaches a new balance in adolescence and becomes more horizontal, with parents not expected to provide as strong support as in childhood (Mastroheodoros et al., 2019). For these reasons, the bidirectional effects may be more typical with children than adolescents. Perhaps parents get enough break from their older children and may be better able to process and regulate their own behavior compared to the time when children were small, less independent and more demanding.

Parental behaviors matter not only in childhood but also in adolescence (Mastrotheodoros et al., 2019), and the effects are equally important over childhood (Gardner et al., 2019) and adolescence (Mastrotheodoros et al., 2019). Parental practices may affect development of their offspring in many ways, and psychopathic traits of young people seem to be no exception (Buck, 2015; Bisby et al., 2017). For example, lower levels of maternal warmth and involvement associate with higher CU traits among male adolescent offenders (Bisby et al., 2017), whereas parental warmth has protective effects on adolescent psychopathic traits (Barker et al., 2011; Ray, 2018). An interesting

question, then, relates to what is the warmth of parenting. Parental warmth can be operationalized as, for example, a supportive and nurturing relationship (see Study IV), frequency with which a parent expressed love, affection, and support (Chinchilla and Kosson, 2016), positive parenting, positive reinforcement and parental involvement (Hawes et al., 2011; Pardini et al., 2007), or sensitivity which is represented a composite of supportive presence, respect for autonomy, and reversed hostility (Buck, 2015). Kochanska (1997) explains, that parental warmth and responsiveness attempt to work against the development of antisocial solutions by advancing empathy and pro-sociality. Based on these definitions, parental warmth may elicit changes in adolescent's sensitivity to others, emotional responsivity, empathy or the ability to prioritize the feelings of others, or it may help adolescent to develop an internalized sense of morality and adopt prosocial values. Studies of parental interventions to reduce adolescent psychopathic traits are almost nonexistent, although they could target to increase parental warmth.

Relationships with parents and peers have long been known to be key factors in youth. Now, researchers have moved away from the traditional assumptions that parents and peers would make competing with each other, but instead, scientists have explored various possible connections between parents and peer relationships as these connections develop during adolescence (Brown and Bakken, 2011; Hill et al., 2007). The data show a continued importance of parenting during adolescence, despite increasing peer influence (Hill et al., 2007), and the impact of parents may even provide a buffer against social isolation or peer problems (Hall-Lande et al., 2007). Accordingly, parental warmth may play a crucial role for adolescent development especially if the friendship quality is disappointing.

It is desirable that future research address the limitations of Study IV. Although it used a longitudinal design with multilevel data analysis of a large sample size of juvenile delinquents, international studies outside criminal settings with both children and adolescent samples are needed. Study IV relied on self-report for all measures, which causes a risk that adolescents with psychopathic traits may exhibit biased perspectives on their parents' or own behaviors. Mastrotheodoros et al. (2019) showed that adolescents' perceptions of parenting differ from those of parents, especially in early adolescence, but they begin to resemble each other in late adolescence. In the future, it would be good to get reports from several different sources, adolescents and parents, and even control for the parental warmth in childhood. Study IV neglected the issues of gene-environment correlation due to the study methodology. Environmental risk factors are intertwined with the adolescent's genetic predisposition so that hereditary risk may have an evocative effect on the environment or, on the other hand, passive gene-environment interactions may influence such that parent and child share the same genetic factors (Hyde et al., 2016; Viding and McCrory, 2018). This would advance the research on parenting and adolescent psychopathic traits onto the next level. In terms of a possible exposure to parental warmth and hostility, the quality and quantity

of the contact with a parental figure was not included in the analyses, which can be considered as an important omission. It would be hypothesized that a consistent, daily or near-daily warmth or hostility from a caregiver would be more impactful than occasional warmth or hostility.

6.4 GENERAL DISCUSSION

6.4.1 ASSOCIATED DETERMINANTS IN PATHWAYS TO PSYCHOPATHIC TRAITS

Studies I–IV investigated psychopathic traits and their associations with sleep, social relationships and parental behaviors among adolescents. Sleep problems in terms of quality and quantity were linked to psychopathic traits and the psychopathy construct's subdomains of impulsivity, narcissism and CU traits, as well as to property and violent criminality. Romantic relationships, peer relationships and parental behaviors had effects on the levels of psychopathic traits, increasing or decreasing them depending on their quality and antisocial nature of the relationship. In regard to sleep, conclusions regarding the protective or harmful effects of sleep on psychopathy cannot be made on the basis of this study because of its cross-sectional nature, although sleep is arguably a confounding factor for psychopathic-like manifestation and delinquent behavior. Sleep and psychopathic traits among children and adolescents should be explored carefully over time in order to understand the causal mechanisms and to draw conclusions regarding sleep's role as a risk or protective factor.

Psychopathy has long been seen as a construct that has a developmental trajectory, its first signs being detected early, in the first years of life (Anderson and Kiehl, 2014; Waller et al., 2016). In terms of causal models in developing the characteristics of psychopathy, it is important to consider several individual and environmental factors when assessing pathways to psychopathic traits (Frick and Ray, 2015). Studies using appropriate methods to analyze protective factors against psychopathy in childhood or adolescence are scarce, despite the fact that they could show critical targets of prevention and intervention by influencing the stability and change of psychopathic features (Frick et al., 2014b). A growing body of psychopathy literature is now focusing on risk factors that may be genetic, neurobiological or environmental. There is little doubt that risk factors might also help identify protective factors, at least by providing information on what risks to avoid. However, directly detecting protective variables for psychopathy would be more beneficial. Risk factors accounting for the levels of psychopathic traits have been argued to alter the normal development of empathy and prosociality, creating callous, uncaring and unemotional features (Frick et al., 2014a; Waller and Hyde, 2018) which associate with disturbed conscience development (Kochanska,

1997; Thompson and Newton, 2010). Given this fact, it is relevant to ask whether protective factors could work conversely, by increasing empathy and diminishing CU features. This idea gets support from Waller and Hyde (2018) who make a good notion that CU behaviors may partly be the "other side of the coin" from normal development of affective empathy and prosociality.

Detecting protective factors for psychopathy is crucial for better understanding psychopathy trajectories and to enable preventing and intervening before the traits lead to more permanent personality disorders (Salekin and Lochman, 2008). Factors that protect against psychopathic traits or the expression of the traits could help youth to achieve more prosocial outcomes and avoid contact with the criminal justice system. Finding protective factors could also help society by reducing the burden of the legal system and public health (Reidy et al., 2015). Especially, if a child has a genetical risk for psychopathy, preventive and protective factors are paramount.

6.4.2 MECHANISMS OF PROTECTIVE FACTORS

Protective factors may function at least in three ways according to Farrington and Bergstrøm (2018). They may refer to 1) direct predictors of low psychopathy, 2) variables that weaken the risk for psychopathy of those with high traits, or 3) protective factors may lower the symptoms of psychopathy. In line with the third option, Hall and Benning (2006) suggest that protective factors may inhibit psychopathic-like behavior and the expression of a psychopathic disorder. However, these may not necessarily be mutually exclusive because same protective factors may affect in all of the ways depending on the target. For example, Caldwell et al. (2012) suggest that factors protecting against psychopathy may simultaneously reduce both psychopathic traits, antisocial behavior and criminality, which directly benefits society. This question can also be addressed through the stability and change of the levels of psychopathic traits and through the four courses identified in the literature: stable high, increasing, decreasing and stable low (Byrd et al., 2018; Fontaine et al., 2010; Hawes et al., 2017; 2018). Adolescents in the courses of decreasing and stable low may show normal maturational processes and their behavior may be mistakenly viewed as an indicator of psychopathy, unlike those who show fledgling psychopathy (Cauffman et al., 2016). The compensatory, protective effects should be explored specifically among adolescents who are developing into life-long psychopaths. The effects of risk and protective factors in these separate groups of adolescents may be different.

The mechanisms of protective variables on psychopathy are ambiguous, although there are many speculations of possible background factors. The compensatory factors may, for example, positively increase the experience of emotions (Keulen-de Vos et al. 2017), advance social skills (Caldwell et al., 2012), increase the desire or motivation to affiliate (O'Nions et al., 2017;

Viding and McCrory, 2019), increase the subjective well-being (Love and Holder, 2016), or improve executive functioning (Lilienfeld et al., 2015). According to Hall and Benning (2006), intervening variables may shape the temperamental base, resulting in a different manifestation of psychopathy. Other possible factors may relate to increased sensitivity to other human beings and improved empathy, advanced emotional responsivity, reduced antisocial behavior and better impulse and self-control. In an unfavorable case, the changes in the levels of psychopathic traits due protective factors in the previous studies may relate simply to study methodology such as self-reports. Factors related to different mechanisms between protective factors and psychopathic traits are shown in Figure 8.

As the mechanisms remain unsolved, so does the duration of the effect, as protective factors may reduce psychopathic-like traits either temporarily or permanently. Also, risk factors that evoke psychopathic features among "healthy" adolescents or which strengthen the traits among already psychopathic individuals may work in either the short or long term. Study III indicated rather a short-term effect of romantic relationships for psychopathic traits than a long-term impact, but this needs to be studied more with appropriate methods, for example through neuroimaging. There is evidence that neurocognitive impairments associate with high levels of psychopathic traits among children and adolescents (Blair, 2013; Viding and McCrory, 2012). If protective factors alter, for example, the deficits of prosociality and affective empathy (Waller and Hyde, 2018), it would be interesting to elucidate the effects on the brain level by neuroimaging methods (Viding and McCrory, 2018). In other words, it is till obscure whether improvement in psychopathic-like behavior due to protective factors affects both behavioral changes and neurobiological systems, or whether the improvement in behavior is caused by other, compensatory mechanisms (Viding and McCrory, 2018). As adolescence is a time of rapid and complex changes in the brain and in behavior, possible alterations in neurobiology due to protective factors, such as parental warmth, high-quality relationships or adequate sleep, are worth studying. The question is also whether environmental protection can counter underlying genetic predispositions or promote genetic expression of prosocial behavior (Henry et al., 2018). It has been found that certain protective environmental factors can reject genetic risk, which usually goes through the environmental context (Viding and Kimonis, 2018). For example, a few recent genetically informative studies have reported that certain environmental factors, such as warm parental practices, might weaken the heritability of CU traits (Henry et al., 2018; Hyde et al., 2016).

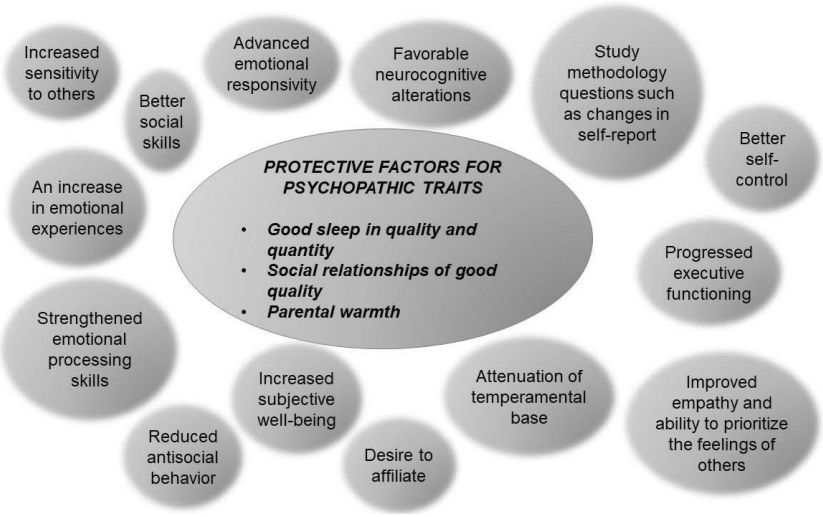

Figure 8 Possible underlying factors between protective factors for adolescent psychopathic traits

6.4.3 CONSTRUCT OF PSYCHOPATHY

It has been debated whether psychopathic traits among youths should be explored exclusively via CU traits or by considering all subdomains (e.g. Salekin et al., 2018b; Salihovic and Stattin, 2016). Although CU traits are important, specific cognitive processes such as impulsive decision-making have been noticed and well-constructed measures have been called for (Viding and McCrory, 2018). Studies II and III separately investigated impulsivity, narcissism and CU traits, and their conclusions supported the multidimensionality of the construct over the narrower investigations of CU traits only. Sleep problems were associated with all three subdomains of psychopathy, although weakest to CU traits, and romantic relationships had a similar impact on impulsivity, narcissism and CU traits. However, friendship quality did not influence the behavioral component of psychopathy in the within-individual analysis, which strengthens earlier findings that impulsive individuals are less influenced by their relationships (Zedaker and Bouffard, 2017). This study project thus strengthens the arguments for examining all the subdomains rather than only CU traits, because impulsivity and narcissism also seem to be related to sleep and social relationships.

In terms of psychopathy's subdimensions, the concept of successful psychopath is worth discussing. Successful psychopaths may work as a reference group for youths who show improvement in psychopathic traits, because successful psychopaths might exhibit elevated levels of interpersonal-affective traits but reduced levels of antisocial behavior, which keeps them "down the road" (Hall and Benning, 2006). Accordingly, protective factors may change psychopathic adolescents into subclinical psychopaths, who "are

definitely psychopaths but in a milder degree" (Cleckley, 1941). These scholars claim that only the behavioral dimension changes due protection, but the core affective features remain the same. Thus, it would be fruitful to investigate which protective factors impact impulsivity, narcissism and CU traits similarly, and which may decrease mainly, for example, the antisocial domain.

6.4.4 IMPLICATIONS FOR FUTURE STUDIES, PREVENTION AND TREATMENT

Studies of psychopathic traits and juvenile delinquency have an undisputed benefit for public health and society given the financial, legal and psychological burden which they may cause. Based on Studies I–II, education for adolescents, parents and teachers on the consequences of sleep problems as well as screening for sleep habits and sleep loss, and offering interventions to improve sleep in school health settings play an important role in reducing negative outcomes. A detailed evaluation of sleep, including parental supervision at bedtime, are also worth taking into account when assessing conduct problems and psychopathic features. Treating sleep problems may potentially diminish psychopathic-like symptoms, which would be of practical importance.

Findings from treatment studies on psychopathy may be informative in detecting protective factors (Frick et al., 2014b). There is evidence that the traits associated with psychopathy are amenable to appropriate treatment in adolescence (Frick et al., 2014b; Reidy et al., 2015), although controversies regarding the treatability of psychopathy still persist today. It has already been demonstrated that evidence-based strategies can reduce the risk of violence (Reidy et al., 2015), and certain intensive interventions can reduce the level of antisocial behavior among youths with elevated psychopathic traits. However, many intervention and treatment studies for youth with psychopathic traits have focused only on behavioral improvement, i.e. reducing the manifestation and experiences of psychopathy and antisocial acts. A few studies have provided promising results via different programs and comprehensive treatment for adolescents in order to minimize callous and unempathetic processing (Frick et al., 2014a). A systematic review by Wilkinson and colleagues (2016) indicated that treatment in the form of behavioral therapy, emotion recognition training or multimodal intervention may reduce specifically CU traits and also the behavioral facet among children and adolescents. About half of the reviewed studies found this effect and the treatment was directly targeted toward behavior, socioemotional or cognitive processing. Salekin et al. (2012) found that an intervention appeared to be effective at increasing positive emotion and improving interpersonal traits, but also impulsivity and callous traits decreased. This study was promising due to the personality change of interpersonal traits. Finally, Caldwell et al. (2006) reported that offending adolescents with high levels of psychopathic traits benefited from an intensive treatment program teaching empathy skills by

using self-interests and reward-oriented goals that motivate adolescents with CU traits. Violent recidivism decreased among those with treatment. The treatment was implemented at the Mendota Juvenile Treatment Center (MJTC) which is a correctional facility designed to provide mental health treatment and improvement of interpersonal functioning and behavioral control for juvenile offenders. Its program helps youths develop social skills and build prosocial relationships and activities, and it has greater treatment resources than standard juvenile corrections institutions. This gives an indication that psychopathic adolescents may benefit from existing treatment techniques if they are consistent and intensive, and do not allow resistances to take over.

Studies III and IV are encouraging, as they show that certain protective factors may buffer psychopathic traits, even in adolescence. Study III implied that teaching adolescents to favour healthier relationships with prosocial individuals and employing positive reinforcement of prosocial relationships may reduce their psychopathic traits. Easy access to services to improve romantic relationship satisfaction should be provided for adolescents. Moreover, adolescents' social contexts should be noted in treatment and intervention programs targeted toward psychopathic individuals or offending adolescents. Reducing affiliations with antisocial peers and partners may prove beneficial for both adolescents with elevated psychopathic traits and their close-ones. Because isolating an adolescent from their high-quality interpersonal relationships may hamper positive socialization, careful consideration of detention facilities and the effects of imprisonment are salient points when dealing with offending adolescents (see Salekin et al., 2010). Study IV showed that promotion of warm and supportive parent–child relationships, and reduction of parental hostility and angry coerciveness may benefit forensic adolescents with psychopathic traits. Interventions and treatment of parenting could be addressed not only with adolescents who are at risk or show early signs of antisociality, but also with adolescents showing serious antisocial behavior. In future studies, parental monitoring and the amount of exposure of parental warmth and hostility, as well as co-occuring social context such as peer and romantic relationships should be taken into account.

Future studies have many questions to answer, including 1) whether protective factors, intervention or treatment can reduce psychopathic traits, specifically affective deficits and problems of interpersonal functioning, alongside deviant behavior; 2) whether they just attenuate the manifestation of psychopathic traits without changing the personality traits; or 3) are protective factors, intervention or treatment able to change underlying neurocognitive deficits and could these be detected with neuroimaging methods. Also, it is important to examine, 4) whether the effects of protective factors are similar for those with primary and secondary psychopaths; and 5) through which mechanisms the protective effect is achieved. It also remains unclear, 6) how early and at which point in the life course parental warmth

and social relationships of good quality are the most effective in terms of decreasing the psychopathic traits, and 7) should the interventions be designed differently with age to be as effective. Finally, 8) which individual and contextual factors, in addition to sufficient sleep, parenting and social relationships, may promote desistance and reduce psychopathic-like behavior. These questions are crucial in treatment education and prevention planning and need to be investigated using extensive longitudinal data and appropriate methods. Public health promotion studies and interventions of children and adolescents should include the measurement of psychopathic traits to identify the key protective factors and select psychopathic youths who show desistance, success and adaptability. To sum up, the literature on the protective factors against psychopathy and its developmental trajectories is still in its infancy and undoubtedly needs future study.

7 CONCLUSIONS

This study project focused on psychopathic traits of adolescents. The principal results and conclusions can be summarized as follows.

Study I shows that sleep quality and quantity were related to violent and property delinquency in adolescents regardless of their psychopathic personality traits or parental supervision at bedtime. Although the relationships between sleep, psychopathy and delinquency are entangled, the findings suggest that an adolescent with inadequate sleep, even without psychopathic features, might be at risk of acting violently or committing property crimes.

Study II shows that youth with frequent and persistent sleep problems as well as continuous short sleep duration report significantly higher levels of psychopathic traits than other adolescents. Higher levels were found also for the sub-dimensions of psychopathy, i.e. impulsivity, narcissism and CU traits. Moreover, in the population-based sample of 15-16-year-olds, more than 3% of adolescents slept too little on all nights and 5% subjectively reported having sleep problems at least three times per week for one or more years reflecting severe sleep disturbances and continuous sleep deprivation.

Study III shows that being satisfied in a romantic relationship and considering this relationship to be of high quality in terms of the amount of love, closeness and interpersonal support, may protect adolescents and young adults from psychopathy. Protection against psychopathy may also be achieved by adolescents' high-quality friendships, in terms of closeness to and support from peers. On the other hand, we also found that partner's antisocial influence (i.e., subjective rating of partner's suggestions regarding antisocial acts) and peer delinquency, reflecting antisocial activity among one's peer group, have a tendency to increase psychopathic traits among youth. The findings suggest that in adolescence, peers and romantic partners can act either as protective or risk factors on psychopathic features, depending on the quality and antisocial activities of the relationships.

Study IV indicates that parental warmth may protect against psychopathic traits and criminal acts of delinquent adolescents. On the other hand, maternal and paternal hostility can increase the psychopathic features and adolescents' antisocial outcomes. The effect of parenting quality and psychopathic traits failed to be moderated by the age of the adolescent, and youth psychopathic traits did not explain parental warmth and hostility. Parenting quality seem to matter in adolescence, such that parental behaviors may act either as protective or risk factors for psychopathic traits and delinquency depending on the warmth and hostility of the relationship at this developmental period.

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