MINNA RYTILÄ-MANNINEN

Adverse Childhood Experiences, Psychopathology, and Self-Harming Behavior

A study of Finnish adolescent inpatients and their age- and gender-matched non-referred controls
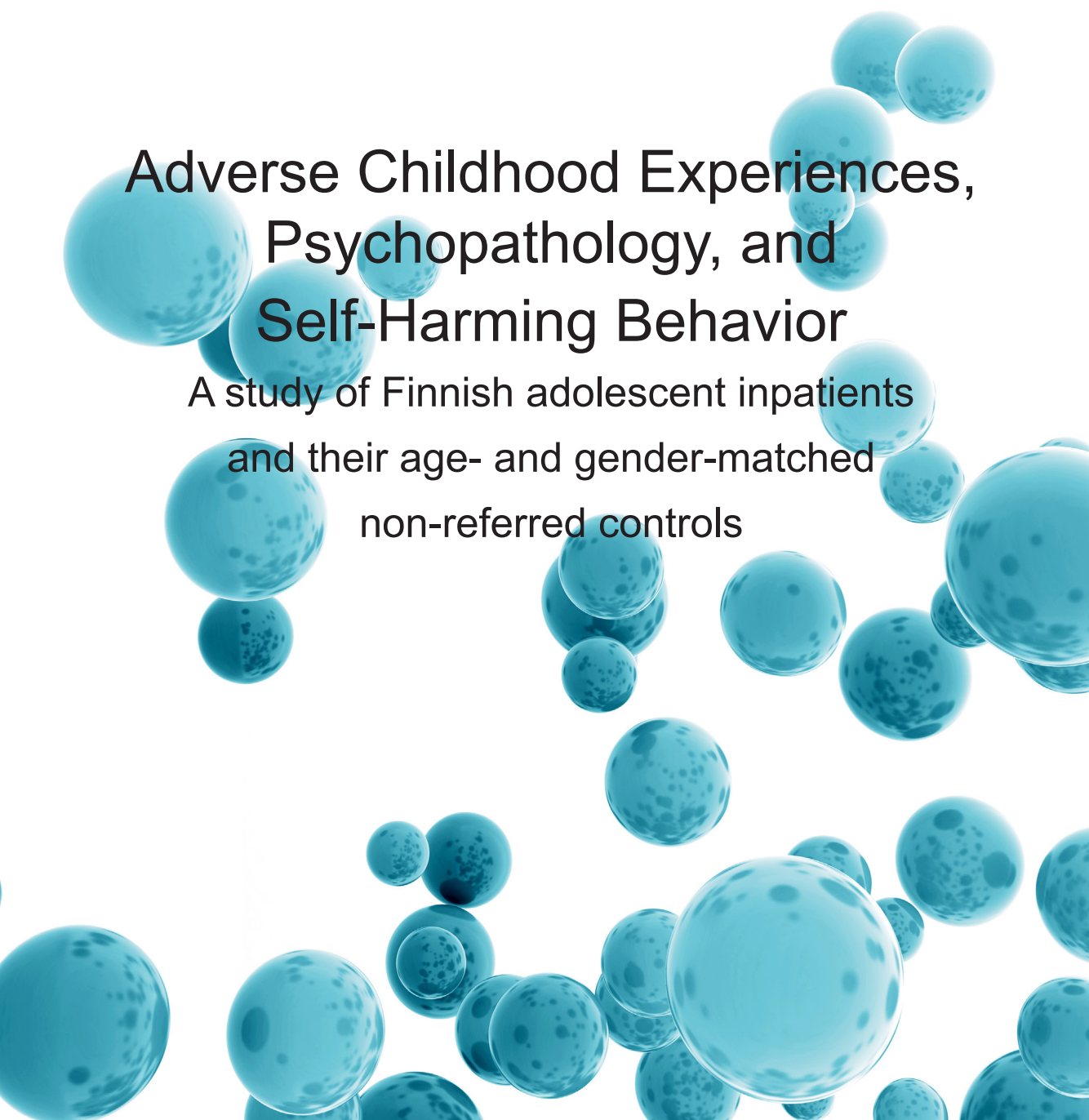
MINNA RYTILÄ-MANNINEN

Adverse Childhood Experiences,
Psychopathology, and Self-Harming Behavior

A study of Finnish adolescent inpatients
and their age- and gender-matched
non-referred controls

■

UNIVERSITY OF TAMPERE

MINNA RYTILÄ-MANNINEN

Adverse Childhood Experiences,
Psychopathology, and Self-Harming Behavior

A study of Finnish adolescent inpatients
and their age- and gender-matched
non-referred controls

UNIVERSITY OF TAMPERE

The originality of this thesis has been checked using the Turnitin OriginalityCheck service in accordance with the quality management system of the University of Tampere.

Cover design by
Mikko Reinikka

441 729
Painotuote

To my family

ABSTRACT

Adolescent psychiatric inpatients more often than adolescents in the community have been exposed to adverse childhood experiences. Adversities in childhood have been demonstrated to be associated with later psychopathology and suicidality.

Studies concerning adverse childhood experiences are mostly retrospective and contain adult samples, and many investigate only one or two adversities at the same time. Further, it is not clear why some individuals exposed to adversities successfully go through adolescence while others fail. Adolescence is known as a second chance, and information to predict adolescents' psychopathology and suicidality or treat adolescents and the whole family is needed to prevent adulthood psychopathology and suicidality.

This study aimed to investigate whether adverse childhood experiences are related to adolescents' psychopathology or to severe psychiatric disorders in inpatients and whether there are special adversities linked to either internalizing or externalizing disorders. To get a more accurate picture of a multidimensional self-report psychiatric symptoms questionnaire's usefulness for adolescents, the psychometric properties of the SCL-90 questionnaire were investigated. Additionally, the mediating roles of psychiatric symptoms, impulsivity, alcohol misuse, and family and social dysfunction between adverse childhood experiences and suicidality were evaluated. Further, to shed light on the risk factors related to adolescent inpatient suicidality, suicidality was divided into the categories of "no self-harming behavior", "suicidal behavior", "non-suicidal self-injury", and "suicidal behavior with non-suicidal self-injury".

Altogether 206 adolescent inpatients and 203 sex- and age-matched adolescents in the community participated in the study. All participants were interviewed with the Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime version (K-SADS-PL) to assess psychiatric diagnoses. Adverse childhood experiences included parental psychiatric and alcohol use problems, parents' divorce, witnessing intimate partner violence, experience of physical and sexual abuse, and parental criminality. Definitions of suicidality, suicidal sum score, suicidal behavior (SB), and non-suicidal self-injury (NSSI) were based on the K-SADS-PL interview. Self-report questionnaires were used to gather information on

adolescents' psychiatric symptoms, impulsivity, and alcohol use as well as experience of family and social dysfunction.

ACEs were associated with adolescent inpatient status, and the odds ratio was greater with those who had more cumulative number of ACEs. Most ACEs were associated with both internalizing and externalizing disorders. The SCL-90 questionnaire proved to be mostly unidimensional, but was a useful tool for screening overall psychopathology in adolescents, and thus, it was included in further studies to measure adolescents' psychiatric symptoms. ACEs had a positive direct effect on suicidality, while psychiatric symptoms, impulsivity, social dysfunction, and family dysfunction had a positive indirect effect. Only alcohol use was not a significant mediator. Multiple mediation analysis revealed that psychiatric symptoms followed by impulsivity were the most significant mediators between ACEs and suicidality. Suicidal Behavior (SB) was related to diagnoses of depression and bipolar disorders and self-reported depression and psychoticism. SB with Non-Suicidal Self-Injury (SB with NSSI) was related to sexual abuse, impulsivity, and self-reported symptoms of depression and psychoticism. NSSI was related only to social dysfunction. ACEs were related to SB with NSSI only at a trend level.

These results indicate that ACEs are a serious risk for later psychopathology and suicidality. Both adolescents and parents need support, advice, and treatment. Healthcare professionals should consider ACEs when faced with an adolescent needing help for mental health problems and/or suicidality. Early identification and treatment of adolescents with ACEs may prevent adulthood psychopathology.

TIIVISTELMÄ

Lapsuus- ja nuoruusiässä koettujen kuormittavien elämäntapahtumien on todettu olevan yhteydessä aikuisiän psyykkisiin ongelmiin ja itsetuhoisuuteen. Tutkimukset ovat olleet pääosin retrospektiivisiä ja tutkittavat henkilöt aikuisia. Monissa tutkimuksissa on myös keskitytty tutkimaan vain yhtä tai kahta kuormittavaa elämäntapahtumaa, vaikka kuormittavilla elämäntapahtumilla on taipumus kasautua. Kuormittavien elämäntapahtumien yhteyttä nuoruusikäisten itsetuhoisuuteen ja itsetuhoisuuden eri muotoihin on myös tutkittu vähän.

Tämä tutkimus on osa Kellokosken sairaalassa toteutettua, "Kellokoski hospital Adolescent Inpatient Follow-Up Study" (KAIFUS) – tutkimus- ja kehittämishanketta. Tutkimukseen osallistuneet nuoret (13–17 -vuotiaat) olivat psykiatrisessa osastohoidossa vuosien 2006–2010 aikana (N=206). Verrokkiaineiston muodosti saman sairaanhoitoalueen kuntien koululaiset ja opiskelijat (N=203), jotka olivat kaltaistettu iän ja sukupuolen mukaan. Diagnosoinnissa ja itsetuhoisuuden arvioinnissa käytettiin puolistrukturoitua K-SADS-PL haastattelua. Itsetuhoisuutta tutkittiin sekä summamuuttujana, että jaoteltuna itsetuhoiseen käyttäytymiseen, ei itsemurhatarkoituksessa tapahtuvaan itsensä vahingoittamiseen ja näiden yhdistelmään. Lisäksi tietoa koottiin hoitajien ja tutkijoiden täyttämällä strukturoidulla taustatietolomakkeella ja tutkittavien täyttämillä strukturoiduilla kyselylomakkeilla.

Tutkimuksessa havaittiin, että osastopotilaat olivat kokeneet kuormittavia elämäntapahtumia huomattavasti enemmän kuin verrokit, ja kuormittavien elämäntapahtumien kasautuminen lisäsi riskiä olla osastopotilas. Suuri osa eri elämäntapahtumista oli yhteydessä sekä sisäänpäin- että ulospäin suuntautuviin oireisiin.

Tutkimuksessa testattiin psyykkisen oiremittari SCL-90 käytettävyyttä nuorilla ja todettiin, että mittari on lähinnä yksiulotteinen, mutta hyvä mittari nuorten yleisen psyykkisen oireilun mittaamiseen. Mittaria käytettiin jatkossa muissakin tutkimuksissa nuorten psyykkisten oireiden määrän mittaamiseen.

Kuormittavilla elämäntapahtumilla todettiin olevan suora yhteys nuorten itsetuhoisuuteen. Psyykkisten oireiden määrä, impulsiivisuus, heikko sosiaalinen toimintakyky ja heikko perheen toimintakyky toimivat kaikki mediaattoreina kuormittavien elämäntapahtumien ja itsetuhoisuuden välillä. Sen sijaan alkoholin

käyttö ei näyttäytynyt merkitsevänä mediaattorina ja jätettiin sen vuoksi pois jatkotutkimuksista. Kun testattiin mediaattoreiden vaikutusta yhtäaikaisesti monimediaattorimallissa, todettiin että vain koetut psyykkiset oireet ja impulsiivisuus olivat merkitseviä mediaattoreita kuormittavien elämäntapahtumien ja itsetuhoisuuden välillä.

Itsetuhoinen käyttäytyminen oli tämän tutkimuksen mukaan yhteydessä diagnosoituun depressioon ja bipolaarihäiriöön, sekä itseraportoituun depressiivisyyteen ja psykoosioireiluun. Seksuaalinen hyväksikäyttö, impulsiivisuus ja itseraportoitu depressiivisyys ja psykoosioireilu olivat yhteydessä itsetuhoiseen käyttäytymiseen, jossa oli mukana myös ei itsemurha tarkoituksessa tapahtuvaa itsensä vahingoittamista. Pelkästään ei itsemurha tarkoituksessa tapahtuva itsensä vahingoittaminen oli yhteydessä itseraportoituun heikkoon sosiaaliseen toimintakykyyn. Kuormittavat elämäntapahtumat olivat yhteydessä itsetuhoiseen käyttäytymiseen, jossa oli mukana myös ei itsemurha tarkoituksessa tapahtuvaa itsensä vahingoittamista, mutta merkitsevyys jäi vain suuntaa-antavaksi, eikä tilastollista merkitsevyyttä voitu todeta.

Kuormittavilla elämäntapahtumilla on merkittävä yhteys nuorten pahoinvointiin. Koska tutkitut kuormittavat elämäntapahtumat koskevat pääsääntöisesti perheessä ilmeneviä ongelmia, on tärkeää, että kuormittavista elämäntapahtumista kysytään haastateltaessa nuorta niin perustasolla kuin erikoissairaanhoidossakin. On tärkeää, että koko perhe on mukana hoidossa ja saa tarvittavaa ohjausta ja neuvontaa, kun nuori oireilee kuormittavien elämäntapahtumien johdosta. Näin voidaan katkaista sukupolvien välistä pahoinvoinnin kierrettä.

LIST OF ORIGINAL ARTICLES

This thesis is based on the following original publications, which are referred to in the text by Roman numerals I-IV:

I Rytilä-Manninen M, Lindberg N, Haravuori H, Kettunen K, Marttunen M, Joukamaa M, Fröjd S. Adverse childhood experiences as risk factors for serious mental disorders and inpatient hospitalization among adolescents (Child Abuse & Neglect 2014, 38, 2021-2032)

II Rytilä-Manninen M, Fröjd S, Haravuori H, Lindberg N, Marttunen M, Kettunen K, Therman S. Psychometric properties of the Symptom Checklist-90 in adolescent psychiatric inpatients and age- and gender-matched community youth (Child and Adolescent Psychiatry and Mental Health 2016, 10:23)

III Rytilä-Manninen M, Haravuori H, Fröjd S, Marttunen M, Lindberg N. Mediators between adverse childhood experiences and suicidality (Child Abuse & Neglect, 2017, 77, 99-109)

IV Rytilä-Manninen M, Haravuori H, Kettunen K, Fröjd S, Marttunen M, Lindberg N. Risk factors related to self-harming behavior in Finnish adolescent inpatients with a history of non-suicidal self-injury, suicidal behavior or both (Psychiatria Fennica 2017, 48, 13-30)

LIST OF FIGURES AND TABLES

ABBREVIATIONS

ACE   Adverse childhood experience

ADHD   Attention-deficit hyperactivity disorder

AUC   Area Under the Curve

CD   Conduct disorder

CFA   Confirmatory factor analysis

CFI   Comparative fit index

CRH   Corticotrophin-releasing hormone

DIF   Differential item functioning

DOR   Diagnostic odds ratio

DSM   Diagnostic and Statistical Manual of Mental Disorders

ECV   Explained common variance index

GAD   Generalized anxiety disorder

GSI   Global Severity Index

HPA   Hypothalamic-pituitary-adrenocortical

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

M   Mean

MAP	Minimum Average Partial correlation
MDD	Major depressive disorder
ML	Maximum likelihood
NSSI	Non-suicidal self-injury
OCD	Obsessive-compulsive disorder
ODD	Oppositional defiant disorder
PA	Parallel Analysis
PTSD	Post-traumatic stress disorder
RMSEA	Root mean square error of approximation
ROC	Receiver Operating Characteristic
SAD	Separation anxiety disorder
SB	Suicidal behavior
SCL-90	Symptom Checklist-90
SD	Standard deviation
SUD	Substance use disorder
VSS	Very Simple Structure
WLS	Weighted least squares
WLSMV	Weighted least squares mean and variance adjusted
WRMR	Weighted root mean square residual

TABLE OF CONTENTS

Original Publications I-IV

1 INTRODUCTION

Safe, stable, nurturing relationships and environments are essential for children to reach their full potential, also maximizing their chances for lifelong health and well-being (Leeb, Paulozzi, Melanson, Simon, & Arias, 2008). Unfortunately, not all children are equipped with this kind of environment, and many face early adversities related to their families or the community.

Adverse childhood experience (ACE) is a term used to describe a wide range of stressful or traumatic events, including neglect, abuse, and household dysfunction such as growing up with family members who have substance use disorders, mental health problems, or intimate partner violence. Extreme economic adversity, bullying, school violence, and community violence are other commonly encountered ACEs (National Child Traumatic Stress Network, 2015). ACEs are strongly associated with the development of a child and a wide range of health problems throughout the individual's lifespan. The first large and systematic ACE research project was conducted by Felitti and colleagues (1998) at Kaiser Permanente's Health Appraisal Center in San Diego, USA from 1995 to 1997 with two waves of data collection and including over 17 000 adults. In 2015 in the United States, there were approximately 683 000 victims of child abuse and neglect reported to child protective services, and about 1670 children died from abuse and neglect that same year. The total lifetime cost of child abuse and neglect has been estimated at 124 billion US dollars (Center on the Developing Child at Harvard University (2016).

Both positive and negative childhood experiences may have an impact on future violence victimization and perpetration as well as on lifelong health and opportunities. When an individual is exposed to a stressful situation, the fight, flight, or freeze response floods the brain with corticotrophin-releasing hormone (CRH). This response is normal and protective in stressful situations. However, if a child is continually exposed to ACEs, the brain also continually produces CRH, and this process results in the child being in a permanently heightened state of alertness, unable to return to the recovered state. Therefore, the child or adolescent is always at an increased level of stress. In this heightened neurological state, the adolescent is unable to think rationally and it is physiologically hard or impossible to learn (Center on the Developing Child at Harvard University, 2016).

ACEs have a negative effect on child and adolescent health. Abused children may suffer from physical injuries like burns or broken bones. Extreme stress can disrupt the development of the nervous and immune systems. Children who have faced abuse and neglect are at increased risk in adulthood for depression, alcoholism, drug abuse, high-risk sexual behavior, chronic diseases, and even suicide (National Child Traumatic Stress Network, 2015). Furthermore, studies have found that child adversities in one generation are positively related to adversities in the next generation (Schofield, Lee, & Merrick, 2013).

The overall goal of the present study was to increase understanding, of how adverse childhood experiences alter developmental processes in ways that increase risk for mental health problems in adolescents. Many studies have shown that approximately one-third of all mental disorders worldwide are attributable to exposure to adverse childhood experiences (Green, et al. 2010; Kessler et al., 2010; McLaughlin et al., 2012). This finding underscores the importance of developing interventions for adolescents, and families that mitigate the mental health consequences of these experiences. This study is part of the enlarging body of research on adverse childhood experiences and its subsequent mental health problems. Improved understanding of the role of the environmental experience in shaping children's development is needed to inform clinical practice, education and policies to prevent disadvantages and promote adaptive development in society's most vulnerable members.

This study is part of the Kellokoski hospital Adolescent Inpatient Follow-Up Study (KAIFUS) which is a longitudinal naturalistic study on clinical characteristics and the impact of treatment in a consecutive sample of adolescent psychiatric inpatients. The study has been conducted in the Helsinki and Uusimaa health care area, specifically in the Hyvinkää health care district, in southern Finland.

2   REVIEW OF THE LITERATURE

2.1 Adolescent development

Adolescence represents a major transition that takes place over the second decade of life. During the shift from a caregiver-dependent child to an autonomous adult the adolescent undergoes physical growth and physiological, psychological, cognitive, and social changes (Paus, 2005). Adolescence is usually divided into three developmental phases: early adolescence (age 10-13 years), middle adolescence (14-17 years), and late adolescence (18-22 years). Each of these periods has it's own special challenges (Christie & Viner, 2005).

In early adolescence, rapid physiological changes are triggered by the release of hormones. This period, known as puberty, is one of intense development, with hormones signaling the advancement to biological and sexual maturity. Girls usually mature two years earlier than boys. Developmental growth includes significant increases in height, weight, internal organ size, and skeletal and muscular systems. Bones grow faster than muscles, causing coordination issues (Kellough & Kellough, 2008). Fluctuations in basal metabolism cause experiences of restlessness and lassitude. Early adolescence is also a period when youth exhibit a wide range of individual intellectual development, including metacognition and independent thought. Moral development tends to appear as idealistic thinking and a strong sense of fairness. As young adolescents strive to maintain peer approval and at the same time are still attached to their parents, feelings of conflict arise due to competing allegiances. While searching for their identity and being involved in self-discovery, young adolescents' feelings of vulnerability may intensify. There is a tendency to be moody, restless, and irritable (Blakemore & Chounhury, 2006; Caissy, 2002; Cristie & Viner, 2005).

Middle adolescence is period entailing changes in how teenagers feel, think, and interact with others, and how their bodies grow. In this period, most girls are physically mature and have completed puberty, while boys are still maturing physically, gaining strength, muscle mass, and height. During this period teens may

be concerned about their physical and sexual attractiveness. The adolescent is developing his/her unique personality and opinions and is gaining a clearer sense of who she/he is. Relationships are important, and teens spend less time with parents and more time with friends and are becoming increasingly independent. Adolescents show more interest in romantic relationships and sexuality appears. Adolescents have more capacity for caring and sharing and developing relationships that are more intimate. Moral reasoning is ongoing and teens are better able to give reasons for their choices, defining what is right and wrong. They seek friends who share the same values, interests, and beliefs. Middle adolescence is also a time when teens may feel sadness or depression, leading to poorer grades at school, alcohol or drug use, unsafe sex, and other problems. Cognitive thinking continues to develop and youths have more capacity to understand complicated problems, set goals, and think about the future (Gentry & Campbell; 2002; Wigfield, Byrnes, & Eccles, 2006).

Late adolescence is characterized by a better sense of self and more emotional stability. Adolescents become more self-reliant and are able to make their own decisions, regardless of peer pressure/opinions. During this period adolescent make decisions about educational goals, leave home, and proceed towards living independently, also economically. Adolescents have improved ability to see parents as individuals, and they can take parents' perspectives better into account. They become more comfortable around their parents (Gentry & Campbell, 2002; Wigfield, Byrnes, & Eccles, 2006).

2.1.1. Brain maturation in adolescence

Brain maturation is a complex and lifelong process. The first two decades of life are crucial for brain maturation. It has been speculated that the earliest phases of brain maturation, during fetal development and childhood, are the most dramatic and important (Toga, Thompson, & Sowell, 2006). During fetal life the cortex and subcortical gray-matter nuclei develop, leading to a hundred billion neurons at birth. The newborn child's brain continues to grow and specialize according to a genetic program, influenced by environmental factors (Toga et al., 2006). As a result of stimulation and experience, the dendritic branching of neurons considerably increases, as does the numbers of synaptic connections. After a period of rapid neural connection proliferation, these connections start to reduce as a normal process. This process is called pruning, and it leads to a more efficient set of connections that are continuously remodeled throughout life. This developing brain

architecture – its nature and quality – is affected by experiences, influencing which circuits are reinforced and which are pruned due to lack of use (Center of the Developing Child at Harvard University, 2016). Most of the synaptic density has reached adult levels by preschool age, when also synapse elimination declines (Toga et al., 2006). An exception is the medial prefrontal cortex. This area contains attentional and regulatory functions. While synaptic overproduction, for example, in the visual cortex reaches a maximum at the fourth postnatal month, in the medial prefrontal cortex this peak occurs at three to four years of age, and the decline begins during mid to late adolescence (Toga et al., 2006).

Another process that occurs during adolescence and continues into the third decade of life is myelination. MRI studies have discovered that myelinogenesis continues and neurocircuity remains structurally and functionally under construction during adolescence because these events are regulated by sex hormones (estrogen, progesterone, and testosterone) that specifically increase during puberty. Especially significant changes occur in the limbic system; these have been speculated to have an impact on self-control, decision-making, emotions, and risk-taking behavior. In the frontal lobe, which is responsible for higher cognitive functions, myelination seems to also continue during adolescence, while ventral and deep brain structures, which are responsible for more primitive functions, are myelinated earlier (Arain et al., 2013).

Significant changes in brain volumes and levels of activity occur in different brain regions during adolescence. Longitudinal studies of children and adolescents have reported that different cortical gray matter regions follow different developmental trajectories. Gray matter loss appears first, between the ages of four and eight years, with the most basic functions, and those processing the senses and movement, following spatial orientation and language areas at 11 to 13 years. In late adolescence, areas with more advanced functions, such as reasoning and other higher order association areas, mature last (Giordio et al., 2010; Toga et al., 2006). Cortical thinning occurs during adolescence and continues into adulthood (Koolschijn & Crone, 2013). White matter volume increases quite steadily throughout adolescence up to even the fifth decade of life, declining thereafter (Paus, 2010; Paus et al., 2001).

Brain imaging studies have revealed some sex and sex-by-age differences, although there are also disconcordant findings. Findings have been replicated fairly consistently with larger intracranial, total brain, and total gray and white matter volumes in males than females. Males have been found to have, on a subcortical level, larger amygda and thalamus volumes. Additionally, males have larger gray matter volumes on all lobar levels (Koolschijn & Crone, 2013). Sex differences in hippocampal volumes and slopes have been inconsistent. Some studies have found

no sex differences (Koolschijn & Crone, 2013; Gogtay et al., 2006), and others have demonstrated a larger hippocampus in females (Bramen et al., 2011). Sex-by-age interaction studies have demonstrated that in cortical volumes males have larger total and lobar gray matter volume decreases with age than females, while white matter volume increases were larger in females (Koolschijn & Crone, 2013). These studies indicate different developmental trajectories for gray and white matter development between the sexes.

2.1.2 Cognitive development in adolescence

Researchers in the field of developmental neuroscience have paid attention to structural and functional aspects of brain development in early adolescence (Steinberg, 2005). As mentioned before, significant change and growth in the multiple regions of the prefrontal cortex – synaptic pruning and processes of myelination during adolescence – increase the efficiency of information processing. These brain changes are believed to improve various aspects of executive functioning, like metacognition, self-evaluation, long-term planning, coordination of affect and cognition, and self-regulation (Keating, 2004), as well as working memory and spatial working memory (Luciana & Nelson, 2002; Vuontella et al., 2003). Additionally, some studies have found that restructuring of the prefrontal cortex and limbic systems is linked to how individuals evaluate and respond to risk and reward (Crone and van der Molen, 2004; Hooper et al., 2004; Spear, 2000).

Social cognition refers to the ability for more abstract, differentiated, and multidimensional thinking about others (Steinberg, 2005), leading to a better capacity to understand and interact with other people. These capacities include processes like prosocial reasoning (Boehnke et al., 1989), impression formation (Crystal et al., 1998), social decision-making, and emotional perspective-taking (Frith & Frith, 2007). Many studies have approached adolescent social cognition from the point of view, how it affects the development of judgment, decision-making or risk-taking. In a laboratory-based study, researchers have found that adolescents are more likely to make risky decisions than adults (high-risk driving or unprotected sex). This finding has been explained as follows: while adolescents share the same logical competencies as adults, social and emotional factors, such as peer influence and impulse control, lead to differences in decision-making between adolescents and adults (Gardner & Steinberg, 2005). Studies that have researched the link between social cognition and social behavior indicate that patterns of social cognitive development during adolescence vary regarding the function of the content under

consideration and the emotional and social context in which the reasoning occurs (Steinberg, 2005). While during adolescence the capability to look at things from another perspective increases, adolescents' social reasoning is influenced by their desires, motives, and interests (Steinberg, 2005).

Social cognition related to arousal and emotion has been shown to have a closer link to pubertal maturation than other cognitive development. For example, pubertal development directly influences the development of romantic interest and sexual motivation (Neeman et al., 1995). Also face processing skills are associated with sexual maturation (Diamond et al., 1983). During adolescence cognitive systems exerting control, particularly control over emotion-related behavior, develop (Thompson & Fox, 1994); this involves the ability to inhibit or modify an emotion or the expression of emotion regarding rules and goals or to avoid negative consequences.

2.1.3   Personality development in adolescence

Adolescence is a period in which the self-system is redefined. Personal development is reflected in personality traits, the core of self, and identity. Personality traits, the way in which individuals' characters differ, emerge in the first years of life. In adolescence, linear with the cognitive capacities to engage in abstract thinking, an adolescent begins to search for sameness and continuity of the self, a process called identity formation (Klimstra, 2013). Both aspects of self, i.e. personality traits and identity formation, are important because they are strongly associated with psychological adjustment (Caspi et al., 2005). There is a consensus that personality traits are relatively stable constructs, but they can be affected by environmental factors such as social roles and relations (Roberts et al., 2005).

Personality traits can be subsumed into five traits, known as the Big Five. These five traits are thought to capture the core of personality: Neuroticism (i.e. the tendency to experience stress), Extraversion (i.e. the tendency towards social dominance and positive emotionality), Openness to Experience (i.e., imagination, creativity, and curiosity), Agreeableness (i.e. cooperativeness, helpfulness, and kindness), and Conscientiousness (i.e. orderliness, responsibility, and perseverance) (Caspi et al., 2005).

During adolescence the personality profile changes towards an adult-like personality. A longitudinal study by Klimstra and colleagues (2009) found that between the ages of 12 and 20 years mean level increases occur in Agreeableness, Extraversion, and Openness, while Neuroticism decreases. Another large cross-

sectional study by Soto and colleagues (2011) demonstrated that changes towards adult-like personality traits occur only after early adolescence.

Another typology (Klimstra, 2013) exists that is popular, especially in research on adolescents. It includes three personality types: resilients (generally well-adjusted individuals), undercontrollers (individuals with a tendency toward externalizing problems), and overcontrollers (individuals with a tendency toward internalizing problems). In a study by Denissen and colleagues (2008), childhood personality types predicted adolescent adjustment, e.g. shyness or aggression, and the timing of leaving home or romantic relationships. Resilients were the best adjusted and had transition earlier than the other two types, while overcontrollers and undercontrollers transitioned later, and also became more aggressive with age. In another study that explored the transition between personality types, the researchers found that most adolescents (73.5%) had a stable type of personality, and the rest changed towards more adult-like personality profiles. As a result, the proportion of overcontrollers decreased slightly, while undercontrollers virtually disappeared (Meeus et al., 2011).

Identity formation is described as a "process in which childhood identifications are replaced by, or reinterpreted as, one's own self-defined set of commitments" (Erikson, 1950). During this process the adolescent moves between a sense of identity (commitment) and role confusion (reconsideration). While this process of reconsideration and commitment is normally in flux (Klimstra et al., 2010), frequent fluctuations, i.e. day-to-day fluctuations, predict weaker identity and an increase in symptoms of internalizing problems (Schwartz et al., 2011). The identity process may cause some changes in adolescents' personalities (Klimstra, 2013). For example, increased identification with adult social roles may be seen as a driving force behind adolescent personality change in the so-called social investment principle (Klimstra, 2013).

2.1.4   Emotional development in adolescence

Emotions are the component of a person's character comprising feelings as opposed to thoughts. Adolescents experience wide fluctuations in their daily emotional states and learning to manage these emotions is vital in later life (Larson & Brown, 2007). During adolescence emotional development involves establishing a coherent and realistic sense of identity in the context of relating to others and learning to manage emotions and cope with stress, and further, to figure out the role of abstract psychological, social, and physiological processes in influencing emotions (Fischer, Shaver, & Carnochan, 1990). Emotions have a vital function for individuals. They

serve as source of information, helping to motivate and direct attention and facilitate relationships (Lewis & Haviland-Jones, 2000). The challenging part of emotional development in adolescence is to learn to distinguish how and when emotions are functional and when they can upset, mislead, or have dysfunctional consequences (Larson, Clore, & Wood, 1999).

Contrary to younger children, adolescents have amassed a relatively large body of knowledge of emotions and competence. Adolescents demonstrate abilities to assume other people's emotions, and further, they become more able to modify their expressions of emotions in response to situational demands and they apprehend strategies for emotional self-control (Larson & Brown, 2007; Saarni et al., 2006). In other words, adolescents seems to have better capacity to understand emotions in relation to complex interacting systems; for example, adolescents have the potential to understand people's momentary emotions from their personalities, and probably due to brain development, teenagers have the potential to attain metacognitive strategies for regulation of negative emotions and enhancement of positive emotions (Larson & Brown, 2007).

Recent research on adolescents' emotional development has moved towards a view of emotions as adaptive and capable of organizing behavior in ways that can enhance as well as disrupt functioning. A dominant paradigm for studying emotions and emotion-related phenomena is emotion regulation (Galambos & Costigan, 2003). Emotion regulation can be defined as the way in which a person uses emotional experiences to provide adaptive functioning (Thompson, 1994) and the extent to which an individual shows emotional control versus emotional reactivity (Maedgen & Carlson, 2000). Skills like flexibility and responsiveness are crucial for effective emotion regulation (Thompson, 1994). The parent-child relationship constitutes the foundation for the shaping of a child's emotional dispositions. According to attachment theory, the child-caretaker relationship is an environment in which a child's experiences of emotions and their regulation affect the child's subsequent emotional tendencies and management skills (Zeidner et al., 2003). As a child becomes a teenager and time spent with parents decreases while time spent with peers increases, this new situation provides opportunities for different types of emotional learning that anticipate the demands of adult settings and build adolescent potential for system thinking and conscious self-regulation (Larson & Brown, 2007). By adolescence, individuals have a better capacity to regulate their emotions and are also capable of cognitively sophisticated emotion regulation strategies such as reframing and taking another's point of view (Galambos & Costigan, 2003).

Context has an important role in determining optimal emotional regulation, which also depends on the goals of the individual in the specific situation. For example, the

situation is different with friends, a stranger, or an authority figure, and ways of dealing with these different situations vary. In addition, an adolescent may show effective emotion regulation in one context, e.g. with peers, but not in other situations, e.g. with siblings (Thompson, 1994), suggesting that emotion regulation is more an interpersonal than an intrapsychic phenomenon (Galambos & Costigan, 2003).

2.2. Psychiatric disorders in adolescence

Three of ten most common causes of disability among people aged 15 to 44 years belong to mental health disorders (Merikangas et al., 2009). Prospective and retrospective research has shown that most adulthood mental disorders begin in childhood and adolescence (Merikangas et al., 2009). According to epidemiological studies, one of every three to four adolescents is estimated to meet mental disorder criteria of the Diagnostic and Statistical Manual of Mental Disorders (DSM). Despite the burden of individual suffering from mental health problems, only a small proportion of these adolescents have a sufficiently severe mental disorder necessitating intervention. An estimated one in ten youth meets the criteria for an severe mental health problem, impacting the adolescent's ability to function socially, academically, and emotionally (Merikangas et al., 2009).

A systematic review in the past 15 years of prevalence rates of psychiatric disorders from childhood to adolescence, and from adolescence to adulthood (Costello et al., 2012), found that about one adolescent in five has a psychiatric disorder. According to this review, rates of depression, panic disorder, agoraphobia, and substance use disorder (SUD) seems to increase from childhood to adolescence, but at the same time separation anxiety disorder (SAD) and attention-deficit hyperactivity disorder (ADHD) decrease. Panic disorder, agoraphobia and SUD continue to increase from adolescence to adulthood, while SAD and ADHD continue to decrease. The rate of psychiatric disorders, based on DSM-IV, was 8.6% at ages 8-10 years, 9.6% at 11-12 years, and 12.2% at 13-15 years. After this, the transition from adolescence to adulthood was marked by an increase in overall rates of psychiatric disorders. The mean prevalence rate of any psychiatric disorder during adolescence (12-19 years) was 21.8%, ranging in different studies from 14.8% to

22.8%. The most common diagnosis was drug abuse (mean 12.1%, range 3.3% to 18.3%). The second most common disorder was anxiety disorder (mean 10.7%, range 5.5% to 14.9%), followed by depressive disorder (mean 6.1%, range 3.1% to 7.2%). Behavioral disorder, including conduct disorder, oppositional defiant disorder, and ADHD, ranged between 3% and 4%.

In the large National Comorbidity Survey-Adolescent Supplement NCS-A study with 10 123 adolescents aged 13-18 years in the United States, Merikangas and colleagues (2010) reported that about one in three adolescents (31.9%) met the criteria for an anxiety disorder. Females were overrepresented in all anxiety subtypes, and the most significant sex difference was observed for post-traumatic stress disorder (PTSD). The second most prevalent disorder was mood disorders (14.3%). Compared with males, females were twice as likely to have unipolar mood disorder and also somewhat more likely to have bipolar disorder. In the same study, the prevalence rate of ADHD was 8.7%. Males were affected by this condition three times more often than females. Oppositional defiant disorder (ODD) affected 12.6% of the sample, and 6.8% met the criteria for conduct disorder (CD). The prevalence rate of SUD was 11.4% of the whole sample. Of these individuals, 8.9% had drug abuse or dependence and 6.4% had alcohol abuse or dependence. Substance use disorders were more frequent in males than females. A somewhat rarer condition was eating disorders, with 2.7% of adolescents affected; eating disorders were twice as prevalent among females.

2.2.1. Internalizing disorders

Most of the children's and adolescents' mental health problems can be divided into two groups: emotional disorders and behavioral disorders, which are also known as internalizing and externalizing behavior problems, respectively (Achenbach, 2001). Internalizing disorders are characterized by emotion over-regulation, reflected as a tendency to feel anxious or preoccupied and accompanied by bodily symptoms. In the taxonomy of psychiatric disorders, internalizing disorders include anxiety disorders and depression.

Earlier research has reported either no gender differences in depression rates in early adolescence or boys having higher rates than girls (Merikangas & Avenevoli, 2002). In middle adolescence, however, a change occurs and the rates of depression are greater among girls than among boys, with this difference persisting into middle

adulthood (Kessler & Walters, 1998; Olsson & von Knorring, 1999). Prospective data have shown that the rates of new onsets of depression increase from 1% to 2% at the age of 13 years and from 3% to 7% at the age of 15 years (Lewinsohn et al., 2000), and the incidence of depression continues to increase throughout early adulthood. An earlier study found no gender differences in the average age of onset of depression (Kessler et al., 2005). According to Merikangas and colleagues (2009) review, in adult samples, depression is associated with lower social class, but the findings in children and adolescents have been less consistent. According to the same review some studies report a lack of an association between depressive and anxiety disorders and social class, while others describe a significant association, at least for the most impoverished groups. (Lewinsohn and colleagues (2002) found in their prospective study that the incidence of bipolar disorder peaks at the age of 14 years in both males and females, gradually decreasing thereafter. Annual incidence rates of the first onset of mania in clinical adolescents have ranged between 1.7 and 2.2 per 100 000 (Soutullo et al., 2005).

Concordant with adults, adolescent females tend to have more of all subtypes of anxiety disorders, irregardless of age. However, the onset of anxiety seems to be the same for the sexes. Prospective community-based research reveals differential peak periods of onset of specific subtypes of anxiety: in middle childhood, separation anxiety and specific phobias, in late childhood overanxious disorder, in middle adolescence social phobia, in late adolescence panic disorder, and in young adulthood GAD and OCD (Merikangas et al., 2009). Prospective studies have revealed a sharp increase in anxiety disorders in females beginning as early as 5 years of age and continuously increasing throughout adolescence. In males, anxiety disorders also increase throughout childhood and adolescence, but the rise is far more gradual than in females, and rates begin to level off in late adolescence. No gender differences exist in the duration of anxiety disorder (Merikangas et al., 2009).

2.2.2. Externalizing disorders

Externalizing disorders are linked to underregulation of behavior and are associated with aggressive and impulsive behaviors that can be destructive towards property or personal relationships (Holmberg, Robinson, Corbitt-Price, & Wiener, 2007). In a psychiatric taxonomy of disorders, externalizing disorders include oppositional

defiant disorder (ODD), conduct disorder (CD), and attention-deficit hyperactivity disorder (ADHD), which predominate in childhood and adolescence.

The prevalence rate of ADHD in 5- to 15-year-olds has found to be 2.2%, (Ford et al., 2003), while the prevalence for individuals aged 4-17 years has varied between 2.0% and 8.7% (Froehlich et al., 2007; Roberts et al., 2007). Males tend to more often have ADHD than females. Rates of ADHD in recent surveys consistently show a male preponderance of ADHD, ranging from 1.5% to 11.8% in boys, and from 0.3% to 5.4% in girls (Merikangas et al., 2009). The finding for whether ADHD is linked to socioeconomic status is inconsistent. While Roberts and colleagues (2007) found no difference between family income and education and rates of ADHD, Froehlich and colleagues (2007) reported that ADHD was twofold within low-income families relative to the wealthiest families. Conduct disorders have been found to be more prevalent (3- to 4-fold) in males than in females, while the gender difference in prevalence rates of ODD is less clear. Some studies find higher rates in boys, but others find very similar rates in boys and girls. Age at onset of disruptive behavior disorders appears to be an important predictor of outcome, with earlier onset associated with more aggressive behaviors (Merikangas et al., 2009). The prevalence rates of substance use disorder are inconsistent. Some studies show the same prevalence rates for the sexes (Angold et al., 2002), other researchers report higher rates for males than for females (Roberts et al., 2007). Substance use disorders have been generally demonstrated to be more common in white youths and equally distributed by parental social class (Merikangas et al., 2009).

2.2.3. Psychiatric comorbidity in adolescence

The term comorbidity in psychiatry describes the presence of an additional psychiatric or medical diagnosis in a person with a psychiatric disorder (Arcelus and Panos, 2005). Comorbidity has been classified into two types according to the nature of the psychiatric disorders. The construct of homotypic comorbidity is used when a person suffers from two or more disorders that are part of the same diagnostic group, e.g. major depressive disorder and dysthymia. By contrast, the construct of heterotypic comorbidity is used when disorders are not part of the same diagnostic group, e.g. obsessive-compulsive disorder and schizophrenia (Arcelus & Panos, 2005).

Psychiatric comorbidity is very common in children and adolescents. For example, a study by Ford and colleagues (2003) found that about 25% of those who had a

psychiatric disorder had at least one other type of disorder, 2-5% had three types of disorders, and 0.7-2% had four types of disorders fulfilling diagnostic criteria. According to this large British Child and Adolescent Mental health survey, researchers demonstrated that disruptive behaviors (including oppositional defiant disorder and conduct disorder) were most prevalent with ADHD. Of those with a diagnosis of ADHD, 30-50% had a comorbid disruptive behavior disorder. Further, disruptive behavior was also linked to comorbid internalizing disorders such as depression and anxiety. A third very common comorbidity was depression with anxiety disorders. These disorders can exist in either order; children with primary anxiety disorder may have comorbid disruptive behavior disorder or children with disruptive behavior disorder can have secondary anxiety disorder. Substance abuse, especially early-onset substance misuse, is highly associated with psychopathology. For example, Abraham and colleagues (2003) studied incarcerated young people and noted that up to 30% of females and 20% of males with substance use disorders had comorbid major psychiatric disorders such as psychosis or affective disorders. Further, in the same study, half of the young people also met the criteria for ADHD.

It seems to be very common that children or adolescents with an anxiety disorder also have another type of anxiety disorder. Masi and colleagues (2004) found that up to 75% of children and adolescents with an anxiety disorder also had another comorbid anxiety disorder. Anxiety disorders have been associated with many other classes of disorders, including mood disorder, eating disorder, disruptive behavior disorder, and substance use disorder (Merikangas et al., 2009). It has been supposed that co-occurrence of anxiety disorder and mood disorder in young people might be a developmental process from early onset of anxiety disorder to later depression in adulthood (Merikangas et al., 2009).

Most adolescents with a diagnosed eating disorder (bulimia nervosa, anorexia nervosa, or eating disorder not otherwise specified) also have comorbid psychiatric diagnoses. Depression has been commonly linked to anorexia. A study by Lucka (2004) found that 73.3% of adolescents diagnosed with anorexia also fulfilled the diagnostic criteria for depression. In the same study, in those teenagers with bulimia nervosa, the rate of comorbid depression was lower, 20%. Milos and colleagues (2004) noted that among patients with an eating disorder 54% also had anxiety, 52% had affective disorder, and 25% had substance-related disorders. This study sample comprised both adolescents and adults.

Both bipolar disorder and major depression disorder have been associated with many other disorders, including anxiety disorder, oppositional defiant disorder, ADHD, and conduct disorder (Merikangas et al., 2009). According to an earlier follow-up study, childhood anxiety disorder and depression and to a lesser extent

disruptive behavior disorder predicted bipolar disorder in early adulthood (Cohen et al., 2000).

2.3 Effect of sociodemographic background and social support on psychiatric disorders

2.3.1 Socioeconomic status and family structure

Socioeconomic status (SES) of the family creates the development environment of a child (Bradley & Corwyn, 2002). Socioeconomic status of the family may be defined by a number of interrelated factors, including parental education, family income, and membership in specific subcultures and communities (Nurmi 2004). Traditionally, family SES has been operationalized as characteristics of the father, such as occupational or labor status and educational level (Entwisle & Astone 1994). In a recent study of adolescent samples, SES has also been measured as parental education and income (absolute measures of SES), relative deprivation and community level income inequality (relative measures of SES), and subjective measures of perceived SES (McLaughlin et al., 2012). According to this national survey of US adolescents, subjective social status was most consistently related to the studied mental disorders such as mood, anxiety, substance and behavior disorders. Lower parental education was also associated with higher odds of mental disorders, while family income and relative measures of SES were not (McLaughlin et al., 2012). In adolescent community samples in Finland, parental education level or occupation has not been found to be associated with adolescents drinking habits or depression (Huurre et al., 2003; Pelkonen et al., 2003).

Family structure is a variable that is widely studied and usually controlled for in studies on adolescent populations. According to the literature the best- adjusted adolescents are associated with the nuclear family, family with two biological parents. Other family structures, such as divorced or single- parent families, blended families or stepparent families, have been associated with depression, anxiety, heavy drinking, use of substances other than alcohol, suicidality, and excessive psychosomatic symptoms in adolescents (Fröjd et al., 2007; Kaltiala-Heino et al., 2001; Seljamo et al., 2006). The reason behind these differences between adjustment in nuclear families and other types of family is usually parental divorce. Parental divorce has been associated with several secondary stressors and thus, it may be that family

processes and different distribution of risk factors between family types explain adjustment better than family composition per se (Barret & Turner, 2005; Barret & Turner, 2006).

2.3.2 Perceived support from family and friends

Adolescents' health experiences are strongly related to social, physical and psychological environments (Välimaa, 2000). The most significant social context in which the child develops is the family (Gariépy, Honkaniemi, & Quesnel-Vallée, 2016). Family is the environment, where identity formation and individuation is developing, helping the adolescent to socialize (Sperry & Widom, 2013; Newman, Harrison, Dashiff, & Davies 2008). Support from family and parents is, more often than any other source, related to adolescent mental health development and protection from depression (Gariépy, Honkaniemi, & Quesnel-Vallée, 2016). Parents are the source of support that children and adolescents rely on to meet their basic emotional and material need (Boudreault-Bouchard et al., 2013). According to the systematic review by Gariépy and colleagues (2016), parental support was important particularly for girls. This same review reported that while maternal support was important for the mental well-being of girls, paternal support was important in child behavior, equally in boys and girls.

Social isolation and low level of perceived social support have been linked to poorer psychological functioning and severe psychopathology (Thompson, 2014). For example, adolescent suicide attempters perceived significantly lower levels of social support than their age- and sex-matched controls (Kumar & George, 2013). It has also been suggested that traumatic events, like abuse and neglect, hamper the development of a child's or adolescent's social cognition, leading to difficulties in getting along with other people (Koizumi & Takagishi, 2014).

The role of peers is important in adolescence. Peer support has been shown to play a prominent role in the psychological development of children (Gariépy et al., 2016). However, friends' support has not been demonstrated to protect children and adolescents from depression. Peers or friends are more transitory and researchers have hypothesized that friends may be less reliable sources of support than family (Gariépy et al., 2016).

2.3.3   Victimization of school bullying

School is the environment, where adolescents spend most of their daytime hours, and if this environment feels safe and there are adequate social contacts it promotes satisfaction with life (Horsmanshof, Punh, & Creed, 2008). It has been shown that adolescents who have lived in a violent environment, either an environment with intimate partner violence or an environment with other family- related maltreatment, may be inclined to become victims of bullying, bullies, or bully-victims (Bauer et al., 2010; Mustanoja et al., 2011). Bullying has recently garnered much attention and has been recognized as a social problem, with about 10-20% of children and adolescents being regularly involved in school bullying, either as victims, bullies, or both (Kaltiala-Heino & Fröjd, 2011). According to the study by Turner and colleagues (2013), adolescents of both genders (N=1874) who had experienced any type of bullying victimization had higher levels of depression and suicide ideation than those who reported no bully victimization. Also adolescents who reported being verbally bullied had higher rates of depression than those not bullied.

2.4   Measurements for adolescent psychopathology

Measurement in psychiatry consists of the operationalization and recording of a subjective experience. In the clinical practice of psychiatry, the presence or absence of a particular disorder is based on the subjective interpretation of mental and behavioral descriptions offered by the patient. The interpretations are based on information provided in questionnaires (also called instruments or scales) or interviews (Gilbody et al., 2003). The classification of psychiatric disorders requires a method for collecting information and a method for combining the information to make an accurate diagnosis. The interview is the most common method for collecting information. Since the interviewer makes the judgment based on the presence of symptoms, these kinds of interviews are called interviewer-based or semistructured (Angold et al., 2012).

Many semistructured and structured diagnostic interview schedules have been developed to assess the lifetime and presence of the major categorical psychiatric disorders in children and adolescents. These include the Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS) and the National

Institute of Mental Health's Diagnostic Interview Schedule for Children (NIMH-DISC). These kinds of interviewer-based instruments provide a standardized format for parent with child or adolescent interviews to determine the presence, duration, and severity of symptoms along DSM diagnostic lines (Sajatovic & Ramirez, 2012). Instruments differ regarding the flexibility permitted to the interviewer, the degree of clinical training required of interviewers, the order and phrasing of questions, and the time frame and range of disorders assessed. Instruments also vary concerning their intended purpose and subject population, e.g. clinical patients versus non-referred community subjects (Angold et al., 2012). Also children and adolescents of different ages need different methods of collecting data and interviewing. Methodological studies and clinical experience suggest that parents or guardians are reliable regarding the reporting of childrens' or adolescents' disruptive or externalizing behaviors (Lempp et al., 2012). On the other hand, adolescents are more trustworthy with regard to reporting internalizing disorders such as anxious or depressive symptoms or suicidal thoughts or behavior (Lempp et al., 2012).

Self-rating scales are useful in quantifying the presenting severity of a symptom, thus serving to monitor clinical progress. Self-rating scales are usually easy and economical to administer since no clinician or professional staff time is required. There are different kinds of rating scales for different purposes. The above-mentioned diagnostic scales are usually designed to be used as a one-time assessment, while others are meant to be repeated sequentially, enabling evaluation of change over time. Symptom-based scales or symptom checklists provide a useful screen for the presence or absence of a particular symptom or a broad range of symptoms. These kinds of scales are not targeted to a specific psychiatric diagnosis (Sajatovic & Ramirez, 2012).

2.4.1. Symptom Checklist-90

One of the self-report rating scales is the Symptom Checklist-90 (SCL-90; Derogatis et al., 1973). SCL-90 is a 90-item multidimensional questionnaire for persons aged at least 13 years. It was constructed to measure both general psychological distress or symptom intensity and specific primary symptoms of distress on nine different subscales. The total score is used as an indicator for general psychological distress, and the nine subscale scores are used as indicators for specific primary symptoms. The SCL-90 subscale scores are interpreted in terms of specific primary symptoms

since they bear a strong relationship to a specific (DSM-5) syndrome (Smits et al., 2015).

The SCL-90 psychometric properties have been tested with community (e.g. Olsen et al., 2004), psychiatric outpatient (e.g. Holi, 2003), and inpatient samples (e.g. McGough & Curry, 1992). The SCL-90 is widely used as an indicator of psychological distress and change in symptoms (Prinz et al., 2013; Nickel et al., 2007) and treatment outcome (Boon & Boer, 2007).

The time period evaluated with the SCL-90 is "seven days including today", but a flexible time window is also possible and evaluations over other specific periods of time are feasible. Items in the questionnaire are rated on a five-point scale of distress, from none (0) to extreme (4). The administration time is 12-20 minutes. Each of the nine dimensions contains six to thirteen items. The SCL-90 comprises the following nine primary symptom dimensions:

Somatization (SOM) contains 12 items reflecting distress arising from bodily sensations from, for instance, the cardiovascular, respiratory, or gastrointestinal systems. These symptoms may reflect anxiety disorders, but also physical illness.

The obsessive-compulsive (O-C) dimension contains 10 items and reflects symptoms typical for obsessive-compulsive disorders. The focus is on thoughts, actions, and impulses experienced as irresistible.

Interpersonal sensitivity (INS) contains 9 items and focuses on feelings of insufficiency and inferiority in comparison with others.

Depression (DEP) contains 13 items that are typical for depressive syndromes such as hopelessness, lack of motivation, and loss of energy. Thoughts of suicide and cognitive and somatic correlates of depression are also included.

Anxiety (ANX) contains 10 items and is composed of symptoms associated with manifestations of anxiety such as nervousness and tension as well as feelings of panic.

Hostility (HOS) contains 6 items and is composed of thoughts, feelings, or actions characteristic of the negative affect state of anger.

Phobic anxiety (PHO) contains 7 items. Phobic anxiety leads a person to avoidance or escape behavior. In this questionnaire, the items focus on manifestations of agoraphobia.

Paranoid ideation (PAR) contains 6 items and is represented in this scale as a disordered mode of thinking, including projective thinking, suspiciousness, grandiosity, fear of loss of autonomy, and delusions.

Psychoticism (PSY) contains 10 items and reflects a continuum of from mild interpersonal alienation to dramatic evidence of psychosis.

The additional items category includes 7 items, which are not scored collectively as a dimension. These items include mainly disturbances in appetite and sleep patterns.

Three global indices reflect mean overall distress. The instrument's global index of distress is termed the Global Severity Index (GSI), and it provides a mean value of all 90 items. The Positive Symptom Distress Index (PSDI) is the average score of all items scored above zero. The Positive Symptom Total (PST) is the number of items scored above zero. The GSI is proposed to be the best indicator of the current level of distress.

Despite the wide use of SCL-90 as a measure of psychopathology, there are some controversial findings of the factor structure with different patient populations and community samples (Hoffman & Overall, 1978; Holcomb et al., 1983; Hafkenscheid, 1993; Holi, 2003). Also one general factor accounting for a large proportion of variance has been found in some studies with adults (e.g. Bonynge, 1993). On the other hand, there are studies that have reported that in using discriminant analysis the ability of SCL-90 to discriminate patients from the community sample was good (Holi, 2003; Bonicatto et al., 1997). Additionally, the SCL-90 subscales of depression and anxiety have shown good convergent and divergent validity (Koeter, 1992; Morgan et al., 1998).

2.5 Adverse childhood experiences

Adverse childhood experiences (ACEs) are stressful or traumatic events that a adolescent encounters during the first 18 years of life. ACEs include abuse, such as physical, sexual, and emotional abuse; neglect, such as physical and emotional neglect; and household dysfunctions, such as intimate partner violence, mother treated violently, substance misuse within the household, household mental illness, parental separation or divorce, and an incarcerated household member (Felitti et al., 1998). Child abuse is defined as "actions that cause harm or the threat of harm to a child". Harm to a child may or may not be the intended consequence (Leeb et al., 2008). Child neglect is defined as "failure to provide for a child's basic physical, emotional, or educational needs or to protect a child from harm or potential harm". Again, harm to a child might not be the intended consequence (Leeb et al., 2008).

ACEs are common. In a large study (Felitti et al., 1998) conducted with adults in California (13 494 respondents), the prevalence of childhood psychological abuse was 11.1%, physical abuse 10.8%, and sexual abuse 22.0%. The prevalence of parental substance abuse was 25.6% and parental mental illness 18.8%. The mother had been treated violently according to 12.5% of respondents, and 3.4% reported criminal behavior in the household. ACEs often co-occur. In the same study, more than half of the respondents (52%) reported being exposed to one or more ACEs, almost 40% reported two or more ACEs, and up to 12.5% experienced four or more ACEs. In a nationally representative American study conducted in 2008 (Finkelhor et al., 2009), 61.0% of children and youth had experienced at least one ACE per year. In 2011, this figure slightly decreased to 57.7% (Finkelhor et al., 2013). Sexual abuse is typically related to female sex (Finkelhor et al., 2013). Of adolescents aged 14-17 years, 22.8% of girls reported sexual victimization in the last year (5.6% of the whole study population), and the proportion of lifetime sexual abuse was significantly higher for girls than for boys (17.7% vs. 4.2%).

ACEs have a dose-response relationship with many health, social, and behavioral problems throughout the lifespan. Studies have discovered that ACEs have graded relationships with later ischemic heart disease, cancer, chronic bronchitis, or emphysema (Felitti et al., 1998), pain and disability (Chartier et al., 2010), sleeping disorders or disturbances (Kajeepeta et al., 2015), alcohol abuse (Dube et al., 2002), risk of illicit drug use, risky sexual behavior, and human immunodeficiency virus, (HIV; Dube et al., 2003), mental health problems like depression (Chapman et al., 2004), anxiety and posttraumatic stress disorder (Mc Laughli, et al. 2012; 2013), and

suicide (Dube et al., 2001). Further, people exposed to ACEs who have mental health disorders are more likely to have also co-occurring alcohol or substance use disorders relative to people without mental health problems (Choi et al., 2017).

ACEs caused by other people, especially parents and significant others lead to childhood interpersonal trauma. Van der Kolk and Andrea (2010) have defined domains of symptoms that this kind of trauma may cause: affect and impulse dysregulation; disturbances in attention, cognition, and consciousness; interpersonal difficulties, and somatization and biological dysregulation. In addition, a systematic review of ACEs and psychological adjustment has shown that exposure to ACEs has negative effects on self-esteem, peer relationships, academic performance and social competence (Pacheco et al., 2014).

The social environment in which children live shape their cognitive development, including both general cognitive ability and executive function (higher-order cognitive abilities such as working memory, attention, cognitive flexibility, and planning (Nelson et al., 2006; Nisbett et al., 2012). Thus, stress or adversity in early life can impair a child's cognitive performance. It has been shown that children who have been exposed to multiple adverse experiences have worse cognitive outcomes than children who have not been exposed to these adversities (Rutter, 1979; Sameroff et al., 1987). Some studies have more specifically explored the relationship of timing of ACEs and cognitive development. For example, Ayoub and colleagues (2009) examined disparities in cognitive scores between children with low and high levels of adversities, and found these disparities to increase as children aged, with the earliest impairments in cognitive performance being evident as early as 14 months in those with high levels of exposure. According to the review by Guinosso and colleagues (2016), studies concerning ACEs and cognitive development support the notion that both general cognitive ability and executive functioning are shaped by experiences over time, and ACEs as early as the first year of life alter developmental trajectories across childhood.

2.5.1. Stress and brain development

No one is immune to stress or adversity, which is why it is crucial to learn how to cope with stress during childhood (Center on the Developing Child at Harvard University, 2016). Stress and stress responses have been categorized into three types. First, stress can be normal or positive, characterized by a brief increase in heart rate, blood pressure, and hormone levels. This kind of stress is essential for development

because it promotes growth by helping children to understand and cope with life's challenges and hardships (Center on the Developing Child at Harvard University, 2016; National Scientific Council on the Developing Child, 2015). Stress can also be tolerable. Tolerable stress is more long-lasting or severe, and it activates the body's alert system to a greater degree. If the response is time-limited and buffered by supportive parental relationship, the brain and organs recover quite quickly (Center on the Developing Child at Harvard University, 2016). This kind of stress helps children develop coping skills needed to respond to adversity (National Scientific Council on the Developing Child, 2015). If stress is characteristic as toxic, resulting from major, frequent, or prolonged adversity, such as repeated abuse or neglect or parental severe mental health problems or alcohol abuse, stress can disrupt the brain architecture. The key feature of toxic stress is the absence of a supportive adult who could help buffer the child's physiological and emotional response, returning the child to baseline. Toxic stress is related to increased risk for stress-related diseases, cognitive impairment, behavior problems, and physical and mental health disorders (Center on the Developing Child at Harvard University, 2016; National Scientific Council on the Developing Child, 2007). With particularly extreme, chronic, and severe abuse during the sensitive early periods of brain development, the regions of the brain involved in impulsive, fear, and anxiety responses may overproduce neural connections at the expense of the regions dedicated to reasoning, planning, and behavior control (National Scientific Council on the Developing Child, 2014).

Toxic stress can affect developing brain circuits and hormonal systems, leading to poorly controlled stress response systems that will be overly reactive or slow to shut down when faced with threats throughout the lifespan. Extensive attention have received two hormonal systems: the sympathetic-adrenomedullary system (SAM), which produces adrenaline in the central part of the adrenal gland, and the hypothalamic-pituitary-adrenocortical system (HPA), which is responsible for producing cortisol in the outer shell of the adrenal gland (National Scientific Council on the Developing Child, 2014). As a result of chronic stress, excessive production of corticotropin-releasing hormone (CRH), which regulates the HPA system, leads to damage of the hippocampus, an area that is critical to learning and memory as well as stress response regulation (Brunson et al, 2002; National Scientific Council on the Developing Child, 2014). Consequently, the brain's focus is on rapid stress responses, leading to impulsive decisions and actions. Children may feel threatened even when no real threat exists. Children may also see anger or hostility in a facial expression that is actually neutral, and an excessively anxious feeling may remain long after a threat has passed (Loman & Gunnar, 2010; National Scientific Council

on the developing child, 2015; Center on the Developing Child at Harvard University, 2011 and 2016).

In a neuroimage study, Walsh and colleagues (2014) found a clear association between ACEs at age 14 years and reduced gray matter volume. They suggested that this association occurs with moderate but relatively chronic parental discord. Additionally, parental discord has been found to be a common trans-diagnostic risk factor for many psychiatric disorders (Kessler et al., 2010). Further, smaller cerebellar vermal GMV has been linked to ADHD, CD, bipolar disorders, affective disorders, and autism (Bledsoe et al., 2009; Baldacara et al., 2011a,b; Courchesne et al., 1988; Fairchild et al., 2011).

Social environment were children's live, shape their cognitive development, including both general cognitive ability and executive function (higher-order cognitive abilities such as working memory, attention, cognitive flexibility, and planning (Nelson et al., 2006; Nisbett et al., 2012). Thus stress or adversity in early life can impair child cognitive performance. It has been shown that those children who have exposed multiple adverse experiences have worse cognitive outcomes related to children who have not exposed adversities (Rutter, 1979; Sameroff et al., 1987). There are some studies that have more accurately explored the relationship of timing of ACEs and cognitive development. For example Ayoub and colleagues (2009) studied disparities in cognitive scores between children with low and high levels of adversities, and they found that disparities increased as children aged, and the earliest impairments in cognitive performance was evident as early as 14 month with those who had exposed high levels of adversities. According to the review by Guinosso and colleagues (2016), studies concerning ACEs and cognitive development support the notion that both general cognitive ability and executive functioning are shaped by experiences over time, and ACEs as early as the first year of life alter developmental trajectories across childhood.

2.5.2. Relation between adverse childhood experiences and adolescent psychopathology

As mentioned before, toxic stress is associated with increased risk for stress-related diseases, cognitive impairment, behavior problems, and physical and mental health disorders. Thus, it is not surprising that adolescents admitted to psychiatric hospital have been exposed to adverse childhood experiences more often than the general population.

A recent Finnish study of 508 adolescent psychiatric inpatients (Isohookana et al., 2013) reported that approximately 25% of adolescent inpatients had experienced physical abuse, 23% of girls and 3% of boys had experienced sexual abuse, and 31% of girls and 28% of boys had witnessed intimate partner violence. Concerning household dysfunctions, 62% of boys and 46% of girls came from families with parents' divorce. Further, 34% of girls and 28% of boys came from families with parental substance use problems and 24% of girls and 13% of boys came from families with parental psychiatric problems. In addition 18% of girls and 26% of boys had exposure to parental unemployment, and 11% of boys and 6% of girls experienced the death of one or both parents. In that study, the highest risk factor for both suicide attempts and non-suicidal self-injuries was sexual abuse. Further, in girls, multiple ACEs were associated with both of these events. According to study of Isohookana and colleagues (2013) among all deceased adolescents (n = 16), ACEs were most notable among those who had died due to accidents and injuries. In a large American child and adolescent psychiatric inpatient study (N = 1079), those individuals who had a history of sexual and/or physical abuse were diagnosed more likely with multiple disorders, they used more medication, and they were treated with antipsychotic medication more often than non-traumatized patients. Both sexual and physical abuses were independently associated with longer treatment periods (Keeshin et al., 2014).

Adverse childhood experiences are a common societal problem with an important role in shaping risk for mental health problems across the lifespan (McLaughlin et al., 2013). Children who have been exposed to adversities are more likely to develop mental health problems than children who have never experienced adversity. Children who have encountered high levels of adversities are more than four times as likely to develop a mental disorder before adulthood relative to children who have not been exposed to adversities (McLaughlin et al., 2012). Adversities are risk factors for childhood mental disorders but they also create a long lasting vulnerability to psychopathology that persists into adulthood (Green et al., 2010).

Such adversities as sexual and physical abuse and neglect in childhood are risk factors for behavioral and emotional problems, including anxiety, depression, posttraumatic stress disorder symptoms, eating disorders, suicide attempts, conduct disorders, and aggressive, disruptive, or violent behavior (Dube et al., 2001; Gilbert et al., 2009; McLaughlin et al., 2012; 2013; Widom, DuMont & Czaja 2007). Studies show that all kinds of abuse may lead to either internalizing or externalizing disorders. For example, physical abuse is related to major depression, emotional regulation, alcohol dependence, and externalizing problems (Afifi, Brownridge, Cox, & Sareen, 2006; Heleniak et al., 2016; Miller-Perrin, Perrin, & Kocur, 2009). Sexual

abuse in childhood is associated with lifetime risk of depression, alcohol and drug dependencies, externalizing disorders, emotion regulation, panic disorder, PTSD, and suicidality (Dube et al., 2001; 2005; Heleniak et al., 2016). Emotional abuse is linked to both internalizing and externalizing disorders and emotion regulation (Heleniak et al., 2016).

Household dysfunctions comprise living situations in a family where parent(s) have mental health or alcohol/substance use disorders, intimate partner violence, parent(s) exhibit criminal behavior, or parents have divorced. Studies have shown an association between adolescent externalizing disorders and parents' divorce, living in a single-parent family, and one or both parents having mental health or substance use disorders (de Boer, van Oort, Donker, Verheij, & Boon, 2012; Bratek et al., 2013; Moffitt & Caspi, 2001; Yule et al., 2013). Parental mental health problems and alcohol or substance use problems have also been linked to internalizing problems in adolescents (Bibilola et al., 2010; Chassin, Pitts, Delucia, & Todd, 1999; Hammen, Rudolph, Weisz, Rao, & Burge, 1999). Further, family history of alcohol dependence has been shown to predict poor neuropsychological functioning of offspring (Dube et al., 2006). Additionally, adolescents living in a home with intimate partner violence exhibit clinical levels of anxiety, PTSD (Graham-Bermann & Levendosky, 1998), and aggression (Mohammad, 2014).

Pietrek and colleagues (2013) investigated whether age at exposure to ACEs has an effect on diagnoses or severity of symptoms. Their study comprised adult patients suffering from borderline personality disorders (BPDs), major depressive disorders (MDDs) and schizophrenia. According to this study, emotional maltreatment was substantial in all patients, irrespective of diagnosis. This study adduced that BPD and MDD differed with respect to adversities across age. Patients with BPD had experienced more adversities and especially sexual abuse than MDD patients particularly around puberty. Patients with schizophrenia had exposed least adversities compared to other groups. This study confirmed early, prepubescent experiences as predictor of BPD, but not MDD and schizophrenia.

Some sex differences in ACEs exist according to Cater and colleagues (2014). In both sexes, the higher the number of types of maltreatment, the higher the prevalence of multiple problems. However, girls tended to more often suffer from anxiety, depression, posttraumatic stress, suicide attempts, self-harm, and multiple problems, whereas boys more often engaged in criminality and alcohol use.

2.6   Suicidality in adolescence

Suicidality refers to all suicide-related behaviors and thoughts, including completed or attempted suicide and suicidal ideation or communication (Bridge, Goldstein, and Brent, 2006). Suicidal behavior (SB) is a continuum from suicidal ideation (SI) to death by self-directed injurious act. Suicidal ideation refers to thoughts of suicide that can range in severity from a vague wish to be dead to active suicidal ideation with a specific plan and intent. SI is defined as thinking about or planning to engage in behaviors with the intent to end one's life. Suicide attempt refers to engagement in potentially self-injurious behavior in which there is at least some intent to die. Finally, suicide is death caused by self-directed injurious behavior with any intent to die as a result of the behavior (Nock, 2010).

SB is rare in children prior to puberty (Evans, Hawton, Rodham et al., 2005). Adolescence and early adulthood are generally seen as periods when the incidence rates of suicidal ideation, suicide attempts, and suicides increase sharply (Nock, 2010). Depression and substance abuse, as psychiatric risk factors, become more frequent in adolescence, and these disorders contribute to the increase of SB. From a developmental point of view, SB may also be related to identity formation, which is the most important crisis in this period of life. Failing to develop a stable and consistent identity may lead to identity confusion and problems in self-integration. Further, identity confusion may be related to depression or substance use disorders in adolescence (Foto-Özemir et al., 2016).

Suicide is an important concern in adolescence. Suicide is the second leading cause of death among individuals aged 15-29 years (WHO, 2014), and between the ages of 15 and 19 years, 4-8% of adolescents show some SB. Suicidal ideation is more frequent than suicide attempt. The prevalence of suicidal ideation is approximately 15-25% in adolescence. Suicidal ideation can vary in severity from thoughts of death and passive ideation to specific suicidal ideation with intent or plan. By contrast, lifetime estimates of suicide attempts among adolescents range from 1.3% to 3.8% in males and from 1.5% to 10.1% in females (Bridge, Goldstein, & Brent, 2006). In Finland, youth suicide rates have declined by approximately one-third during the past two decades and continue to decline (Statistics Finland, 2011, 2012, 2015). In Finland, 37% of all deaths among individual aged 15-24 years were suicides (Statistics Finland, 2012). At the time of data collection for this study, in Finland there were 47 adolescent (age 15-19 years) suicides in the year 2006, 39 in 2010, 28 in 2014, and 23 in 2016. However, estimates are higher in clinical-based adolescent samples than in

the community, estimates for the former being as high as 24-33% (Asarnow et al., 2011). While suicidal ideation is most common at the beginning of adolescence, the prevalence of suicide attempts is highest at the end of adolescence. The number of suicide deaths increases during early adulthood (Grandclerc et al., 2016). Researchers have consistently found that while females are more likely to attempt suicide, males are more likely to die by suicide (Plener et al., 2009; Nock et al., 2008). For every one female death by suicide, three males die by suicide worldwide (Krug et al., 2002).

Suicidal behavior has been documented to be recurrent. A history of suicide attempt is, according to an earlier study, the most powerful risk factor for later SB, including death by suicide (Rudd, 2006). Estimates of the risk of repetition of SB range from 10% in a six-month follow-up to 42% in a 21-month follow-up (Bridge, Goldstein, & Brent, 2006). Previous studies have identified some differences between single and multiple suicide attempters. Multiple attempters are more likely to have borderline traits, suicidal ideation, hopelessness, and more severe depressive symptoms (Forman et al., 2004). Further, multiple attempters come from families with SB, they suffer from severe psychopathology, and they show poorer coping history than single attempters (Bryan et al., 2008; Forman et al., 2004).

According to earlier studies, suicidal intent is a discriminative and predictive variable for repetition of suicide attempts and death by suicide (Brent et al., 1988). Discriminative items between attempters and those who have died by suicide include evidence of planning, expressing a wish to die, taking care to avoid detection, and confiding suicidal plans ahead of time (Brent et al., 1988). One-third of suicide attempters with the highest suicidal intent reported being motivated to die or to permanently escape a painful situation. These adolescents also show a high risk for recurrent suicide attempts (Bridge, Goldstein, & Brent, 2006).

Methods of suicide vary. While in most Western countries, hanging and vehicular exhaust predominate, followed by firearms and poisoning among youth, in the United States the three leading methods of suicide are firearms, hanging, and poisoning. Suicide by jumping is not very common in most countries, except for Hong Kong (Bridge, Goldstein, & Brent, 2006). According to a 25-year database on suicides among children and adolescents (<18 year) in northern Finland, firearms were the predominant method among both genders. For males, hanging was the second most common method, followed by gas. For females, the second most common was traffic suicide, followed by drug overdose. (Lahti et al., 2014). Those carrying out a suicide attempt of high medical lethality (like hanging, shooting, or jumping) are at extremely high risk to die as a result of the attempt. It is noteworthy that a suicide attempt of low lethality does not indicate low suicidal intent. Especially younger children lack sufficient cognitive maturity to formulate and execute a

suicidal plan. By contrast, an impulsive individual with a lethal method available (like firearm or paracetamol) may result in a medically serious or even fatal attempt with a relatively low intent (Bridge, Goldstein, & Brent, 2006).

2.6.1. Non-suicidal self-injury

Non-suicidal self-injury (NSSI) has been defined as intentional destruction of body tissue in the absence of any observable intent to die (Nock, 2010). The most common methods are usually cutting, hitting or banging, scratching, carving, and scraping. The definition excludes indirect self-injurious behaviors, such as drug abuse or eating disorders, and also socially accepted behaviors, such as tattooing or piercing (Zetterqvist, 2015). This definition also explicitly excludes behaviors engaged in with any level of suicidal intent (Nock, 2010).

Epidemiological research suggests that developmental trends exist in rates of NSSI, with the highest rate present in mid-adolescence (around 15-16 years of age), declining towards late adolescence (around 18 years; Brown & Plener, 2017). Recent research has estimated that the prevalence of NSSI in adolescents' ranges from 7.3% as a 12-month rate to 18.0% as a lifetime rate (Muehlenkamp et al., 2012), with the corresponding rates in third- and sixth-graders being 4.0% and 7.6%. Rates of adolescents meeting an independent disorder of NSSI according to DSM-5 are lower, ranging from 1.5% to 6.7% in community samples (Barrocas et al., 2012; Brown & Plener, 2017). Contrary to community samples, adolescent psychiatric patient rates of NSSI have been found to be as high as 60% for one incident of NSSI and about 50% for repetitive NSSI (Brown & Plener, 2017).

Earlier studies have also found gender differences in NSSI. According to Barrocas and colleagues (2012), rates of NSSI did not differ for boys and girls for younger youth (third and sixth grade), but older girls (ninth grade) were three times more often engage in NSSI than same-aged boys; this finding suggests that it is not until the transition to adolescence that the gender difference in NSSI engagement emerges. Also methods differ between genders and development periods. Older girls have reported cutting or carving their skin most often, while same-aged boys have reported hitting themselves. Younger girls have reported hitting themselves most often (Barrocas et al., 2012; Rodham, Hawton, & Evans, 2004).

As noted earlier, the prevalence of NSSI depends on developmental phase, occurring most often in early to mid-adolescence and ceasing in young adulthood. Much attention has recently been focused on the brain development process in

adolescence, as brain maturation continues into late adolescence. Particularly the regions linked to emotional and behavioral reactivity evolve during this period, making adolescence a vulnerable phase for developing NSSI (Brown & Plener, 2017). Even if NSSI decreases in late adolescence, according to earlier studies, onset of NSSI in early age and repetitive NSSI seem to be related to continuing dysfunctional emotion regulation strategies, even after cessation of NSSI. Repetitive NSSI may also show high levels of substance misuse and risk of developing borderline personality disorder later in life (Brown & Plener, 2017; Groschwitz et al., 2015; Nakar et al., 2016). Further, NSSI has been found to be a significant risk factor for later suicide attempts and completed suicides (Brown & Plener, 2017).

2.6.2. Suicidal behavior with non-suicidal self-injury

Despite the different nature of NSSI and SB, NSSI and SB are frequently associated. While NSSI occurs more typically than SB in adolescence, the principal risk is that NSSI will become chronic and progress towards other forms of self-injurious behavior like suicide attempts (Grandclerc et al., 2016). The risk of suicide attempt and death by suicide is higher in adolescents who have engaged in NSSI. In adolescents with a history of NSSI, the prevalence of at least one suicide attempt is 70% and numerous suicide attempts 55% (Nock et al., 2006; Hargus, Hawton, & Rodham, 2009).

Several studies have explored whether NSSI is a risk factor for later suicide attempt. Some studies have established correlations between suicide attempt and frequent NSSI and use of several different NSSI methods (Klonsky & Glenn, 2008; Victor & Klonsky, 2014). Also such NSSI characteristics as duration longer than one year, cutting, high frequency of NSSI, high number of methods, absence of physical pain during the act, and severe physical damage are associated with higher rates of suicidal acts (Grandclerc et al., 2016). However, an anti-suicide model argues that NSSI is a protective factor against suicidal behavior. For example, NSSI could act as a microsuicide, creating an illusion of control over death, thus serving as a coping or self-regulation mechanism (Firestone & Seiden, 1990). Further, NSSI has been seen as a means to avoid suicide attempt by channeling destructive impulses into NSSI (Firestone & Seiden, 1990).

Many authors have tried to elucidate why and how NSSI is a predictive factor for SB for some people but not for others. Even though there are different paths from NSSI to suicide attempt and death by suicide, the current evidence supports no single

theory that can explain all heterogeneous pathways (Hamza et al., 2012, O'Connor & Nock, 2014).

The first effort to understand the relationship between NSSI and SB was a Gateway theory. This theory is based on the assumption that NSSI and fatal suicides are two ends of the same spectrum, i.e. two different manifestations of the same behavior, and thus, NSSI should be seen as an alarm requiring particular attention (Grandclerc et al., 2016). This theory is supported by retrospective and prospective studies (Asarnow et al., 2011; Hamza, Stewart, & Willoughby, 2012; Cooper et al., 2005; Whitlock et al., 2013). For example, NSSI tends to have at an earlier age of onset, and thus, appears to precede SB (Hamza, Stewart, &Willoughby, 2012). NSSI also triples the risk of SB (Whitlock et al., 2013). Further, there is some evidence that NSSI may be a stronger predictor for future suicide attempts than a suicide attempt itself (Asarnow et al., 2011).

A second model, the Third Variable Theory, assumes the presence of a third variable linking NSSI and suicidal behavior. For example, young people who have died due to suicide and those with NSSI have been shown to have a high prevalence of similar psychiatric disorders (90% vs. 87%). According to earlier studies, variables to be taken into account might be depressive state, suicidal ideation, low self-esteem, unsupportive family, and borderline personality disorder (Grandclerc et al., 2016). Additionally, adolescents engaging in NSSI or SB have perceived impaired ability to tolerate stress and show higher levels of physiological reactivity in response to stress. Further, adolescents with NSSI or SB have reduced ability to solve social problems compared to those without lifetime NSSI or SB (Goldston et al., 2001; Nock, & Mendes, 2008).

The two above-mentioned models have faced some criticism due to theoretical and clinical limitations (Grandclerc et al., 2016). Joiner (2005) developed an integrated model adding a variable derived from the neurosciences, pain tolerance. Pain tolerance is due to repetition of NSSI, which might disrupt the pathways involved in stress-induced analgesia. This model known as Acquired Capability for Suicide offers different insight into why individuals with marked NSSI behavior attempt suicide. According to this theory, before one is capable of ending one's life, she/he must overcome the fear and pain associated with suicidal behavior. Thus, NSSI may be one way of habituating an individual to the fear and pain (Joiner, 2005). This theory has gained support from several studies. Individuals who have engaged in NSSI have reported more courage and competency in carrying out suicidal acts than suicide attempters without a history of NSSI (Muehlenkamp & Gutierrez, 2007; Franklin, Hessel, and Prinstein, 2011). Additionally, individuals engaging in NSSI have shown greater pain tolerance and pain thresholds than non-injuring controls

(Franklin et al., 2011; Hooley, Ho, Slater, & Lockshin, 2010). There is also some criticism of Joiner's theory. For example, in the study by Franklin and colleagues (2011), which described greater pain tolerance in those engaging in NSSI than in the control group, the NSSI group did not report more painful experiences than the control group; this suggests that individuals engaging in NSSI may have a higher pain tolerance prior to engagement in NSSI. Moreover, in a study of adolescent inpatients, Nock and colleagues (2006) did not find a significant relation between the frequency of NSSI and the frequency of suicide attempts.

Because none of these theories completely explain the pathway from NSSI to suicidal acts, Hamza and colleagues (2012) created an integrated model proposing several links between NSSI and suicide and including all of the above-mentioned models. They also commented that identifying other methods to assess an individual's intent may be useful in future and proposed that an adolescent's self-report about intent may be a more accurate predictor than using the medical severity of an injury, which may underestimate the individual's perceived lethality of intent.

2.7 Association of family dysfunction, social dysfunction, impulsivity, and alcohol use in adolescent mental health and suicidality

2.7.1. Family dysfunction

According to Offer et al. (1992), family dysfunction implies that an adolescent does not see him/herself as getting along well with his/her parents, and feels tension in the home. The adolescent sees parents as being non-supportive of each other and other family members. Parents are a disappointment, more fit for rejection than for emulation. According to Erkolahti and colleagues (2003), family dysfunction was related to depressive symptoms in both genders in a non-clinical adolescent population, but in boys family dysfunction was the most significant self-image scale associated with depressive symptoms, indicating that boys are more connected to their families than girls are. In a study by Korhonen and colleagues (2001) of adolescents seeking outpatient treatment, only female gender was associated with

family dysfunction. Treger and colleagues (2015) found in their study of an adolescent inpatient sample and control group, that inpatients, all of whom suffered from internalizing disorders, reported significantly more often family dysfunction than the control group. Similarly, Hintikka and colleagues (2002) in a sample of inpatient adolescents found that those suffered from mood disorders more often had family dysfunction especially the girls. Erkolahti and colleagues (2002) investigated adolescent female inpatients suffering from eating disorder, anorexia and bulimia. Comparisons between anorexic and normal comparisons showed no differences in family dysfunction, while bulimic girls showed significantly more family dysfunction than normal controls. In a study by Cetin (2001), three groups were compared; adolescent suicide attempters, non-suicidal psychiatric outpatients, and normal controls. Especially suicidal girls reported family dysfunction more often than girls in the other groups. Similar results were reported by Laukkanen and colleagues (2004). Those suicidal adolescents seeking psychiatric treatment reported significantly more often family dysfunction than non-suicidal adolescents.

2.7.2. Social dysfunction

Social dysfunction indicates that the adolescent has not developed good interpersonal relationships and she or he feels isolated and lonely. The adolescent is unable to achieve and maintain close relationships with peers and feels uncomfortable socializing with same-aged teens (Offer et al., 1992). In a study by Erkolahti and colleagues (2003), social dysfunction was related to depressive symptoms in both genders in a non-clinical adolescent population. In a study of adolescent inpatient girls with eating disorders, bulimic girls showed significantly more often social dysfunction than normal controls, and anorexic girls did not have this kind of problem (Erkolahti et al., 2002). According to a study by Treger and colleagues (2015), an adolescent inpatient sample reported significantly more often social dysfunction than the control group. In a study by Korhonen and colleagues (2001), adolescents (both boys and girls) with MDD seeking outpatient treatment, suffered significantly more often from social dysfunction than the control group, indicating withdrawal from age-mate relationships. The writers concluded that social dysfunction in this group of adolescents may have adverse effects on the ability to establish important friendships that help adolescents survive the trials of

adolescence. Also suicidality has been observed to be associated with social dysfunction (Laukkanen et al., 2004).

2.7.3. Impulsivity

Impulsivity indicates that the teenager's defensive structure is poorly organized. Adolescent has low frustration tolerance and she or he often acts on impulse. When the adolescent encounters stress or tension, she or he copes by trying to achieve immediate resolution. This kind of adolescent is usually oriented to short-term gain despite possible adverse long-term consequences (Offer et al., 1992). Outpatient adolescents, both girls and boys, with MDD have been shown to report weaker impulse control than a non-clinical sample, reflecting a weaker tolerance of the various pressures of the environment in the MDD group than in the control group (Korhonen et al., 2001). Hintikka and colleagues (2002) investigated an adolescent inpatient sample and found that girls reported significantly weaker impulse control than boys, both in the group of all inpatients and in a subgroup of mood-disordered patients. In a study of patients with eating disorders, girls with bulimia nervosa showed significantly more problems in impulse control than girls with anorexia nervosa or normal controls (Erkolahti et al., 2002). Adolescent girls who had attempted suicide reported impulsivity more often than non-suicidal psychiatric outpatients or controls in a study by Cetin and colleagues (2001). Also Laukkanen and colleagues (2004) found that adolescents who reported suicidal ideation reported more often impulsivity than those who had no suicidal ideation.

2.7.4. Adolescent alcohol use

Alcohol use becomes normative in adolescence, but sometimes use reaches high levels (Spear, 2016). Behavior-related alcohol consumption in adolescents is influenced by intrapsychic factors, friends, and attitudes of adults towards alcohol (Laukkanen et al, 2001). Per occasion, alcohol consumption has been found to be higher(even 2-to 3-fold) in adolescents than in adults (Spear, 2016). It has been supposed that these kinds of elevated intakes may be promoted by neural changes that increase adolescent sensitivity to the desired alcohol effect (Spear, 2016). Heavy

drinking during adolescence has been associated with cognitive alterations, including attenuated performance in language and learning as well as deficits in memory and attention (Squeglia et al., 2014). There is also evidence that affective disorders co-occur with alcohol use disorder, but there is diversity in the reported directional relationship between alcohol abuse and affective disorders, suggesting that there may be a bidirectional association between anxiety disorders and substance use disorder (Spear, 2016). According to the study of Laukkanen and colleagues (2001), there are some gender differences associated with adolescents heavy drinking. In girls, heavy drinking was associated with psychosomatic symptoms and a negative social self-image. Heavy drinking girls also had difficulties with concentration and had more externalizing problems than those who consumed alcohol moderately or were abstinent. In boys, heavy drinking was associated with a more negative self-image than in boys who were abstinent. Moreover, heavy drinking in boys was also associated with higher numbers of peer relationships. According to this same study, heavy drinking was associated with smoking, poor social skills in class, and poor school achievement in both boys and girls.

There are contrary findings about the association between adolescents' alcohol use, adverse childhood experiences and suicidality. Alcohol abuse has been related to suicidal ideation, suicide attempts, and completed suicides in adolescents (Groleger et al., 2003), and alcohol abuse mediates between suicidality and adverse childhood experiences in adult samples (Dupe et al., 2001). Cluver and colleagues (2015) and Hart and colleagues (2011) did not, however, observe this effect.

2.8. Adverse childhood experiences related to suicidality

ACEs, comprising forms of abuse, neglect, and household dysfunctions, can affect the development of a child in a variety of ways (Perez et al., 2016). One theoretical perspective used in this area is diathesis-stress explanations, which suggest that predisposing biological (e.g. neurotransmitter imbalance), cognitive (e.g. impaired social problem-solving), and personality factors (e.g. impulsivity), combined with exposure to ACEs and psychopathology, increase the risk of SB (Hawton, Saunders, & O'Connor 2012; Serafini et al., 2015). In this context, critical levels of early-life stress lead to inappropriate stress regulation and increase the long-term vulnerability

to SB. According to this diathesis-stress model, long-lasting stress has an impact on developing personality traits like impulsivity and aggressive behavior, and therefore, the adolescent is prone to act on his/her suicidal feelings (Pelkonen, Karlsson & Marttunen, 2011). In line with this model, recent research has indicated that childhood abuse and neglect essentially increase the risk of both suicidal ideation and suicide attempts among young people (Bruffaerts et al., 2010; Dube et al., 2001; Evans, Hawton, Rodham, & Deeks, 2005; Miller, Esposito-Smythers, Weismoore, & Renshaw, 2013; Thompson et al., 2012). In a large national cohort study, Dube and colleagues (2001) found that adverse childhood experiences in any category (emotional, sexual and physical abuse; parents mental illness, substance abuse, and incarceration; as well as intimate partner violence, separation, or divorce) might increase the risk of attempted suicide up to 2- to 5-fold. The ACE score had a strong graded relationship with attempted suicide during childhood/adolescence and adulthood.

Different dimensions of ACEs have been studied in relation to the risk for developing SB or NSSI. Probably the most examined childhood adversities are physical and sexual abuse. Childhood sexual abuse is related to adult suicidal behavior, while childhood physical abuse is related to later aggression and interpersonal violence (Brodsky et al., 2008; McHolm et al., 2003). Evans and colleagues (2005) found in their systematic review a strong link between childhood physical and sexual abuse and suicidal thoughts and suicide attempts in adolescence. Also Miller and colleagues (2013) emphasized that childhood sexual and emotional abuse might be more important than other forms of adversities. Additionally, childhood physical and sexual abuse has been found to be predictive of earlier onset of suicide attempt (Fergusson et al., 2000; Bruffaerts et al., 2010). Childhood sexual and physical abuse has also been found to be associated with repeated suicidal behavior in adults (Bruffaerts et al., 2010; Cankaya et al., 2012; Ystgaard at al., 2004; Yates et al., 2008). One report (Brodsky & Biggs, 2012) suggests that while sexual abuse seems to lead to recurrent suicidal behavior, physical abuse is related to intermittent (one to two events) suicidal behavior. The explanation for this finding was speculated to be that while sexual abuse may be related to later emotion dysregulation, leading to recurrent suicidal behavior, physical abuse may lead to disruptions in impulse control related to intermittent suicidal behavior.

2.8.1. Pathways from adverse childhood experiences to suicidality

Exposure to adverse life events is strongly linked to suicidality. There is substantial evidence that ACEs shape biological, cognitive, behavioral, and emotional responses that may lead to psychopathology and suicidality (Thompson et al., 2012). Studies have recently focused on pathways from ACEs to later suicidality. Genetic vulnerability and psychiatric, psychological, familial, social, and cultural factors are important contributors to self-harm and suicide (Hawton, Saunders, & O'Connor, 2012). Many experts emphasize the diathesis-stress explanation in theoretical formulations. ACEs constitute an environmental factor that may contribute to the diathesis possibly by altering stress responsivity, and to the stressor, which may be events that trigger memories of ACEs (Hawton et al., 2012; Brodsky & Biggs, 2012). The longitudinal study by Fergusson and colleagues (2000) followed 1265 children for 21 years. This study suggested a causal chain from ACEs occurring before age 16 years, increasing the risk of young people's vulnerability to mental health problems and stressful life events and leading to an elevated risk of suicide. In other words, mental illness or disorders and later stressful life events mediated between ACEs and suicidality.

Yang and Clum (2000) developed a cognitive model. The cognitive factors that they studied were low self-esteem, external locus of control, poor problem-solving skills, and hopelessness. Using structural equation analysis, they found that ACEs had a direct effect on cognitive deficits, such as poor problem solving, which, in turn, had a strong impact on suicidal ideation.

De Bellis (2001) focused on persistent dysfunction of the HPA axis, which underlies chronic PTSD symptoms, especially hyperarousal. Based on this study, De Bellis proposed that hyperaroused stress systems affect brain development, leading to failures in emotion regulation and behavior, which in turn have outcomes like externalizing or internalizing behavior and cognitive and learning disorders.

Perez and colleagues (2016) had a large data (64 329 adolescents) and they examined whether ACEs affect a child's personality development (aggression and impulsivity) and problem behavior (school difficulties and substance abuse) and whether these maladaptive personality and behavioral traits mediate between ACEs and suicidality. Using generalized structural equation modeling, they found that ACEs were significant predictors for two maladaptive personality traits (aggression and impulsivity) as well both problem behaviors (school difficulties and substance

use). However, only the personality traits mediated between ACEs and suicidality, while the problem behaviors did not.

In a longitudinal study of 659 families, Johnson and colleagues (2002) examined whether adolescents' interpersonal difficulties (cruelty towards peers, difficulty making new friends, frequent arguments with adults or peers, loneliness and interpersonal isolation, lack of close friends, poor relationships with friends and peers, and refusal to share with others) mediated between ACEs and adolescents' suicidality. They found that interpersonal difficulties during mid-adolescence mediated the association between ACEs and suicide attempts during late adolescence or early adulthood.

Hardt and colleagues (2011) evaluated with path analysis the relationship of ACEs (sexual and physical abuse) with family functioning (self-report questionnaire related to parent-child relationship, including perceived love from parents, control, ambition, and role reversal during the first 14 years of life), depression, alcohol abuse, and suicidal thoughts. They found that physical abuse predicted the parent-child relationship. Control and low level of perceived love were associated with physical abuse in mothers and fathers. Physical abuse predicted ambition but only in fathers and role reversal only in mothers. Further, a low level of perceived maternal love was indirectly associated with a child's suicidal ideation, and mediated by depression, while perceived low level of paternal love had a direct effect on suicidal thoughts. Additionally, a low level of perceived paternal love was related to sexual abuse. This study established the pathway from ACEs to suicidal ideation by mediating the roles of both mother and father.

As established above, there are different theoretical perspectives and pathways to investigate the impact of ACEs on suicidality and related factors. From the view of neurobiology, adversities are linked to many changes in brain architecture and function and stress-responsive neurobiological systems that predispose adolescents to mental disorders, emotional dysregulation, cognitive deficits, aggression and impulsivity, poor relationships with peers, poor parent-child relationship and finally non-suicidal self-injury, suicidal ideation and behaviors (Brodsky & Piggs, 2012). ACEs are also linked to an increased risk of committing suicide (Dube et al., 2001; Miller, Esposito-Smythers, Weismoore, & Renshaw, 2013; Perez, Jennings, Piquero, & Baglivio, 2016; Thompson et al., 2012).

3 AIMS OF THE STUDY

The aim of this project was to investigate ACEs, psychopathology, and self-harming behavior among Finnish adolescent inpatients and their age- and gender-matched non-referred controls. Specific aims were to explore the following:

1. The relationship between ACEs and psychiatric symptomatology (Study I).

2. The applicability of the SCL-90 questionnaire in assessing psychiatric symptoms (Study II).

3. The relationship between ACEs and suicidality. Also investigated was whether psychiatric symptomatology, impulsivity, family and social dysfunction, or alcohol use mediates this relationship (Study III).

4. Risk factors related to self-harm behavior in inpatients with a history of NSSI, suicidal behavior, or both (Study IV).

4 METHODS

4.1 Procedure

The Kellokoski Hospital Adolescent Inpatient Follow-Up Study (KAIFUS) is a longitudinal naturalistic study of the clinical characteristics of adolescent psychiatric inpatients and the impact of treatment in a consecutive sample of these patients in Southern Finland. The study was performed between September 2006 and August 2010. A flowchart of the recruitment of the inpatients is presented in Figure 1

4.2 Subjects

Inpatient data were collected at Kellokoski Hospital, which is a psychiatric hospital in the Hyvinkää healthcare district. The original sample comprised all adolescents admitted to four inpatient wards for the first time. Of the possible 395 adolescent inpatients, 315 had sufficient knowledge of the Finnish language, adequate cognitive capacity, and a treatment period of at least two weeks, thus being eligible to participate in the study. All eligible patients were native Finns. Some patients (n = 62, 16.4%) declined to participate or their guardians did not provide permission to participate. In 23 cases (6.0%), the patient or his/her parent discontinued the treatment. Further, participants were excluded in 24 cases (6.0%) because they had incomplete data. The final inpatient adolescent sample comprised 65% of all eligible inpatients: 60 boys (29.1%) and 146 girls (70.9%).

The comparison group was drawn from schools in the same geographical area as the study group. Seven schools from four different municipalities participated in the study: two high schools, one vocational college, and four junior high schools. The comparison group consisted of a random sample of age- and sex-matched students. Participants were drawn from the enrollment lists, and if the student refused to participate in the study the next student was drawn from the list. A total of 473 students were invited to take part in the study. Of these, 202 (42.5%) declined to participate and 68 (14.5%) discontinued the study and did not complete the questionnaires. All students, completers and non-completers, were native Finns. Differences between completers and non-completers were not significant regarding socioeconomic status ($p = 0.61$) or living situation ($p = 0.49$). The final sample comprised 203 controls, 148 girls (72.9%) and 55 boys (27.1%).

The same interviews and self-assessments were used in the patient and community samples. Participation was voluntary and written informed consent was required from all participants and their legal guardians. All questionnaires and interviews applied here are in routine use in adolescent inpatient clinical work. The Ethics Committee of Helsinki University Hospital approved the study protocol, and the pertinent institutional authority for the Hyvinkää Hospital Area granted permission to conduct the study.

4.3   Diagnostic assessment

All participants, inpatients, and comparison youths underwent an interview using the original 1996 version of The Schedule for Affective Disorders and Schizophrenia for School-Age Children –Present and Lifetime version (K-SADS-PL; Kaufman et al., 1997) to assess psychiatric diagnoses. This semi-structured instrument has a good or even excellent test-retest reliability and high concurrent validity and inter-rater agreement (Ambrosini, 2000; Brasil & Bordin, 2010; Ghanizadeh, Mohammadi, & Yazdanshenas, 2006; Kaufman et al., 1997). The Finnish translation of this instrument has been successfully used in studies of adolescent inpatients and outpatients (Mustanoja et al., 2011; Tuisku et al., 2006).

Psychiatric nurses conducted the diagnostic interviews after receiving training in the use of the K-SADS-PL instrument. Both present and lifetime information of the disorders was gathered, but only present diagnoses were used in the studies. Based

on the interview and clinical records, psychiatrists specialized in adolescents assigned the psychiatric diagnoses according to the Axis I disorders in DSM-IV (American Psychiatric Association 1994). Especially inpatient adolescent had comorbid disorders. The principal diagnosis was based on symptoms, the reason that the adolescent had admitted to hospital or the primary symptom needing hospital care. Other disorders were settled according to the need for care and attention. Comorbid disorders were rare in the community sample. In case of comorbidity, the clinical degree of difficulty was assessed. The internalizing disorders included anxiety disorders, mood disorders and eating disorders. Externalizing disorders included substance-use disorders (abuse and dependence) and disruptive disorders (oppositional-defiant disorder, conduct disorder and attention-deficit hyperactivity disorder). Diagnostic meetings were held during the data collection and when finalizing the data. Disparities were settled by consensus between three psychiatrists.
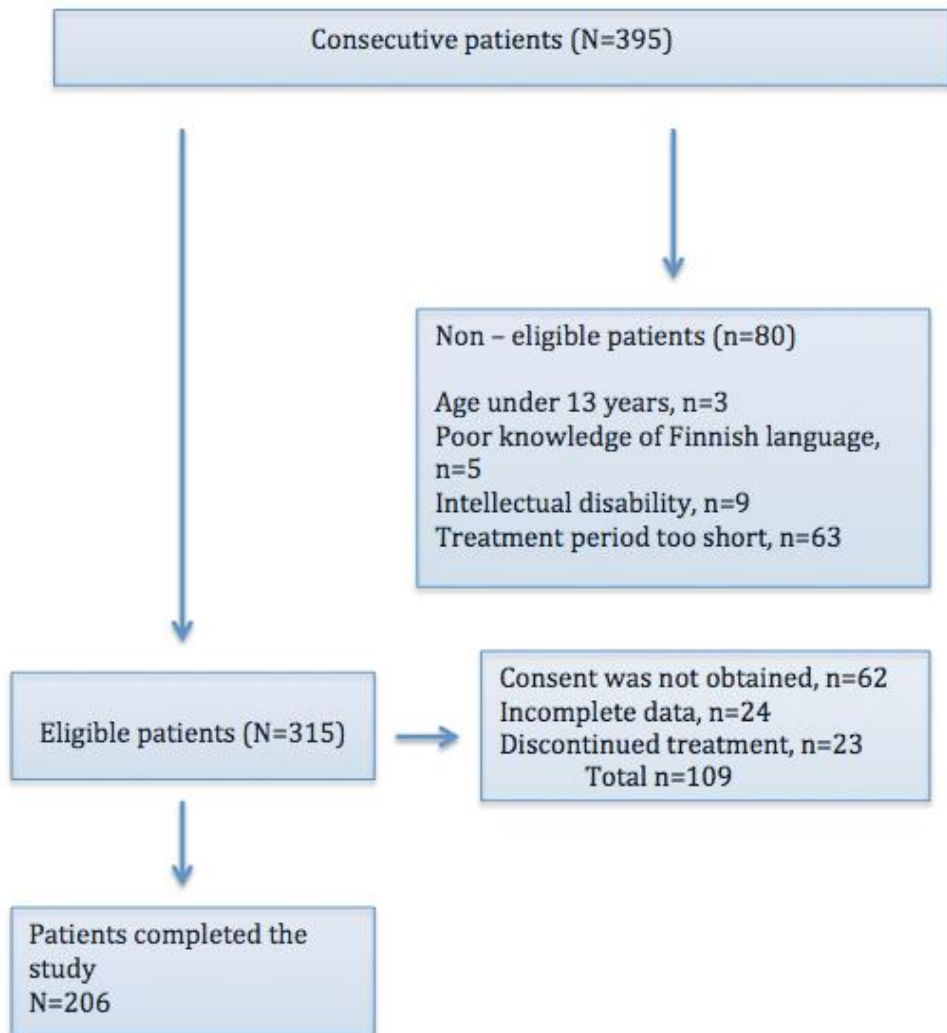
Figure 1. Flowchart of the Kellokoski hospital Adolescent Inpatient Follow-Up Study (KAIFUS) inpatients.

4.4   Assessment and classification of suicidality

Suicidality was measured using questions included in the K-SADS-PL interview. Only "present" information was used. The information on suicidal behavior (SB) was based on the following two questions concerning the suicidal ideation and suicide method: "Have you thought about death?" and "Have you had suicide plans?" ("none" = not present; "sub-threshold" = thought about death but not specific method; and "threshold" = have often thought about death and have also thought the suicide method) and seriousness of suicidal intent: "Have you actually tried to kill yourself?" ("none" = no attempt or gesture with any intent to die; "sub-threshold" = present, but very ambivalent; and "threshold" = definite suicidal intent). The person with SB was regarded as a person who fulfilled the threshold criteria for serious suicidal ideation (often thinks of suicide and has thought of a specific method, and/or fulfilled the sub-threshold or threshold criteria for one or more suicidal acts (with ambivalent or definite suicidal intent).

The information on non-significant self-injury (NSSI) was based on the question about non-suicidal physical self-damaging acts without any intent to die ("none" = not present; "sub-threshold" = infrequent (one to three times a year) but has never caused serious injury; and "threshold" = frequent (four or more times a year) or has caused serious self injury (for example burned skin or broken bones). A person was defined as having engaged in non-significant self-injury if a non-suicidal physical self-damaging act fulfilled the threshold level. A person with no history of SB or NSSI was regarded as a person with no self-harming behavior. Finally, a person could have both types (SB and NSSI) of self-harming behavior.

Suicidality sum score was based on four questions: 1) thoughts of death, 2) suicidal ideation, 3) suicidal acts, seriousness, and 4) suicidal acts, medical lethality. Each question was rated from 1 (not present), 2 (sub-threshold) to 3 (threshold). Persons with no suicidality had a score of 4 and the maximum score was 12.

4.5   Assessment of adverse childhood experiences

In this study, adverse childhood experiences were defined by adapting Felitti and colleagues (1998), and later Dube and colleagues (2001) used ACE questions. In this study, ACEs were defined including physical and sexual abuse, parents' separation or divorce, parents' psychiatric or alcohol use problems, intimate partner violence, and parents' criminality. Interviewed questions covered lifetime adversities.

From the PTSD screening section of the K-SADS-PL interview, answers were gathered to questions concerning intimate partner violence, exposure to physical abuse and sexual abuse. To assess intimate partner violence, the adolescent was asked: Have your parents sometimes argued really bad? Tell me about the worst argue they have had. What happened? If the adolescent had witnessed explosive arguments between the parents that involve threatened or actual harm, the answer was rated as 2 (otherwise 1= not happened, 0= no knowledge). To assess physical abuse, the adolescent was asked: Have your parents ever gotten so angry with you that they have hit you? Have they ever hit you so that you got scratch or bruises, or were badly hurt in some other way? What happened? If the adolescent mentioned that she/he has gotten bruises or scratches on more than one occasion or a more serious injury, the answer was rated as 2 (1= not happened, 0= no knowledge). To assess sexual abuse, the adolescent was asked: Has anyone ever fondled you between the legs, when he/she shouldn't? Has anyone fondled you in a way, that felt bad? Has anybody, who shouldn't, asked you to undress, fondled you between the legs, taken you to bed, or asked you to fondle him/her between the legs? If the adolescent revealed that she/ he had been exposed to an isolated or repeated incidents of genital fondling, oral sex, or vaginal/anal intercourse, the answer was rated as 2 (1= not happened, 0=no knowledge).

Information on parents' divorce, psychiatric problems, or substance use problems was gathered using a structured background data collection sheet. The adolescent was asked: Have your biological parents divorced? (yes=2, no=1, no knowledge=0). Do you know, have your parents ever had mental health problems needing professional help? Tell me about it If the adolescent knew that the mother or father have had psychiatric inpatient or outpatient care and/or medication for mental health problem, the answer was rated as 2 (otherwise 1= no, 0= no knowledge). A parental substance use problem was inquired as follows: Do you know if your parents have a substance use problem? Tell me about it. What kind of problem? If the adolescent mentioned knowing that the parent for example have had care for

substance use, or that the parents have divorced because of a substance use problem or that the parent is or has been unemployed due to a substance use problem, the answer was rated as 2 (otherwise 1=no, 0=no knowledge). The answer to the question concerning parents' criminality: "Has your parent ever been arrested, suspected, or judged for a legal offence?" was gathered from the Life Events Checklist (LEC, Johnson & McCucheon, 1980). This answer was categorized as either yes=2, no=1, or no knowledge=0. The accumulation of adverse childhood experiences (= ACE total score) was a sum score of the number of ACEs (0-7) that the adolescent had been exposed to during childhood.

4.6   Assessment of psychiatric symptoms, impulsivity, family functioning, social functioning, and alcohol use

Subjective psychiatric symptoms were assessed using the Symptom Checklist-90 (SCL-90; Derogatis, Lipman, & Covi, 1973). This self-report measure assesses psychiatric symptoms with 90 questions covering nine primary symptom dimensions: somatization, obsessive-compulsivity, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid idea, and psychoticism. Items are rated on a five-point Likert scale of distress, ranging from "not at all" (0) to "extremely" (4). The raw sum score can thus range from 0 to 360. Adolescents were asked to assess their symptoms during the last two weeks.

Family dysfunction, social dysfunction and impulsivity were measured with the Offer Self-Image Questionnaire (OSIQ-R; Offer, Ostrov, Howard, & Dolan, 1992). This questionnaire covers 12 component scales with 129 items, but in this study, only Family dysfunction, Social dysfunction and Impulsivity were used, because interpersonal difficulties and family factors have demonstrated to mediate between ACEs and suicidality (Anda et al., 2006; Hardt, Herke, & Schier, 2011; Johnson et al., 2002). Also impulsivity has shown to mediate between ACEs and suicidality (Zouk et al., 2006).

This instrument is a personality test for adolescents aged 13-18 years and assesses psychological adjustment based on psychodynamic growth and developmental theory. The impulse control scale covers nine items measuring the ability to handle pressure. A high score indicates that the adolescent has a low frustration tolerance, and thus, often acts in an impulsive way. The scale score can range from 9 to 54.

Social functioning covers nine items and assesses patterns of interpersonal relationships and friendships. A high score indicates that the adolescent has trouble in maintaining close relationships with peers and she/he feels uncomfortable when socializing with same-aged individuals. This scale score can range from 9 to 54. Family functioning covers 19 items. This scale focuses on feelings about and relationships with the adolescent's parents and also the emotional atmosphere at home. A high score indicates that the adolescent feels that there is tension at home and that relationships are problematic, with the adolescent receiving inadequate support from parents or guardians. This scale score can range from 19 to 114. The OSIQ has been validated for Finnish adolescents (Laukkanen, Peiponen, Halonen, Aivio, & Viinamäki, 1999; Laukkanen, Halonen, Aivio, Viinamäki, & Lehtonen, 2000).

Alcohol use was assessed with the Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). This test is a 10-item screening tool to assess alcohol consumption, drinking behavior, and alcohol-related problems. The sum score can range from 0 to 40. AUDIT has shown good psychometric properties (Reinert & Allen, 2002). In adolescents, the optimal cut-off score is 4 (Chung et al., 2000).

4.7 Social support and victimization of school bullying

The Perceived Social Support Scale – Revised (PSSS-R; Blumenthal et al., 1987) was used to assess social support. In this study, of the three possible subscales, only two were used: support from family and support from friends. The total score in both subscales can range from 4 (a low level of support) to 20 (a high level of support). The question concerning school bullying was based on the K-SADS-PL interview. Victimization by school bullying was screened in the school adaptation and social relationship section. School bullying was assessed with the question: "Have you had problems with schoolmates? Have you, for example, been bullied by others?" The answer was categorized as either yes or no.

4.8   Sociodemographic data

The background data collection sheet included questions about parents' socioeconomic status (SES) and adolescents' living situation. SES was ascertained with the question: What is your father's occupation? If an adolescent lived with his/her mother (and stepfather), we recorded the mother's occupation. The SES was classified as high if the guardian was an entrepreneur or upper-level employee, as middle if the guardian was a lower-level employee or manual worker, and as low if the guardian was retired, a student, or unemployed (Classification of Socioeconomic Status, 1989).

If the adolescent lived with both biological parents, the living situation was classified as nuclear family. If the adolescent lived with only one parent or in a blended family, the living situation was classified as another type of family. If the adolescent had been placed in a detention home, the living situation was classified as foster care.

4.9   Statistical analyses

Study I

Pearson's Chi-square test (categorical variables) and Student's t-test (continuous variables) were used to assess group differences between inpatients and comparison groups. Bivariate correlation analysis was performed to investigate the relationship between ACEs, victimization via school bullying, and perceived social support.

To analyze the relationship between ACEs, school bullying, and social support, logistic regression analysis was performed. The relationship between ACEs and internalizing or externalizing disorder against those of comparison group with a multinomial logistic regression model was assessed. Dependent variables were internalizing and externalizing disorders, and the reference group was the comparison group. In this test, we first entered ACE categories, adjusting them with SES, age, and sex. Entered separately were school bullying and perceived social

support, adjusting them in the second wave with SES, age, and sex, and in the third wave, also with the ACE total score. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated, and the two-tailed level of significance was set at 0.05.

Study II

Measurement invariance

The first step in this study was to analyze SCL-90 measurement invariance across groups and time-points. To detect differential item functioning (DIF) under Samejima's graded response model for the full SCL-90, an iterative algorithm was used with the lordif package version 0.3-2 (Choi, Gibbons, & Crane, 2011) for R with default settings ($\alpha = 0.01$). Patient responses were compared with time-points at admission and discharge and with the control group. Summed uniform and non-uniform McFadden pseudo-R^2 was measured to analyze the total item-wise DIF.

Optimal number of factors

To assess the optimal number of factors, Very Simple Structure (VSS), Minimum Average Partial correlation (MAP), and Parallel Analysis (PA) were analyzed with the psych package version 1.5.8 in R version 3.2.3, using the polychoric correlation matrix and both weighted least-squares (WLS) and maximum likelihood (ML) estimation. VSS was investigated at complexity one and two, meaning that an item is allowed to load only on one or two factors. Further, to analyze the comparison data, the approach of Ruscio and Roche (2012) was used, as implemented in R code, using Spearman correlation matrices derived from complete cases.

Factor analyses

To assess factor solution of SCL-90 measurement, confirmatory factor analyses (CFA) was used with the one-dimensional and a priori nine-dimensional model. Analyses were performed separately for patients at admission, patients at discharge, and controls. Since there was compelling evidence for a strong main factor, a bifactor model was generated. The explained common variance index (ECV) was performed to define the ratio of variance explained by the general factor divided by the variance explained by the general plus the group factors. McDonald's omega hierarchical ω_h

and omega subscale ω_s were assessed in order to understand the viability of subscales (Reise, 2012).

Weighted least squares mean and variance-adjusted (WLSMV) algorithm for categorical indicators in Mplus was used for all factor analyses (Muthén & Muthén, 2012). For the comparative fit index (CFI) and the root mean square error of approximation (RMSEA), cut-off values of Hu and Bentler (1999) judging adequacy of fit >0.95 for CFI and <0.06 for RMSEA was followed. For the weighted root mean square residual (WRMR), a cut-off of <1.0 suggested by Yu (2002) under non-normality and small samples was followed. In this study, maximum a posteriori factor scores were calculated for the bifactor model general factor.

Criterion validation

General factor score of SCL-90 was compared with patients' two time-points; admission and discharge, and controls. Because score distributions were approximately normal, Welch's unequal variances *t*-test was employed (two-tailed, α = 0.05); with Glass's Δ (using control/healthy variance only) and Cohen's *d* (pooled variance), the effect sizes and Cohen's *d* (pooled variance) were expressed. Similarly, those individuals with diagnose were compared with those, who had no diagnose in the combined admission and control groups. In all three response sets, gender effects were examined. pROC package version 1.1-2 in R was used to compute receiver operating characteristic (ROC) curves and associated area under the curve (AUC) values with non-parametric confidence intervals. The optimal cut-off point for discriminating between groups was determined with Youden's *J* statistic. The overall discriminability at the chosen cut-offs was expressed as diagnostic odds ratios (DORs).

Study III

To analyze differences according to suicidality sum score and all five mediators (psychiatric symptomatology, impulsivity, alcohol use, family dysfunction, and social dysfunction) between adolescent inpatients and adolescents in the community, an independent samples t-test was performed. After this analysis, to provide more variation for examined factors; suicidality sum score, ACEs, and the tested mediators, inpatient and community samples were combined. Pearson correlation was used to assess the relationships between the ACE total score, the suicidality sum

score, the four different suicidal behaviors, and all five mediators.

To ascertain direct and indirect effects of the ACE total score on suicidality, a simple mediation test was conducted for each variable. Finally, a Preacher and Hayes' (2008) bootstrapping procedure for multiple mediation analysis was used to test simultaneous indirect effects of ACEs on suicidality through mediators (Figure 1). This non-parametric sampling procedure is recommended for multiple mediators since it estimates the path coefficients in a multiple mediator model with bootstrap confidence intervals for total and specific indirect effects of ACEs on suicidality through studied mediator variables. For statistical analyses, Preacher & Hayes (2008) SPSS macro for multiple mediation was used. Using multiple mediator modeling, it is possible to test competing hypotheses within a single model and at the same time it reduces parameter bias due to omitted variables, that is, other possible mediators. In this analysis, age and gender were used as covariates.
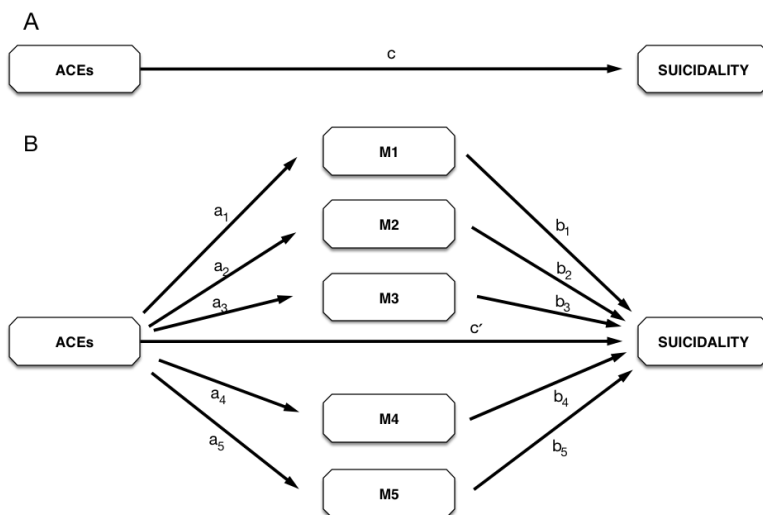
Figure 2. Multiple mediation test with five hypothetical mediators. (A) Adverse childhood experiences (ACEs) have a direct effect on suicidality. (B) ACEs are hypothesized to have an effect on suicidality through the mediators (M1) psychiatric symptoms, (M2) impulsivity, (M3) alcohol misuse, (M4) family dysfunction, and (M5) social dysfunction.

Study IV

Gender and diagnostic distributions as well as self-harm behavior categories and ACE categories are presented as frequencies and percentages for categorical variables. Means (Ms) and standard deviations (SDs) are presented for continuous variables such as psychiatric symptoms, alcohol use, impulsivity, family and social dysfunction, and ACE total score. The Chi-square (χ^2) test, Fisher's exact test, and column proportions were compared with z-test with Bonferroni correction (post hoc analysis). Analysis of variance (ANOVA) with Tukey's post-hoc comparison test was used to assess the effect of SCL-90 subscales in all self-harming groups. Multinomial logistic regression models were used to compare the self-harm groups with different variables. P-values < 0.05 were considered significant. Analyses were performed using SPSS 22.0 for Windows.

5 RESULTS

5.1 Adverse childhood experiences as risk factors for psychopathology and hospitalization among adolescents (Study I)

The distribution of principal diagnoses in the inpatient sample was as follows: mood disorders 47.6%, conduct disorders 23.3%, anxiety disorder 13.6%, psychotic disorder 7.8%, eating disorders 5.8%, and alcohol abuse 0.5%. Of inpatients who suffered from anxiety disorder, 21 (10.2%) had PTSD as a principal diagnosis. Patients suffering from internalizing disorders numbered 139 and from externalizing disorders 49. Altogether 64 patients (31.1%) had no comorbid diagnoses, while 89 (43.2%) had one comorbid diagnosis and 53 (25.7%) had two or more comorbid disorders.

In the comparison group, about one in five subjects (21.2%) were diagnosed with psychiatric disorder. The most prevalent disorder was mood disorder (5.9%), followed by anxiety disorder (5.4%), substance use disorder (4.4%), conduct disorder (3.4%), eating disorder (2.0%), and psychotic disorder (0.5%). Among those with anxiety disorder, one (0.5%) had PTSD as a principal diagnosis.

When inpatients were compared with controls, significant differences were found according to SES, living situation, and prevalence of various ACEs (Table 1). There were also significant differences between groups according to principal diagnosis, albeit minor (not-significant) differences for eating disorder ($p = 0.071$).

The mean ACE total score was 2.2 ($SD = 0.9$) in the inpatient group and 0.95 ($SD = 0.07$) in the comparison group. Almost 60% of inpatients had experienced at least two ACEs and 21% had experienced four or more ACEs. By contrast, over half of the controls had not experienced ACEs and only 2% had experienced four or more of them.

The most typical ACE in both groups was parents' divorce, followed by parental psychiatric disorder.

Table 1. Characteristics of inpatient and comparison samples by sociodemographic factors, principal diagnoses, and adverse childhood experiences.

	Inpatient group (N=206)	Comparison group (N=203)	p
	n (%)	n (%)	
Socioeconomic status			< 0.001
High	19 (9.2)	30 (14.8)	
Middle	78 (37.9)	109 (53.7)	
Low	109 (52.9)	64 (31.5)	
Living situation			< 0.001
Nuclear family	85 (41.7)	127 (62.6)	
Other type of family	92 (45.1)	75 (36.9)	
Foster care	27 (13.2)	1 (0.5)	
Diagnosis			
Mood disorder	98 (47.6)	12 (5.9)	< 0.001
Conduct disorder	48 (23.3)	7 (3.4)	< 0.001
Anxiety disorder	28 (13.6)	11 (5.4)	< 0.01
Psychotic disorder	16 (7.8)	1 (0.5)	< 0.001
Eating disorder	12 (5.8)	4 (2.0)	ns.
Substance use disorder	1 (0.5)	9 (4.4)	< 0.05
Adverse childhood experience			
Abuse			
Physical abuse	47 (22.8)	7 (3.4)	< 0.001

Sexual abuse	44 (21.4)	1 (0.5)	< 0.001
Household dysfunction			
Parents' divorce	112 (54.4)	74 (36.5)	< 0.001
Parental substance use problem	69 (33.5)	9 (4.4)	< 0.001
Parental psychiatric problems	81 (39.3)	21 (10.3)	< 0.001
Witnessing intimate partner violence	64 (31.3)	12 (5.9)	< 0.001
Parental criminality	13 (6.5)	5 (2.5)	< 0.001
ACE total score, *M (SD)*	2.20 (0.9)	0.95 (0.07)	< 0.001
Number of ACEs			
0	31 (15.0)	115 (56.7)	
1	51 (24.8)	64 (31.5)	
2	41 (19.9)	13 (6.4)	
3	39 (18.9)	7 (3.4)	
4	22 (10.7)	3 (1.5)	
5	17 (8.3)	0 (0.0)	
6	4 (2.4)	1 (0.5)	
7	1 (0.5)	0 (0.0)	

ns. = not significant

 * = p < 0.05

 ** = p < 0.01

*** = p < 0.001

Perceived support from family and from friends significantly differed between the groups (Table 1, Study I).

Spearman's or Pearson's correlation revealed associations between ACEs, school bullying, and perceived support from family and friends (Study I, Table 2). All ACEs correlated with each other, except for parents' divorce, which did not correlate with sexual abuse. The strongest correlations were found between witnessing intimate partner violence, physical abuse, and parental alcohol/substance use problems. Also moderate correlations were found between parental substance use, parental psychiatric problems, and parents' divorce. Victimization via school bullying correlated with all ACE variables. A negative correlation was found between victimization via school bullying and perceived support from friends, but not support from family. A significant correlation was also found between perceived support from family and from friends.

Inpatient girls had been exposed to significantly more ACEs than inpatient boys (girls: $M = 2.36$, $SD = 1.57$, boys: $M = 1.83$, $SD = 1.68$, t(206) = 2.069, $p < 0.05$). A significant different existed between the sexes in exposure to sexual abuse (girls: 28.8%, boys: 3.3%, OR = 11.7, 95% CI = [2.7 - 50.1], $p < 0.001$). Other single ACEs had no significant differences between sexes.

Relative to girls, inpatient boys perceived significantly more social support from their families (girls: $M = 13.82$, $SD = 4.59$, boys: $M = 16.33$, $SD = 3.92$, t(206) = 3.874, $p < 0.001$). This finding was not made in the comparison group. In both groups, girls perceived more support from friends than boys. This finding was not significant in the inpatient group (girls: $M = 14.39$, $SD = 4.7$, Boys: $M = 12.89$, $SD = 5.13$, t(203) = -1.954, $p = 0.053$), but was significant in the comparison group (girls: $M = 17.99$, $SD = 2.82$, boys: $M = 15.75$, $SD = 4.23$, t(203) = -4.367, $p < 0.001$).

Compared with girls, boys with externalizing disorders (boys: $M = 16.8$, $SD = 3.2$, girls: $M = 12.3$, $SD = 4.7$, t(47) = 3.905, $p < 0.001$, after adjusting for age and SES: OR = 1.4, CI = [1.1 - 1.6], $p < 0.05$) and internalizing disorders (boys: $M = 15.7$, $SD = 4.7$, girls: $M = 14.1$, $SD = 4.5$, t(130) = 1.678, $p = 0.096$, after adjusting for age and SES: OR = 1.2, CI = [1.0 - 1.30], $p < 0.05$) experienced more social support from their families. Relative to boys, girls with internalizing disorders perceived more support from friends (boys: $M = 11.6$, $SD = 4.3$, girls: $M = 14.4$, $SD = 4.5$, t(136) = -3.041, $p < 0.05$, after adjusting for age and SES: OR = 0.83, CI = [0.73 - 0.93], $p < 0.05$).

Boys suffering from externalizing disorders perceived more support from friends than did boys with internalizing disorders (externalizing: $M = 14.8$, $SD = 5.3$, internalizing: $M = 11.6$, $SD = 4.3$, t(52) = -2.44, $p < 0.05$, after adjusting for age and SES: OR = 1.2, CI [1.0 - 1.3], $p < 0.05$), but no such difference was found regarding perceived support from family. Among girls, no differences were observed in

perceived support from family and friends between those suffering from internalizing disorders and those suffering from externalizing disorders.

No significant differences emerged regarding age or sex related to victimization via school bullying. Age was significantly related to perceived support from family (r = -0.102, p = 0.04), but no correlations were found between age and cumulative ACE score or support from friends.

Multinomial regression analysis was performed in order to assess how ACEs, perceived social support and victimization of school bullying associate with an adolescent being a psychiatric inpatient with an internalizing disorder and, respectively, being a psychiatric inpatient with an externalizing disorder. The comparison group was a reference group (Study I, Table 3). Results were adjusted with SES, age, and sex. In Wave 1, relative to the comparison group, adolescent inpatients with internalizing disorder came from families with physical abuse, parental substance use, and parental psychiatric problems, and they had witnessed intimate partner violence. Sexual abuse was the most significant risk factor for internalizing disorders (OR = 72.4, CI = [8.2 - 636.1]). Adolescents suffering from externalizing disorders, relative to the comparison group, came from families with parental divorce and psychiatric and substance use problems and had experienced physical abuse. Similar to patients with internalizing disorders, the risk for externalizing disorder increased sharply if the adolescent had been exposed to sexual abuse (OR 160.6, CI = [16.1 - 1604.8]). In the second wave, victimization via school bullying and perceived social support were added to the analysis. Victimization via school bullying was related to both internalizing and externalizing disorders. Support from the family was a protective factor for externalizing disorders, while support from friends protected against internalizing disorders. In the third wave, where the ACE total score was added, a high number of ACEs was a risk factor for both internalizing and externalizing disorders. In this model, support from the family protected against externalizing disorders. In all waves, older age was a risk factor for internalizing disorders, and female sex protected against externalizing disorders.

5.2 Psychometric properties of Symptom Checklist-90 in adolescent psychiatric inpatients and age- and gender-matched community youth (Study II)

Group-wise test characteristic curves and the impact of DIF are presented in Figure 1 (Study II). According to item-wise skewness (0.7 at admission, 1.6 at discharge, and 2.0 for controls), the assessment showed a strong floor effect in response distribution, which confirmed that the factor analysis for ordered categorical indicators was necessary.

Measurement invariance assessment between patients and controls in the one-dimensional model flagged 23 items for DIF. McFadden R^2 values for all items had a mean of 0.8%, while the median was 0.4%. Items 15 and 22 showed the highest values, at 5.2% and 5.1%, respectively. The total effect of the DIF of all items was small, as it was estimated to lead to 0.06 higher normalized latent scores in the patient group. When measuring invariance with patients at two time-points, admission and discharge, the algorithm flagged 11 items. McFadden R^2 values for all items had a mean of 0.5% with a median of 0.3%. The highest values were 2.6%, 2.5%, and 2.3% for items 32, 15, and 59, respectively. The total effect of DIF was minimal, resulting in 0.04 higher scores at admission.

When assessing the optimal number of factors, the empirical number of factors LS and ML estimation were almost identical. Table 1 (Study II) shows the former results along with results for the comparison data method. Results revealed that the number of factors ranged from one to nine, indicating a complex factor structure with a strong primary factor.

The next step was to assess factor structure with Confirmatory factor analysis (CFA) with all three subsamples. The a priori nine-dimensional model had the poorest fit (Study II, Table 2). Additionally the latent factors were strongly correlated since the median inter-factor correlations were 0.84 for patients' admission, 0.88 for patients' discharge, and 0.86 for controls. By contrast, the one-dimensional model showed good fit for all three subsamples, and the bifactor model revealed even better fit. To have a successful fit with bifactor model, item 15 ("thoughts to end own life") had to be omitted since it was almost perfectly correlated with the general factor. Table 3 (Study II) presents factor loadings, thresholds, and correlations of the patient admission subsample. Figure 2 (Study II) presents all three subsamples' total information curves of the general factor.

After establishing sufficient measurement invariance, maximum a posteriori factor scores were estimated for the general factor. Parameters of the patient admission bifactor model were used since it was the most multifactorial relative to the other two models and had the most stable parameter estimates. Two items (15 and 22) showing a total DIF effect of over 5% in either analysis were omitted. With control sample, factor scores were standardized to set mean value to zero and SD to one. Results are shown in Table 4 (Study II). A Pearson correlation between the GSI and factor scores was 0.956 in the combined admission and control sample, and the Spearman correlation was 0.997. These results indicate a strong agreement with a curvilinear relationship.

To establish viability of the subscales, the ECV and McDonald's omega values of the general factor in the bifactor analysis were generated. ECV was 56%, 76%, and 82% for admission, discharge, and control datasets, respectively. McDonald's omega values are presented in Table 5 (Study II).

Examining the gender differences with the standardized general factor scores from the bifactor model revealed significant differences according to gender. Boys seemed to score lower than girls in the patient admission sample (Welch test $p <$ .001, Cohen's $d = 0.8$; girls $M = 1.7$, $SD = 1.2$; boys $M = 0.6$, $SD = 1.4$) and in the control sample (Welch test $p < .001$, Cohen's $d = 0.6$; girls $M = 0.1$, $SD = 1.0$; boys $M = -0.4$, $SD = 1.0$).

According to ROC analyses (Figure 2) of the factor scores, patients at admission and discharge showed adequate discrimination (AUC 72%, 95% CI [66.8%, 77.4%]). Also patients at admission and controls (AUC 79% [75.5%, 84.3%]) showed adequate discrimination, and the group difference was significant with large effect ($p < 0.001$, Glass's $\Delta = 1.4$, Cohen's $d = 1.1$). Further, significantly lower scores were found with patients' discharge than with patients' admission (paired test $p < 0.001$, $d = 0.8$). Between controls' and patients' admission, the optimal cut-off point was $\theta = 1.14$, approximately corresponding to a GSI of 0.99, providing 86% specificity, 63% sensitivity, and a DOR of 10.5. When patients at admission and controls were combined, adolescents with and without a psychiatric diagnosis were distinguished on the general factor (AUC 83% [80%, 87%], $p < .001$, $\Delta = 1.7$, $d = 1.3$), with the optimal cut-off being $\theta = 0.68$, approximately corresponding to a GSI of 0.72 (83% specificity, 72% sensitivity, DOR 12.5).
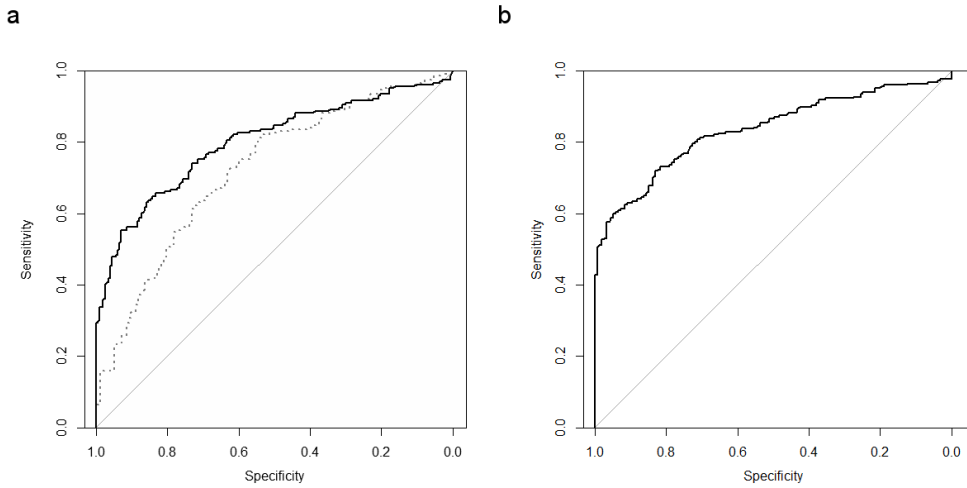
Figure 3. ROC analysis for SCL-90. (**a**) Inpatient admission vs. inpatient discharge (dotted line) and inpatient admission vs. community sample (solid line). (**b**) Individuals with a diagnosis and without a diagnosis.

5.3   Mediators between adverse childhood experiences and suicidality (Study III)

Inpatients and controls significantly differed according to living situation (Table 1). Controls lived more often in nuclear families, whereas inpatients lived more often in other types of family or in foster care ($p < 0.001$).

Recurrent thoughts of death were reported by 98 inpatients (47.0%) and two controls (1.0%). Recurrent suicidal ideation was reported by 94 inpatients (45.6%) and one control (0.5%). Altogether 45 inpatients (21.8%) had attempted suicide versus none in the community sample, and further 31 inpatients (15.0%) had a life-threatening suicidal act versus none in the community sample. The mean sum score

of suicidality was 7.4 (SD 2.7) for inpatients and 4.2 (SD 0.5) for community adolescents ($p < 0.001$).

As expected, inpatients reported more psychiatric symptoms ($M = 115.5$, $SD = 71.1$) than adolescents in the community ($M = 44.4$, $SD = 37.2$, $p < 0.001$). Inpatients also reported being more impulsive (inpatients: $M = 31.4$, $SD = 7.3$; community: $M = 24.9$, $SD = 6.1$, $p < 0.001$) and experiencing more family dysfunction (inpatients: $M = 56.1$, $SD = 16.3$; community: $M = 43.3$, $SD = 13.8$, $p < 0.001$) and social dysfunction (inpatients: $M = 27.9$, $SD = 8.3$; community: $M = 19.9$, $SD = 5.6$, $p < 0.001$) than community youths. Alcohol use did not differ significantly between inpatients and community youths (inpatients: $M = 4.4$, $SD = 6.6$; community: $M = 3.5$, $SD = 4.9$, $p = 0.327$).

Correlations existed between suicidality variables and suicidality sum score as well as psychiatric symptoms, impulsivity, alcohol use, and family and social dysfunctions (Study III, Table 2). The strongest correlations were found between psychiatric symptoms and suicidality sum score as well between impulsivity and suicidality sum score. Significant correlations were found between all variables except for the relationship between recurrent thoughts of death and alcohol use.

To determine direct and indirect effects of the total score of ACE and suicidality (Study III, Table 3) a simple mediation test was conducted. A positive direct effect of the total score of the ACE on suicidality was seen. Also a positive indirect effect of the ACE total score on suicidality sum score through psychiatric symptoms, impulsivity, and family and social dysfunctions was observed, indicating partial mediation effects. By contrast, alcohol use did not affect the relationship between total score of ACE and suicidality sum score, and thus, was excluded from further analyses. Age and gender also had no significant impact on results.

A multiple mediation analysis was conducted to test for simultaneous indirect effects of ACEs on suicidality through four mediators: psychiatric symptoms, impulsivity, social dysfunction, and family dysfunction (Study III, Table 4). In the multiple mediation model ($R^2 = 0.434$, adjusted $R^2 = 0.462$), the total effect of the total score of the ACE on suicidality sum score was 0.754 ($SE = 0.080$; $t = 9.548$; $p < 0.001$), and the direct effect was 0.369 ($SE = 0.077$; $t = 4.770$; $p < 0.001$). The point estimate of the total indirect effect of the ACE total score on suicidality through all four mediators was 0.385. Since the bias- corrected bootstrap CI (95%) was 0.282-0.498, it indicated that all mediators together, psychiatric symptoms, family dysfunctions and social dysfunctions and impulsivity, mediated the effects of ACEs on suicidality. Nevertheless, the specific indirect effects indicated that only psychiatric symptoms and impulsivity were significant mediators.

To ascertain whether the indirect effects significantly differed from each other, pairwise contrast was examined. This examination showed that the specific indirect effect through psychiatric symptoms was larger than it was through impulsivity. The specific indirect effect through psychiatric symptoms was also larger than it was through both family- and social dysfunctions. Despite impulsivity significantly differing from zero, it did not differ from social and family dysfunction in terms of magnitude. Social dysfunction did not differ from family dysfunction. In this analysis, age and gender as covariates had no significant effects on results.

5.4 Risk factors related to self-harm behavior in Finnish adolescent inpatients with a history of non-suicidal self-injury, suicidal behavior, or both (Study IV)

According to bivariate analyses, 86 inpatients (42.0%) reported no history of self-harm, 62 (30.2%) a history of SB, 10 (4.9%) a history of NSSI, and 47 (22.9%) a history of both SB and NSSI.

Fisher's exact test was performed in order to reveal gender and diagnostic distributions in these four groups (Study IV, Table 1). Significant differences were found between self-harm groups in depressive disorders ($p = 0.025$) and bipolar disorder ($p = 0.028$). Other diagnoses revealed no significant group differences. Post hoc analysis revealed no significant group differences. Females were over-represented in all self-harm groups ($p < 0.001$).

Using Fisher's exact test to examine the distribution of various ACEs in four different groups (Study IV, Table 2) revealed significant group differences in parental criminality ($p = 0.045$) and in sexual abuse ($p < 0.001$). Post hoc analysis revealed no significant group differences. Other studied ACEs revealed no significant group differences.

The next step was to examine the group differences with continuous outcome variables, including psychiatric symptoms, alcohol use, impulsivity, family dysfunction, social dysfunction, and ACE total score. Analysis of ANOVA across different self-harm groups indicated an overall effect for group membership (adolescents with no self-harm behavior, adolescents with SB only, adolescents with NSSI only, adolescents with both SB and NSSI) on psychiatric symptom scores,

impulsivity scores, family dysfunction scores, and social dysfunction scores (Study IV, Table 3). Tukeys' post hoc comparison test revealed significantly lower psychiatric symptom scores and social dysfunction scores in participants with no self-harm behavior than in participants in the three self-harm behavior groups. Further, individuals in the no self-harm behavior group showed significantly lower scores on both impulsivity and family dysfunction than those in the SB or SB with NSSI group.

Looking more closely at psychiatric symptoms, the group differences were investigated using SCL-90 subscales (Somatization, Interpersonal sensitivity, Depression, Anxiety, Phobic anxiety, Paranoid ideation, Psychoticism, Obsessive-compulsive behavior, and Hostility). On all subscale scores, ANOVA revealed an overall effect for group membership (Study IV, Table 4). Tukeys's post hoc comparison test indicated significantly lower scores for the no self-harm behavior group than for the three self-harm behavior groups on the subscales of Somatization, Depression, Anxiety, Phobic anxiety, Psychoticism, Obsessive-compulse behavior, and Hostility. Additionally, the no self-harm behavior group exhibited significantly lower scores on the subscales of Interpersonal sensitivity and Paranoid ideation than the SB and SB with NSSI groups.

Multinomial regression analysis was performed to assess potential mutual risk factors for self-harm behavior. In this analysis, the group with no self-harm behavior served as the reference group for the self-harm behavior groups. Age and gender were used as covariates. In the first phase, all psychiatric diagnoses were entered into the model. The analysis revealed a significant association between depressive (OR 4.05, 95% CI 1.65-9.94, p=0.002) and bipolar disorders (OR 15.22, CI 2.72-83.89, p=0.002) and SB. There was also a trend for anxiety disorder to be linked to SB with NSSI, but not significantly (OR 2.17, CI 0.995-4.71, p=0.051). The analyses revealed that none of the diagnoses was significantly associated with NSSI only.

In the second phase, all ACEs were entered into the model. Sexual abuse was the only statistically significant ACE, related to SB with NSSI (OR 7.48, CI 2.53-22.09, p<0.001), but not to other self-harm groups. There was also a trend toward significance for ACE total score to be related to SB with NSSI (OR 1.25, CI 1.00-1.56, p=0.050).

In the third phase, impulsivity, social dysfunction, family dysfunction, alcohol use, and psychiatric symptoms were entered into the model (Study IV, Table 5). Impulsivity was significantly linked to SB with NSSI (OR 1.08, CI 1.00-1.16, p=0.044), and psychiatric symptoms were significantly linked to SB (OR 1.01, CI 1.00-1.02, p=0.023) and to SB with NSSI (OR 1.01, CI 1.00-1.02, p=0.035). When ACE total score was entered into the model, some substantial changes occurred;

psychiatric symptoms were no longer linked to SB significantly, while social dysfunction was now significantly associated with NSSI (OR 1.19, CI 1.00-1.41, p=0.048).

In the fourth and last phase, all SCL-90 subscales were entered into the multinomial regression model (Study IV, Table 6). The subscale Psychoticism was significantly related to all self-harm behavior groups. The strongest association was observed with NSSI (OR 1.45, CI 1.17-1.81, p=0.001), followed by SB with NSSI (OR 1.19, CI 1.05-1.35, p=0.006). Depression was significantly related to SB (OR 1.10, CI 1.03-1.18, p=0.006) and to SB with NSSI (OR 1.10, CI 1.02-1.19, p=0.011). Adding the ACE total score to the model did not change the above relationships, and ACE total score was not significantly related to self-harm behavior groups.

6   DISCUSSION

6.1   Summary of main findings

This thesis investigated adverse childhood experiences, suicidality, psychiatric disorders, impulsivity, alcohol misuse, and family and social dysfunctions among adolescent inpatients and community youth. According to this study, adolescents in psychiatric hospitalization have generally been exposed to many adverse childhood experiences compared with adolescents in the community. While 20% of adolescent inpatients had been exposed to at least four different ACEs, the corresponding proportion in community youths was only 2%. Four different ACEs have been reported to be the threshold value linked to an increased likelihood of adverse health outcome (Dong et al., 2003). The most predominant ACE was parents' divorce followed by parental mental health problems in both inpatient and community samples, but there was a significant difference between the groups. Thus, adolescent inpatients had been exposed significantly more often to ACEs associated to psychopathology. Sexual abuse was the most significant event associated to psychiatric psychopathology. Different ACEs may lead to either internalizing or externalizing disorders. The only significant difference was that adolescents with internalizing disorders had more often witnessed intimate partner violence, while adolescents with externalizing disorders had more often experienced parents' divorce. Some gender differences were found regarding perceived support from family or friends.

In a simple mediation test, psychiatric symptoms, impulsivity, and social and family dysfunctions significantly mediated between ACEs and suicidality. Alcohol misuse, surprisingly, did not mediate this relationship. In the multiple mediation assessment, psychiatric symptoms followed by impulsivity were the most significant mediators between the total score of ACEs and the suicidality sum score.

Looking more closely at the factors associated with either no self-harm behavior, non-suicidal self-injury (NSSI), suicidal behavior (SB) or both NSSI and SB in an inpatient sample, the results revealed that SB was associated with diagnosed depressive and bipolar disorders as well as sum score of self-reported psychiatric

symptoms, and symptoms of depression (measured with SCL-90). Symptoms of depression, sexual abuse, and impulsivity were all associated with SB combined with NSSI. NSSI was related to social dysfunction. Additionally, self-reported psychoticism was associated with all three self-harm groups.

6.2 Adverse childhood experiences as risk factors of psychopathology and hospitalization among adolescents

In this study, ACEs were defined as physical and sexual abuse, witnessing intimate partner violence, parental psychiatric problems, parental alcohol or drug abuse, parental criminal behavior, and parental separation or divorce. Additional social factors were victimization via school bullying and perceived support from parents and friends. This study adduced that adolescent inpatient had experienced significantly more ACEs than comparisons, and this finding is in line with many earlier studies (Anda et al., 2006; Dube et al., 2001, 2002, 2005, 2006; Isohookana et al., 2012).

Parental divorce was the most common ACE in both the inpatient (54.4%) and comparison (36.5%) groups. Given that in Finland every second marriage ends in divorce (Finland's Official Statistics, 2014), this finding is not surprising. However, it is noteworthy that inpatients had experienced parental divorce significantly more frequently than adolescents in the community.

Of the studied ACEs, a parental psychiatric problem was the second most common adverse experience in both inpatients (39.3%) and community youths (10.3%). Epidemiological studies have shown that up to 23% of all families have had at least one parent with psychiatric problems (Maybery et al., 2009). This finding is important since it has been well documented that mental illness of a parent impacts on the capacity to parent. The parent with mental illness has been reported to be less sensitive (Oyserman et al., 2005), less likely to be emotionally available and affectionate (Riley et al., 2008), and to have unusual or inappropriate affective responses to the child (Seeman, 2004). Additionally, families with parental mental illness have shown lower family cohesion and poorer communication (Warner et al., 1995). Further, families with severe parental mental illness have been associated with a significantly greater risk for their offspring to develop mental health problems

(Larrson et al., 2000; Leschied et al., 2005; Mowbray et al., 2004). However, in this study we had no knowledge of the extent of parents psychiatric problem. It is important to pay attention to parents' ability to support positive development of the child, but also to ascertain adequate skills and knowledge of mental health workers to work with the family as a group and offer family-focused interventions (Korhonen et al., 2008).

A clear difference between the groups in this study was that about 20% of adolescent inpatients had been exposed to at least four different ACEs, while the corresponding frequency in the community sample was only 2%. At least four or five ACEs have been observed to be the threshold value associated with an increased likelihood of adverse health outcomes (Dong et al., 2003; Dube et al., 2003). This result shows that ACEs frequently co-occur, consistent with findings elsewhere (Dong et al., 2003, 2004; Isohookana et al., 2012). It has also been reported that the number of ACEs is even more important than a single ACE, with the cumulative number of ACEs predicting psychological distress (Kumar & George, 2013; Rasmussen et al., 2013).

According to this study, inpatients commonly reported to experienced victimization via school bullying (42.7%), while in the comparison group this experience was much less common (5.9%). Victimization of the school bullying is fairly common; previous studies have revealed prevalence rates of regular school bullying, either as the victim, the perpetrator, or both, of 10-20% for children and adolescents. A limitation of this study is that we did not gather information on bullies or bully-victims. Since the experience of victimization via school bullying is quite common, this requires mental health interventions in school healthcare for those who have experienced school bullying as victims, bullies, or both.

In this study, the comparison group perceived more social support from parents than inpatients and also from friends, in accord with a previous study (Kumar & George, 2013). Especially girls in the comparison group reported more social support from friends. According to an earlier study by Procidano and Heller (1983), perceived support from family and friends was inversely related to symptoms of distress and psychopathology, but the relationship was stronger for perceived support from the family than from friends. According to their study, perceived support from friends was more closely related to social competence, and individuals with high perceived support from friends had lower levels of anxiety and also talked more to friends and siblings than those who perceived a lower level of support from their friends. Vaux (1985) has also noted that variations in social support may be the result of cultural norms related to gender-appropriate behavior. Young people with

perceived low support pose a challenge our healthcare and social services, requiring advice and support from professionals before their problems escalate.

Perceived support from both friends and family was negatively correlated with almost all ACEs, confirming earlier studies (Appleyard, Yang, & Runyan, 2010; Sperry & Widom, 2013). For children and adolescents, the most important social context is family, which plays a key role in a child's or adolescent's individuation process and identity formation, providing an environment to explore and learn new roles and values (Noach, Kerr, & Olah, 1999). Family relationships add the support, scaffolding, and protection to a child's or adolescent's life, which both buffers them from developmental disruptions and help build key capabilities; like adapting to changing circumstances, developing the ability to plan and regulate behavior (Center on the Developing Child at Harvard University, 2016), and refining social skills (Newman et al., 2008). According to Camara and colleagues (2014), the kind of support that adolescents most valued was emotional support. Emotional support from peers is reflected in empathic responses, which enforce the feeling that others are concerned about them and;that they are not invisible to others. Adverse experiences may affect the ability to maintain relationships, hinder the child's social cognitive development, and lead to low social support and problems with social adjustment (Koizumi & Takagishi, 2014). It is important to identify dysfunctional families in clinical settings and offer them family-focused therapy. One successfully used short-term therapy is Problem-Centered Systems Therapy, which provides an empirically validated approach to assess and treat dysfunctional families (Miller et al., 2000).

In examining the associations between ACEs, victimization via school bullying, and perceived support from family and friends, all ACEs were correlated with each other, except for parents' divorce and adolescent sexual abuse. School bullying was positively correlated with all ACEs. Some support for this finding is provided by Baldry (2003), who found that especially interparental violence was associated with experiencing school bullying. Baldry (2003) hypothesized that exposure to interparental violence could lead to lowered self-esteem, depression, or fear, reducing a child's capacity to be assertive when victimized at school. Thus, the vicious cycle of victimization may start at home and continue at school. However, in our study, in the logistic regression analysis, after controlling for diagnosis, age, and sex, school bullying was related only to parental criminality and physical abuse. This finding gains some support from the studies of Widom and colleagues (2008) and Logan with colleagues (2009), who report that especially adolescents exposed to physical abuse are at risk for victimization via school bullying. This is also concordant with the results of chronic stress and brain development. We can suppose that the

experience of being victim of school bullying is partly the result of chronic stress in those adolescents exposed to ACEs. As mentioned earlier chronic stress can affect developing brain circuits and hormonal systems, leading to poorly controlled stress response systems when the brain's focus is on rapid stress responses, leading to impulsive decisions and actions. According to this theory, an adolescent may feel threatened even when no real threat exists, and see anger or hostility in a facial expression that is actually neutral. (Loman & Gunnar, 2010; National Scientific Council on the developing child, 2015; Center on the Developing Child at Harvard University, 2011 and 2016). Thus, while the experience of being a victim of school bullying may be true, it may also be a somewhat distorted interpretation caused by chronic stress.

Physical abuse and sexual abuse were linked to both internalizing and externalizing disorders as well as to parental substance use and psychiatric problems. Witnessing intimate partner violence was, however, related to internalizing disorders, while parents' divorce was linked to externalizing disorders. These results are fairly consistent with earlier studies, as most ACEs have been linked to both internalizing and externalizing disorders. In this study, age, sex, and SES were controlled, but in some studies simultaneous controlling for several family determinants may lead to different results. It is also noteworthy that adolescent inpatients had experienced several ACEs. Since ACEs are well-documented risk factors for later psychopathology and suicidality, it is important to help the whole family, and if necessary, guide the parent(s) to personal treatment. Further, it is important to assess whether the child or adolescent can live at home; is it beneficial for normal, healthy development?

One notable result here was that the experience of sexual abuse sharply increased the risk for having either an internalizing or externalizing disorder. Earlier studies have also related sexual abuse to a wide range of psychiatric disorders and problems (Froundfelker et al., 2013; Isohookana et al., 2012). If sexual abuse occurs in childhood it may hinder normal social growth and be a cause of many different psychosocial problems (Maltz, 2002). It has been hypothesized that sexual abuse is a more pathogenic experience than other interpersonal traumas (Brewin et al., 2000; Higgins & McGabe, 2000). Experiencing sexual abuse leaves the child with little control over what happens, and creates a situation of powerlessness. The sense of lack of control likely acts as a stressor that has effects on neurodevelopment that are not gender-specific (Dupe et al., 2005). Survivors may often feel guilt, shame, worthlessness, and self-blame. It has been shown that survivors frequently take personal responsibility for the abuse and have difficulties in externalizing the abuse, thus thinking negatively about themselves (Hall & Hall, 2011, Long et al, 2006).

Feeling of shame may also have an influence on keeping the sexual abuse experience in secret. According to Priebe and Svedin (2008), nearly 40% of adolescent victims had only disclosed the abuse to a same-aged peer and nobody else. Especially if the sexual abuse involves a family member and emotional support is not available in the familial environment, a youth may be more likely to turn to peers for emotional support (Hébert et al., 2014). Although research has shown that there are significant relationship between different types of long-term effects and childhood sexual abuse, all abused victims' responses and experiences are not the same. Different victims may have very different symptoms and, it is important for clinicians to focus on the individual needs of the client (Hall & Hall, 2011).

6.3 Psychometric properties of Symptom Checklist-90 in adolescent psychiatric inpatients and age- and gender-matched community youth

To determine whether the SCL-90 is an applicable measure for adolescents, the first step was to establish measurement invariance across the community and inpatient. The analyses revealed measurement invariance to be satisfactory across two samples and two time-points, and thus, our results support an earlier study with clinical and general adult populations (Arrindell et al., 2006). Symptom checklists are developed to assess symptoms with the goal of following individuals over time and usually comparing groups. Measurement invariance is critical for a valid questionnaire; it should measure identical constructs with the same structure across different groups, i.e. individuals and groups should respond similarly to the items over time, and, as a consequence, factor means can reasonably be compared (Van De Schoot et al., 2015). Therefore, measurement invariance was first ensured in this study.

Bifactor modeling has been rediscovered as an effective approach to modeling construct-relevant multidimensionality in a set of ordered categorical item responses (Reise, 2012). The bifactor model enables the estimation of the separate contributions of a general factor and specific symptom scores. Estimating model-based reliabilities helps to evaluate the degree to which multidimensionality influences the interpretation of both total and subscales scores (Reise et al., 2013; Urbán et al., 2016). Therefore, the bifactor model helps to determine the clinical

usefulness of symptom scores independently from the general distress score (Urbán et al., 2016). Of the three models used in this study, the one-dimensional model had a good fit, but the best fit was found with the bifactor model in all three subsamples. The bifactor model has previously been shown to perform better than alternative models with SCL-90 (Thomas, 2012; Urbán et al., 2014; Ubán et al., 2016).

Concordant with earlier studies, only one strong global distress factor was observed, and weaker symptom factors emerged in the clinical sample, while the control sample indicated unidimensionality (Urbán et al., 2014; Paap et al., 2011, 2012). The finding that especially variance of the depression subscale reflected general distress and not a separate dimension is supported by earlier studies (Sandanger et al., 1998; Smits et al., 2014; Urbán et al., 2016). The symptom checklist has been hypothesized to provide more diagnostic information regarding depression and anxiety than other specific symptoms. Additionally, Paap and colleagues (2011, 2012) concluded that different populations have varying dimensionality results; adult patients with high distress levels supported multidimensionality, while samples with low levels of distress indicated unidimensionality.

At the end, SCL-90 may be useful tool in a clinical setting, as it performs well as a screening instrument and is especially sensitive to change over time. It is worth noting that SCL-90 is more suitable for screening internalizing symptoms like depressive or anxiety symptoms, than externalizing symptoms in adolescents. Diagnostics and interpretations based on symptom profile (scores on different subscales) should be avoided, as inadequate evidence exists for the dimensionality of the SCL-90 (Holi, 2003). SCL-90 subscale scores may still be useful tool as a basis for discussion of adolescents' symptoms.

6.4   Mediators between adverse childhood experiences and suicidality

The cumulative number of ACEs had a direct effect on suicidality sum score, and the same results have been documented in many studies (e.g. Miller et al., 2013). ACEs have been reported as etiological factors in the development of self-harm behaviors. The relationship between ACEs and suicidality has been demonstrated to be robust, even after controlling for other environmental factors (Brodsky & Biggs,

2012; Dube et al., 2001; Yates et al., 2008). The findings that psychiatric symptoms, impulsivity, family dysfunction, and social dysfunction act as mediators between ACEs and suicidality are concordant with earlier studies; the lack of a finding of alcohol misuse as a mediator has some support from recent studies (Cluver et al., 2015; Hardt et al., 2011). Hardt and colleagues (2011) hypothesized that alcohol use may be more an indicator for suicidality rather than a causal link in the development of suicidality. Another explanation may be that in Finland adolescents with severe alcohol use problems are usually treated in units other than psychiatric wards, and thus, this study sample lacked individuals with alcohol problems.

From a developmental point of view, some exposure to stress in childhood and adolescence is normal and also necessary for an individual to gain and develop healthy coping mechanisms and problem-solving skills. If the stress is tolerable, the child's activated stress response system within a supportive environment with the parent(s) is buffered and returned to baseline, resulting in the development of a healthy stress response system. However, stress may be toxic if the child's stress response is long-lasting and extreme without a supportive, buffering adult. This can result in damaged and weakened stress response system and brain architecture, leading to stress-related diseases and cognitive impairment (Center on the Developing Child at Harvard University, 2016; Shonkoff & Garner, 2014). Thus, it is not surprising that in this study family dysfunction was a mediator between ACEs and suicidality. Although one supportive parent is usually sufficient to protect and buffer a child's stress, many adversities encountered by the child and adolescent are family-related, and thus, the entire family dynamic may be imbalanced. It is also not surprising that social dysfunction mediated the relationship between ACEs and suicidality since earlier neurobiology studies have reported that prolonged childhood stress has an effect on brain development, leading to behavioral and social problems (Anda et al., 2006). Thus, interpersonal difficulties with parents and with peers may often occur hand in hand, and maladaptive patterns of interpersonal functioning may contribute to the onset of loneliness, hopelessness, and suicidal behavior (Johnson et al., 2002).

Although interpersonal difficulties were significant mediators in the simple mediation test, psychiatric disorders followed by impulsivity turned out to be the most significant mediators in multiple mediation analyses. Especially adolescents with suicide attempts have been linked to more severe symptoms of psychopathology, severe anhedonia, negative self-evaluation, hopelessness, major depressive disorder, post-traumatic stress disorders, and impulsivity than adolescents with no self-harm behavior or only non-suicidal self-injury (Asarnow et al., 2011; Brausch & Gutierrez, 2010; Dougherty et al., 2009; Muehlenkamp & Gutierrez,

2007; Jacobson et al., 2008). However, adolescents with self-harm behavior report also more family conflicts and abusive history (Asarnow et al., 2011; Whitlock & Knox, 2007). So, both psychopathology and impulsivity have been linked to ACEs and suicidality. The recent studies of neurobiology have suggested that ACEs increase the risk of suicidality by influencing brain structures, stress regulation systems, and serotonin levels. (Braquehais, Oquendo, Baca-García, & Sher, 2010). Additionally low serotonin function has been linked to impulsiveness and aggressive behaviors in adolescents with multiple psychiatric disorders including depression (Braquehais, Oquendo, Baca-García, & Sher, 2010).

There are different perspectives on, how impulsivity is linked to suicidality. From the developmental perspective, adolescence is a period of significant psychosocial and neurobiological changes. The psychosocial perspective stresses that as the youth becomes more autonomous from the parents and reliant on peers, this transition gives rise to greater interpersonal stress and emotional reactivity (Rudolf, 2008). From the neurodevelopmental point of view, the discordant development of prefrontal and limbic circuitry contributes to adolescent risk-taking and impulsivity (Forbes & Dahl, 2005). It has been supposed that the largely intact limbic system drives reward-seeking and goal-directed behavior, while an under-developed prefrontal system is not equipped to inhibit and control impulses (Casey et al., 2008). This discordant neural development contributes, at least partly, to a range of negative, impulsive outcomes in adolescents, e.g. accidents and suicide (Casey et al., 2008).

Researchers who have studied different kind of impulsivities and suicidality have found that negative urgency (strong and immediate need to avoid undesirable emotions) is associated with suicide attempts (Lynam et al., 2011). Emotion-relevant impulsivity (poor control over reactions following emotions) is associated with disorders, that are directly related to suicide risk, like depressive disorder (d' Acremont & Van der Linden, 2007) and borderline personality disorder (Glenn & Klonsky, 2010). Auerbach and colleagues (2017) studied whether distinct domains of impulsivity are associated with suicide ideation, plans and attempts in an adolescent inpatient sample. They found that Pervasive influence of Feelings (tendency for emotions to shape thoughts about the self and the future) was uniquely associated with greater suicidal ideation, while Feelings Trigger Action (impulsive behavioral reactivity to emotions) was uniquely associated with suicide attempts.

In clinical settings, it is important to include the whole family in the treatment and to strength the relationship between child and parent(s), a relationship that should be responsive and buffer the child from developmental disruption. A parent's ability to monitor and regulate behavior enables the child to respond adaptively to

adversities. A supportive relationship between parent(s) and the child strengthen adaptive skills and develop the child's resilience (Center on the Developing Child at Harvard University, 2016). Further, since different combinations of factors can be associated with the risk of suicide, it is important in clinical settings to conduct a comprehensive assessment of risk factors in adolescent patients at risk for suicide (Johnson et al., 2002).

6.5 Risk factors related to self-harm behavior in adolescent inpatients with a history of non-suicidal self-injury, suicidal behavior, or both

The aim of this study was to examine which risk factors are associated with self-harm behavior, non-significant self-injury (NSSI), suicidal behavior (SB), and SB with comorbid NSSI. The examined risk factors were diagnoses, ACEs and the sum score of ACE, and psychiatric symptoms according to the SCL-90 questionnaire, impulsivity, alcohol use, and family and social dysfunctions.

The adolescent inpatients with SB and comorbid NSSI seemed to have the most risk factors of all the groups. This group had been exposed to sexual abuse and had symptoms of impulsivity, depression, and psychoticism. The NSSI only group had the fewest risk factors. This group was characterized by the highest social dysfunction and symptoms of psychoticism. The finding that adolescents with both SB and NSSI may be a group with most severe psychopathology than those with NSSI only is supported in many earlier studies. Compared with NSSI only, those with both SB and NSSI have been reported to have more severe symptoms of psychopathology, more severe anhedonia, hopelessness, and negative self-evaluation, greater depression and impulsivity, and more abuse histories (Brausch & Gutierrez, 2010; Dougherty et al., 2009; Whitlock & Knox, 2007). A somewhat inconsistent finding with earlier studies was that adolescents with NSSI only reported greater social dysfunction than the other two groups. Braush and Gutierrez (2010) did not find any significant difference in the level of social support between NSSI and NSSI with SB groups.

SB only was related in this study to diagnosed depression and bipolar disorders, self-reported psychiatric symptoms, symptoms of depression, and psychoticism.

Consistent with earlier studies, also this group was assessed to have less severe psychopathology than the group with both SB and NSSI. According to previous studies, those who have both SB and NSSI relative to SB only are reported to be more certain that their suicidal attempts would be lethal (Andover & Gibbs, 2010), to feel less fear of suicidal behavior (Muehlenkamp & Gutierrez, 2007), and to have more internalizing anger, risky behaviors, and loneliness (Guertin et al., 2001).

Also consistent with earlier studies, adolescents with SB seems to be more impaired than those with NSSI only. Previous studies have noted that those with SB more often report severe symptoms of psychopathology (Claes et al., 2010; Jacobson et al., 2008), more often are diagnosed with MDD (Jacobson et al., 2008), and more often describe greater depression, depressive reactions, hopelessness, and suicidal ideation than adolescents with NSSI only (Claes et al., 2010).

According to this study, adolescents with SB only seemed to be the most homogeneous group, with depression or bipolar diagnosis and depressive symptoms. Those who had NSSI or NSSI with SB constituted more heterogeneous groups. The only symptom connected to all three self-harm behavior groups was psychoticism. Some explanations have been offered for this finding. Individuals with self-harm behavior (without suicide attempt) usually have depressive symptoms (Haw et al., 2001) and dissociative experiences (Peterson et al., 2008). Depression or dissociative symptoms may be due to ACEs or to borderline personality disorder (Haw et al., 2001), and these depressive and dissociative symptoms may be linked to symptoms of psychoticism (Devillé et al., 2014; Schroeder et al., 2013). Honings and colleagues (2016) conducted a systematic review and meta-analysis of psychotic experiences and risk of self-injurious behavior in the general population. This study covered all suicidal behavior categories from NSSI to suicidal behavior with suicidal intent, to suicide attempt. Psychotic experiences represented delusional or hallucinatory experiences that fell below the threshold of a diagnosable psychotic disorder. The main result of this meta-analysis was that psychotic experiences were associated with an increased risk of self-harm behavior. The writers also reported, based on earlier studies, that an association between psychotic experiences and self-harm behavior is likely to be confounded or mediated by other psychopathology. According to this same systematic review, shared risk factors were found between psychotic experiences and self-harm behavior, such as emotion-oriented coping style and increased emotional reactivity to stress. The writers also concluded that routine assessment of psychotic experiences in individuals with non-psychotic psychopathology has the potential to reveal passive risk markers of self-harm behavior.

6.6   Methodological considerations

6.6.1   Strengths of the study

The study sample was relatively large and based on consecutive referrals of inpatients and age- and sex-matched community youths. One strength is that this study had a comparison group comprising a random sample of gender- and age-matched students. Both inpatients and controls had virtually identical study protocols, which improved the validity of the study (du Fort, Newman & Bland, 1993). However, there was a possibility to gather knowledge of inpatients from clinical records, but not for most of community youths. Since there are a limited number of ACE studies including a comparison sample, this study provided insight into the differences regarding ACEs, sociodemographic factors, psychiatric symptoms, and suicidality that exist between individuals in the community and inpatients suffering from severe psychiatric disorders. The assessments were based on well-studied self-report scales. DSM-IV psychiatric diagnoses and suicidal behavior and non-suicidal self-injury were based on valid and reliable semistructured K-SADS-PL interviews. Diagnostic interviews were supplemented with patient records. Background information on both groups was collected systematically with a structured background data collection sheet.

6.6.2   Limitations of the study

Although the sample was quite large, some attrition occurred and was related to psychotic disorder and male gender. Since boys are known to more often have externalizing disorders than girls, this might have skewed the results of the study. Also the small number of patients with psychotic disorders did not allow a more detailed analysis of the association between ACEs and psychotic disorders. Data were partly collected retrospectively, and this may introduce recall bias. Additionally, even though adverse childhood experiences had occurred in participants' recent past, causality cannot be confirmed. The K-SADS-PL interview does not define the exact time frame of the adverse life events or the appearance of psychiatric symptoms or suicidal behavior.

The participation rate in the comparison group was relatively small. An explanation for this may be that all invited participants were asked for written informed consent from their parents. Participants were also requested to give

permission for researchers to acquire information from official records (e.g. health services use and criminal records) during the next five years for a follow-up study.

Most of the information on ACEs was based on adolescents' self-reports. Additionally, sexual abuse was not distinguished as intra- and extra-familiar sexual abuse. Further, even if this study examined the wide range of adverse events that are the most used in ACE studies internationally, we did not study emotional neglect, which is traditionally included into ACEs. Inter-rater reliabilities of the diagnoses derived from the diagnostic interviews were not measured; however, psychiatrists specialized in adolescent psychiatry made the diagnosis, and in unclear cases, a consensus was reached between at least two experienced psychiatrists. It is also noteworthy that in some analyses disorders were based on principal diagnoses, although many of the adolescents had comorbid disorders.

During the study period patients with severe eating disorders and substance use disorders were not treated in the wards in which this study was conducted, but were referred to specialized units. Also, during the study period, mental health organization was very hospital-orientated, i.e. inpatients may have been less disturbed than nowadays. The results from this study cannot be directly generalized to other inpatients and are merely suggestive.

7　CONCLUSIONS

7.1　Clinical implications

This study support early findings that ACEs, especially cumulative number of ACEs, are related to mental health problems and psychiatric inpatient status. Although most people encounter some ACEs in childhood or adolescence, exposure to numerous ACEs have long-term consequences on adolescence and adulthood and even on subsequent generations. In a child without responsive interaction, the architecture of brain may be weakened, leading to impaired learning, behavior, and health. Severe abuse and neglect decrease development of areas of the brain associated with emotions, attention, stress regulation, and self-control, requiring intensive and costly solutions for treatment. For strengthening core life skills, such as behavior regulation and adapting to changing circumstances, a child needs support from at least one responsive adult. Research has shown that even a child who has been exposed to severe hardships or threats can do well if buffered by a loving and reliable parent, caregiver, or other adult. A supportive relationship, adaptive skills, and positive experiences build a foundation for resilience. Since adolescents exposed to ACEs do not always seek help, primary healthcare professionals and schoolteachers are front-line adults for identifying adolescents with difficulties in coping with normal life situations or school days.

According to this study, children or adolescents with difficulties at school and exhibiting impulsivity, social dysfunction, or signs of mental health and behavior problems should be assessed carefully for ACEs. Only early interventions and treatment will prevent later severe mental health problems. There should, for example, be a psychiatric nurse at school who could explore and assess children and adolescents needing special attention.

Parents or guardians may need help themselves in building and using core capabilities such as self-regulation and executive function. Self-regulation helps an individual to respond effectively to the world and different situations, drawing on the right skills at the right time and resisting inappropriate responses. Executive function includes the ability to resist impulsive behavior and adjust to changing

demands. Parents may need coaching with skills such as assessing stressful situations and selecting new responses. Parents may also need guidance in accessing services, and the stigma attached to getting help should be minimized. Child welfare and healthcare have important roles in modeling these core skills and in supporting parents and children to strengthen their own capabilities.

According to this study, SB was clearly related to depression and bipolar disorder. SB with NSSI was the most disturbed group, with more ACEs than the other groups; its members were significantly more impulsive and showed symptoms of depression and psychoticism. This group needs special attention in healthcare to avoid suicide attempt. NSSI was the least disturbed group in this study. This does not mean, however, that adolescents with NSSI need less attention. Earlier studies have suggested that NSSI is may be a gateway for later suicidal behavior, and thus, to prevent later suicidal acts, this group also requires attention and treatment.

7.2   Implications for future research

Researches concerning adverse childhood experiences have shown inconsistencies in the definition and measure of ACEs, which is a methodological limitation of these studies. As consensus regarding assessment of ACEs is reached, the field will move towards increased consistency, improving comparability of results.

Recent studies have been mainly cross-sectional and retrospective. To gain a more accurate picture of the pathway from ACEs to later psychopathology and suicidal behavior or NSSI, prospective studies must be conducted. Especially prospective studies from early childhood (even birth) to late adolescence could expand our knowledge of the impact of age on the consequences of ACEs in adolescence or adulthood. Neurobiology has increasingly shed light on the mechanism by which ACEs impact neurobiological systems, leading to the development of such personality traits as emotion dysregulation, impulsivity, and aggression, which correlate with suicidal behavior. Still, more studies investigating the mechanisms underlying personality disorders and suicidal behavior are needed. There is also a paucity of studies concerning the effectiveness of interventions, i.e. how different interventions, such as family intervention vs. individual intervention affect the views of prospective studies.

To elucidate the impact of ACEs on later psychiatric symptomatology and suicidality, it would be valuable if the duration, intensity, severity, and age at onset of ACEs could be determined. Moreover, identification of factors protecting against suicidality is critical to develop effective treatment interventions.

8   ACKNOWLEDGMENTS

This research project began over ten years ago in adolescent psychiatric inpatient wards at Kellokoski Hospital, the Hospital District of Helsinki and Uusimaa. The former research in adolescent psychiatry wards in Kellokoski was accomplished in 1972-1975. Because the structure of mental health care was changing, the problems of patients were changed, and the increasing population in the hospital area of Hyvinkää made some pressures to evaluate the direction of inpatient treatment, the need of research was justifiable. The research and development project "Kellokoski hospital Adolescent Inpatient Follow-Up Study (KAIFUS)" began. This study is based on the baseline data. The first meeting concerning this project was held in 2004, so the journey has been long and laborious, but at the same time very instructive and fascinating.

As a novice researcher, I needed a lot of support and advices through this dissertation. I have been lucky to have excellent supervisors. At Tampere University, my first supervisor was Professor, now Emeritus professor Matti "Musi" Joukamaa. He was gentle, skilled and experienced supervisor for me at the beginning of my researcher work. My greatest thanks to Musi. After Musi's well- earned retirement, I have had docent Sari Fröjd as my supervisor in Tampere University. She has considerately providing me with utterly valuable support and advice during the process of writing the articles, and finally this thesis.

I also want sincerely thank Professor Nina Lindberg, PhD, my second supervisor. Her enormous support and encourage in good and bad days, in success and failures has keeping me going further. She has gave me time, when I have needed it, and pushed me further when it was the right time. Her pedagogic and didactic skills have been crucial for the progress of this work. I am proud to be able to say that I have been a member of her research team.

I am grateful to Henna Haravuori, MD, PhD a research team member, who always be there when I needed help. Her expertise as adolescent psychiatry, and methodological understanding was essential in study plans of the articles. She was the first people, I had courage to introduce my drafts, ideas and ask help. She also made a huge work to finalizing the study material. Without her enormous work and persistence, this study could not have been made. My warmest thanks to Henna.

I owe my deepest gratitude to all my family members. You all have been supporting, sympathetic and loving during my almost endless work with this dissertation. Thank you for your patience; you are the light of my life.

This study was financially supported by the Hospital district of Helsinki and Uusimaa and Hyvinkää Hospital Region. I gratefully acknowledge these sponsors.

Loppi, October 2018

Minna Rytilä-Manninen

9 REFERENCES

Abram K, Teplin L, McClelland G, Dulcan M. (2003): Co-morbid psychiatric disorders in youth in juvenile detention. Arch Gen Psychiatry 60:1097–1108.

Ambrosini, P. J. (2000): Historical Development and Present Status of the Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS). Journal of The American Academy of Child and Adolescent Psychiatry. doi:10.1097/00004583-200001000-00016

American Psychiatric Association. (1994): Diagnostic and statistical manual of mental disorders (4th ed.). Washington, DC: American Psychiatric Association.

Anda R, Felitti V, Bremner J, Walker J, Whitfield C, Perry B, Dube S, & Giles W. (2006): The enduring effects of abuse and related adverse experiences in childhood: A convergence of evidence from neurobiology and epidemiology. Eur Arch Psychiatry Clin Neurosci 256: 174-186.

Andover M, Gibb B. (2010): Non-suicidal self-injury, attempted suicide, and suicidal intent among psychiatric inpatients. Psychiatry Res 178:101-5.

Angold A, Erkanli A, Farmer EM, et al. (2002): Psychiatric disorder, impairment, and service use in rural African American and white youth. Arch Gen Psychiatry 59:893–901.

Appleyard K, Yang C, & Runyan D. (2010): Delineating the maladaptive pathways of child maltreatment: A mediated moderation analysis of the roles of self-perception and social support. Development and Psychopathology. doi:10.1017/S095457941000009X

Arain M, Haque M, Johal, L, Marthur P, Nel W, Rais A, Sandhu R, & Sharma, S. (2003): Maturation of the adolescent brain. Neuropsychiatr Dis Treat 9, 449-461.

Arcelus, J., & Panos, V. (2005). Psychiatric comorbidity in children and adolescents. Current Opinion in Psychiatry, 18, 429-434.

Asarnow J, Porta G, Spirito A, Emslie G, Clarke G, Wagner K, Vitiello B, Keller M, Birmaher B, McCracken J, Mayes T, Berk M, Brent D. (2011): Suicide attempts and nonsuicidal self-injury in the treatment of resistant depression in adolescents: Findigs from the TORDIA study. J Am Acad Child Adolesc Psychiatry 50: 772-81.

Auerbach R, Stewart J, & Johnson S. (2017). Impulsivity and suicidality in adolescent inpatients. J Abnorm Child Psychol 45:91-103.

Baldacara L, Jackowski A, Schoedl A, Pupo M, Andreoli S, Mello M, et al. (2011a): Reduced cerebellar left hemisphere and vermal volume in adults with PTSD from a community sample. J Psychiatr Res 45: 1627-1633.

Baldacara L, Nery-Fernandes F, Rocha M, Quarantini L, Rocha G, Guimaraes J, et al. (2011b): Is cerebellar volume related to bipolar disorder? J affect Disord 135: 305-309.

Baldry A. C. (2003). Bullying in schools and exposure to domestic violence. Child Abuse & Neglect. doi:10.1016/S0145-2134(03)00114-5

Barret A, & Turner R. (2005): Family structure and mental health. The mediating effects of socioeconomic status, family process, and social stress. Journal of Health & Social Behavior 46:156-169.

Barret A, & Turner R. (2006): Family structure and Substance use problems in adolescence and early adulthood: Examining explanations for the relationship. Addiction 101:109-120.

Barrocas A, Hankin B, Young, J, & Abela J. (2012): Rates of Nonsuicidal Self-Injury in Youth: Age, Sex, and Behavioral Methods in a Community Sample. Pediatrics 130 (1): 39-45.

Bethell C, Solloway M, Guinosso S, Hassink S, Srivastav A, Ford D, & Guinosso S. (2017): Prioritizing Possibilities for Child and Family Health: An agenda to address adverse childhood experiences and foster the social and emotional roots of well-being in pediatrics. Academic Pediatrics 17:S36-S50.

Bibilola D, Makanjuola V, & Gureja O. (2010): Family related childhood experiences as risk factors for psychiatric disorders in Nigeria. Br J Psychiatry 196: 186-191.

Blakemore S, & Choudhury S. (2006): Development of the adolescent brain: Implications for executive function and social cognition, Journal of Child Psychology and Psychiatry 47:296-312.

Bledsoe J, Semrud-Clikeman M, Pliszka S. (2009). A magnetic resonance imaging study of the cerebellar vermis in chronically treated and treatment-naïve children with attention-deficit/hyperactivity disorder combined type. Biol Psychiatry 65: 620-624.

Boehnke, K., et al. (1989): Developmental pattern of prosocial motivation: A cross national study, J Cross Cult Psychol 20:219-243.

Bonicatto S, Soria J, & Seghezzo M. (1997): Validity and reliability of Symptom Checklist '90 (SCL-90) in an Argentine population sample. Soc Psychiatry Psychiatr Epidemiol 32:332-338.

Bonynge, E. (1993): Unidimensionality of the SCL-90-R scales in adult and adolescent crisis sample. J Clin Psychol 49:212-215.

Boon A, Boer B. (2007): Drug usage as a treat to the stability of treatment outcome. Eur Child Adolesc Psychiatry 16:79-86.

Boudreault-Bouchard A, Dion J, Hains J, Vandermeerschen J, Laberge L, & Perron M. (2013): Impact of parental emotional support and coercive control on adolescents' self-esteem and psychological distress: results of a four year longitudinal study. J Adolesc 36:695-704.

Bradley R, & Corwyn R. (2002): Socioeconomic status and child development. Annu Rev Psychol 53:371-399.

Bramen J, Hranilovich J, Dahl R, Forbes E, Chen J, Toga A, Dinov I, Worthman C, Sowell E. (2011): Puberty influences medial temporal lobe and cortical gray matter maturation differently in boys than girls matched for sexual maturity. Cerebral Cortex 21:636-646.

Brasil H, & Bordin I. (2010): Convergent validity of K-SADS-PL by comparison with CBCL in a Portuguese speaking outpatient population. BMC Psychiatry. doi:10.1186/1471-244X-10-83

Brausch A, & Gutierrez P. (2010): Differences in non-suicidal self-injury and suicide attempts in adolescents. Journal of Youth and Adolescence 39:233-242.

Brent D, Perper J, Goldstein C, Kolko D, Allan M, Allman C, et al. (1988). Risk factors for adolescent suicide. A comparison of adolescent suicide victims with suicidal inpatients. Archives of General Psychiatry 45:581–588.

Brewin C, Andrews B, & Valentine J. (2000): Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. Journal of Consulting and Clinical Psychology. doi:10.1037//0022-006X.68.5.748

Bridge J, Goldstein T, & Brent D. (2006): Adolescent suicide and suicidal behavior. Journal od Child Psychology and Psychiatry 47:372-394.

Brodsky B, & Biggs E. (2012): Adverse childhood experiences and suicidal behavior. Suicidology 17:16-21.

Brodsky B, Mann J, Stanley B, Tin A, Oquendo M, Birmaher B, Greenhill L, Kolko D, Zelazny J, Burke A, Melhem N, & Brent D. (2008): Familial transmission of suicidal behavior: Factors mediating the relationship between childhood abuse and offspring suicide attempts. J Clin Psychiatry 69:584–596.

Brown R, & Plener P. (2017): Non-Suicidal Self-Injury in Adolescence. Curr Psychiatry Rep 19:20.

Bruffaerts R, Demyttenaere K, Borges G, Haro J, Chiu W, Hwang I. et al. (2010): Childhood adversities as risk factors for onset and persistence of suicidal behavior. Br J Psychiatry 197:20-7.

Brunson K, Grigoriadis D, Lorang M, & Baram T. (2002): Corticotropin-releasing hormone (CRH) downregulates the function of its receptor (CRF1) and induces CRF1 expression in hippocampal and cortical regions of the immature rat brain. Experimental Neurology 176:75-86.

Bryan C, Johnson L, Rudd M, & Joiner T. (2008): Hypomanic symptoms among first-time suicide attempters predict future multiple attempt status. Journal of Clinical Psychology 64:519-530.

Caissy, G. (2002). Early adolescents: Understanding the 10 to 15 years olds (2nd ed.). Portsmouth, NH: Heinemann.

Camara M, Bacigalupe G, & Padilla P. (2014): The role of social support in adolescents: Are you helping me or stressing me out? International Journal of Adolescece and Youth 22:123-136

Cankaya B, Talbot N, Ward E, & Duberstein P. (2012): Parental sexual abuse and suicidal behavior among women with major depressive disorder. Can J Psychiatry 57:45–51.

Casey B, Jones R, & Hare T. (2008): The adolescent brain. Annals of the New York academy of Science 1124:111-126.

Caspi A, Roberts B, & Shiner R. (2005): Personality development: Stability and change. Annual Review of Psychology 56:453–484.

Cater Å, Andershed A-K, & Andershed H. (2014): Youth victimization in Sweden: Prevalence, characteristics and relation to mental health and behavioral problems in young adulthood. Child Abuse & Neglect 38:1290-1302.

Center on the Developing Child at Harvard University (2016). Applying the Science of Child Development in Child Welfare Systems. http://www.developingchild.harvard.edu

Cetin F. (2001): Suicide attempts and self-image among Turkish adolescents. Journal of Youth and adolescence 30:641-650.

Choi N, DiNitto D, Marti C, Choi B (2017): Association of adverse childhood experiences with lifetime mental and substance use disorders among men and women aged 50+ years. International Psychogeriatrics 29:359-372.

Choi S, Gibbons L, Crane P. (2011): lordif: An R package for detecting differential item functioning using iterative hybrid ordinal logistic regression/item response theory and Monte Carlo simulations. J Stat Softw 39: 8. doi:10.18637/jss.v039.i08.

Christie D, & Viner R. (2005): Adolescent development. BMJ 330:301-304.

Chung T, Colby S, Barnett N, Rohsenow D, Spirito, A, & Monti P. (2000): Screening adolescents for problem drinking: performance of brief screening against DSM-IV alcohol diagnoses. J Stud Alcohol 61:579-87.

Claes L, Muehlenkamp J, Vandereycken W, Hamelinck L, Martens H, Claes S. (2010): Comparison of non-suicidal self-injurious behavior and suicide attempts in patients admitted to a psychiatric crisis unit. Personal Individ Dif 48:83-7.

Classification of Social Economy Status (1989). National authority for collecting and compiling statistics on various fields of society and economy. Handbooks. (in Finnish).

Cohen D, Taieb O, Flament M, et al. (2000): Absence of cognitive impairment at long-term follow-up in adolescents treated with ECT for severe mood disorder. Am J Psychiatry 157:460–462.

Cooper J, Kapur N, Webb R, Lawlor M, Guthrie E, Mackway-Jones K, et al. (2005): Suicide after deliberate self-harm. A 4-year cohort study. Am J Psychiatry 162:297-303.

Costello E, Copeland W, & Angold A. (2012): Trends in psychopathology across the adolescent years: What changes when children become adolescents, and when adolescents become adults? J Child Psychol Psychiatr 52:1015-1025.

Courchesne E, Yeung-Courchesne R, Press G, Hesselink J, Jemigan T. (1988). Hypoplasia of cerebellar vermal lobules VI and VII in autism. N Engl J Med 318: 1349-1354.

Crone E, & van der Molen M. (2004): Developmental changes in real-life decision-making: Performance on a gambling task previously shown to depend on the ventromedial prefrontal cortex. Dev. Neuropsychol 25:251–279.

Crystal D, Watanabe H, Weinfurt K, & Wu C. (1998). Concepts of human differences: A comparison of American, Japanese, and Chinese children and adolescents. Dev Psychol 34:714-722.

d'Acremont M, & Van der Linden. (2007): How is impulsivity related to depression in adolescence? Evidence from French validation of the cognitive emotion regulation questionnaire. Journal of Adolescence 30:271-282.

De Bellis M. (2001): Developmental traumatology: The psychobiological developmene of maltreated children and its implications for research, treatment, and policy. Development and Psychopathology 13:539-564.

Denissen J, Asendorpf J, & van Aken M. (2008): Childhood personality predicts long-term trajectories of shyness and aggressiveness in the context of demographic transitions in emerging adulthood. Journal of Personality 76:67–99.

Derogatis L, Lippmann R, & Covi L. (1973): SCL-90: an outpatient psychiatric rating scale-preliminary report. Psychopharmacol Bull 9:13-28.

Devillé C, Moeglin C, Sentissi O. (2014): Dissociative disorders: between neurosis and psychosis. Case Rep Psychiatry. Doi:10.1155/2014/425892

Diamond R, Carey S, Back K. (1983): Genetic influences on the development of spatial skills during early adolescence. Cognition 13:167-185.

Dougherty D, Mathias C, Marsh-Richard D, Prevette K, Dawes M, Hatzis E, Palmes G, Nouvion S. (2009): Impulsivity and clinical symptoms among adolescents with non-suicidal self-injury with or without attempted suicide. Psychiatry Res 169:22-27.

Du Fort G, Newman S, & Bland R. (1993): Psychiatric comorbidity and treatment seeking: Sources of selection bias in the study of clinical populations. Journal of Nervous and Mental Disease 181:467-474.

Dube S, Anda R, Felitti V, Chapman D, Williamson D, & Giles W. (2001): Childhood abuse, household dysfunction, and the risk of attempted suicide throughout the life span findings from the adverse childhood experiences study. J. Am. Med 286: 3089–3096.

Dube S, Anda R, Whitfield C, Brown D, Felitti V, Dong M, & Giles W. (2005). Long term consequences of childhood sexual abuse by gender of victim. Am J Prev Med 28:430-438.

Entwisle D, & Astone N. (1994): Some practical guidelines for measuring youth's race/ethnicity and socioeconomic status. Child Dev 65: 1521-1540.

Erikson E. (1950): Childhood and society. New York: Norton.

Erkolahti R, Ilonen T, Saarijärvi S, & Terho P. (2003): Self-image and depressive symptoms among adolescents in a non-clinical sample. Nord J Psychiatry 57:447-451.

Erkolahti R, Saarijärvi S, Ilonen T, & Hagman H. (2002): Self-image of anorexic and bulimic female adolescents. Nord J Psychiatry 56:447-450.

Evans E, Hawton K, Rodham K, & Deeks J. (2005): The prevalence of suicidal phenomena in adolescents: A systematic review of population-based studies. Suicide Life Threat Behav 35:239-50.

Fairchild G, Passamonti L, Hurford G, Hagan C, von dem Hagen E, van Goozen S, et al. (2011). Brain structure abnormalities in early-onset and adolescent-onset conduct disorder. Am J Psychiatry 168:624-633.

Fergusson D, Woodward L, & Horwood L. (2000): Risk factors and life processes associated with the onset of suicidal behaviour during adolescence and early adulthood. Psychol Med 30:23–39.

Finkelhor D, Turner H, Ormrod R, Hamby SL. (2009): Violence, abuse, and crime exposure in a national sample of children and youth. Pediatrics 124:1411–23.

Finkelhor D, Turner H, Shattuck A, Hamby S. (2013): Violence, crime, and abuse exposure in a national sample of children and youth: an update. JAMA Pediatr 167:614–21.

Firestone R, & Seiden R. (1990): Suicide and the continuum of self-destructive behavior. J Am Coll Health 38: 207-213.

Fischer, K. W., Shaver, P. R., & Carnochan, P. (1990). How emotions develop and how they organize development. Cognition and Emotion, 4, 81 – 127.

Ford T, Goodman R, Meltzer H. (2003): The British child and adolescent mental health survey 1999: The prevalence of DSM-IV disorders. J Am Acad Child Adolesc Psychiatry 42:1203–1211.

Forbes E, & Dahl R. (2005): Neural systems of positive affect: relevance to understanding child and adolescent depression? Development and Psychopathology 17:827-850.

Forman E, Berk M, Henriques G, Brown G, & Beck A. (2004): History of multiple suicide attempts as a behavioral marker of severe psychopathology. American Journal of Psychiatry 161:437-443.

Franklin J, Hessel E, & Prinstein M. (2011): Clarifying the role of pain tolerance in suicidal capability. Psychiatry Research 189:362-367.

Frith C, & Frith U. (2007): Social cognition in humans. Curr Biol 17:R724-732.

Froehlich T, Lanphear B, Epstein J, Barbaresi W, Katusic S, Kahn R. (2007): Prevalence, recognition, and treatment of attention-deficit/hyperactivity disorder in a national sample of US children. Arch Pediatr Adolesc Med. 161:857–864.

Frounfelker R, Klodnick V, Mueser K, & Todd S. (2013): Trauma and posttraumatic stress disorder among transition-age youth with serious mental health conditions. J Trauma Stress 26:409-412.

Fröjd S, Kaltiala-Heino R, & Rimpelä M. (2007): The association of parental monitoring and family structure with diverse maladjustment outcomes in middle adolescent boys and girls. Nord J Psychiatry 61:296-303.

Galambos N, & Costigan C. (2003). Emotional and personality development is adolescent. Handbook of Psychology. Four: 14: 351-372.

Gardner M, & Steinberg L. Peer influence on risk taking, risk preference, and risky decision making in adolescence and adulthood: An experimental study. Dev. Psychol. 41: 625-635.

Gentry J, & Campbell M. (2002): Developing Adolescents: Reference for professionals. American Psychological Association. Retrieved from: www.apa.org/pi/pii/develop.pdf.

Ghanizadeh A, Mohammadi M, & Yazdanshenas A. (2006): Psychometric properties of the Farsi translation of the kiddie schedule for affective disorders and schizophrenia-present and lifetime version. BMC Psychiatry 6. doi:10.1186/1471-244X-6-10

Gilbody S, House A, & Sheldon T. (2003): Outcomes measurement in psychiatry. A critical review of outcomes measurement in psychiatric research and practice. Report 24, Centre for Reviews and Dissemination, University of York.

Glenn C, & Klonsky E. (2010). A multimethod analysis of impulsivity in nonsuicidal self-injury. Personality Disorders 1:67-75.

Gogtay N, Nugent T, Herman D, Ordonez D, Greenstein D, Hayashi K, Clasen L, Toga A, Giedd J, Rapoport J, Thompson P. (2006): Dynamic mapping of normal human hippocampal development. Hippocampus 16:664-672.

Goldston D, Daniel S, Reboussin B, Reboussin D, Frazier P, Harris A. (2001): Cognitive risk factors and suicide attempts among formerly hospitalized adolescents: A prospective naturalistic study. Journal of the American Academy of Child & Adolescent Psychiatry 40:91-99.

Grandclerc S, De Labrouhe D, Spodenkiewicz M, Lachal J, & Moro M-R. (2016): Relation between nonsuicidal self-injury and suicidal behavior in adolescence: A systematic review. PLoS One 11: e0153760.

Green J, McLaughlin K, Berglund P, Gruber M, Sampson N, Zaslavsky A, & Kessler R. (2010): Childhood adversities and adult psychopathology in the National Comorbidity Survey Replication (NCS-R) I: Associations with first onset of DSM-IV disorders. Archives of General Psychiatry 62:113-123.

Guertin T, Lloyd-Richardson E, Spirito A, Donaldson D, Boergers J. (2001): Self-mutilative behavior in adolescents who attempt suicide by overdose. J Am Acad Child Adolesc Psychiatry 40:1062-9.

Guinosso S, Johnson S, Riley A. (2016). Multiple adverse experiences and child cognitive development. Pediatric Research 79: 220-226.

Hafkenscheid A. (1993): Psychometric evaluation of the Symptom Checklist (SCL-90) in psychiatric inpatients. Person Individ Diff 14:751-756.

Hall M, & Hall J. (2011): The long-term effects of childhood sexual abuse: counseling implications. Retrieved from http://counselingoutfitters.com/vistas/vistas11/Article_19.pdf

Hamza C, Stewart S, & Willoughby T. (2012): Examining the link between nonsuicidal self-injury and suicidal behavior: A review of the literature and an integrated model. Clinical Psychology Review 32:482-495.

Hardt J, Herke M, & Schier K. (2011): Suicidal Ideation, parent-child relationships, and adverse childhood experiences: A cross –validation study using a Graphical Markov Model. Child Psychiatry Hum Dev 42: 119-133.

Hargus E, Hawton K, & Rodham K. (2009): Distinguishing between subgroups of adolescents who self-harm. Suicide Life Threat Behav 39:518-37.

Haw C, Hawton K, Houston K, Townsend E. (2001): Psychiatric and personality

disorders in deliberate self-harm patients. Br J Psychiatry 178:48-54.

Hawton K, Saunders K, & O'Connor R. (2012): Self – harm and suicide in adolescents. Lancet, 379:2373-82.

Hébert M, Lavoie F, & Blais M. (2014): Post traumatic stress disorder/PTSD in adolescent victims of sexual abuse: resilience and social support as protection factors. Cien Saude Colet 19:685-694.

Heleniak C, Jenness J, Van der Stoep A, McCauley E, & McLaughlin K. (2016): Childhood maltreatment exposure and disruptions in emotion regulation: A transdiagnostic pathway to adolescent internalizing and externalizing psychopathology. Cognitive Therapy and Research 40:394-415.

Higgins D, & McCabe M. (2000): Relationships between Different Types of Maltreatment during Childhood and Adjustment in Adulthood. Child Maltreatment 5:261-272. doi:10.1177/1077559500005003006

Hintikka U, Pelkonen M, Hintikka J, Laukkanen E, & Lehtonen J. (2002): Gender-specific differences in cognitive functioning and self-image among admitted adolescent psychiatric inpatients. Psychiatria Fennica 33:51-66.

Hoffman N, & Overall P. (1978): Factor structure on the SCL-90 in a psychiatric population. J Consult Clin Psychol 46:1187-1191.

Holcomb W, Adams N, & Ponder H. (1983): Factor structure of the Symptom Checklist-90 with acute psychiatric inpatients. J Consult Clin Psychol 51:535-538.

Holi M. (2003): Assessment of psychiatric symptoms using the SCL-90. Academic dissertation. Department of Psychiatry: Helsinki University, Finland.

Honings S, Drukker M, Groen R, & van Os J. (2016). Psychotic experiences and risk of self-injurious behavior in the general population: a systematic review and meta-analysis. Psychological Medicine 46:237-251.

Hooley J, Ho D, Slater J, & Lockshin A. (2010): Pain perception and nonsuicidal self-injury: A laboratory investigation. Personality Disorders, Theory, Research and Treatment 1:170-179.

Hooper C, Luciana M, Conklin H, Yarger R. (2004): Adolescents' performance on the Iowa Gabling Task: Implications for the development of decision-making and ventromedial prefrontal cortex. Dev. Psychol. 40:1148–1158.

Hu L, Bentler P. (1999): Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Struct Equ Modeling 6:1-55.

Huurre T Aro H, & Rahkonen O. (2003): Well-being and health behavior by parental socioeconomic status: a follow-up study of adolescents aged 16 until age 32 years. Soc Psychiatr Epidemiol 38:249-255.

Isohookana R, Riala K, Hakko H, & Räsänen P. (2012): Adverse childhood experiences and suicidal behavior of adolescent psychiatric inpatients. Eur Child Adolesc Psychiatry 22:13-22.

Jacobson C, Muehlenkamp J, Miller A, & Turner J. (2008): Psychiatric impairment among adolescent engaging in different types of deliberate self-harm. Journal of Child and Adolescent Psychology 37:363-375.

Johnson, J. H., & McCutcheon, S.M. (1980): Assessing life stress in older children and adolescents: preliminary findings with the Life Events Checklist. In book: Sarason, J. G., & Spielberger, C. D. (edit.) Stress and Anxiety. Washington DC: Hemisphere Publishing: pp 111-112.

Joiner T. (2005): Why people die by suicide. Cambridge, MA: Harvard University Press.

Kajeepeta S, Gelaye B, Jackson C, & Williams M. (2015): Adverse childhood experiences are associated with adult sleep disorders: a systematic review. Sleep Med 16:320-330.

Kaltiala-Heino R, Rimpelä m, Rantanen P, & Laippala P. (2001): Adolescent depression: The role of discontinuities in life course and social support. J Affect Disord 64:155-166.

Kaufman, J., Birmaher, B., Brent, D., Rao, U., Flynn, C., Moreci, P., . . . Ryan, N. (1997). Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL): Initial Reliability and Validity Data. Journal of The American Academy of Child and Adolescent Psychiatry, 36, 980-988.

Keating D. (2004): Cognitive and brain development. In Handbook of Adolescent Psychology. 2nd edition (Lerner, R.J. and Steinberg, L.D., eds), Wiley, pp. 45–84.

Kellough, R. D., & Kellough, N. G. (2008). Teaching young adolescents: Methods and resources for middle grades teaching (5th ed.). Upper Saddle River, NJ: Pearson Merrill Prentice Hall.

Kessler R, Berglund P, Dernier O, Jin R, Merikangas K, Walters E. (2005): Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. Arch Gen Psychiatry 62:593–602.

Kessler R, McLaughlin K, Green J, Gruber M, Sampson N, Zaslavsky A, et al. (2010). Childhood adversities and adult psychopathology in the WHO World Mental Health Surveys. Br J Psychiatry 197: 378-385.

Kessler R, Walters E. (1998). Epidemiology of DSM-III-R major depression and minor depression among adolescents and young adults in the National Comorbidity Survey. Depress Anxiety 7:3-14.

Klimstra T. (2013). Adolescent personality development and identity formation. Child Development Perspectives 7:80-84.

Klimstra T, Hale III W, Raaijmakers Q, Branje, S, Meeus,W. (2009): Maturation of personality in adolescence. Journal of Personality and Social Psycholog 96:898–912.

Klimstra T, Luyckx K, Hale III W, Frijns T, van Lier, P, & Meeus W. (2010): Short-term fluctuations in identity: Introducing a micro-level approach to identity formation. Journal of Personality and Social Psychology 99:191–202.

Klonsky E, & Glenn C. (2008): Assessing the functions of non-suicidal self-injury: Psychometric properties of the inventory of statements about self-injury (ISAS). J Psychopathol Behav Assess 31:215-219.

Koeter M. (1992): Validity of the GHQ and SCL anxiety and depression scales: a comparative study. J Affect Disord 24:271-280.

Koizumi M, & Takagishi H. (2014): The Relationship between Child Maltreatment and Emotion Recognition. PLoS One 9. doi:10.1371/journal.pone.0086093

Koolschijn C, & Crone E. (2013): Sex differences and structural brain maturation from childhood to early adulthood. Developmental Cognitive Neuroscience 5:106-118.

Korhonen V, Laukkanen E, Peiponen S, Lehtonen J, & Viinamäki V. (2001): Effects of major depression on the self-image of adolescent boys and girls. Journal of Youth and Adolescence 30:697-706.

Korhonen T, Vehviläinen-Julkunen K, & Pietilä A. (2008): Do nurses working in adult psychiatry take into consideration the support network of families affected by parental mental disorder? Journal of Psychiatric and Mental Health Nursing 15:767–776.

Kumar S, & George B. (2013): Life events, social support, coping strategies, and quality of life in attempted suicide. Indian J Psychiatry 55:46-51.

Lahti A, Harju A, Hakko H, Riala K, & Räsänen P. (2014): Suicide in children and young adolescents: A 25-year database on suicides from Northern Finland. Journal of psychiatric Research 58:123-128.

Larrson B, Knutsson-Medin L, Sundelin C, et al. (2000): Social competence and emotional/behavioural problems in children of psychiatric inpatients. European Child and Adolescent Psychiatry 9:122–128.

Larson R, & Brown J. (2007): Emotional development in adolescence: What can be learned from high school theater program? Child Development 78:1083-1099.

Larson R, Clore G, & Wood G. (1999): The emotions of romantic relationships: Do they wreak havoc on adolescents? In: Furman W, Brown B, & Feiring C. (Eds.), Romantic relationships in adolescence. New York: Cambridge University Press,

pp 19-49.

Laukkanen E, Halonen P, Aivio A, Viinamäki H, & Lehtonen J. (2000): Construct validity of the Offer Self-Image Questionnaire in Finnish 13-year-old adolescents: differences in the self-images of boys and girls. Nord J Psychiatry 54:431-35.

Laukkanen E, Honkalampi K, Hintikka J, Hintikka U, & Lehtonen J. (2004): Suicidal ideation among help-seeking adolescents: Association with negative self-image. Archives of Suicide Research 9: 45-55.

Laukkanen E, Peiponen S, Halonen P, Aivio A, & Viinamäki H. (1999): Discriminant validity of the Offer Self-Image Questionnaire in Finnish 13-year-old adolescents. Nord J Psychiatry 53:197-201.

Leeb R, Paulozzi L, Melanson C, Simon T, Arias I. (2008): Child Maltreatment Surveillance: Uniform Definitions for Public Health and Recommended Data Elements, Version 1.0. Atlanta (GA): Centers for Disease Control and Prevention, National Center for Injury Prevention and Control.

Lempp T, de Lange D, Radelo D, Bachmann C. (2012): The clinical examination of children, adolescents and their families. In Rey JM (ed), IACAPAP e-Textbook of Child and Adolescent Mental Health. Geneva: International Association for Child and Adolescent Psychiatry and Allied Professions.

Leschied A, Chiodo D, Whitehead P, Hurley D. (2005): The relationship between maternal depression and child outcomes in a child welfare sample: implications for treatment and policy. Child and Family Social Work 10:281–291.

Lewinsohn P, Moerk K, Klein D. (2000): Epidemiology of adolescent depression. Econom Neurosci 2:52–68.

Lewinsohn P, Seeley J, Buckley M, Klein D. (2002): Bipolar disorder in adolescence and young adulthood. Child Adolesc Psychiatry Clin N Am. 11:461–475.

Lewis M, & Haviland-Jones J. (Eds.). (2000): Handbook of emotions. 2nd edition. New York: Guilford.

Lodi-Smith J, & Roberts B. (2007): Social investment and personality: A meta-analysis of the relationship of personality traits to investment in work, family, religion, and volunteerism. Personality and Social Psychology Review 11:68–86.

Logan J, Leeb R, & Barker L. (2009): Gender-specific mental and behavioral outcomes among physically abused high-risk seventh-grade youths. Public Health Rep 124:234-245.

Loman M, & Gunnar M. (2010): Early experience and the development of stress reactivity and regulation in children. Neuroscience & Biobehavioral Reviews 34:867-876.

Long L, Burnett J, & Thomas V. (2006): Sexuality counseling: An integrative

approach. Upper Saddle River, NJ: Pearson.

Luciana M, & Nelson C. (2002): Assessment of neuropsychological function through use of the Cambridge Neuropsychological Testing Automated Battery: Performance in 4- to 12-year-old children. Dev. Neuropsychol. 22:595–624.

Lucka I. (2004): Depression syndromes in patients suffering from anorexia nervosa. Psychiatr Pol 38:621–629.

Lynam D, Miller J, Miller D, Bornovalova M, & Lejuez C. (2011): Testing the relations between impulsivity-related traits, suicidality, and non-suicidal self-injury: a test of the incremental validity of the UPPS model. Personality Disorders 2:151-160.

Masi G, Millepiedi S, Mucci M, Poli P, Bertini N, Milantoni L. (2004): Generalized anxiety disorder in referred children and adolescents. J Am Acad Child Adol Psychiatry 43:752–760.

Maltz W. (2002): Treating the sexual intimacy concerns of the sexual abuse survivors. Sexual and Relationship Therapy 17:321-327.

Maybery D, Reupert A, Goodyear M., et al. (2009): Prevalence of children whose parents have a mental illness. Psychiatric Bulletin 33:22–26.

McGough J, Curry J. (1992): Utility of the SCL-90-R with depressed and conduct-disordered adolescent inpatients. J Pers Assess 59:552-653.

McHolm A, MacMillan H, & Jamieson E. (2003): The relationship between childhood physical abuse and suicidality among depressed women: results from a community sample. Am J Psychiatry 160:933-938.

McLaughlin K, Costello J, Leblanc W, Sampson N, & Kessler R. (2012): Socioeconomic status and adolescent mental disorders. Am J Public Health 102:1742-1750.

McLaughlin K, Green J, Gruber M, Sampson N, Zaslavsky A, & Kessler R. (2012): Childhood adversities and first onset of psychiatric disorders in a national sample of adolescents. Archives of General Psychiatry 69:1151-1160.

McLaughlin K, Koenen K, Hill E, Petukhova M, Sampson N, Zaslavsky A, & Kessler R. (2013): Trauma exposure and posttraumatic stress disorder in a US national sample of adolescents. Journal of the American Academy of Child & Adolescent Psychiatry, 52:815-830.

Meeus W, van de Schoot R, Klimstra T, & Branje S. (2011): Personality types in adolescence: Change and stability and links with adjustment and relationships. A five-wave longitudinal study. Developmental Psychology 47:1181–1195.

Merikangas K, Avenevoli S. (2002): Epidemiology of mood and anxiety disorders in children and adolescents. In: Tsaung MT, Tohen M, eds. Textbook in Psychiatric Epidemiology, 2nd Edition. New York, NY: Wiley- Liss, pp 657–

704.

Merikangas K, He J-p, Burstein M, Swanson S, Avenevoli S, Cui L, et al. (2010). Lifetime prevalence of mental disorders in US adolescents: results from the National Comorbidity Study-Adolescent Supplement (NCS-A). J Am Acad Child Adolesc Psychiatry 49:980-989.

Merikangas K, Nakamura E, & Kessler R. (2009): Epidemiology of mental disorders in children and adolescents. Dialogues Clin Neurosci 11:7-20.

Miller A, Esposito-Smythers C, Weismoore J, & Renshaw K. (2013): The relation between child maltreatment and adolescent suicidal behavior: A systematic review and critical examination of the literature. Clin Child Fam Psychol Rev 16:146-172.

Miller I, Ryan C, Keitner G, Bishop D, & Epstein N. (2000). The McMaster Approach to Families: theory, assessment and research. Journal of Family Therapy, 22:168-189.

Milos G, Spindler A, Schnyder U. (2004): Psychiatric co-morbidity and eating disorder inventory (EDI) profiles in eating disorders patients. Can J Psychiatry 49:179–184.

Mohammad E, Shapiro E, Wainwright L, & Carter A. (2014): Journal of Abnormal Child Psychology. Retrieved from www.http//doi.dx.10.1007/s10802-014-9889-2.

Morgan C, Wiederman M, & Magnus R. (1998): Discriminant validity of the SCL-90 dimensions of anxiety and depression. Assessment 5:197-201.

Mowbray C, Bybee D, Oyserman D, Allen-Meares P, Macfarlane P, Hart-Johnson T. (2004): Diversity of outcomes among adolescent children of mothers with mental illness. Journal of Emotional and Behavioral Disorders 12:206–221.

Muehlenkamp J, and Gutierrez P. (2007): Risk for suicide attempts among adolescents who engage in non-suicidal self-injury. Archives of Suicide Research 11: 69-82.

Mustanoja S, Luukkonen A, Hakko H, Räsänen P, Säävälä H, & Riala K. (2011): Is Exposure to Domestic Violence and Violent Crime Associated with Bullying Behaviour Among Underage Adolescent Psychiatric Inpatients? Child Psychiatry & Human Development 42:495-506. doi:10.1007/s10578-011-0222-9

Muthén L, Muthén B. (2012): Mplus user's guide (7th ed.). Los Angeles, CA: Muthén & Muthén.

National Child Traumatic Stress Network. (2015): Types of traumatic stress. Retrieved from http://www.nctsn.org/trauma-types.

National Scientific Council on the Developing Child. (2014): Excessive Stress Disrupts the Architecture of the Developing Brain: Working Paper 3. Updated Edition. Retrieved from http://www.developingchild.harvard.edu

Neeman J. et al. (1995): The changing importance of romantic relationship involvement to competence from late childhood to late adolescence. Dev. Psychopathol 7:727–750.

Nelson C, de Hann M, Thomas K. (2006). Neuroscience of Cognitive Development: The role of experience and the developing brain. Hoboken, NJ: Wiley.

Newman K, Harrison L, Dashiff C, & Davies S. (2008): Relationships between parenting styles and risk behaviors in adolescent healt: An integrative literature reviw. Revista Latino-Aamericana de Enfermagem 16:142-150.

Nickel M, Loew T, Gil F. (2007): Aripiprazole in treatment of borderline patients, part II: an 18-month follow-up. Psychofarmacology. doi:10.1007/s00213-007-0740-0

Nisbett R, Aronson J, Blair C, et al. (2012). Intelligence: new findings and theoretical developments. Am Psychol 67:130-159.

Noach P, Kerr M, & Olah A. (1999): Family relations in adolescence. Journal of Adolescence 22:713-717.

Nock M, Borges G, Bromet E, Cha C, Kessler R, & Lee S. (2008): Suicide and suicidal behavior. Epidemiologic Reviews 30:133-154.

Nock M, Joiner E, Gordon K, Lloyd-Richardson E, & Prinstein M. (2006): Non-suicidal self-injury among adolescents: Diagnostic correlates and relation to suicide attempts. Psychiatry Research 144:65-72.

Nock M, & Mendes W. (2008): Physiological arousal, distress tolerance, and social problem-solving deficits among adolescent self-injurers. Journal of Consulting and Clinical Psychology 76:28-38.

Nurmi J. (2004): Socialization and self-development: Channeling, selection, adjustment, and reflection. In: Handbook of Adolescent Psychology (2nd ed.), pp. 85-124. Eds. R Lerner and L Steinberg, John Wiley & Sons, Inc, Hoboken, New Jersey.

O'Connor R, Nock M. (2014): The psychology of suicidal behaviour. Lancet 1:73-85.

Offer D, Ostrov E, Howard K, & Dolan S. (1992): Offer self-Image Questionnaire, Revised (OSIQ-R), manual. Western Psychological Services, Los Angeles, California.

Olsen L, Mortensen E, Bech P. (2004): The SCL-90 and SCL-90R versions validated by item response models in a Danish community sample. Acta Psychiatr Scand 110: 225-229.

Olsson G, von Knorring A-L. (1999): Adolescent depression: Prevalence in Swedish high-school students. Acta Psychiatrica Scandinavia 99:324–331.

Oyserman D, Bybee D, Mowbray C, Hart-Johnson T. (2005): When mothers have serious mental health problems: parenting as a proximal mediator. Journal of Adolescence 28:443–463.

Pacheco J, Irigaray Q, Welang B, Nunes M, & de Lima Argimon II. (2014): Childhood maltreatment and psychological adjustment: a systematic review. Psicologia: Reflexao e Critica 27.

Paus T. (2005): Mapping brain maturation and cognitive development during adolescence. TRENDS in Cognitive Sciences 9:60-68.

Pelkonen M, Karlsson L, & Marttunen M. (2011): Adolescent suicide: Epidemiology, Psychological theories, risk factors, and prevention. Current Pediatric Reviews 7:52-67.

Pelkonen M, Marttunen M, & aro H (2003): Risk for depression: a 6-year follow-up of Finnish adolescents. J Affect Disord 77:41-51.

Perez N, Jennings W, Piquero A, Baglivivo M. (2016). Adverse childhood experiences and suicide attempts: The mediationg influence of personality development and problem behaviors. J Youth Adolescence 45:1527-1545.

Peterson J, Freedenthal S, Sheldon C, Andersen R. (2008): Non-suicidal self-injury in adolescents. Psychiatry (Edgmont) 5:20-26.

Pietrek C, Elbert T, Weierstall R, Muller O, & Rockstroh B. (2013): Childhood adversities in relation to psychiatric disorders. Psychiatry Research 206:103-110.

Plener P, Libal G, Keller F, Fegert J, & Muehlenkamp J. (2009): An international comparison of adolescent non-suicidal self-injury (NSSI) and suicide attempts: Germany and the USA. Psychological Medicine 39:1549-1558.

Polanczyk G, Moffitt T, Arseneault L, Cannon M, Ambler A, Keefe R, Houts R, Odgers C, Caspi A. (2010): Etiological and clinical features of childhood psychotic symptoms: results from a birth cohort. Arch Gen Psychiatry 67:328–338.

Preacher K, & Hayes A. (2008): Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behavior Research Methods 40:879-91.

Prinz U, Nutzinger D, Schulz H, Petermann F, Braukhaus C, Andreas S. (2013): Comparative psychometric analyses of the SCL-90-R and its short versions in patients with affective disorders. BMC Psychiatry 13:104. doi:10.1186/1471-244X-13-104.

Procidano M, & Heller K. (1983): Measures of perceived social support from friends and from family: Three validation studies. American Journal of

Community Psychology 11:1-24.

Reinert D, & Allen J. (2002): The alcohol use identification test (AUDIT): a review of resent research. Alcoholism, Clinical and Experimental Research 26:272-79.

Reise S. (2012): The rediscovery of bifactor measurement models. Multivar Behav Res 47:667-96.

Riley A, Valdez C, Barrueco S, Mills C, Beadslee W, Sandler I, Rawal P. (2008): Development of a family-based program to reduce risk and promote resilience among families affected by maternal depression: theoretical basis and program description. Clinical Child and Family Psychology Review 11:12–29.

Roberts R, Roberts C, Xing Y. (2007): Rates of DSM-IV psychiatric disorders among adolescents in a large metropolitan area. J Psychiatr Res 41:959–967.

Roberts B, Wood D, & Smith J. (2005): Evaluating five factor theory and social investment perspectives on personality development. Journal of Research in Personality 39:166–184.

Robins R, John O, Caspi A, Moffitt T, & Stouthamer-Loeber M. (1996): Resilient, overcontrolled, and undercontrolled boys: Three replicable personality types. Journal of Personality and Social Psychology 70:157–171.

Rodham K, Hawton K, Evans E. (2004): Reasons for deliberate self-harm: comparison of self-poisoners and self-cutters in a community sample of adolescents. J Am Acad Child Adolesc Psychiatry 43:80–87.

Rudd M. (2006): Suicidality in clinical practice: anxieties and answers. Journal of Clinical Psychology 62:157-159.

Rudolph K. (2008): Developmental influences on interpersonal stress generation in depressed youth. Journal of Abnormal Psychology 117:673-679.

Ruscio J, Roche B. (2012): Determining the number of factors to retain in an exploratory factor analysis using comparison data of known factorial structure. Psychol Assess 24: 282-92.

Rutter M. (1979). Protective factors in children's responses to stress and disadvantage. Ann Acad Med Singapore 8:324-338.

Saarni C, Campos J, Camras L, & Witherington D. (2006): Emotional development: action, communication, and understanding. In Damon W & Lerner R. (Series Eds.) & Eisenberg N (Vol. Ed.), Handbook of child psychology: Vol. 3. Social, emotional, and personality development. 6th edition. New York: Wiley, pp 226-229.

Sajatovic M, & Ramirez L. (2012): Rating scales in mental health. 3rd edition. (Handbook). The Johns Hopkins University Press, Baltimore.

Sameroff A, Seifer R, Barocas R, Zax M, Greenspan S. (1987). Intelligence quotient scores of 4-year-old children: social-environmental risk factors. Pediatrics

79:343-350.

Saunders J, Aasland O, Babor T, de la Fuente J, & Grant M. (1993): Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. Addiction 88:791-804.

Schofield T, Lee R, & Merrick M. (2013): Safe, Stable, Nurturing relationships as a moderator of intergenerational continuity of child maltreatment: A meta-analysis. J Adolesc Health 53:S32-S38.

Schroeder K, Fisher H, Schäfer I. (2013): Psychotic symptoms in patients with borderline personality disorder: prevalence and clinical management. Curr Opin Psychiatry 26:113-119.

Schwartz S, Luyckx K, & Vignoles V. (Eds.) (2011): Handbook of identity theory and research. New York: Springer.

Seeman M. (2004): Schizophrenia and motherhood. In: Parental Psychiatric Disorder: Distressed Parents and Their Families, 2nd edition. (eds Göpfert, M., Webster, J. & Seeman, M.V.), Cambridge University Press, Cambridge, pp. 161–171.

Sege R, Bethell C, Linkenbach J, Jones J, Klika B, & Pecora P. (2017): Balancing adverse childhood experiences with HOPE: New insights into the role of positive experience on child and family development. Boston: The Medical Foundation. Retriewed from www.cssp.org

Seljamo S, Aromaa M, Koivusilta L, Rautava P, Sourander A, Helenius H, & Sillanpää M. (2006). Alcohol use in families: A 15-year prospective follow-up study. Addiction 101:984-992.

Serafini G, Muzio C, Piccini G, Flouri E, Ferrigno G, Pompili M, Girardi P, & Amore M. (2015): Life adversities and suicidal behavior in young individuals: a systematic review. Eur Child Adolesc Psychiatry 24:1423-46.

Smits I, Timmerman M, Barelds D, & Meijer R. (2015): The Dutch Symptom Checklist- 90-Revised. Is the use of the subscales justified? European Journal of Psychological Assessment 31:263-271.

Soto C, John O, Gosling S, & Potter J. (2011): Age differences in personality traits from 10 to 65: Big Five domains and facets in a large cross-sectional sample. Journal of Personality and Social Psychology 100:330–348.

Soutullo C, Chang K, Diez-Suarez A, et al. (2005): Bipolar disorder in children and adolescents: international perspective on epidemiology and phenomenology. Bipolar Disord 7:497–506.

Spear L. (2000): The adolescent brain and age-related behavioral manifestations. Neurosci. Biobehav. Rev 24:417–463.

Spear L. (2016): Alcohol consumption in adolescence: a translational perspective. Current Addiction Reports 3:50-61.

Sperry D, & Widom C. (2013): Child Abuse and Neglect, Social Support, and Psychopathology in Adulthood: A Prospective Investigation. Child Abuse & Neglect 37:415-425.

Squeglia L, Jacobus J, & Tapert S. (2014): The effect of alcohol use on human adolescent brain structures and systems. Handb Clin Neurol: 501-510. 10.1016/B978-0-444-62619-6.00028-8.

Steinberg L. (2005): Cognitive and affective development in adolescence. TREND in Cognitive Sciences 9:69-74.

Thompson R, & Fox N. eds. (1994): Emotion regulation: A theme in search of definition. Monogr. Soc. Res. Child Dev 59: No. 240.

Thompson R, Proctor L, English D, Dubowitz H, Narasimhan S, & Everson M. (2012): Suicidal ideation in adolescence: Examining the role of recent adverse experiences. Journal of Adolecence 35:175-186.

Treger B, Matusiak F, Pilecki M, & Rogoz M. (2015): The association between self-image and defence mechanisms in a group of adolescent patients receiving psychiatric treatment. Psychiatr. Pol. 49:747-756.

Tuisku V, Pelkonen M, Karlsson L, Kiviruusu O, Holi M, Ruuttu T, Punamäki R-L, Marttunen, M. (2006): Suicidal ideation, deliberate self-harm behaviour and suicide attempts among adolescent outpatients with depressive mood disorders and comorbid axis I disorders. European Child & Adolescent Psychiatry 15:199-206.

Turner M, Exum L, Brame R, & Holt T. (2013): Bullying victimization and adolescent mental health: General and typological effects across sex. Journal of Criminal Justice 41:53-59.

Vaux A. (1985): Variations in social support associated with gender, ethnicity, and age. Journal of Social Issues 41:199-206.

Victor S, & Klonsky E. (2014): Correlates of suicide attempts among self-injurers: a meta-analysin. Clin Psychol Rev 34:282-297.

Vuontella V, Steenari M-R, Carlson S, Koivisto J, Fjällberg M, Aronen E. (2003): Audiospatial and visuospatial working memory in 6-13 year old school children. Learn. Mem 10:74–84.

Walsh N, Dalgleish T, Lombardo M, Dunn V, van Harmelen A-L, Ban M, & Goodyer I. (2014). General and specific effects of early-life psychosocial adversities on adolescent grey matter volume. NeuroImage: Clinical 4: 308-318.

Warner V, Mufson L, & Weissman M. (1995): Offspring at high and low risk for depression and anxiety: mechanisms of psychiatric disorder. Journal of the American Academy of Child and Adolescent Psychiatry 34:786–797.

West P, & Sweeting H. (2004): Evidence on equalization in health in youth from the west of Scotland. Soc sci Med 59:13-27.

Whitlock J, & Knox K. (2007): The relationship between self-injurious behavior and suicide in a young adult population. Archives of Pediatrics & Adolescent Medicine 161:634-640.

Whitlock J, Muehlenkamp J, Eckenrode J, Purington A, Abrams G, Barreira P,Kress V. (2013): Nonsuicidal self-injury as a gateway to suicide in young adults. J Adolesc Health Off Publ Soc Adolesc Med 52:486-92.

Widom C, Czaja S, & Dutton M. (2008): Childhood victimization and lifetime revictimization. Child Abuse & Neglect 32:785-796. doi:10.1016/j.chiabu.2007.12.006

Wigfield A, Byrnes J, & Eccles, S. (2006): Development During Early and Middle Adolescence. In Alexander P, & Winne P. (Eds.), Handbook of educational psychology. Mahwah, NJ: Lawrence Erlbaum Associates, pp 87-113.

Wittchen H-U, Nelson C, & Lachner G. (1998): Prevalence of mental disorders and psychosocial impairments in adolescents and young adults. Psychological Medicine 28:109–126.

Yang B, & Clum G. (2000): Childhood stress leads to later cuicidality via its effect on cognitive functioning. Suicide and Life-Threatening Behavior 30:183-198.

Yates T, Carlson E, & Egeland B. (2008): A pro- spective study of child maltreatment and self-injurious behavior in a community sample. Dev Psychopathol 20:651–671.

Ystgaard M, Hestetun I, Loeb M, & Mehlum L. (2004): Is there a specific relationship between childhood sexual and physical abuse and repeated suicidal behavior? Child Abuse Negl 28:863–75.

Yu C-Y. (2002): Evaluating cutoff criteria of model fit indices for latent variable models with binary and continuous outcomes (Doctoral dissertation).

Zeidner M, Matthews G, Roberts R, & MacCann, C. (2003): Development of emotional intelligence: Towards a multi-level investment model. Human Development 46:69–96.

Zouk H, Tousingnant M, Sequin M, Lesage A, & Turecki G. (2006): Characterization of impulsivity in suicide completers: clinical behavioral and psychosocial dimensions. J Affect disord 92: 195-204.

ORIGINAL COMMUNICATIONS

Adverse childhood experiences as risk factors for serious mental disorders and inpatient hospitalization among adolescents[☆]

Minna Rytilä-Manninen [a,*], Nina Lindberg [b], Henna Haravuori [c,e],
Kirsi Kettunen [a], Mauri Marttunen [b,c,e], Matti Joukamaa [d], Sari Fröjd [d]

[a] Hospital District of Helsinki and Uusimaa, Kellokoski Hospital, Adolescent Psychiatry Unit, Finland
[b] Helsinki University, Department of Psychiatry, Finland
[c] National Institute for Health and Welfare, Department of Mental Health and Substance Abuse Services, Finland
[d] Tampere University, School of Health Science, Finland
[e] Helsinki University Central Hospital, Department of Psychiatry, Finland

ARTICLE INFO

Introduction

Psychiatric hospitalization is an intense and powerful intervention for patients and is highly expensive for society. Despite the individual and social costs of hospitalization, it is a common practice in the Finnish adolescent mental health care system (Fredriksson & Pelanteri, 2012). Hospitalized adolescents typically suffer from severe psychiatric disorders, have faced several traumatic life events and experience psychosocial difficulties with their families and peer groups (Gyllenberg et al., 2010; Sourander, Helenius, & Piha, 1995). Thus, it is important to identify the most prevalent and powerful childhood psychosocial risk factors for severe mental health disorders among high-risk adolescents to diminish personal agony, prevent the aggravation of psychiatric problems and reduce hospitalization and high health care costs.

Adolescence is a unique period of cognitive, emotional, social, and physical development. Adolescents are particularly vulnerable to the negative effects of exposure to adverse childhood experiences (ACEs, De Bellis, 2005), and many psychiatrically hospitalized adolescents have a history of several ACEs. The most frequently examined ACEs are emotional, physical and sexual abuse, neglect, being bullied and household dysfunction, including parental mental illness, alcohol or drug abuse, divorce, death and criminality. In a recent Finnish study of 508 adolescent psychiatric inpatients, 34.6% of patients (29.3% males and 38.3% females) reported being bullying victims (Mustanoja et al., 2011). The same research group reported that approximately 25% of hospitalized adolescents had been exposed to physical abuse, approximately 23% of girls and 3% of boys had been exposed to sexual abuse and 31% of girls and 28% of boys had witnessed intimate partner violence. For

* Corresponding author.

parent-related ACEs, 62% of boys and 46% of girls came from families that had experienced divorce. In addition, approximately 24% of girls and 13% of boys came from families with parental psychiatric problems, and 34% of girls and 28% of boys came from families with parental substance use problems; 26% of boys and 18% of girls had been exposed to parental unemployment, and 11% of boys and 6% of girls had experienced the death of one or both parents. Sexual abuse was the highest risk factor for suicide attempts and non-suicidal self-injuries. Further, for girls, exposure to multiple ACEs was associated with both events. Among the deceased adolescents in the study ($n = 16$), ACEs were most notable among those who had died due to accidents or injuries (Isohookana, Riala, Hakko, & Räsänen, 2012). In a large American child and adolescent psychiatric inpatient study ($N = 1,079$), individuals with a history of physical and/or sexual abuse were more likely to be diagnosed with multiple disorders, use more medication and be treated with antipsychotic medication than non-traumatized patients. Additionally, physical and sexual abuse are independently associated with longer treatment periods (Keeshin et al., 2014).

Adolescent health experiences cannot be separated from their social, physical and psychological environment (Välimaa, 2000). Thus, several studies have emphasized the importance of the social context in which the child develops (Appleyard, Yang, & Runyan, 2010; Sperry & Widom, 2013). For adolescents, the most significant relationships are with parents and siblings, followed by peers (Higgins & McCabe, 2000). Family plays a key role in an adolescent's individuation and identity formation by providing a forum to explore new roles and values (Noach, Kerr, & Olah, 1999) and helping adolescents socialize (Newman, Harrison, Dashiff, & Davies, 2008). School is an environment in which an adolescent spends most of his/her daytime, and life satisfaction is related to feeling safe and social contacts (Horstmanshof, Punch, & Creed, 2008). The most influential aspect of social support in promoting individual well-being is perceived support: the perception that others provide support when there are stressful challenges. In contrast, social isolation is associated with poor psychological functioning (Thompson, 2014), and low perceived social support is associated with severe psychopathology. A recent study by Kumar and George (2013) found that suicide attempters experienced significantly lower levels of social support than their age- and sex-matched controls. Further, individuals who had documented histories of childhood physical and sexual abuse or neglect reported significantly lower levels of social support in adulthood than a matched control group who had no trauma history (Sperry & Widom, 2013). Traumatic event exposure may also affect the ability to maintain relationships, thus leading to low social support. Research has suggested that abuse and neglect hinders the child's social cognition development, which may lead to problems with social adjustment, as observed by difficulties getting along with other people (Koizumi & Takagishi, 2014). One common example of these difficulties is bullying and being a victim of bullying because children who live in an environment with intimate partner violence or experience other types of family-related maltreatment may be inclined to become bullies, victims of bullying or bully victims (Baldry, 2003; Bauer et al., 2006; Bowes et al., 2009; Mustanoja et al., 2011).

There is a strong relationship between ACEs and mental health problems. Adversities such as childhood physical and sexual abuse or neglect are risk factors for emotional and behavioral problems, including depression, anxiety, posttraumatic stress disorder (PTSD) symptoms, suicide attempts, eating disorders, conduct disorder and other disruptive and violent behavior (Dube et al., 2001; Gilbert et al., 2009; Widom, DuMont, & Czaja, 2007).

Physical abuse is related to major depression, alcohol dependence, and externalizing problems (Afifi, Brownridge, Cox, & Sareen, 2006; Miller-Perrin, Perrin, & Kocur, 2009). Childhood sexual abuse is associated with a lifetime risk for depression, alcohol and drug dependences, panic disorder, PTSD, and suicidality (Dube et al., 2001, 2005). Among adolescents, sexual and physical abuse as well as serious neglect has traditionally been linked to internalizing problems (Schilling, Aseltine, & Gore, 2007). Recently, a study by Mills et al. (2013) found that emotional abuse (both with and without neglect) and multi-type maltreatment were associated with externalizing disorders.

Household dysfunction, including living in a family that experiences intimate partner violence, family psychiatric or substance use disorders and criminality, may cause emotional and behavioral problems in adolescence. Research has revealed relations between adolescent externalizing disorders and low family socioeconomic status (SES), parental divorce, living in a single-parent family and having one or both parents who have psychiatric or substance use disorders (Bratek, Beil, Banach, Jarząbek, & Krysta, 2013; De Boer, van Oort, Donker, Verheij, & Boon, 2012; Moffitt & Caspi, 2001). Parental depression and alcoholism have also been linked to internalizing problems in adolescence (Chassin, Pitts, Delucia, & Todd, 1999; Hammen, Rudolph, Weisz, Rao, & Burge, 1999). Additionally, a family history of alcohol dependence predicted poor neuropsychological functioning in offspring (Dube et al., 2006). Adolescents who live in a home that experiences intimate partner violence exhibit clinical levels of anxiety and PTSD (Graham-Bermann & Levendosky, 1998). Findings from studies focused on ACEs indicate that they are highly correlated with each other (Felitti et al., 1998), and various types of maltreatment are usually repeatedly and simultaneously experienced (Trickett, 1998). According to prior research, there is a relationship between exposure to abuse, either at home or at school, and perceived social support from family and friends. Experiencing family violence induces problem behavior, which then appears in school-based social relationships. Negative peer relationships are predisposed to school bullying (Baldry, 2003; Bauer et al., 2006; Perren & Hornung, 2005) and both bullies and victims of bullying have reported low perceived social support from their parents (Perren & Hornung, 2005). Exposure to multiple types of maltreatment is associated with greater impairment than exposure to a single form of maltreatment (Higgins & McCabe, 2000). Exposure to multiple ACEs appears to be associated with severe behavioral problems (Rasmussen, Nielsen, Petersen, Christiansen, & Bilenberg, 2013), as well as suicide attempts (Kumar & George, 2013).

Current Study

Although ACEs are well-documented risk factors for psychiatric disorders among adults in the general population, more information is needed about ACEs and their relation to school bullying victimization and perceived social support among hospitalized adolescents who have severe psychiatric disorders. This study's aims were to: (a) investigate the prevalence of various ACEs (parental psychiatric and substance use problems, criminality, divorce, witnessing intimate partner violence, physical and sexual abuse, school bullying victimization) and perceived social support from family and friends between an adolescent inpatient group and an age- and sex-matched comparison group; (b) determine whether ACEs and perceived social support are correlated; and (c) investigate associations between ACEs, perceived social support and internalizing or externalizing disorders for the inpatient group.

Method

Participants and Procedure

The Kellokoski Hospital Adolescent Inpatient Follow-Up Study (KAIFUS) is a longitudinal, naturalistic study on clinical characteristics and the impact of treatment in a consecutive sample of adolescent psychiatric inpatient admissions in Southern Finland. The sample comprises adolescents admitted to Kellokoski Hospital for the first time between September 2006 and August 2010 ($N = 395$). The four inpatient wards at the hospital offer psychiatric care to 13–17-year-old citizens in the Hyvinkää health care district, which include assessments, individual therapy, group therapy, family consultations and psychotropic medication when appropriate. Patients are often referred from municipal health care centers and adolescent psychiatric outpatient clinics. Patients who have primary substance-use disorders and severe eating disorders are referred to specialized units.

Study participation was voluntary, and all participants and their legal guardians were required to provide written informed consent after receiving verbal and written information about the study. The questionnaires and interviews used in the study are routinely used in clinical work in Finnish adolescent psychiatry. The Ethics Committee of the Helsinki University Hospital approved the study protocol, and the institutional authority at the Hyvinkää Hospital Area granted permission to conduct the study.

Adolescents between 13 and 17 years of age, who had sufficient knowledge of the Finnish language and adequate cognitive capacity were recruited for the study. Adolescents who had a treatment period of less than two weeks were omitted, consistent with the study protocol. Consequently, of 395 adolescent patients, 315 were eligible. All eligible patients were native Finns. In 62 (16.4%) cases, the adolescent declined to participate or his/her parents/guardians did not provide permission to participate. In 23 cases (6%), patients or their parents discontinued treatment, and 24 cases (6%) had incomplete data. The final sample consisted of 60 (29.1%) boys and 146 (70.9%) girls (Fig. 1). Patients were referred to the hospital from healthcare centers (22.7%), outpatient clinics (61.0%) and other hospitals (16.3%). Admittance was voluntary in 71.9% of the cases and involuntary in 28.1% of the cases. Reasons for referrals included suicidality (34.5%), mood disorders (28.6%), psychotic symptoms (11.8%), antisocial behavior (7.4%), eating problems (6.4%) and other symptoms (11.3%).

Participants and Procedure: Comparisons

The comparison group was drawn from the same geographical area as the study group. Seven schools in four different municipalities participated in the study: two high (secondary) schools, one vocational school and four middle (comprehensive) schools. The comparison group consisted of a random sample of sex- and age-matched students. Participants were drawn from enrollment lists, and if a student refused to participate in the study, another student was drawn from the list. The same interviews and questionnaires were used with the inpatient and comparison groups. Personal interviews and questionnaires were completed during school time. A total of 474 students were invited to participate in the study. Of the invited participants, 43.0% ($N = 203$) completed the interview and the questionnaires, 42.5% ($N = 202$) refused to participate, and 14.5% ($N = 68$) did not complete the questionnaires despite providing consent. There were no significant differences between completers and non-completers in regards to socioeconomic status ($p = 0.61$) or living situation ($p = 0.49$). All comparisons, completers and non-completers were native Finns. A treatment referral was recommended when appropriate for adolescents who completed the K-SADS-PL-interview.

Measures

The Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime version (K-SADS-PL) assessed psychiatric diagnoses. The K-SADS-PL is a semi-structured interview, with good to excellent test–retest reliability and high concurrent validity and inter-rater agreement for the original and translated versions (Ambrosini, 2000; Brasil & Bordin, 2010; Ghanizadeh, Mohammadi, & Yazdanshenas, 2006; Kaufman et al., 1997). The Finnish translation has previously been used in studies of adolescent inpatient and outpatient settings (Mustanoja et al., 2011; Tuisku et al., 2006).

Interviewers were experienced psychiatric nurses who were trained to administer the instrument. Psychiatrists who specialized in adolescent psychiatry assigned psychiatric diagnoses in accord with Axis I disorders in DSM-IV (American

Consecutive patients admitted
into hospital
N=395

Non-eligible patients

Age under 13 years n= 3
Intellectual disability n= 9
Poor knowledge of Finnish language n = 5
Treatment period too short n = 63

Eligible patients
N= 315

Consent was not obtained n = 62
Discontinued treatment n = 23
Incomplete data n = 24

Patients completing the study
N= 206
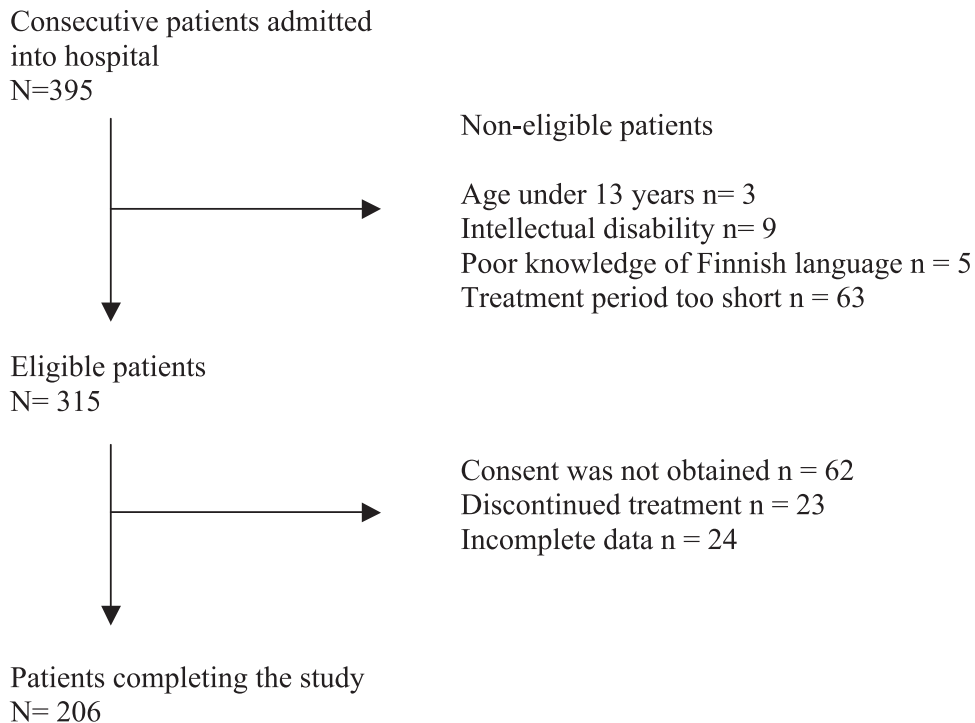
Fig. 1. Recruitment of the inpatients into the KAIFUS study, flow chart.

Psychiatric Association, 1994). Diagnoses were based on the K-SADS-PL and clinical records. Diagnostic meetings were held throughout data collection. Discrepancies were settled by consensus between three psychiatrists. The principal diagnoses from the baseline interview were included in the analyses. Internalizing disorders included anxiety, mood and eating disorders. Externalizing disorders included substance-use (abuse and dependence) and disruptive disorders (oppositional-defiant disorder, conduct disorder and attention-deficit hyperactivity disorder).

There were no relationships between study non-participation and age ($p = 0.31$), SES ($p = 0.38$), living situation ($p = 0.58$), or having a primary diagnosis of substance use ($p = 0.59$), mood ($p = 0.92$), anxiety ($p = 0.39$), eating ($p = 0.34$), or conduct disorders ($p = 0.09$). Study non-participation was associated with the male gender ($p = 0.02$) and psychotic disorders ($p = 0.02$).

Participants were asked about *school bullying* (Have you had problems with schoolmates? Have you, for example, been bullied by others?) at the beginning of the K-SADS-PL interview, in the school adaptation and social relationship sections. Participant's responses to the bullying questions were categorized as yes or no. The PTSD screening section in the K-SADS-PL interview provided information about witnessing *intimate partner violence* (the child witnesses explosive arguments between parents that involve threatened or actual harm) and exposure to *physical* (bruises sustained on more than one occasion or more serious injury) or *sexual abuse* (isolated or repeated incidents of genital fondling, oral sex, or vaginal or anal intercourse), and participants responses were categorized as either yes or no.

Nurses used a structured background data collection sheet to collect socio-demographic information from patients. SES was assessed by the question: What is your father's occupation? If an adolescent lived with his/her mother (and stepfather), we recorded the mother's occupation. The adolescent family's SES was classified as high when the guardian (primarily the father) was a self-employed worker or upper-level employee, middle when the guardian was a lower-level employee or manual worker, and low if the guardian was retired, a student or unemployed (Classification of Socioeconomic Status, 1989). For questions about *parental divorce*, answers were categorized as either yes or no. Each adolescent was asked whether he/she knew if his/her mother or father suffered from *psychiatric* or *substance use problems* requiring professional help. Answers were categorized as either yes or no. Parents' criminality was assessed using one question from the Life Events Checklist (LEC, Johnson & McCutcheon, 1980): Has your parent ever been arrested, suspected or judged for a legal offense. Participant's answers were categorized as yes or no.

Social support was assessed by The Perceived Social Support Scale-Revised (PSSS-R; Blumenthal et al., 1987). This self-report scale consists of 12 items rated on a five-point Likert-type scale ranging from totally disagree (1) to totally agree (5). Three separate, but correlated, factors assess support from the family, significant others and friends. The PSSS-R demonstrated good internal reliability and adequate stability (Blumenthal et al., 1987). A high score indicates a high perceived social support. In this study, two sub-scales were used: *support from family* (e.g., "I get the emotional help and support I need from my family" and "I can discuss my problems with my family") and *support from friends* (e.g., "My friends really support me

when I need help" and "I can discuss my problems with my friends"). The total scores for both sub-scales range from four (low support) to twenty (high support).

The accumulation of adverse childhood experiences (the ACE total score) was assessed by summing the number of ACEs to which a person was exposed during his/her childhood and adolescence (parental substance use and psychiatric problems, parental divorce, parental criminality, witnessing intimate partner violence, physical abuse and sexual abuse). The number of exposures ranged from zero (no exposure) to seven (exposure to all events). The threshold value linked to a significantly increased likelihood of adverse health outcomes in adults is four or more ACEs (Dong, Anda, Dube, Giles, & Felitti, 2003). In this study, we present the frequencies for each ACE category, and also use the number of ACEs as a continue variable.

Data Analysis

We used Pearson's Chi-square tests (categorical variables) and Student's *t*-tests (continuous variables) to assess group differences between the inpatient and comparison groups. Bivariate correlation analyses and logistic regression analyses were performed to investigate the relationship between ACEs, school bullying victimization and perceived social support. A multinomial logistic regression model assessed the relationship between ACEs and internalizing or externalizing disorders for the inpatient and comparison groups. The dependent variables were internalizing vs. externalizing disorders, and the reference group was the comparison group. In this analysis, ACE categories adjusted for SES, age and sex were entered into the first step. School bullying victimization and perceived social support were entered separately and were adjusted for SES, age and sex in the second wave, and the ACE total score in the third wave. We calculated odds ratios (OR) and 95% confidence intervals (CI), and set the two-tailed level of significance to 0.05. SPSS 20.0 software was used to analyze the data.

Results

Sample Characteristics

The principal diagnosis distributions for the inpatient group were: mood (47.6%), conduct (23.3%), anxiety (13.6%), psychotic (7.8%), eating (5.8%), and alcohol abuse disorders (0.5%). Twenty-one (10.2%) patients had a principal diagnosis of PTSD (included in anxiety disorders). In total, 139 patients suffered from internalizing disorders and 49 patients had externalizing disorders. Sixty-four (31.1%) adolescents had no comorbid psychiatric disorder, 89 (43.2%) had one, and 53 (25.7%) had two or more comorbid disorders.

In the comparison group, most (78.8%) participants did not meet the criteria for a psychiatric disorder. For participants who met diagnostic criteria, 5.9% suffered from mood, 5.4% anxiety, 4.4% substance-use, 3.4% conduct, 2.0% eating, and 0.5% had psychotic disorders. One person (0.5%) had PTSD as a principal diagnosis.

There were significant differences between the study groups for SES and the prevalence of ACEs (Table 1). Additionally, the number of persons with psychotic, mood, anxiety, and conduct disorders as principal diagnoses significantly differed between groups, however; there were no differences between groups for eating disorders despite a trending relationship ($p = 0.071$). The mean number of ACEs was 2.2 ($SD = 1.6$) for the inpatient group and 0.6 ($SD = 1.0$) for the comparison group. The most common adverse childhood experience in both groups was parental divorce. For the inpatient group, school bullying victimization was the second most common adverse experience (42.7%), followed by parental psychiatric treatment (39.3%) and alcohol or substance use problems (33.5%). For the comparison group, parental divorce was followed by parental psychiatric problems (10.3%). The co-occurrence of different ACEs was frequent in the inpatient group. Almost 60% of the inpatient group had experienced two ACEs, and 21% of the inpatient group had experienced four or more ACEs. More than half of the comparison sample had not experienced any ACEs and only 2% had experienced four or more ACEs. Perceived social support both from family and friends significantly differed between the inpatient and comparison groups.

Correlations Between ACEs, School Bullying Victimization and Perceived Social Support

Spearman's or Pearson's correlations examined the relations between ACEs, school bullying victimization and perceived social support. As shown in Table 2, the ACEs were correlated with each other, however; parental divorce was not correlated with sexual abuse. The strongest correlations were between witnessing intimate partner violence and physical abuse and parental alcohol or substance use problems. There were moderate correlations between parental substance use and psychiatric problems and parental divorce. School bullying victimization was frequently related to the ACEs. Perceived social support from both family and friends was negatively correlated with all ACEs. School bullying victimization was negatively correlated with perceived social support from friends, but not with perceived social support from family. Perceived social support from family and friends were significantly correlated with each other.

The Effect of Age and Sex

The number of ACEs was significantly higher among inpatient girls than boys (girls: $M = 2.36$, $SD = 1.57$, boys: $M = 1.83$, $SD = 1.68$, $t(206) = 2.069$, $p < 0.05$). Compared to boys, inpatient girls were significantly more often exposed to sexual abuse (girls: 28.8%, boys: 3.3%, OR = 11.7, 95% CI = [2.7, 50.1], $p < 0.001$). Inpatient boys perceived significantly more social support

Table 1
Characteristics of the patient and comparison samples by sociodemographic factors, principal diagnoses, adverse childhood experiences and social factors.

	Patients (N = 206) n (%)	Comparisons (N = 203) n (%)	p
Socioeconomic status			***
High	19 (9.2)	30 (14.8)	
Middle	78 (37.9)	109 (53.7)	
Low	109 (52.9)	64 (31.5)	
Diagnoses			
Conduct disorder	48 (23.3)	7 (3.4)	***
Anxiety disorder	28 (13.6)	11 (5.4)	**
Eating disorder	12 (5.8)	4 (2.0)	ns
Mood disorder	98 (47.6)	12 (5.9)	***
Substance use disorder	1 (0.5)	9 (4.4)	*
Psychotic disorder	16 (7.8)	1 (0.5)	***
Abuse			
Physical abuse	47 (22.8)	7 (3.4)	***
Sexual abuse	44 (21.4)	1 (0.5)	***
Household dysfunctions			
Parents' divorce	112 (54.4)	74 (36.5)	***
Parental substance use problems	69 (33.5)	9 (4.4)	***
Parental psychiatric problems	81 (39.3)	21 (10.3)	***
Witnessing intimate partner violence	64 (31.3)	12 (5.9)	***
Parental criminality	13 (6.5)	5 (2.5)	ns
Social factors			
Perceived support from parents, M (SD)	14.6 (4.5)	16.6 (3.8)	***
Perceived support from friends, M (SD)	13.9 (4.9)	17.4 (3.4)	***
School bullying	88 (42.7)	12 (5.9)	***
ACE total score, M (SD)	2.20 (0.9)	0.95 (0.07)	***
ACE categories			
0	31 (15.0)	115 (56.7)	
1	51 (24.8)	64 (31.5)	
2	41 (19.9)	13 (6.4)	
3	39 (18.9)	7 (3.4)	
4	22 (10.7)	3 (1.5)	
5	17 (8.3)	0 (0.0)	
6	4 (2.4)	1 (0.5)	
7	1 (0.5)	0	

ns = not significant.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

from their families than girls (girls: $M = 13.82$, $SD = 4.59$, boys: $M = 16.33$, $SD = 3.92$, $t(206) = 3.874$, $p < 0.001$). These findings were not observed in the comparison group. Inpatient girls perceived more support from their friends than boys, but this finding was not statistically significant (girls: $M = 14.39$, $SD = 4.7$, boys: $M = 12.89$, $SD = 5.13$, $t(203) = -1.954$, $p = 0.053$). In the comparison group, girls perceived significantly more support from friends than boys (girls: $M = 17.99$, $SD = 2.82$, boys: $M = 15.75$, $SD = 4.23$, $t(203) = -4.367$, $p < 0.001$).

Boys who had both *externalizing* disorders (boys: $M = 16.8$, $SD = 3.2$, girls: $M = 12.3$, $SD = 4.7$, $t(47) = 3.905$, $p < 0.001$, after adjusting for age and SES: $OR = 1.4$, $CI = [1.1, 1.6]$, $p < 0.05$) and *internalizing* disorders (boys: $M = 15.7$, $SD = 4.7$, girls: $M = 14.1$, $SD = 4.5$, $t(130) = 1.678$, $p = 0.096$, after adjusting for age and SES: $OR = 1.2$, $CI = [1.0, 1.30]$, $p < 0.05$) perceived higher social support from their families than girls. In contrast, boys who had *internalizing* disorders perceived significantly less social support from their friends than girls (boys: $M = 11.6$, $SD = 4.3$, girls: $M = 14.4$, $SD = 4.5$, $t(136) = -3.041$, $p < 0.05$, after adjusting for age and SES: $OR = 0.83$, $CI = [0.73, 0.93]$, $p < 0.05$).

Boys who had *externalizing* disorders perceived significantly more social support from friends than boys who had *internalizing* disorders (externalizing: $M = 14.8$, $SD = 5.3$, internalizing: $M = 11.6$, $SD = 4.3$, $t(52) = -2.44$, $p < 0.05$, after adjusting for age and SES: $OR = 1.2$, $CI [1.0, 1.3]$, $p < 0.05$), but there was no significant difference in perceived support from family members. There were no significant differences for support from family or friends between girls who had internalizing and externalizing disorders.

There were no significant differences between sex and school bullying victimization. There were also no significant differences between school bullying victimization and age. Bivariate Pearson's correlation analysis examined the relationship between age, the ACE total score and social support from family and friends. Age was related to perceived support from family ($r = -0.102$, $p = 0.04$). There were no significant correlations between age, the ACE total score and support from friends.

Table 2
The correlations between adverse childhood experiences, school bullying, and perceived social support.

Category	Physical abuse	Sexual abuse	Parental substance use problems	Parental psychiatric problems	Intimate partner violence	Parents' divorce	Parental criminality	School bullying	Perceived support from family
Sexual abuse	0.232**								
Parental substance use problems	0.270**	0.187**							
Parental psychiatric problems	0.259**	0.104*	0.382***						
Intimate partner violence	0.408**	0.133**	0.472**	0.277**					
Parents' divorce	0.197**	0.082	0.305**	0.230**	0.296**				
Parental criminality	0.164**	0.117*	0.228**	0.123*	0.203**	0.116*			
School bullying	0.198**	0.164**	0.216**	0.211**	0.196**	0.186**	0.157**		
Perceived support from family	−0.215**	−0.145**	−0.146**	−0.169**	−0.163**	−0.109*	−0.096	−0.077	
Perceived support from friends	−0.182**	−0.109*	−148**	−0.176**	−0.099*	−0.075	−0.087	−0.243**	0.371** a

Note. Spearman correlations and a Pearson correlation[a] were calculated.

 * $p < 0.05$.
 ** $p < 0.01$.

Associations Between ACEs, School Bullying Victimization and Perceived Social Support

Logistic regression analyses explored the association between the ACEs, school bullying victimization and perceived support from family and friends. After controlling for age, sex and psychiatric disorders, school bullying victimization was associated with parental criminality (OR = 7.4, CI = [1.23, 15.78], *p* = 0.02) and physical abuse (OR = 2.1, CI = [1.03, 4.13], *p* = 0.04). Age, sex, and psychiatric disorders were not related to school bullying.

Perceived support from family was not associated with any of the ACEs, but low perceived support from friends was associated with physical abuse (OR = 0.93, CI = [0.87, 0.99], *p* = 0.04).

Associations Between Internalizing and Externalizing Disorders, Perceived Social Support and School Bullying Victimization

Multinomial regression analysis explored how the ACEs, perceived social support and school bullying victimization were associated with internalizing or externalizing disorder inpatient status. Analyses for the different ACEs with SES, age and sex (Table 3, Wave 1) revealed that individuals in the inpatient group who had internalizing disorders were significantly more likely to come from families where they had experienced physical abuse, parental substance use, parental psychiatric problems, and witnessed intimate partner violence than the comparison group. The risk for suffering from an internalizing disorder sharply increased if the person had experienced sexual abuse (OR = 72.4, CI = [8.2, 636.1]). Inpatient group members who had externalizing disorders were significantly more likely to come from families where they had experienced physical abuse, parental psychiatric disorders and parental substance use problems than the comparisons group. Externalizing disorders were also associated with parents' divorce. The risk for suffering from an externalizing disorder sharply increased if the person had experienced sexual abuse (OR 160.6, CI = [16.1, 1,604.8]). Being female protected against having an externalizing disorder diagnosis.

A second multinomial regression analysis was performed on the social factors related to school bullying, perceived social support from family and friends, SES, age and sex (Table 3, Wave 2). School bullying victimization was associated with both internalizing and externalizing disorders. Perceived support from friends protected against internalizing disorders and perceived support from family protected against externalizing disorders. Higher age was a risk factor for internalizing disorders while the female sex protected against externalizing disorders.

In the third analysis, the ACE total score was added with social factors (school bullying, social support from family, social support from friends), SES, age and sex (Table 3, Wave 3). A higher number of ACEs was a risk factor for both internalizing and externalizing disorders. Again, school bullying victimization was associated with both internalizing and externalizing disorders. Social support from friends protected against internalizing disorders, while the protective effect of family support attenuated with the externalizing disorders. Higher age as a risk factor for internalizing disorders and female sex as protective factor against externalizing disorders remained significant.

Discussion

The first aim of this study was to investigate the prevalence of ACEs, school bullying victimization, and perceived social support from family and friends among adolescent inpatient and comparison groups. More than 80% of the inpatient group reported that they had experienced at least one negative life event. In both groups, parental divorce was the most frequent ACE. The finding was not surprising given Finland's Official Statistics, which suggest that approximately one in every two marriages ends in divorce (Finland's Official Statistics, 2014). In the inpatient group, almost 43% of the adolescents reported that they had been school bullying victims, and, of those, it was the second most prevalent ACE. Previous research has shown that approximately 10–20% of children and adolescents are regularly involved in school bullying either as victims, bullies, or both (Kaltiala-Heino & Fröjd, 2011), and bullying has been widely recognized as a social problem and an issue of widespread concern. Interventions to reduce bullying are important, but there is clearly a need for individually tailored mental health interventions in school health care for youth who report being bullying victims. Mental health interventions may prevent the adolescent from proceeding down a path toward severe psychiatric disorders that demand high-level psychiatric intervention. Parental mental health problems were also frequently reported between both groups. According to the Finnish Health 2000-study, a national health survey, almost 25% of all adult respondents suffered from mild burnout, while 2.5% of all adult respondents suffered from severe burnout (Aromaa & Koskinen, 2002). Thus, attention should be given to parent's capacity to support positive adolescent development in addition to their own mental health needs.

The co-occurrence of ACEs was frequent in the inpatient group. Approximately one in five inpatient group members had experienced at least four different ACEs, which has previously been observed as the threshold value linked to an increased likelihood of adverse health outcomes (Dong et al., 2003). Thus, our findings are in line with previous research, which reported that ACEs typically co-occur (Dong et al., 2003, 2004; Isohookana et al., 2012). In fact, there is some evidence that the total number of adverse childhood experiences is more important than single adverse experiences in predicting psychological distress (Kumar & George, 2013; Rasmussen et al., 2013).

In line with previous research (Kumar & George, 2013), the comparison group perceived significantly more social support from both their families and friends than the inpatient group. Further, girls, especially those in comparison group, reported more social support from friends than boys. This finding is consistent with findings from Vaux (1985) in the adult population. Vaux (1985) noted that variations in social support were the result of cultural norms related to gender appropriate

Table 3

Multinomial logistic regression analyses of associations between internalizing and externalizing disorders requiring adolescent's hospitalization, and childhood abuse, household dysfunction as well as social factors.

	Internalizing disorder ($n = 139$)		Externalizing disorder ($n = 51$)	
	OR (95% CI)[a]	p	OR (95% CI)[a]	p
Wave 1				
Socioeconomic status				
High	Ref.		Ref.	
Middle	1.3 (0.5–3.0)		1.1 (0.3–4.6)	
Low	1.9 (0.8–4.6)		2.3 (0.6–9.3)	
Age	1.2 (1.0–1.5)		0.9 (0.6–1.12)	
Sex				
Boy	Ref.		Ref.	
Girl	0.9 (0.5–1.6)		0.2 (0.1–0.5)	***
Abuse by category				
Physical	3.2 (1.1–10.1)	*	6.1 (1.7–21.9)	**
Sexual	72.4 (8.2–636.1)	***	160.6 (16.1–1,604.8)	***
Household dysfunction by category				
Parents' divorce	1.2 (0.7–2.0)		2.4 (1.1–5.4)	*
Parental substance abuse problems	3.9 (1.5–10.0)	**	8.5 (2.7–26.2)	***
Parental psychiatric problems	3.8 (2.0–7.3)	***	4.1 (1.7–10.0)	**
Witnessing intimate partner violence	2.6 (2.0–6.1)	*	1.6 (0.5–5.0)	
Criminal behavior in household	4.6 (0.9–22.3)		4.7 (0.7–32.5)	
Wave 2				
Socioeconomic status				
High	Ref.			
Middle	1.3 (0.6–3.0)		1.2 (0.3–4.4)	
Low	1.6 (0.7–3.8)		3.0 (0.9–10.4)	
Age	1.4 (1.1–1.7)	**	0.9 (0.7–1.2)	
Sex				
Boy	Ref.		Ref.	
Girl	1.9 (1.0–3.8)		0.4 (0.2–0.8)	**
Social factors				
School bullying	10.5 (5.1–21.6)	***	7.35 (3.09–17.53)	***
Perceived support from family	1.0 (0.9–1.0)		0.9 (0.8–1.0)	**
Perceived support from friends	0.8 (0.8–0.9)	***	0.9 (0.9–1.0)	
Wave 3				
Socioeconomic status				
High	Ref.		Ref.	
Middle	1.1 (0.4–2.6)		1.0 (0.2–3.5)	
Low	1.3 (0.5–3.2)		1.7 (0.5–6.5)	
Age	1.4 (1.1–1.7)	**	0.9 (0.6–1.2)	
Sex				
Boy	Ref.		Ref.	
Girl	1.4 (0.7–2.8)		0.2 (0.1–0.5)	**
Social factors				
School bullying	7.8 (3.7–16.7)	***	4.6 (1.8–12.2)	**
Perceived support from family	1.0 (0.9–1.1)		1.0 (0.9–1.0)	
Perceived support from friends	0.8 (0.8–0.9)	***	0.9 (0.8–1.0)	
ACE total score	2.1 (1.6–3.0)	***	3.1 (2.3–4.2)	***

[a] Comparison group was the reference category of the dependent variable (comparisons $n = 203$).

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

behavior. Our findings highlight the need to further develop adolescent health care and social services to support youth with low threshold symptoms who do not need official referrals. In such settings, youth could obtain advice and support from professionals before their problems start to escalate.

The second aim of our study was to determine the correlations between the ACEs, school bullying victimization and perceived social support. Indeed, the ACEs were highly correlated with each other with few exceptions. Interestingly, school bullying victimization positively correlated with all ACE categories. This finding is consistent with the hypothesis that being a school bullying victim results from a cycle of victimization that starts in early childhood and continues through adolescence (Baldry, 2003). However, after controlling for diagnosis, age and sex in the logistic regression analysis, school bullying victimization was only associated with parental criminality and physical abuse. This finding is aligned with prior research conducted by Widom, Czaja, and Dutton (2008) and Logan, Leeb, and Barker (2009), who reported that physically abused adolescents are at risk for school bullying victimization.

Perceived social support from family and friends was negatively correlated with most ACEs. In clinical settings, it is important to identify families that are dysfunctional and where children are at risk for maladjustment. For example, The Problem-Centered Systems Therapy of the Family might prove useful in clinical practice. This short-term intervention has successfully been used in numerous settings, and it provides an empirically validated approach to assess and treat dysfunctional families (Miller, Ryan, Keitner, Bishop, & Epstein, 2000). This therapy might improve adolescent's perceived support from his/her family members.

The third aim of this study was to examine which ACEs were most strongly associated with internalizing or externalizing disorders in the inpatient group. Internalizing disorders were associated with physical abuse, parental psychiatric and substance use problems, and witnessing intimate partner violence. Externalizing disorders were related to physical abuse, parental psychiatric and substance use problems, and parental divorce. However, our major finding was that the risk for having an internalizing or externalizing disorder sharply increased if the person had experienced sexual abuse. This finding is consistent with reports that sexual abuse is related to a wide range of psychiatric disorders and problems, including depression, panic disorder, PTSD, sexual disorders, non-suicidal self-injury and suicide attempts (Frounfelker, Klodnick, Mueser, & Todd, 2013; Isohookana et al., 2012) and that it is a more pathogenic experience than physical abuse or any other interpersonal trauma (Brewin, Andrews, & Valentine, 2000; Higgins & McCabe, 2000). In our study, approximately 21% of the inpatient group reported being victims of sexual abuse. This finding indicates a need for more child abuse prevention activities.

In addition to sexual abuse, school bullying victimization is an important risk factor for having an internalizing or externalizing psychiatric disorder in adolescence. Bullying victimization increases emotion dysregulation and lowers self-esteem, which may mediate the relationship between being bullied and psychiatric disorders. Researchers have reported that children who have been bullied exhibit a high prevalence of internalizing and social problems as well as psychosomatic symptoms in early adolescence (Kumpulainen & Räsänen, 2000; Ranta, Kaltiala-Heino, Fröjd, & Marttunen, 2013). However, situations of abuse, humiliation and frustration may also provoke anger and conduct-disordered behavior, leading to externalizing disorders. Fortunately, social support from friends appears to protect against internalizing disorders and support from family protects against externalizing disorders.

Study Strengths and Limitations

One strength of this study was the high sample of consecutive inpatient group members. It is noteworthy that our study included a comparison group with a random sample of gender- and age-matched students from the same geographical area as the inpatient group. Both groups abided by the same protocols, which improved the study's validity (Du Fort, Newman, & Bland, 1993). We used highly reliable and valid semi-structured K-SADS-PL interviews to determine DSM-IV-based psychiatric diagnoses. Social support was assessed using the PSSS-R, which has demonstrated good internal reliability and adequate stability. A structured background data collection sheet allowed for consistently collected background information for both the inpatient and comparison groups.

The results of our study should be interpreted with caution. Although participants had experienced recent traumatic events, we cannot assume causal relationships between study variables. Recall bias may have occurred because some data collection relied on retrospective reports. Attrition was related to male gender and a psychotic disorder diagnosis. In addition, boys are more likely to have externalizing disorders than girls, which may have skewed our results. The small number of patients who had psychotic disorders did not allow for detailed analyses of the associations between ACEs and psychotic disorders. Additionally, the sample sizes for certain subgroup analyses were small, which may have decreased the power to detect significant differences.

We did not measure inter-rater reliabilities for the diagnoses derived from the K-SADS-PL. However, experienced psychiatrists who were specialized in adolescent psychiatry determined the diagnoses and, in cases that were unclear, consensus was negotiated between two or more psychiatrists. Information about parental psychiatric and substance use problems as well as intimate partner violence were based on adolescents' self-reports. Further, the study method did not allow us to separate intra- and extra-familiar sexual abuse. It is important to acknowledge that the categories for externalizing and internalizing disorders were based on participant's principal diagnoses, as many patients had comorbid conditions.

The rate of comorbid diagnoses for the inpatient group was low in comparison to rates in the broader literature. During the study period, the Finnish adolescent mental health organization was highly hospital-oriented, which may have resulted in inpatient participants who were less disturbed and who had lower rates of comorbid disorders than is currently found, as mental health organizations have moved from traditional inpatient hospital care toward diverse outpatient services. Additionally, during the study period, patients who had primary substance-use disorders and the most severe eating disorders were referred to specialized units.

Conclusions

Among the adolescent inpatient group, adverse childhood experiences, school bullying victimization and social relationship dysfunctions were associated with having a serious psychiatric disorder. The odds of being in the adolescent inpatient group increased with the cumulative number of ACEs. This study provides additional support for the importance of developing preventive interventions against school bullying, sexual abuse and other ACEs. Specific attention should be paid to

family relationships and adolescents' problem solving capabilities. Poor family and peer relationships, early sexual activity and sexual risk behavior (particularly in girls), school bullying victimization, and positive attitudes toward violence may be indicators of adverse childhood experiences. Adolescents who experience ACEs do not always seek help, and, if they do seek help, it may be for other problems. Professionals should be prepared to listen carefully to adolescents to determine the severity of abuse. Adolescents who have faced traumatic events need specific attention and expert treatment. The complex interplay between childhood risk and protective factors should be further investigated with more rigorous study designs and methodologies.

References

Afifi, T. O., Brownridge, D. A., Cox, B. J., & Sareen, J. (2006). Physical punishment, childhood abuse and psychiatric disorders. *Child Abuse & Neglect*, *30*, 1093–1103. http://dx.doi.org/10.1016/j.chiabu.2006.04.006

Ambrosini, P. J. (2000). Historical development and present status of the schedule for affective disorders and schizophrenia for school-age children (K-SADS). *Journal of the American Academy of Child and Adolescent Psychiatry*, http://dx.doi.org/10.1097/00004583-200001000-00016

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: American Psychiatric Association.

Appleyard, K., Yang, C., & Runyan, D. K. (2010). Delineating the maladaptive pathways of child maltreatment: A mediated moderation analysis of the roles of self-perception and social support. *Development and Psychopathology*, http://dx.doi.org/10.1017/S095457941000009X

Aromaa, A., & Koskinen, S. (2002). *Health and functional capacity in Finland: Baseline results of the Health 2000 Health Examination Survey*. Hakapaino Oy, Helsinki: Publications of the National Public Health Institute. B12/2004. http://urn.fi/URN:ISBN:951-740-262-7

Baldry, A. C. (2003). Bullying in schools and exposure to domestic violence. *Child Abuse & Neglect*, http://dx.doi.org/10.1016/S0145-2134(03)00114-5

Bauer, N. S., Herrenkohl, T. I., Lozano, P., Rivara, F. P., Hill, K. G., & Hawkins, J. D. (2006). Childhood bullying involvement and exposure to intimate partner violence. *Pediatrics*, *118*, e235–e242.

Blumenthal, J. A., Burg, M. M., Barefoot, J., Williams, R. B., Haney, T., & Zimet, G. (1987). Social support, type A behavior and coronary artery disease outcome of prepubertal depressive. *Psychosomatic Medicine*, *49*, 331–340.

Bowes, L., Arseneault, L., Maughan, B., Taylor, A., Caspi, A., & Moffitt, T. E. (2009). School, neighborhood, and family factors are associated with children's bullying involvement: A nationally representative longitudinal study. *Journal of the American Academy of Child and Adolescent Psychiatry*, http://dx.doi.org/10.1097/CHI.0b013e31819cb017

Brasil, H. H., & Bordin, I. A. (2010). Convergent validity of K-SADS-PL by comparison with CBCL in a Portuguese speaking outpatient population. *BMC Psychiatry*, http://dx.doi.org/10.1186/1471-244X-10-83

Bratek, A., Beil, J., Banach, M., Jarząbek, K., & Krysta, K. (2013). The impact of family environment on the development of alcohol dependence. *Psychiatria Danubina*, *25*(2).

Brewin, C. R., Andrews, B., & Valentine, J. D. (2000). Meta-analysis of risk factors for posttraumatic stress disorder in trauma-exposed adults. *Journal of Consulting and Clinical Psychology*, http://dx.doi.org/10.1037//0022-006X.68.5.748

Chassin, L., Pitts, S. C., Delucia, C., & Todd, M. (1999). A longitudinal study of children of alcoholics predicting young adult substance use disorders, anxiety, and depression. *Journal of Abnormal Psychology*, *108*, 106–119.

Classification of Social Economy Status. (1989). *National authority for collecting and compiling statistics on various fields of society and economy. Handbooks.* (in Finnish).

De Bellis, M. D. (2005). The psychobiology of neglect. *Child Maltreatment*, *10*, 150. http://dx.doi.org/10.1177/1077559505275116

De Boer, S. B., van Oort, F. V., Donker, M. C., Verheij, F., & Boon, A. E. (2012). Childhood characteristics of adolescent inpatients with early-onset and adolescent-onset disruptive behavior. *Journal of Psychopathology and Behavioral Assessment*, *34*, 415–422.

Dong, M., Anda, R. F., Felitti, V. J., Dube, S. R., Williamson, D. F., Thompson, T. J., & Giles, W. H. (2004). The interrelatedness of multiple forms of childhood abuse, neglect, and household dysfunction. *Child Abuse & Neglect*, *28*, 771–784. http://dx.doi.org/10.1016/j.chiabu.2004.01.008

Dong, M., Anda, R. F., Dube, S. R., Giles, W. H., & Felitti, V. J. (2003). The relationship of exposure to childhood sexual abuse to other forms of abuse, neglect, and household dysfunction during childhood. *Child Abuse & Neglect*, *27*, 625–639. http://dx.doi.org/10.1016/S0145-2134(03)00105-4

Dube, S. R., Anda, R. F., Felitti, V. J., Chapman, D. P., Williamson, D. F., & Giles, W. H. (2001). Childhood abuse, household dysfunction, and the risk of attempted suicide throughout the life span: Findings from the adverse childhood experiences study. *JAMA – Journal of the American Medical Association*, *286*, 3089–3096. http://dx.doi.org/10.1001/jama.286.24.3089

Dube, S. R., Anda, R. F., Whitfield, C. L., Brown, D. W., Felitti, V. J., Dong, M., & Giles, W. H. (2005). Long-term consequences of childhood sexual abuse by gender of victim. *American Journal of Preventive Medicine*, *28*, 430–438. http://dx.doi.org/10.1016/j.amepre.2005.01.015

Dube, S. R., Miller, J. W., Brown, D. W., Giles, W. H., Felitti, V. J., Dong, M., & Anda, R. F. (2006). Adverse childhood experiences and the association with ever using alcohol and initiating alcohol use during adolescence. *Journal of Adolescent Health*, *28*, 444e1–444e10. http://dx.doi.org/10.1016/j.jadohealth.2005.06.006

Du Fort, G. G., Newman, S. C., & Bland, R. C. (1993). Psychiatric comorbidity and treatment seeking: Sources of selection bias in the study of clinical populations. *Journal of Nervous and Mental Disease*, *181*, 467–474. http://dx.doi.org/10.1097/00005053-199308000-00001

Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., & Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults the Adverse Childhood Experiences (ACE) study. *American Journal of Preventive Medicine*, *14*, 245–258.

Finlands Official Statistics. (2014). *Changes of marital status*. Retrieved from Statistics Finland Research Reports in website: http://www.stat.fi/til/ssaaty/

Fredriksson, S., & Pelanteri, S. (2012). *Statistical report: Psychiatric specialist medical care 2012*. National Institute for Health and Welfare Finland. Official Statistics of Finland (Health). Retrieved from http://urn.fi/URN:NBN:fi-fe201402274339

Frounfelker, R., Klodnick, V. V., Mueser, K. T., & Todd, S. (2013). Trauma and posttraumatic stress disorder among transition-age youth with serious mental health conditions. *Journal of Traumatic Stress*, *26*, 409–412.

Ghanizadeh, A., Mohammadi, M. R., & Yazdanshenas, A. (2006). Psychometric properties of the Farsi translation of the kiddie schedule for affective disorders and schizophrenia – present and lifetime version. *BMC Psychiatry*, *6* http://dx.doi.org/10.1186/1471-244X-6-10

Gilbert, R., Widom, C. S., Browne, K., Fergusson, D., Webb, E., & Janson, S. (2009). Burden and consequences of child maltreatment in high-income countries. *Lancet*, *373*, 68–81. http://dx.doi.org/10.1016/S0140-6736(08)61706-7

Graham-Bermann, S. A., & Levendosky, A. A. (1998). Traumatic stress symptoms in children of battered women. *Journal of Interpersonal Violence*, *13*, 111–128. http://dx.doi.org/10.1177/088626098013001007

Gyllenberg, D., Sourander, A., Niemelä, S., Helenius, H., Sillanmäki, L., Piha, J., & Almqvist, F. (2010). Childhood predictors of later psychiatric hospital treatment: Findings from the Finnish 1981 birth cohort study. *European Child & Adolescent Psychiatry*, http://dx.doi.org/10.1007/s00787-010-0129-1

Hammen, C., Rudolph, K., Weisz, J., Rao, U., & Burge, D. (1999). The context of depression in clinic-referred youth: Neglected areas in treatment. *Journal of the American Academy of Child and Adolescent Psychiatry*, *38*, 64–71. http://dx.doi.org/10.1097/00004583-199901000-00021

Higgins, D. J., & McCabe, M. P. (2000). Relationships between different types of maltreatment during childhood and adjustment in adulthood. *Child Maltreatment*, *5*, 261–272. http://dx.doi.org/10.1177/1077559500005003006

Horstmanshof, L., Punch, R., & Creed, P. A. (2008). Environmental correlates of well-being among final-year high school students. *Australian Journal of Psychology*, *60*, 101–111.

Isohookana, R., Riala, K., Hakko, H., & Räsänen, P. (2012). Adverse childhood experiences and suicidal behavior of adolescent psychiatric inpatients. *European Child & Adolescent Psychiatry, 22,* 13–22.

Johnson, J. H., & McCutcheon, S. M. (1980). Assessing life stress in older children and adolescents: Preliminary findings with the Life Events Checklist. In J. G. Sarason, & C. D. Spielberger (Eds.), *Stress and anxiety* (pp. 111–112). Washington, DC: Hemisphere Publishing.

Kaltiala-Heino, R., & Fröjd, S. (2011). Correlation between bullying and clinical depression in adolescent patients. *Adolescent Health, Medicine and Therapeutics, 2,* 37–44.

Kaufman, J., Birmaher, B., Brent, D., Rao, U., Flynn, C., Moreci, P., & Ryan, N. (1997). Schedule for affective disorders and schizophrenia for school-age children-present and lifetime version (K-SADS-PL): Initial reliability and validity data. *Journal of the American Academy of Child and Adolescent Psychiatry, 36,* 980–988. http://dx.doi.org/10.1097/00004583-199707000-00021

Keeshin, B., Strawn, J. R., Luebbe, A. M., Saldana, S. N., Wehry, A. M., DelBello, M. P., & Putnam, F. M. (2014). Hospitalized youth and child abuse: A systematic examination of psychiatric morbidity and clinical severity. *Child Abuse & Neglect, 38,* 76–83.

Koizumi, M., & Takagishi, H. (2014). The relationship between child maltreatment and emotion recognition. *PLOS ONE, 9* http://dx.doi.org/10.1371/journal.pone.0086093

Kumar, S., & George, B. (2013). Life events, social support, coping strategies, and quality of life in attempted suicide. *Indian Journal of Psychiatry, 55*(1), 46–51.

Kumpulainen, K., & Räsänen, E. (2000). Children involved in bullying at elementary school age: Their psychiatric symptoms and deviance in adolescence. *Child Abuse & Neglect, 24,* 1567–1577. http://dx.doi.org/10.1016/S0145-2134(00)00210-6

Logan, J. E., Leeb, R. T., & Barker, L. E. (2009). Gender-specific mental and behavioral outcomes among physically abused high-risk seventh-grade youths. *Public Health Reports, 124,* 234–245.

Miller-Perrin, C. L., Perrin, R. D., & Kocur, J. L. (2009). Parental physical and psychological aggression: Psychological symptoms in young adults. *Child Abuse & Neglect, 33,* 1–11. http://dx.doi.org/10.1016/j.chiabu.2008.12.001

Miller, I. W., Ryan, C. E., Keitner, G. I., Bishop, D. S., & Epstein, N. B. (2000). The McMaster approach to families: Theory, assessment and research. *Journal of Family Therapy, 22,* 168–189.

Mills, R., Scott, J., Alati, R., O'Callaghan, M., Najman, J. M., & Strathearn, L. (2013). Child maltreatment and adolescent mental health problems in a large birth cohort. *Child Abuse & Neglect, 37,* 292–302.

Moffitt, T. E., & Caspi, A. (2001). Childhood predictors differentiate life-course persistent and adolescence-limited antisocial pathways among males and females. *Development and Psychopathology, 13,* 355–375. http://dx.doi.org/10.1017/S0954579401002097

Mustanoja, S., Luukkonen, A., Hakko, H., Räsänen, P., Säävälä, H., & Riala, K. (2011). Is exposure to domestic violence and violent crime associated with bullying behaviour among under age adolescent psychiatric inpatients? *Child Psychiatry & Human Development, 42,* 495–506. http://dx.doi.org/10.1007/s10578-011-0222-9

Newman, K., Harrison, L., Dashiff, C., & Davies, S. (2008). Relationships between parenting styles and risk behaviors in adolescent health: An integrative literature review. *Revista Latino-Americana de Enfermagem, 16,* 142–150.

Noach, P., Kerr, M., & Olah, A. (1999). Family relations in adolescence. *Journal of Adolescence, 22,* 713–717.

Perren, S., & Hornung, R. (2005). Bullying and delinquency in adolescence: Victims' and perpetrators' family and peer relations. *Swiss Journal of Psychology, 64,* 51–64. http://dx.doi.org/10.1024/1421-0185.64.1.51

Ranta, K., Kaltiala-Heino, R., Fröjd, S., & Marttunen, M. (2013). Peer victimization and social phobia: A follow-up study among adolescents. *Social Psychiatry and Psychiatric Epidemiology, 48,* 533-544.

Rasmussen, C. S., Nielsen, L. G., Petersen, D. J., Christiansen, E., & Bilenberg, N. (2013). Adverse life events as risk factors for behavioural and emotional problems in a 7-year follow-up of a population-based child cohort. *Nordic Journal of Psychiatry,* http://dx.doi.org/10.3109/08039488.2013.794473

Schilling, E. A., Aseltine, R. H., & Gore, S. (2007). Adverse childhood experiences and mental health in young adults: A longitudinal survey. *BMC Public Health, 7,* 30. http://dx.doi.org/10.1186/1471-2458-7-30

Sourander, A., Helenius, H., & Piha, J. (1995). Parent and teacher reports of problem behaviors in child psychiatric inpatients: Cross-informant correlations on admission and at 5-month follow-up. *Child Psychiatry & Human Development, 26,* 85–95.

Sperry, D. M., & Widom, C. (2013). Child Abuse and neglect, social support, and psychopathology in adulthood: A prospective investigation. *Child Abuse & Neglect, 37,* 415–425.

Thompson, R. A. (2014). Social support and child protection: Lessons learned and learning. *Child Abuse & Neglect,* http://dx.doi.org/10.1016/j.chiabu.2014.06.011

Trickett, E. (1998). Toward a framework for defining and resolving ethical issues in the protection of communities involved in primary prevention projects. *Ethics & Behavior, 8,* 321–337. http://dx.doi.org/10.1207/s15327019eb0804_5

Tuisku, V., Pelkonen, M., Karlsson, L., Kiviruusu, O., Holi, M., Ruuttu, T., & Marttunen, M. (2006). Suicidal ideation, deliberate self-harm behaviour and suicide attempts among adolescent outpatients with depressive mood disorders and comorbid axis I disorders. *European Child & Adolescent Psychiatry, 15,* 199–206.

Vaux, A. (1985). Variations in social support associated with gender, ethnicity, and age. *Journal of Social Issues, 41,* 199–206. http://dx.doi.org/10.1111/j.1540-4560.1985.tb01118.x

Välimaa, R. (2000). (*Adolescents' perceived health based on surveys and focus group discussions, English summary*) *Nuorten koettu terveys kyselyaineistojen ja ryhmähaastattelujen valossa* (Academic dissertation). Jyväskylä: University of Jyväskylä.

Widom, C. S., Czaja, S. J., & Dutton, M. A. (2008). Childhood victimization and lifetime revictimization. *Child Abuse & Neglect, 32,* 785–796. http://dx.doi.org/10.1016/j.chiabu.2007.12.006

Widom, C. S., DuMont, K., & Czaja, S. J. (2007). A prospective investigation of major depressive disorder and comorbidity in abused and neglected children grown up. *Archives of General Psychiatry, 64,* 49–56.

Child and Adolescent Psychiatry
and Mental Health

Open Access

CrossMark

Psychometric properties of the Symptom Checklist-90 in adolescent psychiatric inpatients and age- and gender-matched community youth

Minna Rytilä-Manninen[1,2*], Sari Fröjd[3], Henna Haravuori[2,4], Nina Lindberg[5], Mauri Marttunen[2,4], Kirsi Kettunen[2] and Sebastian Therman[4]

Abstract

Background: The Symptom Checklist-90 (SCL-90) is a questionnaire that is widely used to measure subjective psychopathology. In this study we investigated the psychometric properties of the SCL-90 among adolescent inpatients and community youth matched on age and gender.

Methods: The final SCL-90 respondents comprised three subsets: 201 inpatients at admission, of whom 152 also completed the instrument at discharge, and 197 controls. The mean age at baseline was 15.0 years (*SD* 1.2), and 73 % were female. Differential SCL-90 item functioning between the three subsets was assessed with an iterative algorithm, and the presence of multidimensionality was assessed with a number of methods. Confirmatory factor analyses for ordinal items compared three latent factor models: one dimension, nine correlated dimensions, and a one-plus-nine bifactor model. Sensitivity to change was assessed with the bifactor model's general factor scores at admission and discharge. The accuracy of this factor in detecting the need for treatment used, as a gold standard, psychiatric diagnoses based on clinical records and the Schedule for Affective Disorders and Schizophrenia for School-Age Children—Present and Lifetime (K-SADS-PL) interview.

Results: Item measurement properties were largely invariant across subsets under the unidimensional model, with standardized factor scores at admission being 0.04 higher than at discharge and 0.06 higher than those of controls. Determination of the empirical number of factors was inconclusive, reflecting a strong main factor and some multidimensionality. The unidimensional factor model had very good fit, but the bifactor model offered an overall improvement, though subfactors accounted for little item variance. The SCL-90s ability to identify those with and without a psychiatric disorder was good (AUC = 83 %, Glass's Δ = 1.4, Cohen's *d* = 1.1, diagnostic odds ratio 12.5). Scores were also fairly sensitive to change between admission and discharge (AUC 72 %, Cohen's *d* = 0.8).

Conclusions: The SCL-90 proved mostly unidimensional and showed sufficient item measurement invariance, and is thus a useful tool for screening overall psychopathology in adolescents. It is also applicable as an outcome measure for adolescent psychiatric patients. SCL-90 revealed significant gender differences in subjective psychopathology among both inpatients and community youth.

Keywords: Adolescent, Bifactor, Clinical, Differential item functioning, Factor structure, Measurement invariance, Psychometric property, Symptom Checklist-90, SCL-90, Validity

*Correspondence: minna.rytila-manninen@hus.fi
[1] Hospital District of Helsinki and Uusimaa, Kellokoski Hospital,
04500 Kellokoski, Finland
Full list of author information is available at the end of the article

Rytilä-Manninen *et al. Child Adolesc Psychiatry Ment Health* (2016) 10:23

Page 2 of 12

Background

Adolescence is a transitional stage from childhood to adulthood during which the individual undergoes many physiological, psychological, cognitive, and social changes. It is a risk period for the emergence of many psychiatric disorders [1, 2]. The incidence of psychiatric disorders increases from childhood through mid-adolescence, peaking in late adolescence and young adulthood [3], and approximately one adolescent in five suffers from a psychiatric disorder [4]. In Finland, about 3 % of the adolescent population (ages 13–22) is referred to adolescent psychiatric secondary care, and approximately 0.4–0.6 ‰ require psychiatric hospitalization [5].

Symptom inventories provide an economical means of assessing adolescents' mental disturbance levels and treatment effectiveness. As Symptom Checklists and rating scales provide extensive amounts of clinical information relatively quickly, self-report symptom inventories are commonly used by both clinicians and researchers to gather information on patients' mental states. Furthermore, self-report questionnaires can be used to monitor the quality of medical and psychological interventions in mental health services, and to screen for symptoms of psychopathology [6]. Because psychiatric comorbidity is typical for adolescents with mental disorders, a growing body of research has supported using multidimensional scales [7]. One such questionnaire is the Symptom Checklist-90 (SCL-90) [8], a widely applied self-assessment tool for individuals with a broad range of mental disorders and symptom intensity. It contains 90 items and takes approximately 12–15 min to administer, yielding nine scores for primary symptom dimensions and three for global distress. The symptom dimensions comprise somatization, obsessive–compulsive behavior, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism [8]. The main global index of distress is the global severity index (GSI), which is the average of all responses. A time reference of 1–2 weeks is usually used.

The SCL-90 has been tested in different settings, including community [6, 9–13] and psychiatric outpatient [14, 15] and inpatient samples [16–18]. It is commonly used as an indicator of change in symptoms [19, 20] and as a treatment outcome measure [21, 22]. The SCL-90s ability to discriminate patients from non-patients is adequate [13, 14], but correlations with analogous and non-analogous measures have been somewhat controversial [17, 23]. Significant gender differences have also emerged [13, 21, 24]. The main criticism of the instrument, however, has focused on the original 9-factor structure, with substantial difficulties arising in its replication. One general factor accounting for a large proportion of variance has been proposed in some studies with adults [14, 17, 19, 25].

The aim of the present study was to investigate the measurement invariance, factor structure, reliability, and validity of the SCL-90 among adolescents. A new approach is the use of a bifactor model, which according to Reise [26], is effective when modeling construct-relevant multidimensionality. A bifactor model consists of general factor and a number of specific factors, allowing each item to load both on the general factor and specific factor [26, 27]. In this study we compare two groups, inpatients and controls, and also the same patient sample at two time points, namely admission and discharge. As a prerequisite for comparing these two groups and two time points accurately, a measurement invariance analysis was executed. Measurements invariance signifies that the association between the items and the latent factors should not depend on group membership or measurement occasion, but the measurement instrument and the construct being measured are operating in the same way across diverse samples of interest [28].

To the best of our knowledge, this is the first study that examines the dimensionality and viability of the SCL-90 subscale scores in an adolescent sample by applying a bifactor model. In line with recent findings supporting a bifactor model of the SCL-90 with adults [29], we expect that the model with nine specific factors and one general factor of symptoms would be the best fitting solution. Our second aim is to estimate the screening performance of the SCL-90 and to determine optimal cut-off point. To our knowledge, there are no discrimination thresholds for distinguishing between adolescent patients and the general population or between adolescents with a diagnosed mental disorder and those without. An earlier study in a Finnish adult sample [10] has shown that the screening properties of this SCL-90 translation are good.

The findings could provide important information on the best practices for using the SCL-90 questionnaire and interpreting SCL-90 scores among adolescents.

Methods

Participants and procedure

Inpatients

The Kellokoski Hospital Adolescent Inpatient Follow-Up Study (KAIFUS) is a longitudinal naturalistic study on clinical characteristics and impact of treatment in a consecutive sample of adolescent psychiatric inpatients in Southern Finland. The sample comprises 13- to 17-year-old adolescents admitted to Kellokoski Hospital for the first time between September 2006 and August 2010 ($N = 395$). We excluded adolescents with a treatment period of less than 2 weeks, with intellectual disability, with an age under 13 years, or with a poor knowledge of Finnish language ($n = 80$, 20 %). Furthermore, 62 adolescents (16 %) declined to participate, 23 (6 %)

Rytilä-Manninen *et al. Child Adolesc Psychiatry Ment Health* (2016) 10:23

Page 3 of 12

discontinued their treatment, and 24 (6 %) had incomplete data. The final inpatient admission sample comprised 60 boys (29 %) and 146 girls (71 %) with a mean age of 15.1 years ($SD = 1.2$). Non-participation was unrelated to age ($p = 0.31$, two-sided t test), living situation ($p = 0.58$), socioeconomic status ($p = 0.38$), or the presence of substance use disorders ($p = 0.59$), mood disorders ($p = 0.92$), conduct disorder ($p = 0.09$), anxiety disorders ($p = 0.39$), or eating disorders ($p = 0.34$), but was higher among boys ($p = 0.02$) and among patients with psychotic disorders ($p = 0.02$). Patients were diagnostically interviewed with the Schedule for Affective Disorders and Schizophrenia for School-Age Children—Present and Lifetime version [30]. The patients were requested to complete the SCL-90 at the beginning of their stay as well as at discharge. The treatment duration was between 31 and 90 days in 38 % of the cases, 42 % of the patients stayed in hospital for over 90 days, and 20 % of the patients for less than 31 days. For more details, see Rytilä-Manninen et al. [31]. The study was designed to detect clinically meaningful group differences, and the planned sample size of 200 patients and 200 controls is sensitive enough to achieve 80 % power even for small effect sizes ($d > 0.28$) when α is set to 0.05 on a *t* test.

Community sample

The control group comprised a random sample of sex- and age-matched students from two secondary, one vocational, and four comprehensive schools, collected from the same geographical area as the inpatients. A total of 473 students were invited; 202 (43 %) refused to participate, and 68 (14 %) failed to complete the self-assessments despite providing consent. The final sample consisted of 55 males (27 %) and 148 females (73 %). All were native Finns, with a mean age of 14.9 years ($SD = 1.2$). No significant differences were found between adolescents who participated and those who did not with regard to socioeconomic status ($p = 0.61$) or living situation ($p = 0.49$). The same interviews and questionnaires were used with the community youth group as with patients. Based on the diagnostic interviews, 21 % of these youths met the criteria for at least one psychiatric disorder. For more details, see Rytilä-Manninen et al. [31].

Ethical aspects

Participation was voluntary, and all participants and their legal guardians were required to provide written informed consent after receiving both verbal and written information about the study. The Ethics Committee of Helsinki University Hospital approved the study protocol. Permission to conduct the study was granted by the authorities of the Helsinki and Uusimaa Hospital District

and school administrations. The study was performed in accordance with the Declaration of Helsinki.

Measures

Schedule for affective disorders and schizophrenia for school-age children—present and lifetime version (K-SADS-PL)

Psychiatric diagnoses were assessed based on the K-SADS-PL interview [30]. This is a semi-structured interview with good to excellent test–retest reliability and high concurrent validity and inter-rater agreement between the original and translated versions [30, 32–34]. The Finnish translation has previously been used in studies of both adolescent in- and outpatients [35, 36].

Psychiatrists specialized in treating adolescents assigned the psychiatric diagnoses according to the Axis-I disorders in DSM-IV [37] based on the K-SADS-PL and clinical records. Discrepancies were resolved by consensus between the psychiatrists. The psychiatric diagnoses present at the time of the baseline interview were included in the analyses, here dichotomized as having at least one psychiatric diagnosis present or no psychiatric diagnosis present.

Scl-90

SCL-90 is a self-report measure for persons aged at least 13 years. It consists of 90 items that represent nine factors and seven additional questions that are configure items, primarily concerning disturbances in appetite and sleep patterns, and are not scored collectively as a dimension [8]. Each of the nine symptom dimensions contains 6-13 items. Items are rated on a five-point Likert-scale of distress, ranging from "not at all" (0) to "extremely" (4). The General Severity Index (GSI) is the average score for all responded items and serves as an overall measure of psychiatric distress. In this study, the time of reference for the symptoms was the previous two weeks.

Statistical analyses

Measurement invariance

To establish sufficient measurement invariance across groups and time points, an iterative algorithm was employed to detect differential item functioning (DIF) under Samejima's graded response model for the full SCL-90, using the lordif package version 0.3–2 [38] for R with default settings (α = 0.01). The algorithm uses items tentatively flagged as invariant as anchors in an iterative process until a stable solution is identified. Patient responses at admission were separately compared with responses at discharge and control group responses. Total item-wise DIF was measured with summed uniform and non-uniform McFadden pseudo-R^2.

Rytilä-Manninen *et al. Child Adolesc Psychiatry Ment Health* (2016) 10:23

Page 4 of 12

Optimal number of factors

The multifactoriality of the subsample datasets were investigated with a number of indices for the optimal number of factors to extract: very simple structure (VSS), minimum average partial correlation (MAP), and parallel analysis (PA) [39–41]. These were calculated with the psych package version 1.5.8 in R version 3.2.3, using the polychoric correlation matrix and both weighted least-squares (WLS) and maximum likelihood (ML) estimation. VSS was investigated at complexity one and two, where an item is allowed to load on one or two factors only. In addition, the comparison data approach of Ruscio and Roche [42] was used, as implemented in R code supplied by the authors, using Spearman correlation matrices derived from complete cases.

Factor analyses

After establishing sufficient measurement invariance, the one-dimensional and a priori nine-dimensional model of the SCL-90 was fitted in confirmatory factor analyses (CFA) separately for patients at admission, patients at discharge, and controls.

In addition, in light of the evidence for a strong main factor, a bifactor model was specified with a general factor uncorrelated with the nine subfactors, which correlated with each other. The percentage of common variance attributable to the general factor was expressed with the explained common variance index (ECV) and the usefulness of individual subscales was assessed with McDonald's omega hierarchical ω_h and omega subscale ω_s [26].

All factor analyses used the weighted least squares mean and variance adjusted (WLSMV) algorithm for categorical indicators in Mplus 7.3 [43], which performs well with skewed ordinal variables [44, 45] and with smaller samples [46]. Three fit indices were employed; for the comparative fit index (CFI) and the root mean square error of approximation (RMSEA) we followed the suggested cut-off values of Hu and Bentler [47] in judging adequacy of fit: >0.95 for CFI and <0.06 for RMSEA; for the weighted root mean square residual (WRMR) Yu [48] has suggested a cut-off of <1.0 under non-normality and small samples. Note that the one-dimensional and bifactor models included the six items not assigned to any of the nine subfactors. *Maximum* a posteriori factor scores were calculated for the bifactor model general factor.

Criterion validation

The three response sets of patients at admission, patients at discharge, and controls were compared on their SCL-90 general factor scores. As score distributions were approximately normal, Welch's unequal variances t-test was employed (two-tailed, $\alpha = 0.05$), and effect sizes were expressed with Glass's Δ (using control/healthy variance only) and Cohen's d (pooled variance). Similarly, diagnosed individuals were compared with non-diagnosed individuals in the combined admission and control groups. Gender effects were examined in all three response sets. Receiver operating characteristic (ROC) curves and associated area under the curve (AUC) values with non-parametric confidence intervals were computed with the pROC package [49] version 1.1-2 in R. The optimal cut-off point for discriminating between groups was determined with Youden's J statistic [50], maximizing the sum of sensitivity and specificity. The overall discriminability at the chosen cut-offs was expressed as diagnostic odds ratios (DOR).

Results

Basic item distribution properties of SCL-90

From admission, discharge, and control sets 0.1, 0.4 and 0.2 % of SCL-90 responses were missing, respectively, with no individual having more than 30 missing responses. All models and scores were therefore estimated using all available data, assuming missingness at random. There was a strong floor effect in response distributions (item-wise skewness averaged 0.7 at admission, 1.6 at discharge, and 2.0 for controls), which in combination with the five-point response scale confirmed the necessity of employing factor analyses suitable for ordered categorical indicators.

Measurement invariance

When investigating the measurement invariance of items between patients and controls in the one-dimensional model, the iterative algorithm converged after 4 rounds, flagging 23 items for DIF, and McFadden R^2 values for all items had a mean of 0.8 % and a median of 0.4 %. The highest values were observed for items 15 and 22 at 5.2 and 5.1 %. However, the total effect of the DIF of all items was small, as it was estimated to lead to 0.06 higher normalized latent scores in the patient group. Group-wise test characteristic curves and the impact of DIF are presented in Fig. 1.

When comparing admission and discharge responses of patients, the algorithm also converged after four rounds, flagging 11 items. McFadden R^2 values for all items had a mean of 0.5 % and a median of 0.3 %, the highest values being 2.6, 2.5 and 2.3 % for items 32, 15, and 59, respectively. Again, the total effect of DIF was minimal, resulting in 0.04 higher scores at admission.

Optimal number of factors

The empirical number of factors using WLS and ML estimation were almost identical, and only the former results are shown, along with results for the comparison

Rytilä-Manninen *et al. Child Adolesc Psychiatry Ment Health* (2016) 10:23

Page 5 of 12

Fig. 1 a Test characteristic curves by group based on all items. **b** Group-wise impact on theta estimates from accounting for DIF
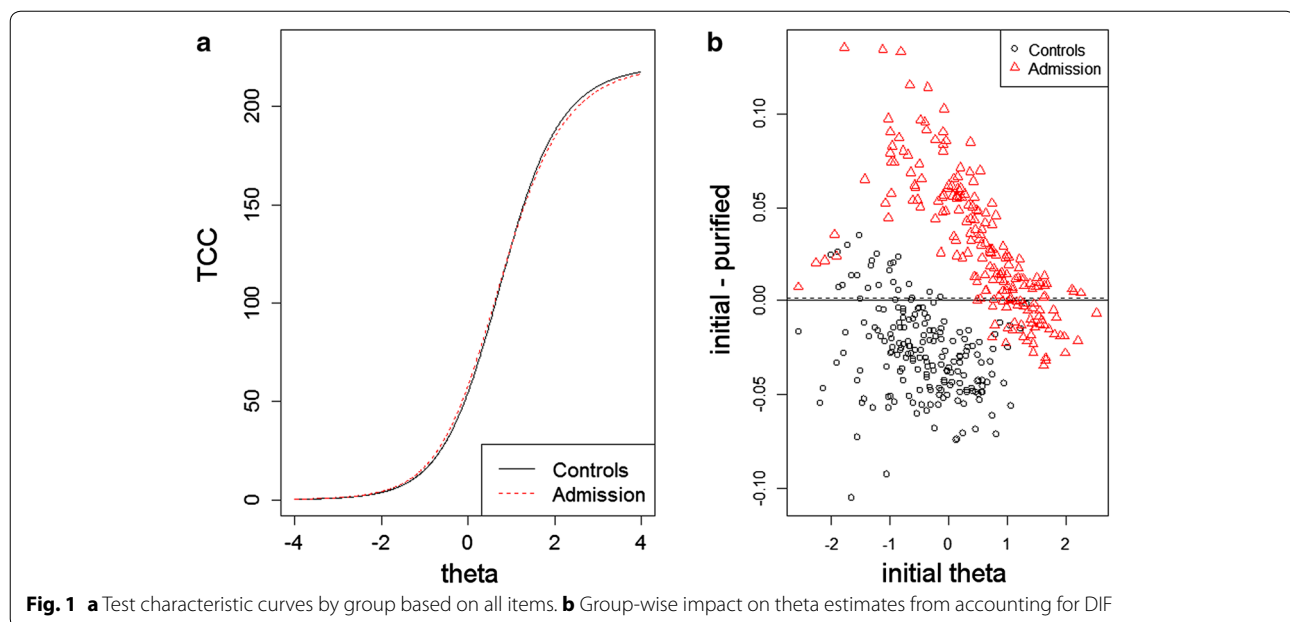
data method, in Table 1. The various indices were highly divergent, with nominated number of factors ranging from one to nine, consistent with a complex factor structure with a strong primary factor.

Confirmatory factor analyses

The one-dimensional CFA models had good fit in all three subsamples (Table 2). In contrast, the fit was poor for the a priori nine-dimensional models, and latent factors were very strongly correlated; the median interfactor correlations were 0.84, 0.88, and 0.86 for the admission, discharge, and control datasets, respectively. The bifactor models had an even better fit than the corresponding one-dimensional models in the same subsamples. However, successfully fitting the bifactor models required leaving out item 15 from the depression subfactor, as the item was almost perfectly correlated with the general factor. Fit statistics of all models are presented in Table 2, and factor loadings, thresholds, and subfactor correlations of the patient admission subsample in Table 3. Total information curves of the general factor in the three subsamples are presented in Fig. 2.

Table 1 Suggested number of factors by various indices

Subsample	VSS complexity 2	MAP	Empirical BIC	PA	CD
Admission	2	5	5	9	1
Discharge	2	9	2	2	1
Controls	2	7	5	7	1

VSS very simple structure; *MAP* minimum average partial; *BIC* Bayesian information criterion; *PA* parallel analysis; *CD* comparison data method

As sufficient measurement invariance was established, *maximum* a posteriori factor scores for the general factor were estimated for all groups using the parameters of the patient admission bifactor model, which was the most multi-factorial of the three and had the most stable parameter estimates; the two items (15 and 22) showing a total DIF effect of over 5 % in either analysis were left out. Factor scores were standardized to set the control sample mean to zero and standard deviation to one, and are presented in Table 4. In the combined admission and control sample, the Pearson correlation between the GSI and factor scores was 0.956 and the Spearman correlation was 0.997, indicating very strong agreement with a curvilinear relationship.

Subscale viability

The ECV of the general factor in the bifactor analyses was 56 % for the admission sample, 76 % at discharge, and 82 % for controls. McDonald's omega values for the general factor and subscales are shown in Table 5.

Group differences

The GSI scores by group are shown in Table 4. Using the standardized general factor scores from the bifactor model, boys had lower scores than girls in both admission (Welch test $p < 0.001$, Cohen's $d = 0.8$; girls $M = 1.7$, $SD = 1.2$; boys $M = 0.6$, $SD = 1.4$) and control samples ($p < 0.001$, $d = 0.6$; girls $M = 0.1$, $SD = 1.0$; boys $M = -0.4$, $SD = 1.0$).

In the ROC analyses of the factor scores, adequate discrimination was found between patients at admission

Rytilä-Manninen *et al. Child Adolesc Psychiatry Ment Health* (2016) 10:23

Page 6 of 12

Table 2 Fit statistics for CFA models

Dimensions	Items	Subsample	CFI	RMSEA	WRMR	Explained variance (%)
1	90	Admission	0.94	0.05	1.32	48
		Discharge	0.97	0.04	1.14	57
		Controls	0.96	0.03	1.10	43
9	84	Admission	0.50	0.13	3.53	56
		Discharge	0.66	0.13	3.43	64
		Controls	0.76	0.07	2.18	50
1 + 9 (bifactor)	90	Admission	0.97	0.03	1.02	58
		Discharge	0.98	0.03	0.93	66
		Controls	0.98	0.02	0.94	51

CFI comparative fit index; *RMSEA* root mean square error of approximation; *WRMR* weighted root mean square residual

and discharge (AUC 72, 95 % CI [66.8, 77.4 %]) as well as between patients at admission and controls (AUC 79 % [75.5, 84.3 %]). Formulated differently, the group difference between patients at admission and controls was statistically highly significant and the effect was large ($p < 0.001$, Glass's $\Delta = 1.4$, Cohen's $d = 1.1$). Patients' scores were also significantly lower at discharge than at admission (paired test $p < 0.001$, $d = 0.8$). The optimal cut-off point to distinguish between controls and patients at admission was at $\theta = 1.14$, approximately corresponding to a GSI of 0.99, providing 86 % specificity, 63 % sensitivity, and a DOR of 10.5. In the combined admission and control sample, individuals with and without a psychiatric diagnosis were very well separated on the general factor (AUC 83 % [80, 87 %], $p < 0.001$, $\Delta = 1.7$, $d = 1.3$), the optimal cut-off being $\theta = 0.68$, approximately corresponding to a GSI of 0.72 (83 % specificity, 72 % sensitivity, DOR 12.5). ROC curves are shown in Fig. 3.

Discussion

In this study we analyzed the psychometric properties of the SCL-90 questionnaire in adolescent inpatients and a community sample. We found the measurement invariance to be satisfactory between patient and control responses and between patients at admission and discharge. We also examined the dimensionality of measurement with methods intended for exploratory factor analysis and via confirmatory factor and bifactor analysis. The explained common variance was estimated for the latter. To better understand the viability of subscales, we also calculated omega-hierarchical and omega-subscale indices. Receiver operating curves were calculated in order to evaluate the SCL-90s ability to distinguish between controls and patients and between individuals with and without a psychiatric diagnosis.

Measurement invariance analyses revealed sufficient measurement invariance across patients and controls and across time points, in line with an earlier clinical and general population study of adults [51]. These findings support using all the items for the GSI or a general factor, though at least one but perhaps a few items show enough DIF in the unidimensional model to be considered for exclusion. The sample sizes were unfortunately too small to formally test structural invariance in multidimensional models.

We calculated estimates of the number of empirically found number of dimensions, which were highly divergent, and therefore limited our factor analyses to confirmatory testing of previously proposed models. The fit of the unidimensional factor model proved adequate, but the nine-factor structure of the SCL-90 proposed by the original author of the scale [8] was not supported, as it showed poor fit and very highly correlated subscales. In contrast, the bifactor model with one general factor of symptoms and the same nine specific factors yielded an excellent fit to the data in all three subsamples (patient admission, patient discharge, and controls). Similar results have been found also by Urbán et al. [29] and Thomas [52].

As in the previous study by Urbán et al. [29] with an adult sample, we observed a strong global distress factor and weaker specific symptom factors in our patient sample, while our control sample data appeared unidimensional. There are some other previous studies that have similar results among adults. For example, Paap et al. [53, 54] have also found that different populations have varying dimensionality results using Mokken scale analysis: while samples of patients with high levels of distress support multidimensionality of the SCL-90 [53], samples characterized by a low level of distress indicate unidimensionality [54]. Lastly, adolescent inpatients usually suffer from comorbid disorders, and symptomatically homogenous groups without symptoms of other mental disorders are rarely found [55], which may explain the strong unidimensionality also in our clinical sample.

Rytilä-Manninen *et al. Child Adolesc Psychiatry Ment Health* (2016) 10:23

Page 7 of 12

Table 3 Standardized thresholds and factor loadings of nine-dimensional bifactor model of patient admission responses to SCL-90

Subfactor	Item	Thresholds				Explained variance (%)	Loadings	
		1	2	3	4		General factor	Subfactor
Somatization	48	0.06	0.63	1.26	1.81	71	0.48	0.70
	49	0.08	0.69	1.31	1.81	61	0.48	0.61
	56	0.05	0.76	1.20	1.70	68	0.56	0.61
	52	−0.09	0.54	1.08	1.65	52	0.40	0.60
	27	0.35	0.81	1.41	1.96	41	0.33	0.55
	58	0.31	0.92	1.52	2.33	50	0.48	0.52
	12	0.32	0.90	1.44	2.06	35	0.31	0.51
	42	−0.07	0.65	1.38	1.88	43	0.42	0.51
	4	−0.66	0.19	0.82	1.51	46	0.48	0.49
	53	0.04	0.65	1.31	1.88	51	0.54	0.47
	40	−0.32	0.34	1.11	2.06	41	0.47	0.44
	1	−0.88	−0.02	0.86	1.56	26	0.44	0.26
Obsessive–compulsive	65	0.29	0.77	1.15	1.44	58	0.34	0.68
	51	−0.51	0.13	0.71	1.41	64	0.52	0.61
	9	−0.69	−0.02	0.63	1.26	55	0.44	0.59
	45	−0.22	0.50	0.98	1.65	62	0.54	0.58
	38	−0.20	0.54	1.13	1.96	66	0.60	0.55
	46	−0.79	−0.14	0.51	1.25	63	0.62	0.50
	55	−0.78	−0.16	0.28	1.00	57	0.61	0.45
	28	−0.65	−0.02	0.59	1.08	76	0.76	0.43
	10	−0.46	0.08	0.69	1.38	48	0.56	0.41
	3	−0.74	−0.30	0.20	0.85	55	0.65	0.36
Interpersonal sensitivity	73	−0.36	0.11	0.69	1.20	70	0.54	0.65
	69	−0.11	0.41	0.87	1.40	72	0.57	0.63
	61	−0.82	−0.10	0.45	1.02	70	0.62	0.56
	37	−0.55	0.06	0.74	1.25	63	0.64	0.47
	36	−0.57	0.07	0.56	1.18	61	0.63	0.46
	34	−0.36	0.32	0.92	1.44	50	0.56	0.44
	6	−0.21	0.53	1.26	1.81	32	0.42	0.38
	21	−0.09	0.48	1.20	1.70	23	0.32	0.36
	41	−0.71	−0.17	0.44	0.85	76	0.86	0.16
Depression	5	−0.08	0.45	1.02	1.59	53	0.53	0.50
	14	−0.88	−0.24	0.40	1.02	64	0.67	0.44
	31	−1.00	−0.47	0.17	0.88	67	0.70	0.42
	29	−0.71	−0.07	0.40	0.90	63	0.68	0.41
	71	−0.72	−0.20	0.35	0.95	76	0.78	0.39
	22	−0.62	−0.23	0.49	1.15	64	0.71	0.38
	32	−0.66	−0.06	0.54	1.06	54	0.64	0.36
	30	−1.04	−0.59	0.08	0.74	79	0.82	0.34
	54	−0.57	−0.07	0.51	1.04	71	0.78	0.32
	20	−0.66	−0.17	0.35	1.02	43	0.59	0.28
	79	−0.48	0.03	0.44	0.95	80	0.86	0.23
	26	−0.59	−0.02	0.49	1.02	68	0.80	0.21
	15	−0.39	0.02	0.39	0.92	88	0.94	0.00

Rytilä-Manninen *et al. Child Adolesc Psychiatry Ment Health* (2016) 10:23

Page 8 of 12

Table 3 continued

Subfactor	Item	Thresholds				Explained variance (%)	Loadings	
		1	2	3	4		General factor	Subfactor
Anxiety	39	0.06	0.51	1.18	1.70	58	0.43	0.63
	72	−0.13	0.47	1.06	1.44	73	0.58	0.62
	33	−0.38	0.11	0.69	1.26	71	0.60	0.59
	57	−0.52	0.04	0.72	1.48	71	0.62	0.57
	23	−0.02	0.56	1.04	1.52	63	0.56	0.57
	17	−0.04	0.57	1.13	1.60	56	0.53	0.53
	80	0.05	0.50	1.02	1.60	50	0.57	0.42
	2	−1.31	−0.66	−0.04	0.92	59	0.65	0.41
	78	−0.24	0.36	1.02	1.51	51	0.60	0.39
	86	−0.18	0.41	0.91	1.44	53	0.67	0.28
Hostility	67	0.24	0.92	1.31	1.81	79	0.49	0.74
	63	0.03	0.82	1.15	1.65	62	0.37	0.70
	81	−0.18	0.37	0.92	1.28	70	0.61	0.58
	24	−0.50	0.16	0.73	1.41	52	0.56	0.46
	11	−0.95	−0.29	0.39	1.06	54	0.58	0.45
	74	0.03	0.81	1.51	2.05	29	0.38	0.38
Phobic anxiety	47	0.43	0.88	1.15	1.60	69	0.25	0.79
	70	−0.33	0.29	0.76	1.20	72	0.41	0.74
	50	−0.06	0.38	0.88	1.20	80	0.52	0.73
	13	−0.18	0.31	0.71	1.26	79	0.51	0.73
	25	0.34	0.68	1.15	1.65	60	0.49	0.60
	82	0.45	0.97	1.51	1.96	43	0.46	0.47
	75	−0.09	0.41	0.99	1.65	45	0.56	0.37
Paranoid ideation	43	−0.49	0.02	0.54	1.00	70	0.57	0.61
	18	−0.59	−0.03	0.50	1.08	63	0.53	0.59
	68	−0.14	0.47	0.92	1.37	64	0.59	0.54
	83	−0.01	0.66	1.02	1.48	49	0.51	0.48
	8	0.04	0.74	1.23	1.96	18	0.08	0.42
	76	−0.10	0.69	1.23	1.65	44	0.54	0.39
Psychoticism	62	0.33	0.88	1.31	1.88	59	0.52	0.57
	87	0.10	0.69	1.04	1.51	60	0.55	0.55
	84	0.67	1.19	1.88	2.17	42	0.37	0.54
	16	0.57	1.02	1.38	1.70	44	0.41	0.52
	7	0.39	0.92	1.48	2.17	39	0.41	0.48
	35	−0.14	0.44	0.98	1.52	56	0.59	0.47
	90	−0.31	0.08	0.47	0.97	58	0.65	0.39
	88	0.14	0.67	1.18	1.44	45	0.57	0.36
	77	−0.30	0.16	0.64	1.22	64	0.75	0.26
	85	0.24	0.74	1.10	1.75	41	0.60	0.21
(None)	19	−0.42	0.13	0.76	1.28	35	0.59	–
	44	−0.66	−0.14	0.39	1.04	57	0.76	–
	59	−0.56	−0.11	0.27	0.74	94	0.97	–
	60	0.27	0.71	1.06	1.44	30	0.55	–
	64	−0.41	0.19	0.79	1.44	37	0.60	–
	66	−0.40	0.11	0.57	1.13	62	0.79	–
	89	−0.45	0.06	0.52	1.10	78	0.89	–

Rytilä-Manninen *et al. Child Adolesc Psychiatry Ment Health* (2016) 10:23

Page 9 of 12
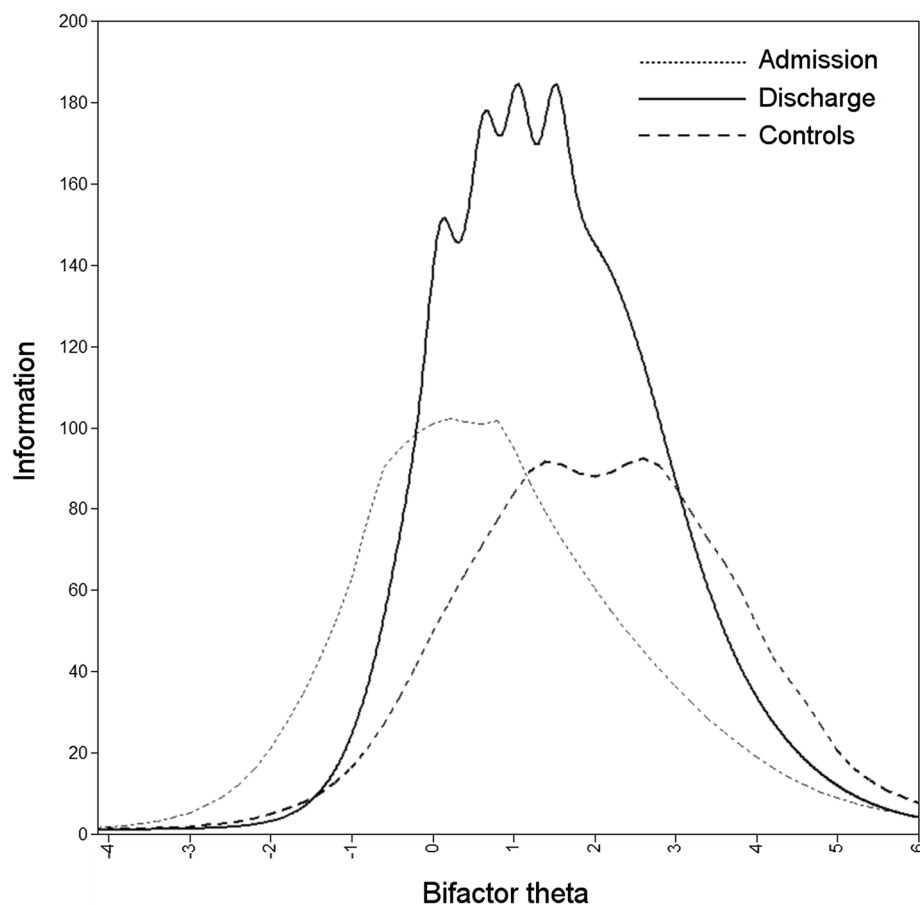
Fig. 2 Total information curves as a function of theta for the general factor in admission (*dotted line*), discharge (*solid line*), and control subsamples. Note that the theta scale is normalized separately in each subsample

The explained common variance (ECV) index reflected the same findings on dimensionality and higher level of distress in our study. In our patient admission subsample, with severe distress, the ECV of the general factor was 56 %, which means that the explained variance is approximately equally spread across general and group factors, while at discharge, the common variance explained by the general factor was 76 %, and the highest ECV was found in the control sample 82 %, which approaches unidimensionality [26]. Interestingly, in the study by Urbán et al. [29] their adult community sample had almost the same ECV index (83 %) as our adolescent controls, which implies continuity across age groups for this measurement property.

Overall, the analysis of general- and domain-specific components yielded strong support for the presence of a general factor of symptoms within the SCL-90 items and, on the other hand, gave limited evidence for the viability of the a priori multidimensional structure even in the inpatient admission sample. The specific symptom factors

Phobic Anxiety ($\omega_s = 0.40$) and Hostility ($\omega_s = 0.32$) had the strongest, but still weak, contributions to explaining the variance of the admission responses. These same two subscales had the strongest coefficients also in the patient discharge and control samples. These two factors also stood out in the study by Urbán et al. [29], indicating that these subfactors are more independent or distinct from other subscales of the SCL-90. The weakest reliability coefficients in this study was found for the depression subscale, suggesting that the depression items in the SCL-90 measure general distress addressed by the whole questionnaire, and that the depression scale does not reflect depression specific factor of symptoms. Thus, the nine subscales demonstrated low reliability as estimated by omega subscale coefficients, showing that these subscales comprise too small amount of reliable variance to reliably interpret. The results of the present research suggest that there is limited value in using the very highly correlated SCL-90 subscale scores among adolescents, because they primarily reflect variations in general symptoms.

Rytilä-Manninen *et al. Child Adolesc Psychiatry Ment Health* (2016) 10:23

Page 10 of 12

Table 4 Score distributions and group comparisons

Subsample	N	Raw item means		Standardized general factor	
		Mean (SD)	Range	Mean (SD)	Range
Patients at admission	201	1.28 (0.79)	[0, 3.19]	1.37 (1.36)	[−2.8, 4.3]
Patients at discharge	152	0.68 (0.64)	[0, 2.52]	0.26 (1.39)	[−2.8, 3.1]
Controls	197	0.49 (0.41)	[0, 1.86]	0 (1)	[−2.8, 2.2]

Table 5 Viability of subscales in bifactor models

Scale	Subsample		
	Admission	Discharge	Controls
Omega-hierarchical (ω_h)	0.89	0.95	0.97
Omega-subscale (ω_s)			
Somatization	0.28	0.22	0.12
Obsessive–compulsive	0.28	0.15	0.07
Interpersonal sensitivity	0.23	0.10	0.04
Depression	0.12	0.03	0.02
Anxiety	0.26	0.12	0.07
Hostility	0.32	0.25	0.25
Phobic anxiety	0.42	0.28	0.23
Paranoid ideation	0.28	0.15	0.13
Psychoticism	0.20	0.15	0.09

Summed raw scores correlated extremely well with scores on the general factor, which is expected with a large number of items and a strong general factor, and the association was stable across the score range. Sum scores can thus confidently be used as a proxy for the latent factor. In this study factor score distributions discriminated well between patient at admission, patients at discharge, and controls. The scores of the patient admission sample were clearly higher than the scores of the patient discharge, being lowest in the controls. Our community sample seemed to exhibit somewhat lower SCL-90 GSI scores than those of an Italian community sample of 15- to 19-year-old adolescents [24]. However, the profile of our sample and that of a previous Swedish community sample of adolescents under 20 years of age [13] resembled each other, showing that there may be some cultural differences in the proneness to report symptoms.

The SCL-90s screening properties as investigated with ROC analyses indicated that it adequately discriminates patients from the community sample and individuals with psychiatric diagnosis from those without, a result resembling those of earlier studies among adult patients [6, 10]. Adequate discrimination was found also between

Fig. 3 Receiver operating curves for the SCL-90 general latent factor score differentiating between (**a**) admission vs. discharge (*dotted line*) and admission vs. controls (*solid line*) and (**b**) individuals with or without a diagnosis in the combined admission and control sample

Rytilä-Manninen *et al. Child Adolesc Psychiatry Ment Health* (2016) 10:23

Page 11 of 12
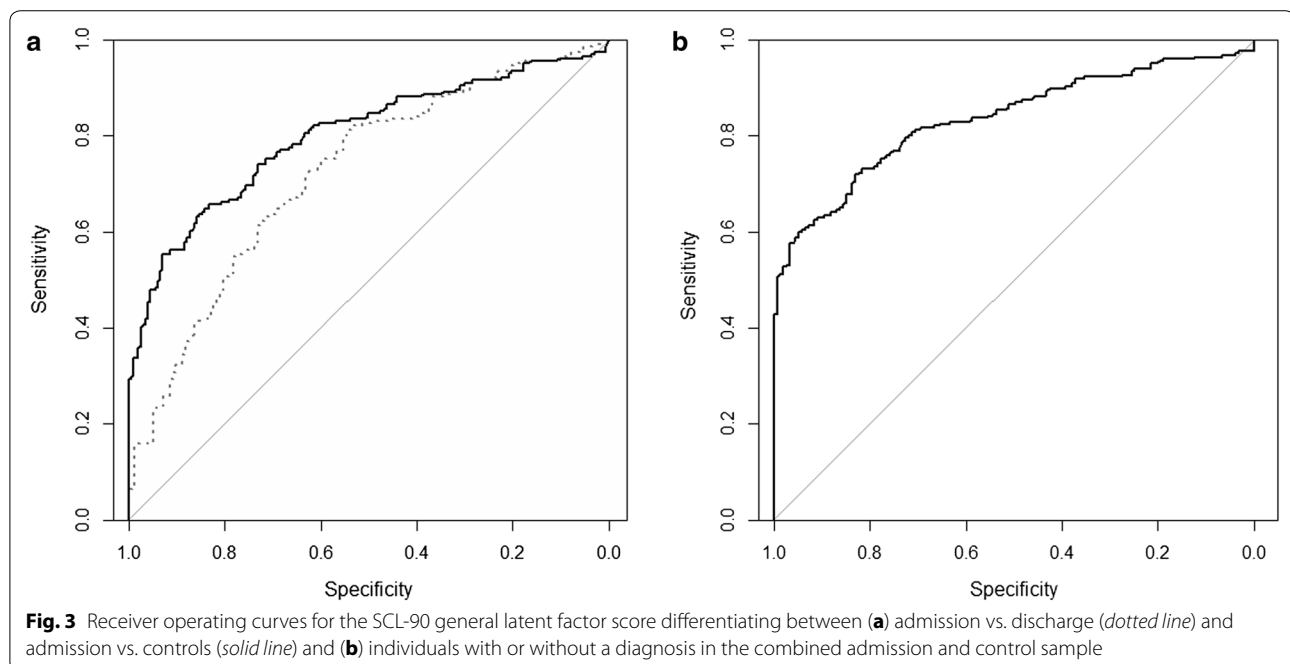
patients at admission, who have severe symptoms, and the same patients at discharge who were largely recovered but still symptomatic. This finding supports earlier studies [19] that the SCL-90 is also a sensitive tool to measure changes in symptoms. Interestingly, the overall information yielded by the questionnaire was highest at discharge, perhaps reflecting an improved ability to understand the items.

Strengths and limitations

Strengths of this study include a relatively high number of consecutive inpatients and a sample of community youth matched for age and gender. Almost identical study protocols were used in both groups, and patients were followed prospectively. Furthermore, the psychiatric diagnoses were based on highly reliable and valid K-SADS-PL interviews, supplemented by patient records. The SCL-90 is a widely used and established questionnaire in clinical practice. A limitation of our study is the relatively small participation rate in the comparison group. A partial explanation is that participants had to have written informed consent from their legal guardians, and refusals were thus not necessarily due to the approached individual's preferences. In addition, participants were asked to take part in a five-year follow-up study, and in this context, give their permissions for researchers to acquire information from official records concerning for example their future criminal records and use of health services.

These expectations may have influenced students' willingness to participate in the study. However, we ascertained that community sample participants and non-participants did not differ on a number of socioeconomic variables used in matching, showing that our sampling was representative in this respect. The overall sample size was also too small for testing the measurement invariance of multifactorial models.

Conclusions and clinical implications

As the confirmatory bifactor model improved on the unidimensional model in all subsamples on all fit indices, and achieved excellent fit, it can be considered a sufficient description of the data. As most subscales had a very small contribution, however, it would be interesting to perform exploratory bifactor analyses in future studies. Nevertheless, the general factor was dominant, and the SCL-90 can thus be used as a unidimensional index of psychiatric distress, also when using the raw item score average (GSI). As the subscales were poorly distinguishable from the main factor and each other, they should be considered to measure mostly general distress, and their use to assess separate symptom dimensions does not appear warranted. Among adolescents, the SCL-90 appears to be

a useful screening tool as well as a valuable instrument for assessing change in average symptom levels within patient populations.

Abbreviations
AUC: area under the curve; CFA: confirmatory factor analysis; CFI: comparative fit index; DIF: differential item functioning; DOR: diagnostic odds ratios; ECV: explained common variance index; GSI: global severity index; K-SADS-PL: the Schedule for Affective Disorders and Schizophrenia for School-Age Children—Present and Lifetime; MAP: minimum average partial correlation; ML: maximum likelihood; PA: parallel analysis; RMSEA: root mean square error of approximation; ROC: receiver operating characteristic; SCL-90: the Symptom Checklist-90; VSS: very simple structure; WLS: weighted least-squares; WLSMV: weighted least squares mean and variance adjusted; WRMR: weighted root mean square residual.

Author details
[1] Hospital District of Helsinki and Uusimaa, Kellokoski Hospital, 04500 Kellokoski, Finland. [2] Adolescent Psychiatry, University of Helsinki and Helsinki University Hospital, Helsinki, Finland. [3] School of Health Sciences, University of Tampere, Tampere, Finland. [4] Department of Health, Mental Health Unit, National Institute for Health and Welfare, Helsinki, Finland. [5] Forensic Psychiatry, University of Helsinki and Helsinki University Hospital, Helsinki, Finland.

References
1. Kim-Cohen J, Caspi A, Moffit T, Harrington H, Milne B, Pulton R. Prior juvenile diagnoses in adults with mental disorder: developmental follow-back of a prospective-longitudinal cohort. Arch Gen Psychiatry. 2003;60:709–17.
2. Kessler R, Berglund P, Demler O, Jin R, Merikangas K, Walters E. Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the national comorbidity survey replication. Arch Gen Psychiatry. 2005;62:593–602.
3. Newman D, Moffit T, Caspi A, Silva P, Stanton W. Psychiatric disorder in a birth cohort of young adults; prevalence, comorbidity, clinical significance, and new case incidence from ages 11 to 21. J Consult Clin Psychol. 1996;64:552–62.
4. Costello J, Copeland W, Angold A. Trends in psychopathology across the adolescent years: what changes when children become adolescents, and when adolescents become adults? J Child Psychol Psychiatry. 2011;52:1015–25.
5. Pylkkänen K. Quality guidelines for adolescent psychiatry. Psychiatr Fennica. 2013;44:89–94.
6. Schmitz N, Hartkamp N, Kiuse J, Franke G, Reister G, Tress W. The Symptom Checklist-90-R (SCL-90-R): a German validation study. Qual Life Res. 2000;9:185–93.
7. Vander Stoep A, Adrian M, Rhew I, McCauley E, Herting J, Kraemer H. Identifying comorbid depression and disruptive behavior disorders: comparison of two approaches used in adolescent studies. J Psychiatr Res. 2012;46:873–81.

Rytilä-Manninen *et al. Child Adolesc Psychiatry Ment Health* (2016) 10:23

Page 12 of 12

8. Derogatis L, Lipman R, Covi L. SCL-90: an outpatient psychiatric rating scale- preliminary report. Psychopharmacology. 1973;9:13–28.

9. Olsen L, Mortensen E, Bech P. The SCL-90 and SCL-90R versions validated by item response models in a Danish community sample. Acta Psychiatr Scand. 2004;110:225–9.

10. Holi M. Assessment of psychiatric symptoms using the SCL-90. Academic dissertation. Finland: Department of Psychiatry: Helsinki University; 2003.

11. Barker-Collo S. Culture and validity of the Symptom Checklist-90-revised and profile of mood states in a New Zealand student sample. Cultur Divers Ethnic Minor Psychol. 2003;2:185–96.

12. Essau C. Comorbidity of anxiety disorders in adolescents. Depress Anxiety. 2003;18:1–6.

13. Fridell M, Cesarec Z, Johansson M, Thorsen S. SCL-90: Svensk normering, standardisering och validering av symtomskalan. Statens institutions styrelse, Rapport nr 4/2002.

14. Holi M, Sammallahti P, Aalberg V. A Finnish validation study of the SCL-90. Acta Psychiatr Scand. 1998;97:42–6.

15. Steinberg M, Barry D, Sholomskas D, Hall P. SCL-90 symptom patterns: indicators of dissociative disorders. Bull Menninger Clin. 2005;69:237–49.

16. Bjørkly S. SCL-90-R profiles in a sample of severely violent psychiatric inpatients. Aggress Behav. 2002;28:446–57.

17. Bonynge E. Unidimensionality of SCL-90-R scales in adult and adolescent crisis samples. J Clin Psychol. 1993;49:212–5.

18. McGough J, Curry J. Utility of the SCL-90-R with depressed and conduct-disordered adolescent inpatients. J Pers Assess. 1992;59:552–653.

19. Prinz U, Nutzinger DO, Schulz H, Petermann F, Braukhaus C, Andreas S. Comparative psychometric analyses of the SCL-90-R and its short versions in patients with affective disorders. BMC Psychiatry. 2013;13:104. doi:10.1186/1471-244X-13-104.

20. Nickel M, Loew T, Gil F. Aripiprazole in treatment of borderline patients, part II: an 18-month follow-up. Psychofarmacology. 2007. doi:10.1007/s00213-007-0740-0.

21. Boon A, Boer B. Drug usage as a treat to the stability of treatment outcome. Eur Child Adolesc Psychiatry. 2007;16:79–86.

22. Levy K, Becker D, Grilo C, Mattanah J, Quinlan D, Edell W, et al. Concurrent and predictive validity of the personality disorder diagnosis in adolescent inpatients. Am J Psychiatry. 1999;156:1522–8.

23. Dinning D, Evans R. Discriminant and convergent validity of the SCL-90 in psychiatric inpatients. J Pers Assess. 1977;41:304–11.

24. Miotto P, De Coppi M, Frezza D, Masala C, Preti A. Suicidal ideation and aggressiveness in school-aged youths. Psychiatr Res. 2003;120:247–55.

25. Vallejo M, Jordan C, Diaz M, Comeche M, Ortega J. Psychological assessment via the internet: a reliability and validity study of online (vs paper and pencil) versions of the general health questionnaire-28 (GHQ-28) and the symptoms check-list-90—revised (SCL-90-R). J Med Internet Res. 2007;9:e2.

26. Reise SP. The rediscovery of bifactor measurement models. Multivar Behav Res. 2012;47:667–96.

27. Reise SP, Moore TM, Haviland MG. Bifactor models and rotations: exploring the extent to which multidimensional data yield univocal scale scores. J Pers Assess. 2010;92:544–59.

28. Van De Schoot R, Schmidt P, De Beuckelaer A, Lek K, Zondervan-Zwijnenburg M. Editorial: measurement invariance. Front Psychol. 2015;6:1064. doi:10.3389/fpsyg.2015.01064.

29. Urbán R, Kun B, Farkas J, Paksi B, Kökönyei G, Unoka Z, Felvinczi K, Oláh A, Demetrovics Z. Bifactor structural model of Symptom Checklists: SCL-90-R and brief symptom inventory (BSI) in a non-clinical community sample. Psychiatry Res. 2014;216:146–54.

30. Kaufman J, Birmaher B, Brent D, Rao U, Flynn C, Moreci P, et al. Schedule for affective disorders and schizophrenia for school-age children-present and lifetime version (K-SADS-PL): initial reliability and validity data. J Am Acad Child Adolesc Psychiatry. 1997;36:980–8.

31. Rytilä-Manninen M, Lindberg N, Haravuori H, Kettunen K, Marttunen M, Joukamaa M, et al. Adverse childhood experiences as risk factors for serious mental disorders and inpatient hospitalization among adolescents. Child Abuse Negl. 2014;38:2021–32.

32. Ambrosini P. Historical development and present status of the Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS). J Am Acad Child Adolesc Psychiatry. 2000. doi:10.1097/00004583-200001000-00016.

33. Ghanizadeh A, Mohammadi M, Yazdanshenas A. Psychometric properties of the Farsi translation of the kiddie schedule for affective disorders and schizophrenia-present and lifetime version. BMC Psychiatry. 2006;6:1.

34. Brazil H, Bordin I. Convergent validity of K-SADS-PL by comparison with CBCL in a Portuguese speaking outpatient population. BMC Psychiatry. 2010. doi:10.1186/1471-244X-10-83.

35. Tuisku V, Pelkonen M, Karlsson L, Kiviruusu O, Holi M, Ruuttu T, et al. Suicidal ideation, deliberate self-harm behaviour and suicide attempts among adolescent outpatients with depressive mood disorders and comorbid axis I disorders. Eur Child Adolesc Psychiatry. 2006;15:199–206.

36. Mustanoja S, Luukkonen A, Hakko H, Räsänen P, Säävälä H, Riala K. Is exposure to domestic violence and violent crime associated with bullying behaviour among underage adolescent psychiatric inpatients? Child Psychiatry Hum Dev. 2011;42:495–506.

37. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed. Washington DC: American Psychiatric Association; 1994.

38. Choi S, Gibbons L, Crane Lordif P. An R package for detecting differential item functioning using iterative hybrid ordinal logistic regression/item response theory and Monte Carlo simulations. J Stat Softw. 2011;39:8. doi:10.18637/jss.v039.i08.

39. Revelle W, Rocklin T. Very simple structure: an alternative procedure for estimating the optimal number of interpretable factors. Multivar Behav Res. 1979;14:403–14.

40. Velicer WF. Determining the number of components from the matrix of partial correlations. Psychometrika. 1976;41:321–7.

41. Horn JL. A rationale and test for the number of factors in factor analysis. Psychometrika. 1965;30:179–85.

42. Ruscio J, Roche B. Determining the number of factors to retain in an exploratory factor analysis using comparison data of known factorial structure. Psychol Assess. 2012;24:282–92.

43. Muthén LK, Muthén BO. Mplus user's guide. 7th ed. Los Angeles: Muthén & Muthén; 2012.

44. DiStefano C, Morgan GB. A comparison of diagonal weighted least squares robust estimation techniques for ordinal data. Struct Equ Model. 2014;21:425–38.

45. Li CH. The performance of MLR, USLMV, and WLSMV estimation in structural regression models with ordinal variables (Doctoral dissertation); 2014.

46. Beaducel A, Herzberg PY. On the performance of maximum likelihood versus means and variance adjusted weighted least squares estimation in CFA. Struct Equ Model. 2006;13:186–203.

47. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct Equ Model. 1999;6:1–55.

48. Yu CY. Evaluating cutoff criteria of model fit indices for latent variable models with binary and continuous outcomes (Doctoral dissertation); 2002.

49. Robin X, Turck N, Hainard A, Tiberti N, Lisacek F, Sanchez J, Müller M. pROC: an open-source package for R and S + to analyze and compare ROC curves. BMC Bioinformatics. 2011;12:1. doi:10.1186/1471-2105-12-77.

50. Youden WJ. Index for rating diagnostic tests. Cancer. 1950;3:32–5.

51. Arrindell WA, Barelds DP, Janssen IC, Buwalda FM, van der Ende J. Invariance of SCL-90-R dimensions of symptom distress in patients with peripartum pelvic pain (PPPP) syndrome. Br J Clin Psychol. 2006;45:377–91.

52. Thomas ML. Rewards of bridging the divide between measurement and clinical theory: demonstration of a bifactor model for the brief symptom inventory. Psychol Assess. 2012;24:101–13.

53. Paap MC, Meijer RR, Van Bebber J, Pedersen G, Karterud S, Hellem FM, Haraldsen IR. A study of the dimensionality and measurement precision of the SCL-90-R using item response theory. Int J Methods Psychiatr Res. 2011;20:e39–55. doi:10.1002/mpr.347.

54. Paap MC, Meijer RR, Cohen-Kettenis PT, Richter-Appelt H, de Cuypere G, Kreukels BP, Pedersen G, Karterud S, Malt UF, Haraldsen IR. Why the factorial structure of the SCL-90-R is unstable: comparing patient groups with different levels of psychological distress using Mokken scale analysis. Psychiatry Res. 2012;200:819–26.

55. Ha C, Balderas JC, Zanarini MC, Oldham J, Sharp C. Psychiatric comorbidity in hospitalized adolescents with borderline personality disorder. J Clin Psychiatry. 2014;75:e457–64. doi:10.4088/JCP.13m08696.

Mediators between adverse childhood experiences and suicidality

Minna Rytilä-Manninen[a,*], Henna Haravuori[a,b], Sari Fröjd[d], Mauri Marttunen[a,b], Nina Lindberg[c]

[a] Adolescent Psychiatry, Helsinki University and Helsinki University Hospital, Helsinki, Finland
[b] National Institute for Health and Welfare, Department of Health, Mental Health Units, Helsinki, Finland
[c] Forensic Psychiatry, Helsinki University and Helsinki University Hospital, Helsinki, Finland
[d] University of Tampere, School of Health Sciences, Tampere, Finland

ARTICLE INFO

ABSTRACT

We investigated whether psychiatric symptomatology, impulsivity, family and social dysfunction, and alcohol use mediate the relationship between adverse childhood experiences (ACEs) and suicidality.

The study population comprised 206 adolescent psychiatric inpatients and 203 age- and gender-matched adolescents from the community. ACEs and suicidality were assessed using the Schedule for Affective Disorders and Schizophrenia for School-Age Children – Present and Lifetime version, the Life Events Checklist, and a structured background data collection sheet. Psychiatric symptomatology was measured using the Symptom Checklist − 90. Impulsivity, social dysfunction, and family dysfunction were measured using the Offer Self-Image Questionnaire, and alcohol use was assessed with the Alcohol Use Disorders Identification Test. A simple mediation test and multiple mediation analyses were conducted.

A positive direct effect of ACEs on suicidality was observed. Also seen was a positive indirect effect of ACEs on suicidality through psychiatric symptomatology, impulsivity, and family and social dysfunctions. Alcohol misuse did not, however, mediate the relationship between ACEs and suicidality. According to the multiple mediation analyses, psychiatric symptomatology was the most significant mediator, followed by impulsivity.

Psychiatric symptoms, impulsivity, and family and social dysfunctions are factors that should be taken into consideration when assessing suicidality in adolescents.

1. Introduction

Suicidality increases substantially from childhood into adolescence (Kessler, Borges, & Walters, 1999), representing a major burden on health and a leading indication for psychiatric hospitalization (Isohookana, Riala, Hakko, & Räsänen, 2012) in young people. Looking more closely, suicidality can be regarded as an umbrella term for various forms of suicidal thoughts and behaviors. Suicidal ideation refers to thoughts about engaging in behaviors intended to end one's life. It varies from fleeting thoughts about death to more extensive ideas and plans for suicide (Vander Stoep, McCauley, Flynn, & Stone, 2009). A suicide attempt is defined as deliberately causing harm to oneself with at least some intent to die. Finally, a completed suicide is a lethal suicide attempt. All of these behaviors can be distinguished from non-suicidal self-injury (NSSI), which refers to self-injurious behavior occurring in the absence of suicidal intent (Miller, Esposito-Smythers, Weismoore, & Renshaw, 2013). According to a nationally representative study

of US adolescents by Nock et al. (2013), the lifetime prevalence of suicide ideation, plans, and attempts was 12.1%, 4.0%, and 4.1%, respectively. Suicide accounts for 17.6% of all deaths among individuals aged 15–29 years in high-income countries, making it a leading cause of death for people in this age group.

1.1. Suicidality and adverse childhood experiences

Adverse childhood experiences (ACEs) comprise childhood emotional, physical, and sexual abuse, emotional and physical neglect, and various household dysfunctions (mother treated violently, substance abuse, mental illness, criminal behavior, parental separation/divorce), which are directed to an underaged individual (Felitti et al., 1998). In this study, we define childhood adverse experiences as physical and sexual abuse, witnessing intimate partner violence, parental psychiatric problems, parental alcohol or drug abuse, parental criminal behavior, and parental separation or divorce. ACEs often co-occur (Dong, Anda, Dube, Giles, Felitti, 2003; Dong et al., 2004; Isohookana et al., 2012; Rytilä-Manninen et al., 2014) and serve as risk factors for diverse social, emotional, and medical problems later in life (Anda et al., 2006; Dube et al., 2001; Dube, Anda, Felitti, Edwards, & Croft, 2002; Dube et al., 2005, 2006). Anda et al. (2006) reported that the risks of adverse health outcomes increase in a graded fashion as the ACE score increases; regarding psychological stress, accumulation of ACEs may be more important than any specific negative experience (Kumar and George, 2013; Rasmussen, Nielsen, Petersen, Christiansen, Bielnberg, 2013)

Suicidality can be regarded as an outcome of a complex interplay between genetic, biological, psychiatric, psychological, social, and cultural factors (Hawton, Saunders, & O'Connor, 2012). Experts emphasize diathesis-stress explanations in theoretical formulations, specifically that predisposing biological (e.g. neurotransmitter imbalance), personality (e.g. impulsivity), and cognitive vulnerabilities (e.g. impaired social problem-solving), combined with exposure to ACEs and psychopathology, increase the risk of suicidal behaviors (Hawton et al., 2012; Serafini et al., 2015). In this context, diathesis refers to an increased and long-term vulnerability to suicidal behavior as a consequence of critical levels of early-life stress leading to inappropriate stress regulation. According to the diathesis-stress model, a suicide attempt can be realized because a person is impulsive or prone to aggressive behavior, therefore being more likely to act on his/her suicidal feelings (Pelkonen, Karlsson, & Marttunen, 2011). In line with the diathesis-stress model, researchers have reported that childhood abuse and neglect substantially increase the risk of both suicidal ideation and attempted suicide in young people (Bruffaerts et al., 2010; Dube et al., 2001; Evans, Hawton, Rodham, & Deeks, 2005; Miller et al., 2013; Thompson et al., 2012). A systematic review by Evans et al. (2005) found a strong link between childhood physical and sexual abuse and suicidal thoughts/attempted suicides in adolescence. Similarly, Miller et al. (2013) concluded that although all forms of maltreatment are associated with suicidal ideation and suicide attempts in adolescence, childhood sexual and emotional abuse might be more important risk factors than physical abuse. Additionally, there are studies that have found a strong dose-response relationship between the number of adversities or negative life events and suicidal behavior in youths and adults (Dube et al., 2001; Felitti et al., 1998; Kumar & George, 2013; Serafini et al., 2015).

1.2. Factors mediating the relationship between ACEs and suicidality

ACEs shape the cognitive and affective styles that predispose young people to suicidality (Thompson et al., 2012). From the perspective of neurobiology, ACEs are linked to a variety of changes in brain structure and function and stress-responsive neurobiological systems, which, in turn, predispose young people to mental health problems (Anda et al., 2006), emotional dysregulation, non-suicidal self-injury, and suicidal ideation and behaviors (Brodsky & Biggs, 2012) as well as increase their risk of committing suicide (Dube et al., 2001; Miller, Esposito-Smythers, Weismoore, & Renshaw, 2013; Perez, Jennings, Piquero, & Baglivio, 2016; Thompson et al., 2012). Although ACEs increase the risk of suicidal behavior, not all adolescents exposed to ACEs are suicidal, suggesting that this relation must be mediated (or moderated) by some additional variables. Because mental health and behavioral problems have been associated with suicide ideation (Stewart et al., 2017) and suicide attempts (Groschwitz et al., 2015; Stewart et al., 2017; Tuisku et al., 2006) as well as with exposure to adverse experiences (Anda et al., 2006; Dube et al., 2005, 2006; Rytilä-Manninen et al., 2014), they might act as mediators. In fact, among adults, both depression and alcohol use disorders have been reported to mediate the relation between suicidality and ACEs (Dube et al., 2001, 2002; Felitti et al. 1998). Both interpersonal difficulties (Johnson et al., 2002) and family factors influence suicidal behavior in adolescents (Laukkanen, Honkalampi, Hintikka, Hintikka, & Lehtonen, 2005; Randall, Doku, Wilson, & Peltzer, 2014). Interestingly, in a longitudinal study by Johnson et al. (2002), interpersonal difficulties mediated the association between maladaptive parenting and offspring's later suicidality. Moreover parent-child-relationship has documented to mediate between ACEs and suicidality (Hardt, Herke, & Schier, 2011).

1.3. Present study

Although ACEs are well-documented risk factors for adolescent suicidality, more information about the variables mediating this relation is needed (Pelkonen et al., 2011).

An approach based on multiple levels of analysis (Preacher & Hayes, 2008), incorporating information from various aspects, is needed to advance the identification of potential mediators of the relationship between ACEs and suicidality. Testing several potential mediators simultaneously minimizes the risk of attributing mediational status to a single process when other relevant processes are omitted from the analysis. Simultaneous testing also allows each individual mediator to compete for variance in a specified outcome, leading to more effective identification of the putative mediation processes responsible for the development of suicidality in adolescents exposed to various ACEs (Preacher & Hayes, 2008).

A

B
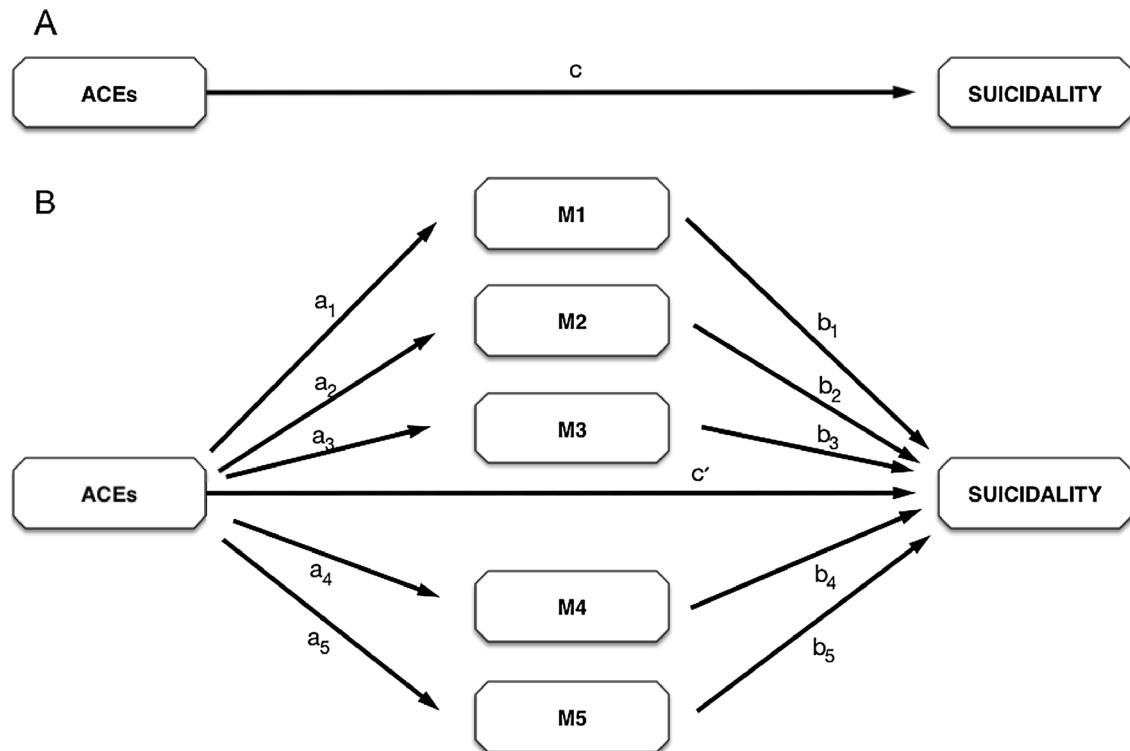
Fig. 1. Multiple mediation design with five mediators. (A) Adverse childhood experiences (ACE) affect suicidality. (B) ACE is hypothesized to exert indirect effects on suicidality through (M1) psychiatric symptoms, (M2) impulsivity, (M3) alcohol misuse, (M4) family dysfunction, and (M5) social dysfunction.

By adopting an approach using multiple levels of analysis, the present study simultaneously tested the potential role of psychiatric symptomatology, impulsivity, alcohol use, and family and social dysfunction in mediating the relationship between ACEs and suicidality among adolescents. Three primary hypotheses were tested: 1) ACEs have a direct effect on suicidality; 2) each studied mediator (psychiatric symptomatology, impulsivity, alcohol use, family dysfunction, and social dysfunction) influences the relationship between ACEs and suicidality; and 3) each potential mediator has a significant indirect effect on ACEs and suicidality when simultaneously estimated with other indirect effects (see Fig. 1).

2. Method

2.1. Participants and procedure

The Kellokoski Hospital Adolescent Inpatient Follow-Up Study (KAIFUS) is a longitudinal naturalistic study of the clinical characteristics and impact of treatment in a consecutive sample of Finnish adolescent psychiatric inpatients. This inpatient sample consists of 13- to 17-year-old adolescents referred to psychiatric hospital for the first time in their lives between 2006 and 2010 ($N = 395$). Non-eligible patients were those who had a treatment period of less than two weeks, those who showed intellectual disability, those under 13 years of age, and those with poor knowledge of the Finnish language (n = 80, 20.2%). Of the 315 eligible patients, 62 (16.4%) declined to participate or their parents/guardians did not provide permission to participate. In 23 cases (6%), patients or their parents discontinued the treatment period, and 24 cases (6%) had incomplete data. Thus, the final sample comprised 206 inpatients: 60 boys and 146 girls. Non-participation was unrelated to age ($p = 0.31$), socioeconomic status ($p = 0.38$), living situation ($p = 0.58$), substance use ($p = 0.59$), mood ($p = 0.92$), anxiety ($p = 0.39$), eating ($p = 0.34$), or conduct disorders ($p = 0.09$) as principal diagnoses, but it was associated with male gender ($p = 0.02$) and a diagnosis of psychotic disorder ($p = 0.02$). For further details, see Rytilä-Manninen et al. (2014).

The community sample comprised gender- and age-matched students from the same geographical area as the inpatient sample. They were recruited from two high schools, one vocational collage and four junior high schools. Altogether 473 students were invited to take part in the study. Of these, 202 (42.5%) refused to participate and 68 (14.5%) did not complete the whole study protocol despite providing consent. A total of 203 students (42.9%, 55 boys and 148 girls)) successfully completed both the interview and self-assessments, thus comprising the final sample. No significant differences were found between completers and non-completers with regard to socioeconomic status or living situation.

The same interviews and self-questionnaires were used in the inpatient and community samples. All inpatients had a diagnosed mental disorder and many patients had comorbid conditions. Altogether 43 community adolescents (21.2%) were diagnosed with a

mental disorder. For details, see Rytilä-Manninen et al. (2014).

Participation was voluntary for both inpatients and community youth. All participants and their legal guardians gave written, informed consent. Permission to conduct the study was granted by the authorities of the Helsinki and Uusimaa Hospital District and the school administrations. The Ethics Committee of Helsinki University Hospital approved the study protocol.

3. Measures

The Schedule for Affective Disorders and Schizophrenia for School-Age Children −Present and Lifetime Version (K-SADS-PL; Kaufman et al., 1997) was used to assess psychiatric diagnoses and suicidality. K-SADS-PL is a semi-structured interview with good to excellent test-retest reliability and high concurrent validity and inter-rater agreement (Kaufman et al., 1997).

Data concerning socioeconomic status (SES) and living situation were gathered using a structured background data collection sheet. SES was assessed by the question: What is your father's occupation? If the adolescent lived with his/her biological mother, we recorded the mother's occupation. Family's SES was classified as high if the primary guardian was a self-employed worker or upper-level employee, as middle if the guardian was a lower-level employee or manual worker, and as low if the guardian was unemployed, retired, or a student (Classification of Social Economy Status, 1989). Living situation was classified as a nuclear family if the adolescent lived with both of the biological parents, as another type of family if the adolescent lived with only one primary guardian (due to parental death or divorce) or in a blended family, and as foster care if the adolescent had been placed in a detention home.

Suicidality was measured using four questions included in the K-SADS-PL interview. The questions cover a) thoughts of death (rating: 1 = the person had not experienced thoughts of death; 2 = the person had experienced transient thoughts of death; 3 = the person had experienced recurrent thoughts of death); b) suicidal ideation (rating: 1 = the person had not thought of suicide; 2 = the person had occasionally thought of suicide; 3 = the person had often thought of suicide as well as a specific method of carrying it out); c) suicidal acts: seriousness of the act (rating: 1 = the person had no history of suicide attempts; 2 = the person had made one or more suicide attempts, but was ambivalent regarding an actual wish to die; 3 = the person had made one or more suicide attempts with a definite suicidal intent); d) suicidal acts: medical lethality of the act (rating 1 = the person had no history of suicide attempts; 2 = the suicide attempt/s were not regarded as life-threatening, the person had showed transient and mild medical symptoms; 3 = the suicide attempt/s had been potentially life-threatening, e.g. unconsciousness). For cross-tabulation, the rating was categorized as negative if the item was scored 1 or 2, and positive if it was scored 3. Based on a previous study by Tuisku et al. (2006), the suicidality sum score was created by summing up the scores of these four questions. Thus, the suicidality sum score can range from 4 (= the person showed no suicidality) to 12 (= the person showed extreme suicidality).

Data concerning ACEs were gathered using a structured background data collection sheet, the K-SADS-PL interview screening section for PTSD, and the Life Events Checklist (LEC; Johnson and McCutcheon, 1980). Adolescents were asked whether their parents were divorced (no/yes), and whether their mother or father suffered from *psychiatric* or *substance use problems* requiring professional help (no/yes). Parents' criminality was assessed using the LEC question: "Have your parents ever been arrested or suspected or judged for a criminal offence?" (no/yes). The information about witnessing *intimate partner violence* (no/yes) and exposure to *physical* (no/yes) or *sexual abuse* (no/yes) was based on the K-SADS-PL interview. Choosing the above-mentioned variables was based on earlier ACE studies (Anda et al., 2006; Dong et al., 2003; Dong et al., 2004; Dube et al., 2001, 2002, 2005, 2006). The same questions have been used in our previous study concerning adolescents' ACEs (Rytilä-Manninen et al., 2014).

The accumulation of different ACE categories was described by creating the ACE total score, which can range from zero (the person had not been exposed to any studied ACE categories) to seven (the person had been exposed to all studied ACE categories). The mean ACE total score was 2.2 (*SD* 1.6) for inpatients and 0.6 (*SD* 1.0) for adolescents in the community (p < 0.001).

Psychiatric symptomatology was measured using the Symptom Checklist-90 (SCL-90; Derogatis, Lipman, & Covi, 1973), a self-report measure for people aged 13 years or older. It consists of 90 items, which measure subjective symptoms on nine primary symptom dimensions. Items are rated on a five-point Likert scale of distress, ranging from "not at all" (0) to "extremely" (4). Thus, the sum score can range from 0 to 360. The reference period for the symptoms is the last two weeks. The psychometric properties of SCL-90 have been shown to be good for adolescents, and it is a useful tool for assessing overall psychopathology in adolescents (Rytilä-Manninen et al., 2016). In this study, Cronbach alphas ranged from 0.800 (paranoid ideation) to 0.943 (depressive disorders) among inpatients and from 0.749 (phobic anxiety) to 0.908 (depressive disorders) in the community sample. For further analyses, the SCL-90 sum score was used.

Impulsivity, family dysfunction, and social dysfunction were measured with the Offer Self-Image Questionnaire (OSIQ-R; Offer, Ostrov, Howard, & Dolan, 1992), which is a 129-item personality test for adolescents aged between 13 and 18 years. The questionnaire assesses psychological adjustment based on psychodynamic growth and developmental theory. The above-mentioned three dimensions of self-image are known to be risk factors for adolescents' suicidality (Cetin, 2001; Laukkanen et al., 2005). Items are rated on a six-point Likert scale, ranging from "describes me very well" (1) to "does not describe me at all" (6). OSIQ-R comprises 12 component scales, but in this study only those described below were used. *Impulse control* is a nine-item scale to measure whether the adolescent can handle pressure. The scale score can range from 9 to 54. Higher scores suggest that a teenager has a low frustration tolerance and often acts on impulse. In this study, the Cronbach alpha for this scale was 0.659 in the inpatient sample and 0.629 in the community sample. *Social functioning* is a nine-item scale used to assess patterns of interpersonal relationships and friendships. The scale score can range from 9 to 54. Higher scores indicate that a teenager is unable to have and maintain close relationships with same-aged individuals and feels uncomfortable when socializing with peers. In this study, the Cronbach alpha for this scale was 0.819 for inpatients and 0.729 for young people in the community. *Family functioning* is a 19-item scale focusing on an adolescent's feelings about and relationships with his/her parents as well as on the emotional atmosphere at home. The scale score can range from 19 to

114. Higher scores indicate that the adolescent feels that there is tension at home, that the relationships are problematic, and that he/she is not getting support from parents. In this study, the Cronbach's alpha for this scale was 0.842 in the inpatient sample and 0.837 in the community sample. The OSIQ has been widely used and validated for Finnish adolescents (Laukkanen, Peiponen, Halonen, Aivio, & Viinamäki, 1999; Laukkanen, Halonen, Aivio, Viinamäki, & Lehtonen, 2000).

Alcohol use was self-assessed with the Alcohol Use Disorders Identification Test (AUDIT; Saunders, Aasland, Babor, de la Fuente, & Grant, 1993), which includes 10 items scored from 0 to 4. Thus, the AUDIT sum score can range from 0 to 40. Self-assessment has shown good psychometric properties (Reinert & Allen, 2002). In adolescents, compared against the DSM-IV diagnosis of alcohol use disorders, AUDIT has demonstrated optimal performance at a cut-off score of 4 (Chung et al., 2000). In this study, the Cronbach alpha was 0.914 for inpatients and 0.862 for the community sample.

4. Data analysis

To analyze the differences between young people as inpatients and in the community in suicidality sum score and in all five mediators (psychiatric symptomatology, impulsivity, alcohol use, family dysfunction, and social dysfunction), an independent samples *t*-test was performed. For further analyses, inpatient and community groups were combined to provide a broader range or more variation in the factors examined: suicidality sum score, ACEs, and the tested mediators.

The relationships between the ACE total score, the four different suicidal behaviors, the suicidality sum score, and all five mediators were explored using correlation analysis. A simple mediation test was then conducted for each variable to determine direct and indirect effects of the ACE total score on suicidality. Finally, a multiple mediation analysis was conducted to test for simultaneous indirect effects of ACEs on suicidality through multiple mediators. For this, we used Preacher and Hayes' (2008) bootstrapping procedure, which is a nonparametric sampling procedure recommended for multiple mediators. The SPSS macro for multiple mediation (Preacher & Hayes, 2008) was used for statistical analyses. It estimates the path coefficients in a multiple mediator model and generates bootstrap confidence intervals (including percentile, bias-corrected, and bias-corrected and accelerated) for total and specific indirect effects of ACEs on suicidality through one or more mediator variables. Multiple mediator modeling enables the testing of competing hypotheses within a single model, and reduces parameter bias due to omitted variables, that is, other possible mediators. Testing for significant mediation requires that bias-corrected 95% confidence intervals not overlap with zero. Age and gender were used as covariates.

5. Results

5.1. Characteristics of adolescents

Sociodemographic characteristics of inpatients and non-referred adolescents are presented in Table 1. SES of community youth was significantly higher than that of inpatients, and non-referred adolescents lived significantly more often than inpatients in nuclear families (p < 0.001). Inpatients, on the other hand, lived significantly more often in other types of families or in foster care (p < 0.001).

Altogether 98 inpatients (47.6%) and two community adolescents (1.0%) had experienced recurrent thoughts of death. Ninety-four inpatients (45.6%) and one non-referred adolescent (0.5%) had recurrent suicidal ideation. A suicide attempt was reported by 45 inpatients (21.8%) but none of the community sample, and potentially life-threatening suicidal acts were reported by 31 inpatients (15.0%) but none in the community sample. The mean suicidality sum score was 7.4 (SD 2.7) for inpatients and 4.2 (SD 0.5) for community youth (p < 0.001).

Psychiatric symptomatology was significantly higher among inpatients ($M = 115.5$, $SD = 71.1$) than among adolescents in the community ($M = 44.4$, $SD = 37.2$, $p < 0.001$). Inpatients were also more impulsive (inpatients: $M = 31.4$, $SD = 7.3$; community: $M = 24.9$, $SD = 6.1$, $p < 0.001$) and experienced more family dysfunction (inpatients: $M = 56.1$, $SD = 16.3$; community: $M = 43.3$,

Table 1
Sociodemographic characteristics of inpatients and community youth.

	Patients (n = 206)	Controls (n = 203)	p
Sex, n (%)			0.661
Girl	146 (70.9)	148 (72.9)	
Boy	60 (29.1)	55 (27.1)	
Age, mean (SD)	15.05 (1.24)	14.88 (1.23)	0.160
Socioeconomic status, n (%)			< 0.001
High	19 (9.2)	30 (14.8)	
Middle	78 (37.9)	109 (53.7)	
Low	109 (52.9)	64 (31.5)	
Living situation, n (%)			< 0.001
Nuclear family	85 (41.7)	127 (62.6)	
Other type of family	92 (45.1)	75 (36.9)	
Foster care	27 (13.2)	1 (0.5)	

Chi-square test was used to compare the groups.

Table 2

Pearson correlations between both adverse childhood experiences (ACEs) (=ACE total score) and suicidality (=suicidality sum score and its subscores related to recurrent thoughts of death, suicidal ideation, and suicidal acts) and impulsivity (=OSIQ *Impulse control* factor total score), alcohol misuse (=AUDIT total score), psychiatric symptoms (=SCL-90 total score), social dysfunction (=OSIQ-R *Social functioning* factor total score), and family dysfunction (=OSIQ-R *Family functioning* factor total score).

	Impulsivity	Alcohol misuse	Psychiatric symptoms	Social dysfunction	Family dysfunction	ACEs
ACEs	.326***	.198***	.404***	.253***	.436***	
Suicidality	.509***	.173**	.579***	.487***	.465***	.402***
Recurrent thoughts of death	.443***	.044 NS	.536***	.448***	.413***	.357***
Suicidal ideation	.408***	.108*	.508***	.468*	.370***	.331***
Suicidal acts: seriousness of the act	.313***	.184***	.303***	.240***	.256***	.194***
Suicidal acts: lethality of the act	.256***	.180***	.169**	.119*	.176**	.190***

AUDIT = Alcohol Use Disorders Identification Test; SCL–90 = Symptom Checklist −90; OSIQ-R = Offer Self-Image Questionnaire, revised; NS = not significant.

* p < 0.05.
** p < 0.01.
*** p < 0.001.

$SD = 13.8$, $p < 0.001$) and social dysfunction (inpatients: $M = 27.9$, $SD = 8.3$; community: $M = 19.9$, $SD = 5.6$, $p < 0.001$). With regard to alcohol use, no significant difference was observed between the groups (inpatients: $M = 4.4$, $SD = 6.6$; community: $M = 3.5$, $SD = 4.9$, $p = 0.327$).

5.2. Correlations

Correlations between different variables are presented in Table 2. Significant correlations existed between suicidality variables and the ACE total score as well as psychiatric symptoms, impulsivity, alcohol use, family dysfunction, and social dysfunction; not significant was the correlation between recurrent thoughts of death and alcohol use. The strongest correlations were found between psychiatric symptoms and the suicidality sum score and between impulsivity and the suicidality sum score.

5.3. Direct and indirect effects of cumulative ACEs on suicidality

A positive direct effect of the ACE total score on suicidality was observed (Table 3). Additionally, a positive indirect effect of the ACE sum score on suicidality through psychiatric symptoms, impulsivity, family dysfunction, and social dysfunction was seen. All of these variables had partial mediation effects. Alcohol use, by contrast, did not affect the relationship between the ACE total score and suicidality and was excluded from further analyses. Age and gender had no significant impact on results.

5.4. Multiple mediation model of the effect of cumulative ACEs on suicidality

In the multiple mediation model ($R^2 = 0.434$, adjusted $R^2 = 0.462$), the total effect of the ACE total score on suicidality was 0.754 ($SE = 0.080$; $t = 9.548$; $p < 0.001$), whereas the direct effect was 0.369 ($SE = 0.077$; $t = 4.770$; $p < 0.001$). The difference between the total effect and the direct effect is the total indirect effect of the ACE total score on suicidality through four mediators; its point estimate was 0.385 (Table 4). The bias-corrected bootstrap 95% *confidence interval* was 0.282-0.498, reflecting that psychiatric symptoms, impulsivity, and family and social dysfunctions together mediated the effects of ACEs on suicidality.

However, the specific indirect effects indicated that only psychiatric symptoms and impulsivity were significant mediators (Table 4). To determine whether these indirect effects differed significantly from each other, the pairwise contrast was examined. Pairwise contrast of the indirect effects showed that the specific indirect effect through psychiatric symptoms was larger than it was through impulsivity. Further, the specific indirect effect through psychiatric symptoms was larger than it was through family dysfunction or social dysfunction. However, impulsivity did not differ from social dysfunction or family dysfunction in terms of magnitude, despite impulsivity being significantly different from zero, while the other variables were not. Neither did social dysfunction differ from family dysfunction. Including age and gender as covariates in the analyses had no significant effects on results.

6. Discussion

We examined the impact of cumulative ACEs on suicidality as well as the possible mediating effects of psychiatric symptoms, impulsivity, alcohol use, and family and social dysfunctions on the relationship between ACEs and suicidality in adolescents.

As expected, the cumulative ACE score had a direct effect on suicidality. This finding is in line with previous research on suicidal ideation and suicide attempts (Bruffaerts et al., 2010; Dube et al., 2001; Evans et al., 2005; Isohookana et al., 2012; Miller, Esposito-Smythers, Weismoore, & Renshaw, 2013; Thompson et al., 2012). Psychiatric symptoms, impulsivity, family dysfunction, and social dysfunction each mediated the association between ACEs and suicidality. In our sample, alcohol use was not a significant mediator, although substance abuse has been related to suicidal ideation, suicide attempts, and completed suicides in adolescents in many earlier studies (e.g. Groleger, Tomori, & Kocmur, 2003) and also to ACEs (Rothman, Edwards, Heeren, & Hingson 2008). There are also opposite findings (Bolton, Belik, Enns, Cox, Sareen, 2008; Cluver, Orkin, Boyes, & Sherr 2015; Hardt et al., 2011). For example

Table 3

Simple mediation tests of the effects of adverse childhood experiences (ACEs) on suicidality through five mediators: impulsivity, alcohol misuse, psychiatric symptoms, social dysfunction, and family dysfunction.

Impulsivity	R-sq	0.3341				Product of coefficients = Sobel			95% CI	BC 95% CI	BCa 95% CI
	Adj R-sq	0.3307									
Path[*]	Coefficient	SE	t	p		SE	Z	p			
a	1.5805	0.2337	6.7638	0							
b	0.1454	0.0155	9.3868	0							
c	0.721	0.0785	9.1863	0							
c'	0.4912	0.075	6.553	0							
ab	0.2298					0.0418	5.4972	0	.1539–.3135	.1574–.3189	.1566–.3175
Alcohol misuse	R-sq	0.1675									
	Adj R-sq	0.1632									
a	0.743	0.1877	3.9589	0.0001							
b	0.0433	0.0208	2.0867	0.0376							
c	0.6613	0.0772	8.561	0							
c'	0.6291	0.0784	8.0198	0							
ab	0.0322					0.0174	1.8502	0.0643	−.0020–.0826	.0004–.0886	.0011–.0914
Psychiatric symptoms	R-sq	0.3742									
	Adj R-sq	0.371									
a	17.2872	1.9807	8.7277	0							
b	0.0187	0.0017	11.2229	0							
c	0.6731	0.0749	8.9865	0							
c'	0.3498	0.0713	4.9083	0							
ab	0.3233					0.0468	6.9018	0	.2439–.4126	.2465–.4160	.2445–.4133
Social dysfunction	R-sq	0.3352									
	Adj R-sq	0.3317									
a	1.3812	0.2576	5.3621	0							
b	0.1346	0.014	9.5811	0							
c	0.711	0.0788	9.0284	0							
c'	0.5251	0.0734	7.153	0							
ab	0.1859					0.0397	4.6867	0	.1137–.2719	.1170–.2773	.1143–.2735
Family dysfunction	R-sq	0.2764									
	Adj R-sq	0.2725									
a	4.5066	0.4994	9.0237	0							
b	0.0521	0.0079	6.6089	0							
c	0.7525	0.0802	9.3768	0							
c'	0.5175	0.0839	6.1665	0							
ab	0.235					0.044	5.3437	0	.1481–.3343	.1492–.3371	.1480–.3342

BC = bias-corrected; BCa = bias-corrected and accelerated; 5000 bootstrap samples.

[*]Paths: a = effect of the ACE total score on the mediator; b = effect of the mediating variable on suicidality sum score; c = overall effect of the ACE total score on suicidality sum score; c' = effect of the ACE total score on suicidality sum score controlling for mediator; ab = the amount of mediation = indirect effect.

Cluver et al. (2015) have reported that mental health, but not drug or alcohol misuse, mediates the relationships between the cumulative ACE score and suicidality. Accordingly, Hardt et al. (2011) found that alcohol abuse had no relationship between ACEs and suicidality. They explained this finding that alcohol use is perhaps more an indicator rather than a causal link in the development of suicidality. The most probable explanation for our finding is that, in Finland, adolescents with severe alcohol misuse are typically referred to specialized units for substance users, and thus, our sample lacked individuals with substantial alcohol problems.

Our findings that both family dysfunction and social dysfunction are mediators are congruent with Johnson et al. (2002), who found that interpersonal difficulties during adolescence mediated the association between ACEs and suicide attempts in early adulthood. Our finding is also congruent with the study by Hardt et al. (2011), which reported that missing parental warmth or love, is a powerful predictor for suicidal thoughts of offspring experienced ACEs, and in turn, one or both parents showing warmth serves as a protective factor against suicidal thoughts.

Our result of family dysfunction serving as a mediator also supports the theory that while some stress in childhood or adolescence is normal and even necessary for the development of healthy coping mechanisms and problem-solving skills, ACEs may become "toxic" when there is strong, frequent, or prolonged activation of the body's stress response system in the absence of the buffering protection of a supportive parental (at least one parent) relationship (Shonkoff and Garner, 2012; Center on the Developing Child at Harvard University, 2016). Our finding that social dysfunction mediated the relationship of ACEs and suicidality also supports earlier findings from neurobiology about numerous effects of childhood stress on brain and physical systems and represents a common pathway for a variety of important long-term behavioral and social problems (Anda et al., 2006). Given this result, one could assume that ACEs may disrupt social relations and hamper the development of social skills, thus hindering the adolescent́s ability to maintain normal, healthy social relationships with peers. Without these skills and abilities, the adolescent may become socially isolated, contributing to the onset of suicidal behavior. From the developmental viewpoint, adolescence is a period in which dependence on parents shifts towards dependence on peers (Collins & Laursen, 2004). Parents nonetheless remain a vital source of social and emotional support. In fact, constant and serious family conflicts can often be seen as a continuation of poor relations rather than a

Table 4

Multiple mediation test of the effect of adverse childhood experiences (ACEs) on suicidality through psychiatric symptoms, impulsivity, social dysfunction, and family dysfunction.

Tests	Point estimate	Product of coefficient	Bootstrapping							
				Percentile 95% CI		BC 95% CI		BCa 95% CI		
		_SE_	Z	Lower	Upper	Lower	Upper	Lower	Upper	
			Indirect effects							
Psychiatric symptoms	0.2310	0.0498	4.6394***	.1310	.3375	.1340	.3426	.1319	.3386	
Impulsivity	0.0819	0.0329	2.4904*	.0109	.1663	.0131	.1710	.0156	.1749	
Social dysfunction	0.0369	0.0273	1.3514 NS	−0.0239	0.1109	−0.0232	0.1112	−0.0232	0.1112	
Family dysfunction	0.0353	0.0383	0.9219 NS	−0.0507	0.1310	−0.0466	0.1357	−0.0457	0.1367	
Total	0.3851	0.0572	6.7348***	.2880	.4979	.2879	.4979	.2851	.4949	
			Contrast							
Psychiatric symptoms vs. Impulsivity	0.1491	0.0630	2.3647	.0086	.2854	.0070	.2844	.0027	.2797	
Psychiatric symptoms vs. Social dysfunction	0.1941	0.0629	3.0882	.0482	.3378	.0533	.3435	.0488	.3393	
Psychiatric symptoms vs. Family dysfunction	0.1957	0.0637	3.0738	.0595	.3362	.0623	.3406	.0609	.3394	
Impulsivity vs. Social dysfunction	0.0450	0.0458	0.9834	−0.0688	0.1605	−0.0624	0.1651	−0.0602	0.1693	
Impulsivity vs. Family dysfunction	0.0466	0.0553	0.8437	−0.0906	0.1832	−0.0901	0.1851	−0.0884	0.1867	
Social dysfunction vs. Family dysfunction	0.0016	0.0522	0.0309	−0.1246	0.1294	−0.1330	0.1236	−0.1329	0.1245	

BC = bias corrected; BCa = bias corrected and accelerated; 5000 bootstrap samples.

NS = not significant.

* p < 0.05.

*** p < 0.001.

special characteristic of adolescence itself (Collins & Laursen, 2004). The mediating role of family dysfunction highlights the importance of including the family in the treatment of suicidal adolescents. It is important to strengthen the relationship between parent (s) and offspring, which, in turn, helps the adolescent to increase his/her ability to plan for the future, regulate behavior, and develops skills to adapt to changing circumstances. This foundation is known as resilience (Center on the Developing Child at Harvard University, 2016).

The multiple mediation analyses where the mediator variables competed against each other revealed that perceived psychiatric symptoms were the most significant mediator between ACEs and suicidality. Youth suicide has been found to be associated with many psychiatric disorders, especially depression. Major depression has been estimated to be present in at least 35% of adolescent suicides (Spirito & Esposito-Smythers, 2006). Many studies examining the relationship between ACEs and suicidality have used mental health problems, such as depression, as controlling variables, showing a trend of a mediating effect of mental health problems on the relationship between ACEs and suicidality (Johnson et al., 2002; Thompson et al., 2012). These studies provide some evidence that psychiatric symptoms or depressive disorders partially mediate the link between ACEs and suicidality.

In this study, the other significant mediator was impulsivity. This finding receives some support from the work of Zouk, Tousingnant, Sequin, Lesage, and Turecki (2006), who found in their retrospective study that impulsive suicide completers were more likely to have a history of childhood abuse. Stressful life events and early adversity have been observed to increase the risk of suicidality via their influence on child brain structures, stress regulation systems, and serotonin levels (Braquehais, Oquendo, Baca-García, & Sher, 2010). Furthermore, low serotonin function has been associated with impulsive and aggressive behaviors in adolescents with different psychiatric diagnoses including depression (Braquehais et al., 2010). Impulsivity has been assumed to be related to trauma in two different ways. First, as a consequence of childhood trauma (mainly as a personality trait), it could be an acquired inability of the brain to inhibit some negative actions. Second, impulsivity (as a trait or state) could also be seen as a risk factor for exposure to traumas and the development of post-traumatic stress disorder (Braquehais et al., 2010).

Based on this research, we can presume that ACEs have an independent effect on suicidality. Moreover, ACEs increase the risk of suffering from psychiatric symptoms in adolescence, and these symptoms heighten the risk of suicidality. Further, ACEs may increase impulsivity, thus increasing the risk of suicidality by mediating between ACEs and suicidality. Family and social dysfunctions have mediating effects on the relationship between ACEs and suicidality, but psychiatric symptoms and impulsivity attenuated these effects in the multiple mediating test.

Our study supports previous research on the developmental pathway from childhood adversities through psychological problems to suicidality. Brain development is active in the early years, and although genes provide the brain's basic blueprint, experiences modify the neurobiological development of a child. To learn to cope with stress is a vital part of childhood development. When a child's stress response system is activated in a supportive environment, the physiological effects are buffered and returned to baseline, which, in turn, results in the development of a healthy response system. If the stress is strong and frequent without protective parental support, the prolonged activation of the stress response systems disrupts neurodevelopment. As a result, the child's ability to cope with negative or disruptive emotions is impaired, leading to emotional dysregulation and impulsivity. During adolescence the young can adopt negative coping mechanisms such as suicidal behavior (Hawton et al., 2012; Center on the Developing Child at Harvard

University, 2014; Shonkoff & Garner, 2012). Therefore, it is important to recognize and prevent stressful adverse experiences as early as possible. In cases of severe problems, rehabilitation and attempts to reduce the long-term suffering and disabilities associated with adversities are needed (Braquehais et al., 2010).

According to the systematic review by Ougrin, Tranah, Stahl, Moran, and Asarnow (2015), therapies with the greatest impact on treating adolescent suicidal behavior are dialectical behavior therapy for adolescents (DBT-A), cognitive-behavioral therapy (CBT), and mentalization-based therapy (MBT). DBT-A improves adolescents' global and social adjustment and personality functioning. In DBT-A, also parents or other caregivers participate in the skills training groups (Mehlum et al., 2016). CBT, particularly its suicide prevention model (CBT-SP), focuses on developing cognitive, behavioral, and interactional skills that will enable the adolescent to refrain from further suicidal behavior. Parents participate in family sessions, which focus specifically on suicide risk reduction strategies (Stanley et al., 2009). MBT, which is based on attachment theory and psychodynamic principles, has a high degree of structure and a clear treatment goal of improving patients' metalizing skills. The parent-child relationship is also regarded as an important treatment target (Beck et al., 2016). Parent-child interaction therapy (PCIT) and child-parent psychotherapy (CPP) are evidence-based treatment modalities to prevent and manage ACEs and their impact on intra-familial relationships (Center on the Developing Child at Harvard University, 2016).

6.1. Study strengths and limitations

The main strength of this study was that we were able to collect a consecutive sample of adolescent inpatients. It is also noteworthy that our study included a gender- and age-matched community sample of students from the same geographical area as the inpatient group. The protocols were identical to both samples, improving the study's validity (Du Fort, Newman, & Bland, 1993). We used reliable and valid semi-structured K-SADS-PL interviews to determine DSM-IV-based psychiatric diagnoses and suicidality. A structured background data collection sheet allowed us to systematically collect the same background information from both samples.

The study also has some obvious limitations. Recall bias may have occurred because some data collection relied on retrospective reports. The Adverse Childhood Experience (ACE) Questionnaire was not used, as it is designed for adults and our study comprises underaged individuals. We also used categorical ACE variables, and thus, the influence of a single ACE was not taken into account. The gender distribution was suboptimal; the samples were female-dominated. Also attrition in inpatients was related to male gender and a psychotic disorder diagnosis. Data on psychiatric symptoms were based on the SCL-90 self-report questionnaire, which has the strongest association with depressive symptoms (Rytilä-Manninen et al., 2016). Therefore, externalizing symptoms may have been underestimated. Additionally, in the index hospital district, patients who suffer from severe substance use problems or severe eating disorders are referred to specialized units, not to the psychiatric hospital. In Finland, most adolescents with serious conduct disorders are referred to child welfare services, not to mental health services.

7. Conclusion

ACEs have an independent effect on the suicidality of adolescents. Of the studied mediators, psychiatric symptoms and impulsivity produce the most powerful mediation effects. Family dysfunction and social dysfunction have lesser, albeit significant effects on suicidality as single mediators. Thus, interpersonal problems should also be taken into account when assessing suicidality of an adolescent.

References

Anda, R., Felitti, V., Bremner, J. D., Walker, J., Whitfield, C., Perry, B., et al. (2006). The enduring effects of abuse and related adverse experiences in childhood: A convergence of evidence from neurobiology and epidemiology. *European Archives of Psychiatry and Clinical Neuroscience, 256*, 174–186.

Beck, E., Bo, S., Gondan, M., Poulsen, S., Pedersen, L., Pedersen, J., et al. (2016). Mentalization-based treatment in groups for adolescents with borderline personality disorder (BPD) or subthreshold BPD versus treatment as usual (M-GAB): Study protocol for a randomized controlled trial. *Trials, 17*, 314. http://dx.doi.org/10.1186/s13063-016-1431-0 [Retrieved from].

Bolton, J., Belik, S., Enns, M., Cox, B., & Sareen, J. (2008). Exploring the correlates of suicide attempts among individuals with major depressive disorder; findings from the national epidemiologic survey on alcohol and related conditions. *Journal of Clinical Psychiatry, 69*, 1139–1149.

Braquehais, D., Oquendo, M., Baca-Garcia, E., & Sher, L. (2010). Is impulsivity a link between childhood abuse and suicide? *Comprehensive Psychiatry, 51*, 121–129.

Brodsky, B., & Biggs, E. (2012). Adverse childhood experiences and suicidal behavior. *Suicidology, 3*, 16–21.

Bruffaerts, R., Demyttenaere, K., Borges, G., Haro, J., Chiu, W., Hwang, I., et al. (2010). Childhood adversities as risk factors for onset and persistence of suicidal behavior. *British Journal of Psychiatry, 197*, 20–27.

Center on the Developing Child at Harvard University (2014). Key concepts: Toxic stress. Retrieved from http://developingchild.harvard.edu.

Center on the Developing Child at Harvard University (2016). Applying the Science of Child Development in Child Welfare Systems. Retrieved from http://www.developinchild.harvard.edu.

Cetin, F. (2001). Suicide attempts and self-image among Turkish adolescents. *Journal of Youth and Adolescence, 30*, 641–650.

Chung, T., Colby, S., Barnett, N., Rohsenow, D., Spirito, A., & Monti, P. (2000). Screening adolescents for problem drinking: Performance of brief screening against DSM-IV alcohol diagnoses. *Journal of Studies on Alcohol, 61*, 579–587.

Classification of Social Economy Status (1989). *National authority for collecting and compiling statistics on various fields of society and economy. Handbooks.* in Finnishz.

Cluver, L., Orkin, M., Boyes, M., & Sherr, L. (2015). Child and adolescent suicide attempts, suicidal behavior, and adverse childhood experiences in South Africa: A prospective study. *Journal of Adolescent Health, 57*, 52–59.

Collins, W., & Laursen, B. (2004). Parent-adolescent relationships and influences. In S. Lerner, & L. Steinberg (Eds.). *Handbook of adolescent psychology*. New Jersey: John Wiley & Sons Hoboken.

Derogatis, L., Lipman, R., & Covi, L. (1973). SCL-90: An outpatient psychiatric rating scale- preliminary report. *Psychopharmacology, 9*, 13–28.
Dong, M., Anda, R., Dube, S., Giles, W., & Felitti, V. (2003). The relationship of exposure to childhood sexual abuse to other forms of abuse, neglect, and household dysfunction during childhood. *Child Abuse & Neglect, 27*, 625–639.
Dong, M., Anda, R., Felitti, V., Dube, S., Williamson, D., Thompson, T., et al. (2004). The interrelatedness of multiple forms of childhood abuse, neglect, and household dysfunction. *Child Abuse & Neglect, 28*, 771–784.
Du Fort, G., Newman, S., & Bland, R. (1993). Psychiatric comorbidity and treatment seeking: Sources of selection bias in the study of clinical populations. *Journal of Nervous and Mental Disease, 181*, 467–474.
Dube, S., Anda, R., Felitti, V., Chapman, D., Williamson, D., & Giles, W. (2001). Childhood abuse, household dysfunction, and the risk of attempted suicide throughout the life span: Findings from the adverse childhood experiences study. *JAMA, 286*, 3089–3096.
Dube, S., Anda, R., Felitti, V., Edward, V., & Croft, J. (2002). Adverse childhood experiences and personal alcohol abuse as an adult. *Addictive Behaviors, 27*, 713–725.
Dube, S., Anda, R., Whitfield, C., Brown, D., Felitti, V., Dong, M., et al. (2005). Long-term consequences of childhood sexual abuse by gender of victim. *American Journal of Preventive Medicine, 28*, 430–438.
Dube, S., Miller, J., Brown, D., Giles, W., Felitti, V., Dong, M., et al. (2006). Adverse childhood experiences and the association with ever using alcohol and initiating alcohol use during adolescence. *Journal of Adolescent Health, 28*, 444e1–444e10.
Evans, E., Hawton, K., Rodham, K., & Deeks, J. (2005). The prevalence of suicidal phenomena in adolescents: A systematic review of population-based studies. *Suicide and Life-Threatening Behavior, 35*, 239–250.
Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., et al. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults the adverse childhood experiences (ACE) study. *American Journal of Preventive Medicine, 14*, 245–258.
Groleger, U., Tomori, M., & Kocmur, M. (2003). Suicidal ideation in adolescence − an indicator of actual risk? *Israel Journal of Psychiatry and Related Sciences, 40*, 202–208.
Groschwitz, R., Kaess, M., Fischer, G., Ameis, N., Schulze, U., Brunner, R., et al. (2015). The association of non-suicidal self-injury and suicidal behavior according to DSM-5 in adolescent psychiatric inpatients. *Psychiatry Research, 228*, 454–461.
Hardt, J., Herke, M., & Schier, K. (2011). Suicidal Ideation, parent-child relationships, and adverse childhood experiences: A cross −validation study using a Graphical Markov Model. *Child Psychiatry & Human Development, 42*, 119–133.
Hawton, K., Saunders, K., & O'Connor, R. (2012). Self −harm and suicide in adolescents. *The Lancet, 379*, 2373–2382.
Isohookana, R., Riala, K., Hakko, H., & Räsänen, P. (2012). Adverse childhood experiences and suicidal behavior of adolescent psychiatric inpatients. *European Child & Adolescent Psychiatry, 22*, 13–22.
Johnson, J. H., & McCutcheon, S. M. (1980). Assessing life stress in older children and adolescents: Preliminary findings with the Life Events Checklist. In J. G. Sarason, & C. D. Spielberger (Eds.). *Stress and anxiety* (pp. 111–112). Washington DC: Hemisphere Publishing.
Johnson, J., Cohen, P., Gould, M., Kasen, S., Brown, J., & Brook, J. (2002). Childhood adversities, interpersonal difficulties, and risk for suicide attempts during late adolescence and early adulthood. *Archives of General Psychiatry, 59*, 741.
Kaufman, J., Birmaher, B., Brent, D., Rao, U., Flynn, C., Moreci, P., et al. (1997). Schedule for affective disorders and schizophrenia for school-Age children-Present and lifetime version (K-SADS-PL): Initial reliability and validity data. *Journal of The American Academy of Child and Adolescent Psychiatry, 36*, 980–988.
Kessler, R., Borges, G., & Walters, E. (1999). Prevalence of and risk factors for lifetime suicide attempts in the National Comorbidity Survey. *Archives of General Psychiatry, 56*, 617.
Kumar, S., & George, B. (2013). Life events, social support, coping strategies, and quality of life in attempted suicide. *Indian Journal of Psychiatry, 55*, 46–51.
Laukkanen, E., Peiponen, S., Halonen, P., Aivio, A., & Viinamäki, H. (1999). Discriminant validity of the offer self-Image questionnaire in finnish 13-year-old adolescents. *Nordic Journal of Psychiatry, 53*, 197–201.
Laukkanen, E., Halonen, P., Aivio, A., Viinamäki, H., & Lehtonen, J. (2000). Construct validity of the Offer Self-Image Questionnaire in Finnish 13-year-old adolescents: Differences in the self-images of boys and girls. *Nordic Journal of Psychiatry, 54*, 431–435.
Laukkanen, E., Honkalampi, K., Hintikka, J., Hintikka, U., & Lehtonen, J. (2005). Suicidal ideation among help-seeking adolescents: Association with a negative self-image. *Archives of Suicide Research, 9*, 45–55.
Mehlum, L., Ramberg, M., Tormoen, A., Haga, E., Diep, L., Stanley, B., et al. (2016). Dialectical Behavior therapy compared with enhanced usual care for adolescents with repeated suicidal and self-harming behavior: Outcomes over a one-year follow-up. *Journal of the American Academy of Child & Adolescent Psychiatry, 55*, 295–300.
Miller, A., Esposito-Smythers, C., Weismoore, J., & Renshaw, K. (2013). The relation between child maltreatment and adolescent suicidal behavior: A systematic review and critical examination of the literature. *Clinical Child and Family Psychology Review, 16*, 146–172.
Nock, M., Green, J., Hwang, I., McLaughlin, K., Sampson, N., Zaslavsky, A., et al. (2013). Prevalence, correlates, and treatment of lifetime suicidal behavior among adolescents: Results from the National Comorbidity Survey Replication Adolescent Supplement. *JAMA Psychiatry, 9*, 1–11.
Offer, D., Ostrov, E., Howard, K., & Dolan, S. (1992). *Offer self-Image questionnaire, revised (OSIQ-R), manual.* Los Angeles, California: Western Psychological Services.
Ougrin, D., Tranah, T., Stahl, D., Moran, P., & Asarnow, J. (2015). Therapeutic interventions for suicide attempts and self-harm in adolescents: Systematic review and meta-analysis. *Journal of the American Academy of Child & Adolescent Psychiatry, 54*, 97–107.
Pelkonen, M., Karlsson, L., & Marttunen, M. (2011). Adolescent suicide: Epidemiology, Psychological theories, risk factors, and prevention. *Current Pediatric Reviews, 7*, 52–67.
Perez, N., Jennings, W., Piquero, A., & Baglivio, M. (2016). Adverse Childhood Experiences and suicide attempts: The Mediating influence of personality development and problem behaviors. *Journal of Youth and Adolescence, 8*, 1527–1545.
Preacher, K., & Hayes, A. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*, 879–891.
Randall, J., Doku, D., Wilson, M., & Peltzer, K. (2014). Suicidal behaviour and related risk factors among school-aged youth in the republic of Benin. *PUBLIC LIBRARY OF SCIENCE*. http://dx.doi.org/10.1371/journal.pone.0088233 [Retrieved from].
Rasmussen, C., Nielsen, L., Petersen, D., Christiansen, E., & Bielnberg, N. (2013). Adverse life events as risk factors for behavioural and emotional problems in a 7–year follow-up of a population-based child cohort. *Nordic Journal of Psychiatry*. http://dx.doi.org/10.3109/08039488.2013.794473 Retrieved from.
Reinert, D., & Allen, J. (2002). The alcohol use identification test (AUDIT): A review of resent research. *Alcoholism, Clinical and Experimental Research, 26*, 272–279.
Rothman, E., Edwards, E., Heeren, T., & Hingson, R. (2008). Adverse childhood experiences predict earlier age of drinking onset: results from a representative US sample of current or former drinkers. *Pediatrics, 122*, e294–e297.
Rytilä-Manninen, M., Lindberg, N., Haravuori, H., Kettunen, K., Marttunen, M., Joukamaa, M., et al. (2014). Adverse childhood experiences as risk factors for serious mental disorders and inpatient hospitalization among adolescents. *Child Abuse & Neglect, 38*, 2021–2032.
Rytilä-Manninen, M., Fröjd, S., Haravuori, H., Lindberg, N., Marttunen, M., Kettunen, K., et al. (2016). Psychometric properties of the Symptom Checklist-90 in adolescent psychiatric inpatients and age- and gender −matched community youth. *Child and Adolescent Psychiatry and Mental Health, 10*, 23.
Saunders, J., Aasland, O., Babor, T., de la Fuente, J., & Grant, M. (1993). Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. *Addiction, 88*, 791–804.
Serafini, G., Muzio, C., Piccini, G., Flouri, E., Ferrigno, G., Pompili, M., et al. (2015). Life adversities and suicidal behavior in young individuals: A systematic review. *European Child and Adolescent Psychiatry, 24*, 1423–1446.
Shonkoff, J. P., & Garner, A. S. (2012). American academy of pediatrics committee on psychosocial aspects of child and family health; committee on early childhood adoption, and dependent care; section on developmental and behavioral pediatrics. the lifelong effects of early childhood adversity and toxic stress. *Pediatrics, 129*(1), e232–e246.
Spirito, A., & Esposito-Smythers, C. (2006). Attempted and completed suicide in adolescence. *Annual Review of Clinical Psychology, 2*, 237–266.
Stanley, B., Brown, G., Brent, D., Wells, K., Poling, K., Curry, J., et al. (2009). Cognitive-behavioral therapy for suicide prevention (CBT-SP): Treatment model, feasibility: and acceptability. *Journal of the American Academy of Child and Adolescent Psychiatry, 48*, 1005–1013.

Stewart, J., Esposito, E., Glenn, C., Gilman, S., Pridgen, B., Gold, J., et al. (2017). Adolescent self-injurers: Comparison non-ideators, suicide ideators, and suicide attempters. *Journal of Psychiatric Research, 84*, 105–112.

Thompson, R., Proctor, L., English, D., Dubowitz, H., Narasimhan, S., & Everson, M. (2012). Suicidal ideation in adolescence: Examining the role of recent adverse experiences. *Journal of Adolecence, 35*, 175–186.

Tuisku, V., Pelkonen, M., Karlsson, L., Kiviruusu, O., Holi, M., Ruuttu, T., et al. (2006). Suicidal ideation, deliberate self-harm behaviour and suicide attempts among adolescent outpatients with depressive mood disorders and comorbid axis I disorders. *European Child & Adolescent Psychiatry, 15*, 199–206.

Vander Stoep, A., McCauley, E., Flynn, C., & Stone, A. (2009). Thoughts of death and suicide in early adolescence. *Suicide and Life-Threatening Behavior, 39*, 599.

Zouk, H., Tousingnant, M., Sequin, M., Lesage, A., & Turecki, G. (2006). Characyerization of impulsivity in suicide completers: Clinical behavioral and psychosocial dimensions. *Journal of Affective Disorders, 92*, 195–204.

Risk factors related to self-harming behaviour in Finnish adolescent inpatients with a history of non-suicidal self-injury, suicidal behaviour or both

Minna Rytilä-Manninen, Henna Haravuori, Kirsi Kettunen, Sari Fröjd, Mauri Marttunen, Nina Lindberg

Abstract

Theoretically, non-suicidal self-injury and suicide attempt are regarded as behaviours on a single continuum of self-injury. The aim of the present study was to shed more light on clinical differences between adolescent inpatients with non-suicidal self-injury (NSSI), those with suicidal behaviour (SB) and those with both SB and NSSI. We studied risk factors related to self-harming behaviour in an inpatient sample (N=205) consisting of 13- to 17-year-old adolescents referred to psychiatric hospital for the first time in their lives between 2006 and 2010. Of them, 86 (42.0%) reported no history of self-harm, 62 (30.2%) showed a history of SB but no history of NSSI, 10 (4.9 %) had a history of NSSI and 47 (22.9%) had a history of both SB and NSSI. Depressive disorders and bipolar disorders, self-reported psychiatric symptoms (measured by SCL-90) and symptoms of depression were associated with SB. Social dysfunction was related to NSSI. Sexual abuse, impulsivity and symptoms of depression were related to SB with NSSI. Self-reported psychoticism was associated with all three self-harming groups. As could be expected, more severe self-harming behaviour (SB) was closely related with psychiatric diagnosis, while the risk factors for NSSI were related to difficulties in peer relationships.

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

Risk factors related to self-harming behaviour in Finnish adolescent inpatients with a history of non-suicidal self-injury, suicidal behaviour or both

Introduction

Rates of non-suicidal self-injury (NSSI) and suicidal behaviour increase from childhood to adolescence and peak in prevalence among 15- to 19-year olds (1). Both NSSI and suicide attempt are regarded as behaviours on a single continuum of self-injury (1). The most common function of NSSI in adolescents is to escape from either adverse emotions (e.g. sadness and anxiety) or cognitive (e.g. negative memories or thoughts) states (2). NSSI has been regarded as a strategy of emotional adaptation and regulation (1), but if this strategy fails, the adolescent may undertake more severe forms of self-injury, which become progressively closer to suicidal behaviour (SB) (1).

By definition, both NSSI and SB involve intentional harm of oneself, but, unlike adolescents with SB, those with NSSI do not show an intention to die (3). The increasing rate of NSSI is of particular concern since individuals with a history of NSSI are at increased risk of suicide (4). According to the interpersonal theory of suicide, NSSI builds up suicide capability by habituating the self-injurer to the pain and fear involved in a suicide attempt (5).

Adolescents with NSSI and SB share many common risk factors including childhood trauma and abuse (6-8), negative peer interaction (9), family conflict (8), isolation, loneliness, impulsivity, history of borderline personality disorder, (4), high level of physiological reactivity in response to stress, reduced ability to tolerate stress and deficits in social problem solving ability (8,10-11). On the other hand, adolescents with NSSI and those with SB also show a clinically important difference: adolescents with NSSI show a more positive attitude toward life than those with SB (4,12).

Previous research, studying factors that differentiate between adolescents who show NSSI only, adolescents with SB only and adolescents with both SB and NSSI, has found that adolescents with both SB and NSSI show a higher prevalence of psychiatric disorders, particularly major depressive disorder and post-traumatic stress disorder (PTSD), than adolescents in other self-harming groups (2). Adolescents with both SB and NSSI exhibit greater psychiatric symptom severity (e.g. depressive symptoms) and higher traits of impulsivity than adolescents with NSSI only or adolescents with SB only (2). Further, adolescents with a history of both SB and NSSI show higher levels

Risk factors related to self-harming
behaviour in Finnish adolescent inpatients
with a history of non-suicidal self-injury,
suicidal behaviour or both

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

of self-directed aggressiveness during inpatient treatment than the other groups. They have also experienced more frequently sexual abuse, hospitalizations and residential treatment placements than adolescents with NSSI only or adolescents with SB only. According to Boxer and colleagues (7), adolescents with NSSI only and those with both SB and NSSI spent significantly more time in psychiatric treatment compared to adolescents with SB only.

The aim of the present study was to study differences between adolescent inpatients with NSSI only, those with SB only and those with both SB and NSSI. Our special interest was on risk factors related to self-harming behaviour.

Based on extant literature, we analysed differences in psychiatric disorders, psychiatric symptoms, impulsivity, alcohol use, adverse childhood experiences, family factors and social functioning between the above mentioned patient groups.

Method

Participants and procedure

The Kellokoski Hospital Adolescent Inpatient Follow-Up Study (KAIFUS) is a longitudinal naturalistic study of the clinical characteristics in a consecutive sample of adolescent psychiatric inpatients in Finland. This inpatient sample consists of 13- to 17-year-old adolescents referred to psychiatric hospital for the first time in their lives between 2006 and 2010 (N=395). Non-eligible patients were those who had a treatment period of less than two weeks, those who showed intellectual disability, those under 13 years of age and those with poor knowledge of the Finnish language (N=80, 20.2%). Of the 315 eligible patients, 62 (19.7%) declined to participate, or their parents or legal guardians did not provide their permission to participate. In 23 (7.3%) cases, patients or their parents discontinued the treatment period, and 24 (7.6%) cases had incomplete data. Thus, the sample comprised 206 inpatients. Non-participation was unrelated to age (p=0.31), living situation (p=0.58), substance use (p=0.59), mood (p=0.92), anxiety (p=0.39), eating (p=0.34) or conduct disorders (p=0.09) as principal diagnoses, but it was associated with male gender (p=0.02) and a diagnosis of psychotic disorder (p=0.02). When we analysed the variables related to self-harm, data of one girl turned out to be missing. So, the final sample of this study comprised 205 adolescents (60 boys) with a mean age of 15.1 years (SD=1.2). For more details, see Minna Rytilä-Manninen and colleagues (13).

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

Risk factors related to self-harming behaviour in Finnish adolescent inpatients with a history of non-suicidal self-injury, suicidal behaviour or both

Measurements

The Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL) (14) was performed to assess psychiatric diagnoses.

Self-harm was measured using questions included in the K-SADS-PL interview. The information on suicidal behaviour was based on the following two questions concerning the suicidal ideation and suicide method: "Have you thought about death?" and "Have you had suicide plans?" ("none"=not present; "sub-threshold"=thought about death but not specific method; and "threshold"=have often thought about death and have also thought the suicide method) and the seriousness of suicidal intent: "Have you actually tried to kill yourself?" ("none"=no attempt or gesture with any intent to die; "sub-threshold"=present, but very ambivalent; and "threshold"=definite suicidal intent). The person with SB was regarded as a person who fulfilled the threshold criteria for serious suicidal ideation (often thinks of suicide and has thought of a specific method, and/or fulfilled the sub-threshold or threshold criteria for one or more suicidal acts (with ambivalent or definite suicidal intent). The information on non-significant self-injury was based on the question about non-suicidal physical self-damaging acts without any intent to die ("none"=not present; "sub-threshold"=infrequent (one to three times a year) but has never caused serious injury; and "threshold"=frequent (four or more times a year) or has caused serious self-injury (for example burned skin or broken bones). A person was defined as having engaged in non-significant self-injury if a non-suicidal physical self-damaging act fulfilled the threshold level. A person with no history of SB or NSSI was regarded as a person with no self-harming behaviour. And finally, a person could have both types (SB and NSSI) of self-harming behaviour.

Data on adverse childhood experiences (ACE) were gathered using a structured background data collection sheet, the K-SADS-PL interview screening section for PTSD, and the Life Events Checklist (LEC) (15). Adolescents were asked if their parents had divorced (no/yes), and if their mother or father had suffered from psychiatric or substance use problems requiring professional help (no/yes). Parents' criminality was assessed using the LEC question: "Have your parents ever been arrested or suspected or judged for a criminal offence?" (no/yes). The information about witnessing intimate partner violence (no/yes) and exposure to physical (no/yes) or sexual abuse (no/yes) was based on the K-SADS-PL interview.

Risk factors related to self-harming
behaviour in Finnish adolescent inpatients
with a history of non-suicidal self-injury,
suicidal behaviour or both

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

The accumulation of different ACE categories was described by creating an ACE total score, ranging from zero (the person had not been exposed to any studied ACE categories) to seven (the person had been exposed to all studied ACE categories). In this study, the mean ACE total score was 2.2 (SD 1.6). For details, see Rytilä-Manninen and colleagues (13).

Psychiatric symptoms were measured using the Symptom Checklist-90 (SCL-90) (16), which is a self-report measure for people aged 13 or older. It consists of 90 items, which measure subjective symptoms on nine primary symptom dimensions. Items are rated on a five-point Likert scale of distress, ranging from "not at all" (0) to "extremely" (4). Thus, the sum score can range from zero to 360. The reference period for the symptoms is the last two weeks. The psychometric properties of SCL-90 have been shown to be good for adolescents (17). In this study, Cronbach's alphas ranged from 0.800 (paranoid ideation) to 0.943 (depressive disorders). For further analyses, the SCL-90 sum score was used.

Impulsivity, family dysfunction and social dysfunction were measured with the Offer Self-Image Questionnaire (OSIQ-R) (18), which is a 129-item personality test for adolescents between the ages of 13 and 18. Items are rated on a six-point Likert scale, ranging from "describes me very well" (1) to "does not describe me at all" (6). OSIQ-R comprises twelve component scales, but, in this study, only those described below were used. *Impulse control* is a nine-item scale to measure whether the adolescent can handle pressure. The scale score can range from 9 to 54. Higher scores suggest that a teenager has low frustration tolerance and often acts on impulse. In this study, the Cronbach's alpha for this scale was 0.659. *Social functioning* is also a nine-item scale used to assess patterns of interpersonal relationships and friendships. The scale score can range from 9 to 54. Higher scores indicate that a teenager is unable to have and maintain close relationships with individuals of his or her own age and feels uncomfortable when socializing with peers. In this study, the Cronbach's alpha for this scale was 0.819. *Family functioning* is a 19-item scale focusing on the adolescent's feelings about, and relationships with his or her parents, as well as emotional atmosphere at home. The scale score can range from 19 to 114. Higher scores indicate that the adolescent feels that there is tension at home, that the relationships are problematic and that he/she is not getting support from his/her parents. In this study, the Cronbach's alpha for this scale was 0.842. The OSIQ has been widely used and validated for Finnish adolescents (19-22).

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

Risk factors related to self-harming
behaviour in Finnish adolescent inpatients
with a history of non-suicidal self-injury,
suicidal behaviour or both

Alcohol use was self-assessed with the Alcohol Use Disorders Identification Test (AUDIT) (23), which includes 10 items scored from 0 to 4. Thus, the AUDIT sum score can range from zero to 40. Self-assessment has shown good psychometric properties (24). In this study, the Cronbach's alpha was 0.914.

Ethics

Participation was voluntary. All participants and their legal guardians gave their written informed consent. Permission to conduct the study was granted by the authorities of the Helsinki and Uusimaa Hospital District. The Ethics Committee of Helsinki University Hospital approved the study protocol.

Data analysis

The distributions of variables are presented as percentages for categorical variables and means (M) and standard deviations (SD) for continuous variables. The chi-square (χ^2) test, Fisher's exact test and columns proportions were compared with z-test with Bonferroni correction (post hoc analysis), analysis of variance (ANOVA) with Tukey's post hoc comparison test, and multinomial logistic regression models were used to compare the groups. P-values <0.05 were considered statistically significant. Analyses were performed using SPSS 22.0 for Windows.

Results

Bivariate analyses

Of 205 adolescent inpatients, 86 (42.0%) reported no history of self-harm, 62 (30.2%) showed a history of SB but no history of NSSI, 10 (4.9 %) had a history of NSSI and 47 (22.9%) had a history of both SB and NSSI. Gender and diagnostic distributions in these four groups are presented in Table 1. Fisher's exact test revealed significant differences between the self-harming groups on depressive disorder (p=0.025) and bipolar disorder (p=0.028), but other diagnoses showed no significant group differences. When the different forms of self-harming behaviour were tested against each other in the post hoc analyses, no significant differences were found. Female gender seemed to be over-represented in all three self-harming groups and this gender difference was significant (p<0.001).

Risk factors related to self-harming
behaviour in Finnish adolescent inpatients
with a history of non-suicidal self-injury,
suicidal behaviour or both

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

Table 1. Distribution of gender and psychiatric diagnoses in different self-harming groups.					
	Adolescents with no self-harming behaviour (n=86)	Adolescents with SB but without NSSI (n=62)	Adolescents with NSSI but without SB (n=10)	Adolescents with both SB and NSSI (n=47)	Total (N=205)	p
Gender; n (%)						
Female	45 (52.3)	50 (80.6)	9 (90.0)	41 (87.2)	145 (70.7)	<0.001
K-SADS-PL Diagnosis; n (%)						
Depressive disorder	44 (51.2)	45 (72.6)	4 (40.0)	31 (66.0)	124 (60.5)	0.025[a]
Bipolar disorder	2 (2.3)	9 (14.5)	1 (10.0)	3 (6.4)	15 (7.3)	0.028[b]
Anxiety disorder	27 (31.4)	21 (33.9)	6 (60.0)	22 (46.8)	76 (37.1)	0.131
Alcohol use disorder	10 (11.6)	5 (8.1)	1 (10.0)	3 (6.4)	19 (9.3)	0.760
Conduct disorder	25 (29.1)	15 (24.2)	0 (0.0)	11 (23.4)	51 (24.9)	0.239
Psychotic disorder	11 (12.8)	4 (6.5)	2 (20.0)	5 (10.6)	22 (10.7)	0.394
Eating disorder	14 (16.3)	10 (16.1)	2 (20.0)	6 (12.8)	32 (15.6)	0.885
PTSD or adjustment disorder	8 (9.3)	5 (8.1)	1 (10.0)	9 (19.1)	23 (11.2)	0.288
ADHD	11 (12.8)	6 (9.7)	0 (0.0)	3 (6.4)	20 (9.8)	0.613

SB=suicidal behaviour, NSSI=non-suicidal self-injury
[a] column proportions do not significantly differ from each other in the post hoc analysis
[b] column proportion of no self-harming behaviour differs significantly from SB without NSSI in post hoc analysis but the self-harming behaviours do not differ from each other

The distribution of various ACE is presented in Table 2. According to Fisher's exact test, significant group differences were found on parental criminality (p=0.045) and sexual abuse (p<0.001). Again, the different forms of self-harming behaviour did not differ from each other in the post hoc analyses. Other ACE showed no significant group differences.

To determine group differences in the continuous outcome variables, including psychiatric symptoms, alcohol use, impulsivity, family dysfunction, social dysfunction and ACE total score, ANOVA was conducted. Analysis indicated an overall effect for group membership (adolescents with no self-harming behaviour, adolescents with SB only, adolescents with NSSI only, adolescents with both SB and NSSI) on psychiatric symptom scores, impulsivity scores, family dysfunction scores and social dysfunction scores (Table 3). Tukey's post hoc comparison test showed that the participants with no self-harming behaviour had significantly lower psychiatric symptom scores and social dysfunction scores than the three groups with self-harming behaviour. The group with no self-harming behaviour scored significantly lower on both impulsivity and family dysfunction scores than the SB group and the SB and NSSI group.

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

Risk factors related to self-harming
behaviour in Finnish adolescent inpatients
with a history of non-suicidal self-injury,
suicidal behaviour or both

Next, the group differences in the SCL-90 sub-scales (Somatization, Interpersonal sensitivity, Depression, Anxiety, Phobic anxiety, Paranoid ideation, Psychoticism, Obsessive-compulsivity and Hostility) were investigated (Table 4). ANOVA indicated an overall effect for group membership (adolescents with no self-harming behaviour, adolescents with SB only, adolescents with NSSI only, adolescents with both NSSI and SB) on all sub-scale scores. Tukey's post hoc comparison test revealed that the group with no self-harming behaviour showed significantly lower scores on sub-scales Somatization, Depression, Anxiety, Phobic anxiety, Psychoticism, Obsessive compulsivity and Hostility than the three groups with self-harming behaviour. The group with no self-harming behaviour exhibited significantly lower scores on both Interpersonal sensitivity and Paranoid ideation sub-scales than the SB group and the SB and NSSI group.

Table 2. Distribution of adverse childhood experiences in different self-harming groups.

	Adolescents with no self-harming behaviour (n=86)	Adolescents with SB but without NSSI (n=62)	Adolescents with NSSI but without SB (n=10)	Adolescents with both SB and NSSI (n=47)	Total (N=205)	p
Parental divorce	51 (59.3)	30 (48.4)	7 (70.0)	24 (51.1)	112 (54.6)	0.513
Parental psychiatric problems	33 (38.4)	27 (43.5)	5 (50.0)	16 (34.0)	81 (39.5)	0.674
Parental alcohol problems	29 (33.7)	21 (33.9)	3 (30.0)	16 (34.0)	69 (33.7)	1.000
Parental criminality	3 (3.5)	2 (3.2)	1 (10.0)	7 (14.9)	13 (6.3)	**0.045**[a]
Witnessing intimate partner violence	28 (32.6)	18 (29.0)	3 (30.0)	15 (31.9)	64 (31.2)	0.979
Physical abuse	18 (20.9)	15 (24.2)	1 (2.1)	13 (27.7)	47 (22.9)	0.678
Sexual abuse	6 (7.0)	15 (24.2)	2 (20.0)	21 (44.7)	44 (21.5)	**< 0.001**[b]

SB=suicidal behaviour, NSSI=non-suicidal self-injury
[a] column proportions do not significantly differ from each other in the post hoc analysis
[b] column proportion of no self-harming behaviour differs significantly from SB without NSSI, and from SB with NSSI in post hoc analysis but the self-harming behaviours do not differ from each other

Risk factors related to self-harming behaviour in Finnish adolescent inpatients with a history of non-suicidal self-injury, suicidal behaviour or both

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

Table 3. Descriptive statistics for analysed continuous variables across different self-harming groups.

	Adolescents with no self-harming behaviour (n=86)	Adolescents with SB but without NSSI (n=62)	Adolescents with NSSI but without SB (n=10)	Adolescents with both SB and NSSI (n=47)	F	df	p
Psychiatric symptoms; mean (SD)	79.0 (62.3)	132.9 (69.4)	162.8 (60.9)	148.9 (60.1)	16.26	3, 192	< 0.001[a]
Alcohol use	3.0 (5.8)	4.4 (6.7)	2.7 (5.8)	5.8 (7.8)	1.98	3, 187	NS
Impulsivity	27.9 (7.11)	32.5 (6.3)	34.7 (6.8)	35.3 (6.5)	12.25	3, 179	< 0.001[b]
Family dysfunction	49.4 (14.9)	59.7 (17.1)	57.2 (5.0)	61.7 (14.8)	7.24	3, 170	< 0.001[c]
Social dysfunction	23.9 (8.1)	29.8 (7.5)	34.1 (5.1)	30.6 (7.5)	7.24	3, 170	< 0.001[d]
ACE total score	2.1 (1.6)	2.2 (1.6)	2.5 (1.2)	2.6 (1.8)	1.38	3, 201	NS

Comparisons made using ANOVA with Tukey's post hoc test.

SB=suicidal behaviour, NSSI=non-suicidal self-injury, NS=not statistically significant

[a] The psychiatric symptoms sum score of adolescents with no self-harming behaviour was significantly lower than those of all three self-harming groups

[b] The impulsivity sum score of adolescents with no self-harming behaviour was significantly lower than that of adolescents with SB and that of adolescents with both SB and NSSI, but no statistically significant difference was observed between adolescents with no self-harming behaviour and those with NSSI

[c] The family dysfunction sum score of adolescents with no self-harming behaviour was significantly lower than that of adolescents with SB and that of adolescents with both SB and NSSI, but no statistically significant difference was observed between adolescents with no self-harming behaviour and those with NSSI

[d] The social dysfunction sum score of adolescents with no self-harming behaviour was significantly lower than those of all three self-harming groups

Table 4. The Symptom Checklist-90 sub-scales in different self-harming groups.

	Adolescents with no self-harming behaviour (n=86)	Adolescents with SB but without NSSI (n=62)	Adolescents with NSSI but without SB (n=10)	Adolescents with both SB and NSSI (n=47)	F	df	p
Somatization	8.6 (8.1)	12.5 (8.7)	17.4 (7.7)	14.3 (8.0)	7.34	3, 201	< 0.001[a]
Interpersonal sensitivity	9.1 (8.1)	14.7 (8.2)	15.9 (8.7)	16.0 (7.3)	10.12	3, 196	< 0.001[b]
Depression	15.2 (12.1)	27.8 (14.1)	29.1 (8.9)	30.4 (10.6)	20.39	3, 196	< 0.001[a]
Anxiety	8.3 (7.9)	14.8 (9.0)	19.9 (7.7)	16.2 (8.0)	14.27	3, 196	< 0.001[a]
Phobic anxiety	4.7 (5.4)	8.5 (7.3)	11.9 (7.4)	8.2 (6.3)	7.35	3, 196	0.001[a]
Paranoid ideation	5.3 (4.6)	8.5 (5.9)	8.2 (4.9)	8.9 (5.3)	6.76	3, 196	< 0.001[b]
Psychoticism	5.1 (5.4)	10.5 (8.6)	16.1 (8.7)	12.7 (6.7)	17.33	3, 196	< 0.001[a]
Obsessive-compulsivity	10.8 (8.7)	16.2 (9.1)	21.6 (7.4)	18.9 (8.9)	11.56	3, 196	< 0.001[a]
Hostility	5.1 (4.7)	7.3 (5.3)	9.6 (5.2)	9.3 (4.9)	8.65	3, 196	< 0.001[a]

SB=suicidal behaviour, NSSI=non-suicidal self-injury

[a] The sub-scale score of adolescents with no self-harming behaviour was significantly lower than those of all three self-harming groups

[b] The sub-scale score of adolescents with no self-harming behaviour was significantly lower than that of adolescents with SB and that of adolescents with both SB and NSSI, but it did not significantly differ from that of adolescents with NSSI

Risk factors related to self-harming behaviour in Finnish adolescent inpatients with a history of non-suicidal self-injury, suicidal behaviour or both

Multinomial analyses

In order to assess potential mutual risk factors for self-harming behaviour, multinomial regression analysis was performed. The group with no self-harm served as a reference group for all three self-harming groups. Age and gender were used as covariates in the analyses. First, all psychiatric diagnoses (see Table 1) were entered into the model. Depressive (OR 4.05, CI 1.65-9.94, p=0.002) and bipolar disorders (OR 15.22, CI 2.72-83.89, p=0.002) were significantly related to SB. Anxiety disorder was linked to SB with NSSI, but the finding did not quite reach statistical significance (OR 2.17, CI .995-4.71, p=0.051). None of the studied diagnoses were significantly related to NSSI only.

In the second phase, all adversities (parents' divorce, parental mental health problems, parental alcohol use problems, parental criminality, witnessing intimate partner violence, physical abuse and sexual abuse) were entered into the model. Only one statistically significant result was found: sexual abuse was significantly related to SB with NSSI (OR 7.48, CI 2.53-22.09, p<0.001). Multinomial regression analysis revealed that the ACE total score was related to SB with NSSI, but the finding did not reach statistical significance (OR 1.25, CI 1.00-1.56, p=0.050).

In the third phase, impulsivity, social dysfunction, family dysfunction, alcohol use and psychiatric symptoms were entered into the model (Table 5). Impulsivity was significantly related to SB with NSSI (OR 1.08, CI 1.00-1.16, p=0.044), and psychiatric symptoms were significantly related to SB (OR 1.01, CI 1.00-1.02, p=0.023) and to SB with NSSI (OR 1.01, CI 1.00-1.02, p=0.035). Entering the ACE total score to the model revealed some substantial changes: psychiatric symptoms no longer associated significantly with SB, but social dysfunction was significantly related to NSSI (OR 1.19, CI 1.00-1.41, p=0.048).

In the fourth phase, in order to assess psychiatric symptomatology more closely, we entered all SCL-90 sub-scales into the multinomial regression model (Table 6). The sub-scale Psychoticism was significantly associated with all three self-harming groups, with the strongest association with NSSI (OR 1.45, CI 1.17-1.81, p=0.001), followed by SB with NSSI (OR 1.19, CI 1.05-1.35, p=0.006). The sub-scale Depression was significantly related to SB (OR 1.10, CI 1.03-1.18, p=0.006) and to SB with NSSI (OR 1.10, CI 1.02-1.19, p=0.011). When the ACE total score was entered to the model, the significances did not change.

Risk factors related to self-harming
behaviour in Finnish adolescent inpatients
with a history of non-suicidal self-injury,
suicidal behaviour or both

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

Table 5. Multinomial regression analyses of associations between different groups of self-harming behaviour and impulsivity, social dysfunction, family dysfunction, alcohol use and psychiatric symptoms.

Group	Variable	OR	CI 95%	p
Step 1				
SB	Impulsivity	1.02	0.950-1.092	0.610
	Social dysfunction	1.04	0.977-1.110	0.215
	Family dysfunction	1.02	0.989-1-048	0.230
	Alcohol use	1.02	0.955-1.099	0.504
	Psychiatric symptoms	1.01	1.001-1.017	**0.023**
NSSI	Impulsivity	1.06	0.908-1.240	0.453
	Social dysfunction	1.17	0.997-1.373	0.054
	Family dysfunction	0.99	0.919-1.056	0.678
	Alcohol use	1.02	0.875-1.188	0.807
	Psychiatric symptoms	1.01	0.991-1.022	0.435
SB+NSSI	Impulsivity	1.08	1.002-1.164	**0.044**
	Social dysfunction	1.04	0.966-1.114	0.314
	Family dysfunction	1.02	0.985-1.051	0.291
	Alcohol use	1.04	0.965-1.117	0.320
	Psychiatric symptoms	1.01	1.001-1.018	**0.035**
Step 2				
SB	Impulsivity	1.01	0.942-1.087	0.745
	Social dysfunction	1.04	0.975-1.111	0.231
	Family dysfunction	1.01	0.982-1.044	0.430
	Alcohol use	1.01	0.936-1.085	0.837
	Psychiatric symptoms	1.01	1.001-1.016	**0.035**
	ACE total score	1.04	0.817-1.412	0.767
NSSI	Impulsivity	1.05	0.895-1.229	0.557
	Social dysfunction	1.19	1.001-1.406	**0.048**
	Family dysfunction	0.97	0.904-1.041	0.403
	Alcohol use	1.00	0.856-1.172	0.986
	Psychiatric symptoms	1.00	0.988-1.020	0.627
	ACE total score	1.35	0.686-2.661	0.385
SB+NSSI	Impulsivity	1.10	1.000-1.168	**0.049**
	Social dysfunction	1.06	0.980-1.141	0.151
	Family dysfunction	1.01	0.972-1.042	0.712
	Alcohol use	1.03	0.995-1.110	0.443
	Psychiatric symptoms	1.01	0.999-1.017	0.071
	ACE total score	1.29	0.958-1.748	0.093

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

Risk factors related to self-harming
behaviour in Finnish adolescent inpatients
with a history of non-suicidal self-injury,
suicidal behaviour or both

Table 6. Multinomial regression analyses of associations between different groups of self-harming behaviour and the Symptom Checklist-90 sub-scales.

Category	Variable	OR	CI 95%	p
SB	Somatization	0.95	0.879-1.026	0.191
	Interpersonal sensitivity	0.92	0.827-1.017	0.102
	Depression	1.10	1.028-1.182	**0.006**
	Anxiety	1.04	0.926-1.174	0.490
	Phobic anxiety	0.99	0.897-1.100	0.900
	Paranoid ideation	0.99	0.872-1.132	0.922
	Psychoticism	1.15	1.023-1.292	**0.019**
	Obsessive-Compulsivity	0.94	0.882-1.054	0.425
	Hostility	0.93	0.828-1.049	0.244
NSSI	Somatization	0.94	0.813-1.082	0.381
	Interpersonal sensitivity	0.88	0.706-1.092	0.243
	Depression	0.94	0.801-1.099	0.428
	Anxiety	1.16	0.931-1.452	0.184
	Phobic anxiety	1.07	0.868-1.320	0.526
	Paranoid ideation	0.72	0.543-0.957	0.023
	Psychoticism	1.45	1.173-1.812	**0.001**
	Obsessive-Compulsivity	1.12	0.935-1.344	0.219
	Hostility	0.87	0.694-1.086	0.216
SB+NSSI	Somatization	0.95	0.871-1.033	0.228
	Interpersonal sensitivity	0.93	0.828-1.038	0.187
	Depression	1.10	1.022-1.188	**0.011**
	Anxiety	1.02	0.893-1.154	0.818
	Phobic anxiety	0.95	0.844-1.058	0.323
	Paranoid ideation	0.93	0.807-1.072	0.320
	Psychoticism	1.19	1.051-1.345	**0.006**
	Obsessive-Compulsivity	1.02	0.926-1.118	0.723
	Hostility	1.01	0.892-1.133	0.931

SB=adolescents with suicidal behaviour, but without non-suicidal selfinjury;
NSSI=adolescents with non-suicidal self-injury, but without suicidal behaviour;
SB + NSSI=adolescents with both suicidal behaviour and nonsuicidal self-injury

Risk factors related to self-harming
behaviour in Finnish adolescent inpatients
with a history of non-suicidal self-injury,
suicidal behaviour or both

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

Discussion

The aim of the present study was to study differences between adolescent inpatients with different kinds of self-harming behaviour. As compared to previous inpatient studies with approximately 30% of adolescents being engaged in NSSI (7,25), the prevalence of our adolescents with NSSI only, turned out to be remarkably low (4.9%). This is most probably explained by the Finnish treatment culture, where patients with NSSI are mainly treated in outpatient clinics. In accordance with previous studies (7,25) approximately 30% of our inpatients showed a history of SB but no NSSI. The prevalence of adolescents with a history of both SB and NSSI was approximately 23%. In earlier studies, the prevalence of these inpatients has ranged from 18.9% (26) to 30.9% (7), and even up to over 70% (25,27). Despite these somewhat inconsistent findings, it looks clear that NSSI and SB often co-occur. Indeed, studies have demonstrated that NSSI is a strong risk factor for later suicidality (26,28-29) even after adjusted for other risk factors (1,30) and thus, NSSI could be regarded as a gateway toward more severe forms of self-harming behaviour. These findings indicate that NSSI should always be taken seriously in clinical settings in order to prevent later suicidality.

Both depressive and bipolar disorders were significantly associated with SB, but we were unable to find any other substantial relations between different diagnoses and self-harming groups. Our finding related to depressive disorders is in accordance with some earlier studies, which have reported that suicidal adolescents are more likely to have a diagnosis of depression compared to their counterparts with NSSI (31-32). Different from our finding, Hamza and colleagues (30) have reported that adolescents with both SB and NSSI are more likely have a diagnosis of major depressive disorder and post-traumatic stress disorder (PTSD) than adolescents with NSSI only (32). Further, NSSI, SB, as well as SB together with NSSI have all been associated with borderline personality disorder in adolescence (32). Unfortunately, we were unable to study this kind of relation, since, during the study period, personality disorder diagnoses were not made in the index study wards. Nowadays, borderline personality disorder diagnosis is made according to national Treatment Guideline.

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

Risk factors related to self-harming
behaviour in Finnish adolescent inpatients
with a history of non-suicidal self-injury,
suicidal behaviour or both

Focusing on ACE, adolescents with self-harming behaviour did not significantly differ from those with no self-harming behaviour with regard to parents' divorce, parental mental health or alcohol problems, witnessing intimate partner violence or physical abuse. In univariate analyses both sexual abuse and parents' criminality showed significant group differences. In multivariate analyses, however, only sexual abuse was significantly associated with SB with comorbid NSSI. This finding has been verified in numerous previous studies which all have reported that adolescents with both suicidality and NSSI commonly have experienced sexual and other abuse as well as childhood maltreatment (2,7,33-35). The relationship between abuse and maltreatment and later suicidality with NSSI appears to be explained by two factors (7). First, childhood abuse is a significant risk factor for future psychopathology, especially for internalizing problems (13,36-37). Secondly, being a victim of abuse and/or maltreatment habituates a person to pain, as well as to the anticipatory anxiety associated with pain.

In our sample, impulsivity was associated with SB with comorbid NSSI, but not with NSSI only. The finding is in accordance with a previous study by Dougherty and colleagues (38), which showed that adolescents with both SB and NSSI exhibit higher levels of impulsivity than their counterparts with NSSI only. It is known that adolescents with self-harming behaviour are more likely to report being bullied by their peers than their counterparts with no self-harming behaviour (39). It has also been reported that, among suicidal adolescents, loneliness increased the risk of self-mutilation to almost 6-fold (40). In the present study, subjective social dysfunction was associated with NSSI only. The finding is interesting, since it has previously been reported that adolescents with NSSI only tend to show less psychosocial dysfunction compared to SB and NSSI and those with SB only (1).

Self-reported depressive symptoms were associated with both SB and SB with comorbid NSSI, and the finding is in line with several previous studies (1,41). Our finding that self-reported psychoticism was associated with all self-harming groups is less often discussed in earlier studies. Stewart and colleagues (2) reported higher rates of psychotic symptoms among adolescents with no current suicide ideation and no lifetime suicide attempts, and among those with current ideation and at least one lifetime attempt, compared to adolescents with current ideation and no lifetime attempts. On the other hand, in a community sample by Honings and colleagues (42), psychotic symptoms were regarded as a risk factor of both suicide ideation and suicide attempt. The explanation for our finding might be that all self-harming groups associate with depressive symptoms (43) and dissociative experiences (44), usually due to ACE and/or a borderline personality disorder (43). These depressive and dissociative symptoms, in turn, link to symptoms of psychoticism (45-46).

Risk factors related to self-harming
behaviour in Finnish adolescent inpatients
with a history of non-suicidal self-injury,
suicidal behaviour or both

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

Strengths and limitations

One of the strengths of this study was its relatively high number of consecutive inpatients. However, of the eligible inpatients, as many as 109 (34.6%) dropped out from the study. Dropping out was related to male gender and psychotic disorder. Boys are known to suffer from externalizing disorders more often than girls, which may have somewhat skewed our results. We used the highly reliable and valid semi-structured K-SADS-PL interviews to set the DSM-IV-based psychiatric diagnoses. Unfortunately, the inter-rater reliabilities of the diagnoses derived from the K-SADS-PL was not measured. A structured background data collection sheet enabled us to consistently collect background information on all inpatients. However, data was partly collected retrospectively, which may have introduced a recall bias. The study method did not allow us to separate intra- and extrafamilial sexual abuse. In the hospital area, where the study took place, adolescent patients with neuropsychiatric, substance use and serious eating disorders are referred to special tertiary units rather than to local adolescent psychiatric wards. Further, in Finland, most adolescents with severe conduct disorders receive treatment under child welfare services, not under the specialty of adolescent psychiatry.

References

1. Grandclerc S, De Labrouhe D, Spodenkiewicz M, Lachal J, Moro M-R. Relations between nonsuicidal self-injury and suicidal behavior in adolescence: A systematic review. PLoS One 2016; 11(4): e0153760.

2. Stewart J, Esposito E, Glenn C, Gilman S, Pridgen B, Gold J, Auerbach R. Adolescent self-injurers: Comparing non-ideators, suicide ideators, and suicide attempters. J Psychiatr Res 2017; 84: 105-12.

3. Andover M, Gibb B. Non-suicidal self-injury, attempted suicide, and suicidal intent among psychiatric inpatients. Psychiatry Res 2010; 178: 101-5.

4. Muehlenkamp J, Gutierrez P. Risk for suicide attempts among adolescents who engage engage in non-suicidal self-injury. Arch Suicide Res 2007;11:69-82.

5. Van Orden K, Witte T, Cukrowicz K, Braithwaite S, Selby E, Joiner T. The interpersonal theory of suicide. Psychol Rev 2010; 117: 575-600.

6. Baetens I, Claes L, Muehlenkamp J, Grietens H, Onghena P. Non-Suicidal and Suicidal self-injurious behavior among Flemish adolescents: A Web-Survey. Arch Suicide Res 2011; 15: 56-67.

7. Boxer, B. Variations in risk and treatment factors among adolescents engaging in different types of deliberate self-harm in an inpatient sample. J Clin Child Adolesc Psychol 2010; 39: 470-80.

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

Risk factors related to self-harming behaviour in Finnish adolescent inpatients with a history of non-suicidal self-injury, suicidal behaviour or both

8. Gulbas L, Hausmann-Stabile C, De Luca S, Tyler T, Zayas L. An exploratory study of non-suicidal self-injury and suicidal behaviors in adolescent Latinas. Am J Orthopsychiatry 2015; 85: 302-14.

9. Muehlenkamp J, Brausch A, Quigley K, Whitlock J. Interpersonal features and functions of nonsuicidal self-injury. Suicide Life Threat Behav 2013; 43: 67-80.

10. Goldston D, Daniel S, Reboussin D, Frazier P, Harris A. Cognitive risk factors and suicide attempts among formerly hospitalized adolescents: A prospective naturalistic study. J Am Acad Child Adolesc Psychiatry 2001; 40: 91-9.

11. Nock M, Mendes W. Physiological arousal, distress tolerance and social problem-solving deficits among adolescent self-injurers. J Consult Clin Psychol 2008; 76: 28-38.

12. Muehlenkamp J, Gutierrez P. An investigation of differences between self-injurious behavior and suicide attempts in a sample of adolescents. Suicide Life Threat Behav 2004; 34: 12-23.

13. Rytilä-Manninen M, Lindberg N, Haravuori H, Kettunen K, Marttunen M, Joukamaa M, Fröjd S. Adverse childhood experiences as risk factors for serious mental disorders and inpatient hospitalization among adolescents. Child Abuse Negl 2014; 38: 2021-32.

14. Kaufman J, Birmaher B, Brent D, Rao U, Flynn C, Moreci P, Williamson D, Ryan N. Schedule for Affective Disorders and Schizophrenia for School-Age Children-Present and Lifetime Version (K-SADS-PL): Initial Reliability and Validity Data. J Am Acad Child Adolesc Psychiatry 1997; 36: 980-8.

15. Johnson JH, McCutcheon SM. Assessing life stress in older children and adolescents: preliminary findings with the Life Events Checklist. In JG Sarason & CD Spielberger (Eds.), Stress and Anxiety (pp. 111-112). Washington DC: Hemisphere Publishing, 1980.

16. Derogatis L, Lipman R, Covi L. SCL-90: an outpatient psychiatric rating scale-preliminary report. Psychopharmacology. 1973; 9: 13-28.

17. Rytilä-Manninen M, Fröjd S, Haravuori H, Lindberg N, Marttunen M, Kettunen K, Therman S. Psychometric properties of the Symptom Checklist-90 in adolescent psychiatric inpatients and age- and gender - matched community youth. Child Adolesc Psychiatry Ment Health 2016; 10: 23.

18. Offer D, Ostrov E, Howard K, Dolan S. Offer Self-Image Questionnaire, Revised (OSIQ-R). Los Angeles, California: Western Psychological Services, 1992.

19. Erkolahti R, Janssen J, Offer D, Steinhausen H. Comparison of the self-image of teenager in Finland, the United States, and Germany. J Adolesc Health 1992: 3: 392-5.

20. Laukkanen E, Halonen P, Viinamäki H. Stability and internal consistency of the Offer Self-Image Questionnaire: A study of Finnish Adolescents. J Youth Adolesc 1999; 28: 71-7.

21. Laukkanen E, Peiponen S, Halonen P, Aivio A, Viinamäki, H. Discriminant validity of the Offer Self-Image Questionnaire in Finnish 13-year-old adolescents. Nord J Psychiatry 1999; 53: 197-201.

22. Laukkanen E, Halonen P, Aivio A, Viinamäki H, Lehtonen J. Construct validity of the Offer Self-Image Questionnaire in Finnish 13-year-old adolescents: differences in the self-images of boys and girls. Nord J Psychiatry 2000; 54: 431-5.

23. Saunders J, Aasland O, Babor T, de la Fuente J, Grant M. Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. Addiction 1993; 88: 791-804.

24. Reinert D, Allen, J. The alcohol use disorders identification test (AUDIT): a review of recent research. Alcohol Clin Exp Res 2002; 26: 272-9.

Risk factors related to self-harming
behaviour in Finnish adolescent inpatients
with a history of non-suicidal self-injury,
suicidal behaviour or both

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

25. Wolff J, Frazier E, Esposito-Smythers C, Burke T, Sloan E, Spirito A. Cognitive and social factors associated with NSSI and suicide attempts in psychiatrically hospitalized adolescents. J Abnorm Child Psychol 2013; 41:1005-13.

26. Groschwitz R, Kaess M, Fischer G, Ameis N, Schulze U, Brunner R, Koelch M, Plener P. The association of non-suicidal self-injury and suicidal behavior according to DSM-5 in adolescent psychiatric inpatients. Psychiatry Res 2015; 228: 454-61.

27. Nock M, Joiner T, Gordon K, Lloyd-Richardson E, Prinstein M. Non-suicidal self-injury among adolescents: Diagnostic correlates and relation to suicide attempts. Psychiatry Res 2006; 144: 65-72.

28. Klonsky E, May A, Glenn C. The relationship between nonsuicidal self.injury and attempted suicide: converging evidence from four samples. J Abnorm Psychol 2013; 122: 231-7.

29. Wilkinson P, Kelvin R, Roberts C, Dubicka B, Goodyer I. Clinical and psychosocial predictors of suicide attempts and nonsuicidal self-injury in the adolescent depression antidepressants and psychotherapy trial (ADAPT). Am J Psychiatry 2011; 168: 495-501.

30. Hamza C, Stewart S, Willoughby T. Examining the link between nonsuicidal self-injury and suicidal behavior: A review of the literature and an integrated model. Clin Psychol Rev 2012; 32: 482-95.

31. Claes L, Muehlenkamp J, Vandereycken W, Hamelinck L, Martens H, Claes S. Comparison of non-suicidal self-injurious behavior and suicide attempts in patients admitted to a psychiatric crisis unit. Personal Individ Dif 2010; 48: 83-7.

32. Jacobson C, Muehlenkamp J, Miller A, Turner B. Psychiatric impairment among adolescents engaging in different types of deliberate self-harm. J Clin Child Adolesc Psychol 2008; 37:363-75.

33. Asarnow JR, Porta G, Spirito A, Emslie G, Clarke G, Wagner KD, Vitiello B, Keller M, Birmaher B, McCracken J, Mayes T, Berk M, Brent DA. Suicide attempts and nonsuicidal self-injury in the treatment of resistant depression in adolescents: Findigs from the TORDIA study. J Am Acad Child Adolesc Psychiatry 2011; 50: 772-81.

34. King C, Merchant C. Social and interpersonal factors relating to adolescent suicidality: A review of the literature. Arch Suicide Res 2008; 12: 181-96.

35. Whitlock J, Knox K. The relationship between self-injurious behavior and suicide in young adult population. Arch Pediatr Adolesc Med 2007; 161: 634-40.

36. Gilbert R, Widom C, Browne K, Fergusson D, Webb E, Janson S. Burden and consequences of child maltreatment in high-income countries. Lancet 2009; 373: 68-81.

37. Schilling E, Aseltine R Jr, Gore S. Adverse childhood experiences and mental health in young adults. BMC Public Health; 2007; 7: 30.

38. Dougherty D, Mathias C, Marsh-Richard D, Prevette K, Dawes M, Hatzis E, Palmes G, Nouvion S. (2009). Impulsivity and clinical symptoms among adolescents with non-suicidal self-injury with or without attempted suicide. Psychiatry Res 2009; 169: 22-7.

39. Fisher H, Moffit T, Houts R, Belsky D, Arseneault L, Caspi A. Bullying victimization and risk of self harm in early adolescence: longitudinal cohort study. BMJ 2012; 344: e2683.

40. Guertin T, Lloyd-Richardson E, Spirito A, Donaldson D, Boergers J. Self-mutilative behavior in adolescents who attempt suicide by overdose. J Am Acad Child Adolesc Psychiatry 2001; 40:1062-9.

41. Hawton K, Saunders K, O'Connor R. Self-harm and suicide in adolescents. Lancet 2012; 379: 2373-82.

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30

Risk factors related to self-harming behaviour in Finnish adolescent inpatients with a history of non-suicidal self-injury, suicidal behaviour or both

42. Honings S, Drukker M, Groen R, van Os J. Psychotic experiences and risk of self-injurious behavior in the general population: a systematic review and meta-analysis. Psychol Med 2016; 46: 237-51.

43. Haw C, Hawton K, Houston K, Townsend E. Psychiatric and personality disorders in deliberate self-harm patients. Br J Psychiatry 2001; 178: 48-54.

44. Peterson J, Freedenthal S, Sheldon C, Andersen R. Nonsuicidal self injury in adolescents. Psychiatry (Edgmont) 2008; 5: 20-6.

45. Devillé C, Moeglin C, Sentissi O. Dissociative disorders: between neurosis and psychosis. Case Rep Psychiatry. 2014; 2014:425892.

46. Schroeder K, Fisher H, Schäfer I. Psychotic symptoms in patients with borderline personality disorder: prevalence and clinical management. Curr Opin Psychiatry 2013; 26: 113-9.

Minna Rytilä-Manninen, MNSc
Helsinki University and Helsinki University Hospital, Adolescent Psychiatry

Henna Henna, MD, PhD
Helsinki University and Helsinki University Hospital, Adolescent Psychiatry
National Institute for Health and Welfare, Mental Health Unit

Kirsi Kettunen, MD
Helsinki University and Helsinki University Hospital, Adolescent Psychiatry

Sari Fröjd, PhD, docent
Tampere University, School of Health Science

Mauri Marttunen, MD, PhD, professor
Helsinki University and Helsinki University Hospital, Adolescent Psychiatry

Nina Lindberg, MD, PhD, professor
Helsinki University and Helsinki University Hospital, Forensic Psychiatry

Correspondence:
minna.rytila-manninen@hus.fi

Risk factors related to self-harming
behaviour in Finnish adolescent inpatients
with a history of non-suicidal self-injury,
suicidal behaviour or both

Rytilä-Manninen et al.
Psychiatria Fennica 2017;48:13-30