Tampere University

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Finnish Adolescents Treated in Psychiatric Inpatient Care from 1980 to 2010 and Their Long-term Life Situations

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ACADEMIC DISSERTATION
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ABSTRACT

Mental disorders during adolescence are often diverse and variable. They often recur in or continue into adulthood and have a significant impact on adolescents' future. Earlier research has shown that adolescent-onset mental disorders are associated, for example, with less education, lower socioeconomic status, increased criminality and also increased hospitalization and mortality. Since the 1980s the adolescent psychiatric services in Finland have undergone developments aiming to treat mental disorders by taking account of the developmental stage of the patient. These exceptional services are expected to improve the outcomes of early onset mental disorders.

Comprehensive follow-up studies are crucial for the prognosis of mental disorders during adolescence and therefore in preventing marginalization. This register-based study examined subsequent use of psychiatric inpatient care, criminality, education and mortality among those Finnish adolescents aged 13-17 who had their first psychiatric inpatient care during adolescence between 1980 and 2010. Incidence and prevalence of schizophrenia was also studied. Subjects (N 17112) were followed up in the registers of the Finnish Institute of Health and Welfare, the Finnish Centre for Pensions and Statistics Finland until end of 2014.

An increase in adolescent psychiatric inpatient care was observed from the mid-1990s, the growth being especially prominent in the late 2000s. An increasing proportion of adolescents were hospitalized in psychiatric inpatient care, the growth being especially prominent in girls. The proportion of mood disorders as the primary diagnostic reason for inpatient care increased significantly, but this could not be explained by epidemiological reasons, but instead by changes in society and healthcare policies.

There was a decrease in length of stay, especially in the 1980s and 1990s, but this seemed not to impair the the prognoses of mental disorders nor to increase the risk for rehospitalization. Mental disorders requiring adolescent psychiatric inpatient care were observed to have a negative effect on adolescents' future. The educational level of those adolescents who had been psychiatric inpatients was generally lower than that in general population; only 50% of those had completed post-comprehensive school education compared to 85% of general population. Those needing inpatient

care due to externalizing disorder (conduct, personality or substance use disorder) or schizophrenia spectrum psychoses diagnoses were at risk for lower educational attainment. Those with externalizing disorder diagnoses were also at the higher risk for criminal behaviour. Also, those adolescents undergoing psychiatric inpatient care had a high risk for later receiving a diagnosis of schizophrenia diagnosis. Despite the development and increased availability of outpatient and other support services in recent decades, the outcomes of mental disorders requiring inpatient care during adolescence have not shown any marked improvement.

Severe mental disorders compromise normal adolescent development, increase the risk of antisocial development and of marginalization due to the negative effect, for example on the educational pathway. Therefore, it is important to focus on adequate support in everyday life, availability of psychiatric care and school welfare especially in those adolescents with episodes of psychiatric inpatient care. It is beneficial to aim at keeping the duration of inpatient care is as short as possible and keeping adolescents' care and rehabilitation as close as possible to their environment in everyday life.

TIIVISTELMÄ

Nuoruusiän mielenterveyshäiriöt ovat usein hyvin monimuotoisia ja muuttuvia sekä usein ne jatkuvat aikuisuuteen tai uusiutuvat myöhemmin. Niillä voi olla myös huomattava vaikutus nuoren tulevaisuuteen, kun aiemmissa tutkimuksissa ne on liitetty esimerkiksi alhaisempaan koulutustasoon ja sosioekonomiseen asemaan sekä lisääntyneeseen rikollisuuteen, kuolleisuuteen ja sairaalahoidon käyttöön. Suomessa on etenkin 1980-luvulta lähtien rakennettu ainutlaatuista, ikävaihespesifillä tavalla mielenterveyshäiriöitä hoitavaa nuorisopsykiatrisen palvelujärjestelmää, jonka on odotettu parantavan nuoruusiän mielenterveyshäiriöiden ennustetta.

Mielenterveyshäiriöiden ennusteen sekä siten esim. syrjäytymisen ehkäisemiseksi tarvitaan laaja-alaisia seurantatutkimuksia. Tässä väitöskirjatutkimuksessa selvitettiin rekisteritutkimuksen keinoin Suomessa vuosien 1980–2010 aikana nuoruusiässä (13–17 v) ensimmäistä kertaa psykiatriseen sairaalahoitoon joutuneiden (N 17112) myöhempää psykiatrisen sairaalahoidon käyttöä, rikollisuutta, koulutusta, kuolleisuutta sekä skitsofrenian esiintyvyyttä ja ilmaantuvuutta. Tutkimuksessa tutkittavia seurattiin Terveyden ja hyvinvoinnin laitoksen, Eläketurvakeskuksen sekä Tilastokeskuksen rekistereissä vuoden 2014 loppuun saakka.

Tutkimuksessa havaittiin nuorisopsykiatrisen sairaalahoidon määrän lisääntyneen 1990-luvun puolivälistä lähtien kasvun ollessa erityisen voimakasta 2000-luvun loppupuolella ikäryhmästään yhä useamman nuoren, erityisesti tyttöjen, oltua hoidettavana nuorisopsykiatrisella osastolla. Mielialahäiriödiagnoosin osuus hoidon syynä kasvoi merkittävästi, mutta tämä ei ole selitettävissä epidemiologisin syin vaan todennäköisesti taustalla on yhteiskunnan muutokset ja terveyspoliittiset tekijät. Sairaalahoitojaksot lyhenivät erityisesti 80- ja 90-luvuilla, mutta tämä ei näytä huonontaneen ennustetta tai lisänneen uudelleen sairaalahoitoon joutumisen riskiä.

Nuorisopsykiatrista sairaalahoitoa edellyttävillä mielenterveyshäiriöllä oli havaittavissa negatiivinen vaikutus hoidossa olleiden nuorten tulevaisuuteen. Sairaalahoidossa olleiden koulutustaso jäi muuta samanikäistä väestöä huonommaksi, kun vain 50% hoidossa olleista oli suorittanut peruskoulun jälkeisen koulutuksen verrattuna 85% vastaavan ikäisestä väestöstä. Erityisessä riskissä alhaiseen koulutustasoon olivat externalisoivan häiriön (päihdehäiriö, käytöshäiriö, persoonallisuushäiriö) tai skitsofreniaryhmän psykoosin vuoksi sairaalahoidossa

olleet., minkä lisäksi eksternalisoivan häiriön vuoksi sairaalahoidossa olleet olivat myös kohonneessa riskissä syyllistyä rikoksiin. Nuorisopsykiatrisessa sairaalahoidossa olleilla oli myös suuri riski saada myöhemmin skitsofreniadiagnoosi. Vaikka viimeisten vuosikymmenten aikana nuorisopsykiatristen palveluita ja muita tukimuotoja onkin kehitetty aktiivisesti sekä niiden saatavuus on parantunut huomattavasti, kuitenkaan nuoruusiässä sairaalahoitoa edellyttäneiden mielenterveyshäiriöiden ennuste ei näytä silti parantuneen huomattavasti.

Vakavat mielenterveyden häiriöt vaarantavat normaalia nuoruusiän kehitystä, lisäävät riskiä antisosiaaliselle kehityssuunnalle sekä syrjäytymiselle vaikuttamalla negatiivisesti mm. kouluttautumiseen. Sen vuoksi on syytä kiinnittää huomiota riittävään arjen tukeen, psykiatriseen hoitoon, opiskelun tukemiseen erityisesti nuorisopsykiatrisessa sairaalahoidossa olleiden kohdalla. Hyödyllistä olisi pyrkiä mahdollisimman lyhyisiin osastojaksoihin ja siirtää nuoren hoidon ja kuntoutuksen fokus mahdollisimman lähelle nuoren normaalia arjen toimintaympäristöä

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ABBREVIATIONS

ADHD	attention-deficit hyperactivity disorder
CI	confidence interval
GAS	global assessment scale
HR	hazard ratio
ICD	International Classification of Diseases
LOS	length of stay
MR	mortality rate
OR	odds ratio
SCH	schizophrenia
SD	standard deviation
WHO	World Health Organization

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LIST OF ORIGINAL PUBLICATIONS

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AUTHOR'S CONTRIBUTION

Study I: The author of this dissertation participated in the design of the study, performed the data preparation and all statistical analyses, and participated in the drafting and the revision of the manuscript.

Studies II, III and IV: The author of this dissertation participated in the design of the study, performed the data preparation and all statistical analyses, wrote the first draft of the manuscript, and participated in the revision of the manuscript

1 INTRODUCTION

Psychiatric morbidity increases exponentially from childhood to adolescence. For example, the prevalence of depression, anxiety disorders, conduct disorder, substance use and eating disorders increases significantly and many psychotic disorders also have their onset during adolescence (Paus et al., 2008; Solmi et al., 2021). Adolescent-onset mental disorders commonly continue to or recur in adulthood (Fichter et al., 2009; Jones, 2013; Kim-Cohen et al., 2003). Mental disorders during adolescence have a significant negative impact on a young person's future life, affecting, for example, education, employment, and socioeconomic status. Also, research has shown that adolescents who have been in psychiatric care during adolescence made more use of healthcare and social services in later and were more likely to obtain disability benefits or have higher mortality rates (Asselmann et al., 2018; Fichter et al., 2009; Gibb et al., 2010; Kjelsberg & Dahl, 1998; R. S. C. Lee et al., 2017). Therefore, mental disorders during adolescence place a considerable burden on their lives and their quality of life.

Since the 1980s there has been shift in focus in Finnish psychiatric care from inpatient-centric care to more outpatient-centric care due to deinstitutionalization ideology. Community and outpatient care have thought to be more integrative, more humane and more therapeutically effective than inpatient care (Alanko, 2017). This change has been more profound in adult psychiatry than in adolescent psychiatry as in adolescent psychiatric services there was still an increase in available hospital beds in the 1990s and early 2000s, with major growth in and development of outpatient care services occurring in the 2000s. Although the decrease in the use of inpatient care has caused concern in the prognoses of mental disorders, and especially fear of increased mortality, no research evidence supporting this has been presented (Johannessen et al., 2009; Meagher et al., 2012; Swadi & Bobier, 2005). The availability of more effective treatments, for example medications, and the increased availability and development of community and outpatient care have been thought to contribute to better prognoses (Johannessen et al., 2009). This ought to be especially apparent among adolescent psychiatric patients; as adolescent psychiatric services, like other support services such as social care, school welfare and

educational support benefitted from increased funding and resources in the early 2000s because of increased concern about adolescents' mental health among the public and policymakers.

Longitudinal studies on mental disorders commonly focus on only specific mental disorders, whereas mental disorders during adolescence are often quite diverse and variable. Therefore, there is need for studies focusing holistically on mental health problems in adolescence. Follow-up studies with long enough follow-up time are needed to evaluate the impact of mental disorders especially on later life, and to prevent marginalization due to mental health problems. Only few studies have been presented in Finland on those receiving psychiatric care during adolescence and their subsequent morbidity, use of healthcare and social services and overall later life trajectories, for example education, employment and disability, mortality and criminality. Also, while there has been a significant increase in the availability of adolescent psychiatric services and services have been actively developed, studies focusing on the impact of these on prognoses are scarce

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2 REVIEW OF THE LITERATURE

2.1 Adolescence

As the great ancient Greek philosopher Aristotle once noted: "The young are heated by nature as drunken men by wine", adolescence is a period of life beset by numerous emotional and behavioural changes marked by confusion in the minds of teenagers as well as the adults surrounding them. However, the future of societies depends on their success in providing pathways whereby young people can develop and prepare themselves to be contributing adults to their communities (Larson et al., 2002). In preindustrial societies the period of adolescence was relatively short, but with earlier puberty, an upward shift in the timing of parenthood resulting from extended education, changing social norms regarding marriage and parenthood in modern societies, adolescence has extended, taking a greater proportion of the life and being more relevant for human development than ever before. Extended adolescence creates an opportunity to acquire greater assets and capabilities and has been accompanied by the emergence of distinct youth cultures, greater media and peer engagement. Yet it has also created shifting patterns of health and health risk (Patton et al., 2018).

2.1.1 Definition of adolescence

The definition of adolescence has long been problematic. As the phase of life stretching between childhood and adulthood, it is commonly accepted that it begins with puberty, the endpoint being less precisely defined. At the beginning of 20th century, the pioneering American psychologist Hall in his treatise on adolescence loosely defined adolescence as the developmental period ranging from age 14 to 24 years. (Hall, 1904). The World Health Organization later defined adolescence as the phase of life between childhood and adulthood ranging from ages 10 to 19 (WHO, 2001). However, with a better understanding of adolescence development in recent years, it has been proposed that a definition of 10-24 would correspond more

correspond more closely to adolescent growth and popular understanding. (Sawyer et al., 2018).

In research adolescence is often divided to three different stages: early adolescence, middle adolescence and late adolescence/young adulthood, although there is less uniformity in agreement on age ranges of stages especially between early and middle adolescence (Blos, 1962; Feixa, 2011; Feldman & Elliott, 1990; Sawyer et al., 2018). Blos divided adolescence into early adolescence 13-15 years, adolescence proper 15-18 years and late adolescence 18-20 years (Blos, 1962). Elliot et al. (Feldman & Elliott, 1990) defined early adolescence as 10-14 years, middle as 15-17 years, and late adolescence as 18 to the mid-20s. The same definition is also used in this study.

2.1.2 Development in adolescence

Adolescence is a period of marked and rapid physiological, psychological (cognitive and emotional) and social changes. To develop from a child in need of adults' support into an independent, emotionally mature adult, adolescents need to go through important developmental tasks that can be summarized as the achievement of biological and sexual maturation, the development of personal identity, the development of intimate sexual relationships with an appropriate peer and the establishment of independence and autonomy in the context of the sociocultural environment. (Christie & Viner, 2005)

Puberty marks the beginning of adolescence. It is characterized by the development of secondary sexual characteristics and gonadal maturation leading to the attainment of reproductive capacity. It is iniatiated by the reactivation of the hypothalamic-pituitary-gonadal axis by an underlying mechanism not yet fully understood (Patton & Viner, 2007)

During adolescence there are notable changes in brain structure and function. Imaging studies have observed a loss of grey matter by synaptic pruning throughout the cerebral cortex, especially in portions of the prefrontal cortex and temporal lobe, but also in the subcortical structure (Galván, 2021; Sturman & Moghaddam, 2011; Vijayakumar et al., 2018). At the same time there is an increase in white matter by increased myelination, axonal remodelling in cortical and subcortical networks, especially in connection to prefrontal cortex (Paus, 2010; Vijayakumar et al., 2018). During adolescence prominent changes occur in neurotransmitter systems, particularly in glumatinergic and gamma-aminobutyric acidergic systems (Sturman &

Moghaddam, 2011). These changes in brain morphology, in neural networks and in neurotransmitters affect the progression of cognitive development, for example, by enhancing cognitive control capacities by functional specialization, maturation of prefrontal cortex and by reducing competitive activity and interference between irrelevant brain networks (Galván, 2021; Steinberg, 2005; Sturman & Moghaddam, 2011). This leads to notable development and maturation in cognitive abilities for learning and memory, but also in aggression and affect regulation (Galván, 2021; Steinberg, 2005).

Adolescence is also a crucial and sensitive period for social change and development with increased autonomy from parents and individuation. During adolescence, together with cognitive development, there is also increased maturation of social cognitive skills (for example emotion recognition, mentalizing, face processing) with skills becoming more sophisticated (Galván, 2021). This is facilitated by the development of the brain areas and neural circuits responsible for socio-cognitive processing (social brain), but more time spent with peers also supports the development of sensitivity for social affective input (for example, recognition of others' emotions) and readiness to take account of others' perspectives and feelings, also known as mentalizing (Galván, 2021). Although peer relationships support decreasing dependency on familial relationships, they also predispose adolescents to reward-seeking behaviour and risk-taking affecting decision-making (Gardner & Steinberg, 2005). Also, sensitivity to peer feedback, fear of social rejection and the tendency for the immature brain to make flawed interpretations predispose adolescents to increased social stress and therefore to increased risk for poorer mental health (Galván, 2021; Nelson et al., 2005).

2.2 Psychiatric disorders in adolescence

The rapid physical, emotional, social and cultural changes in youth predispose adolescents to mental disorders as the prevalence of these increases significantly from childhood to adolescence (Costello et al., 2011; Patel et al., 2007; Paus et al., 2008; Solmi et al., 2021)

The lifetime prevalence of mental disorders is estimated to mean that from one third to almost a half of general population will have some kind of mental disorder during their lifetime (Kessler et al., 2005; Steel et al., 2014) and that most of these have their onset in youth or in young adulthood, thereby accounting for a large proportion of the burden of disease in young people (Kessler et al., 2005; Patel et

al., 2007; Paus et al., 2008; Solmi et al., 2021). In a large meta-analysis of 192 epidemiological studies world-wide, Solmi et al. (Solmi et al., 2021) estimated that 48% of all mental disorders had their onset during childhood and adolescence (by 18 years) the proportions depending on the disorder (Figure 1). The median age at onset of all mental disorders was 18 years (peak age 14.5) with naturally neurodevelopmental disorders (such as autism spectrum disorders, ADHD) having the lowest age of onset (median 12). Anxiety and eating disorders commonly had onset by age 18, median age of onset for all anxiety disorders 17 and for eating disorders 18. Among anxiety disorders social anxiety disorders had the highest proportion (79%) onsetting by age 18 (median age of onset 13), while among eating disorders the onset of anorexia nervosa was typical during adolescence as 18% of anorexia nervosa diagnoses were set by 14 years and 55% by 18 years (median age 17). For mood disorders median age of onset was 31, with 12% having onset by the age 18. For schizophrenia onset the median age was 25 years with only 8.2% of diagnoses being set by age 18. (Solmi et al., 2021)

In a nationwide study of English-speaking residents in the USA Kessler et al. found that of all lifetime mental disorders half had their onset by age 14 and three fourths by age 24. Anxiety and impulse-control disorders had earlier median age of onset (11 years for both) than mood disorders (30 years) or substance use (20 years) (Kessler et al., 2005).

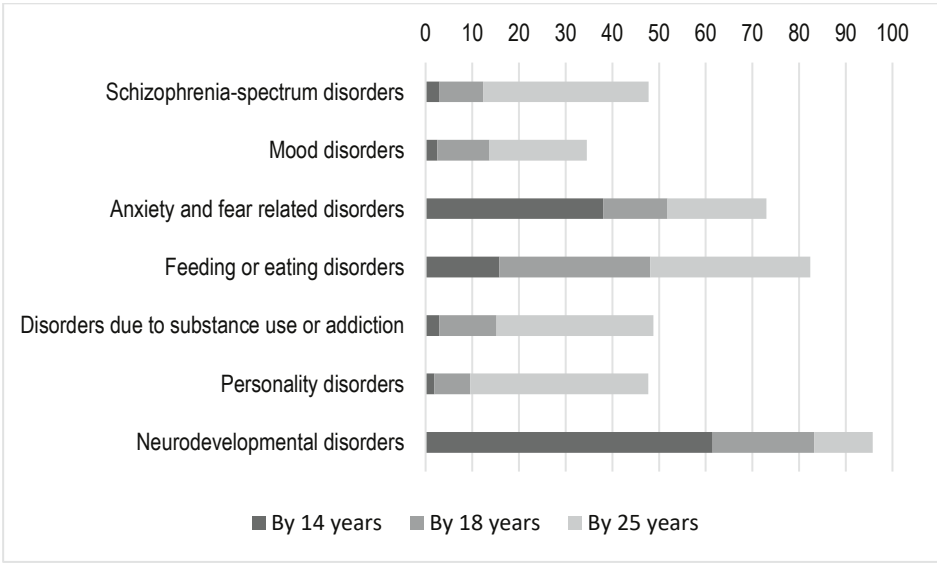

Figure 1. Proportion (%) of mental disorders onset by age according to Solmi et al., 2021

2.2.1 Incidence and prevalence of psychiatric disorders in adolescence

In epidemiological studies on child and adolescent mental disorders, 15-40% of young people had at least one diagnosable mental disorder, with anxiety, mood and behavioural disorders (including ADHD) being the most common (Table 1)

In a meta-analysis of 41 studies in 27 countries around the world on the prevalence of mental disorders in children and adolescents, Polanczyk et al. found that the worldwide pooled prevalence was 13.4% for any mental disorder, 6.5% for anxiety disorders, 2.6% for depressive disorders, 3.4% for ADHD and 5.7% for any disruptive disorder (Polanczyk et al., 2015). In a systematic review and meta-analysis of 43 studies focusing on mental disorders in adolescents aged 10 to 19, Silva et al. found that the prevalence of common mental disorders was 25–31 % and was higher among females (Silva et al., 2020).

Anxiety and mood disorders tend to be more prevalent among females than males while externalizing disorders (such as conduct disorder, ADHD, substance use) are more prevalent among males although the incidence for anxiety and mood disorders may be higher in childhood in males than in females with the ratios reversing in adolescence (Costello et al., 2003, 2011; Dalsgaard et al., 2020)

Incidence and prevalence of psychotic disorders, especially schizophrenia, in adolescents had been somewhat less explored in extensive epidemiological studies, probably due to their relative rarity in general population especially in childhood and early adolescence (McClellan M.D & Stock M.D, 2013). Although onset of schizophrenia has begun to show a significant increase in males at around age 15, reaching a maximum in early adulthood (age 15 to 24 years) and in females slightly later with a peak around ages 15 to 30 years (Häfner, 2019) only a small proportion of lifetime schizophrenia diagnoses are set before the age of 18 (Okkels et al., 2013). In a Danish study on the incidence of early onset schizophrenia (onset before 18 years) between years 1971 and 2010 Okkels et al. found that the incidence rate of early onset schizophrenia was 9.1 per 100 000 person-years in age group 12–18 years with the male preponderance disappearing in more recent years (Okkels et al., 2013). Another large Danish register study found that 0.76% of females and 0.5% of males born 1996–2016 had schizophrenia spectrum disorder and 0.2% of females and 0.1% of males a schizophrenia diagnosis by age 18 (Dalsgaard et al., 2020).

Table 1. Epidemiological studies on adolescent mental disorders

Author	Study population	Results
Costello et al. 2003	N 1420 USA, 9-13y old at intake, followed until age 16.	Cumulative prevalence of psychiatric disorder 36.7% (31% of females, 42% of males) by age 16. 9.9% anxiety disorder (12.1% females, 7.7% males) 9.5% depressive disorder (11.7%, 7.3%) 23.0% Any behavior disorder (16.1%, 29.9%)
Kessler et al, 2012	N 10123, USA, 13-17y	40.3% any psych disorder (12 month prevalence) 24.9% anxiety disorder 10.0% mood disorder 16.3% behaviour disorders 8.3% substance use
Roberts et al. 2007	N 4175, USA, age 11-17	17.1% any psych diagnosis in past year 6.9% anxiety disorder 3.0% mood disorder 8.5% behaviour disorder (conduct or ADHD) 5.3% substance use
Merikangas et al. 2010	N 10123 USA, age 13-18y,	51% any psych disorder (22.2% severe impairment) 31.9% anxiety disorder (8.3% severe) 14.3% mood disorder (11.2% severe) 19.6% behavior disorder (9.6% severe)
Lopes et al, 2016	N 74589, Brazil, age 12-17	30.0% any psychiatric disorder (38.4 female, 21.6% male)
Dalsgaard et al. 2020	1.3 million born in 1995-2016, Denmark, followed-up to end of 2016	15% any mental disorder diagnosis by age 18. (14.6% females, 15.5% males) 7.9 % females, 4.6% males anxiety disorder 2.5% females, 1.0% males mood disorder 3.5% females, 7.3% males behavior disorder (conduct or adhd) 0.76% females, 0.5% males schizophrenia spectrum disorder (0.2%, 0.1% schizophrenia dg)
Li et al. 2022	N 73992, China, age 6-16	17.5% point prevalence of any psych disorder 4.7% anxiety disorder 3.0% mood disorder 10.2% behaviour disorder (conduct, ADHD)

2.2.2 Continuity of adolescent psychiatric disorders

A majority of mental disorders in adults have their roots in adolescence or even in childhood as many of the mental disorders onsetting in adolescence continue or recur in adulthood (Castagnini et al., 2016; Colman et al., 2007; Copeland et al., 2013; Fichter et al., 2009; Kessler et al., 2005; Kim-Cohen et al., 2003; Solmi et al., 2021). Continuity can be roughly divided into homotypic or heterotypic. Homotypic continuity of mental disorders means that later disorders are preceded by their manifestations in earlier developmental phases whereas heterotypic continuity occurs when a particular disorder predicts another subsequent disorder (Fichter et al., 2009; Schwarz et al., 2016).

The most marked homotypic continuity of all psychiatric disorders has been observed in schizophrenia; 80-90% of those adolescents with a schizophrenia diagnosis continue to have it as adults (Castro-Fornieles et al., 2011; Fraguas et al., 2008; Hollis, 2000; Remberk et al., 2014). In bipolar disorders, too, diagnostic stability from adolescence to adulthood has been found to be strong in spite of a considerable shift towards schizophrenia diagnosis. (Castro-Fornieles et al., 2011; Consoli et al., 2014; Lewinsohn et al., 2000). In externalizing disorders (such as conduct disorders, ADHD, substance use) continuity is common and characterized by homotypic or diagnostic shifting typically occurring in externalizing group diagnoses (Copeland et al., 2013).

In other disorders heterotypic continuity is more common: depressive disorders predict anxiety disorders, generalized anxiety predicts depression and oppositional defiant disorder predicts both depression and anxiety (Copeland et al., 2009, 2013; Costello et al., 2011; Ranøyen et al., 2018). In almost all mental disorders there is also a transition towards schizophrenia (Andersen et al., 2013; Consoli et al., 2014; Dalsgaard et al., 2013; Kim-Cohen et al., 2003), with over 70% of young adults with schizophrenia having had some preceding psychiatric diagnosis with onset in childhood and adolescence (Andersen et al., 2013). Those with psychotic disorder diagnoses other than schizophrenia have been found to be at especially elevated risk for later schizophrenia diagnosis as at least almost a third of them will later have a schizophrenia diagnosis (Castro-Fornieles et al., 2011; Conrad et al., 2016; Correll et al., 2005; Fraguas et al., 2008; Maibing et al., 2015).

Moreover, as psychiatric comorbidity is very common among adolescents, a specific disorder may also present with multiform symptoms and therefore meet the diagnostic criteria for several disorders (Angold et al., 1999; Ranøyen et al., 2018).

2.3 Mental health services for adolescents in Finland

While in many countries there are some kind of mental health services treating only adolescents, the general availability of these tends to be low with many professionals reporting a lack of mental health care facilities specifically dedicated to adolescents (Coppens et al., 2015; Remschmidt & Belfer, 2005). In Europe, an exception to this is Finland, where the availability of four main types of adolescent mental health services (residential care services, day care services, home-based services and outreaching care and outpatient ambulatory care) has been rated good (Coppens et al., 2015).

Adolescent mental health services in Finland are mainly provided by publicly funded specialist-level health care units commonly comprising adolescent psychiatric outpatient and inpatient services in a central hospital, in spite of an increase in outpatient services provided by municipalities, especially for the treatment of less severe mental health problems. In addition, school and student health services and primary health care are in a central role in identifying mental health problems and catering mental health and overall health needs. Adolescent psychiatric services are mainly provided on an outpatient basis, as emphasized in the legislation (Mental Health Act 1116/1990 and Health Care Act 1326/2010). Inpatient services are provided for those with the most serious psychiatric symptoms and significant functional impairments or who are at risk of harming themselves or others (Evans et al., 2019).

The development of mental health services for adolescents in Finland began in the 1960's, when the first specialized hospital beds for adolescents were established in psychiatric hospitals (in 1959 in Pitkäniemi hospital in Nokia and in 1961 in Hesperia in Helsinki) with more specialized wards established in the 1970s with systematic work to improve services for adolescents gaining momentum in the late 1970s (Hyvönen, 2008; Laukkanen et al., 2003). At first the development formed part of child and adult psychiatry; adolescent psychiatry was established as a subspeciality of psychiatry or child psychiatry in 1979, becoming an independent medical speciality in 1999, which was unique in Europe.

At first, the development of psychiatric services for adolescents mainly took the form of inpatient care, but from the 1980s adolescent services began to develop rapidly. In 1987 the Finnish National Strategy for prioritizing specialized adolescent psychiatric services was published by the Task Force of the Finnish National Board for Specialized Psychiatric Services for Adolescents proposed that a specialized psychiatric service system should be established for the adolescent population with

special psychiatric beds (inpatient care) for adolescents and an outpatient team for adolescent psychiatry in every healthcare district. Also, services should be easily accessible with priority for the early detection of adolescent mental disorders by primary care and to provide services in community-based outpatient services (Lääkintöhallitus, 1987; Laukkanen et al., 2003). Resources for specialized adolescent psychiatric services were mainly obtained from adult psychiatry, which was a deliberate choice to reallocate resources from long-term hospital beds in adults to an earlier phase of mental disorders, namely the onset (Hyvönen, 2008; Pylkkänen, 1998). The declared aims of the strategy were mainly achieved by 2000 for resources with hospital beds for minors in 17 out of 22 hospital districts (Laukkanen et al., 2003).

The Mental Health Act of 1991 stated that involuntary treatment of those under 18 years of age must be arranged on wards specially designed for minors and separate from adult patients unless it was otherwise in the best interests of the young (Mental Health Act 1116/1990). This accelerated the development for increasing the number of hospital beds for adolescents. In contrast to adult psychiatry, where the trend was to decrease inpatient care by reducing numbers of hospital beds due to deinstitulization in the 1990s, in adolescent psychiatry the number of hospital beds available for adolescents under 18 increased remarkably, doubling in the first half of the 1990s to 209 beds in 1995 and to 270 beds in 2000 with a total increase of over 130% in beds available in the 1990s, which continued to increase by another 30 % to a total of 342 beds in 2002 (Laukkanen et al., 2003; Pylkkänen, 1998). In addition to this increase in the number of hospital beds, there has also been an exponential increase in private family care and rehabilitation homes operating under the child welfare legislation from the 1990s, with concerns about this becoming an alternative system of adolescent psychiatric inpatient care (Pylkkänen, 2003).

At the end of the 1990s there was public and political concern about the mental wellbeing of children and adolescents and about the regional inequality of child and adolescent psychiatric services, especially the long waiting times to receive treatment (Laukkanen et al., 1999, 2003; Pylkkänen, 2003). To respond to this the first guarantee of treatment for child and adolescent psychiatry was enacted in 2001 requiring providers to assess the need for treatment within three weeks from referral to specialized care and to start appropriate treatment within three months (Health Care Act 1326/2010). Also, the Parliament of Finland since the 2000s has allocated special funding on a yearly basis for child and adolescent psychiatric services, amounting in the 2000s to over 40 million euros, while the municipalities also increased their funding, especially for child and adolescent psychiatric and other

specialized level services (Reports of the Ministry of Social Affairs and Health, 2004). This led to a situation in which, between 1980 and 1990 there was an increase in adolescent psychiatric inpatient services, and in the 2000s there was a substantial increase in the availability of outpatient adolescent psychiatric services not only at specialized level but also in local and in primary health care and also in other support services intended to improve access to services and support and thereby also the outcome of adolescents' mental health problems (Pylkkänen, 2003, 2013).

2.3.1 Use of mental health services

Although psychiatric disorders are quite common in adolescence, not all adolescents with mental health problems will receive help for them from mental health services. Merikangas et al. estimated that in the USA only a third of adolescents with mental disorders used mental health services in the early 2000s. Those with behavioural problems were decidedly more likely to access services than those with internalizing disorders (Merikangas et al., 2011). In a systematic review and meta-analysis of rates of mental health service utilization among children and adolescents in the USA between 2001 and 2018, Duong et al. found that 7.3% of young people in general population used mental health services in school, 7.3% in outpatient care and 1.8% in inpatient care, while 9.1% of those with more severe symptoms or clinical diagnoses received inpatient care (Duong et al., 2021). In 2001–2002, a national audit of adolescent psychiatric services in Finland ('Nuotta') found that outpatient services were used by 1.8% of adolescents aged 13-22, while the need was estimated at 4% (Pylkkänen, 2003). A subsequent national audit in 2010 ('Nalle') reported that the share of adolescents in contact with adolescent psychiatric services had risen to 3% of adolescents aged 13–22 (Pylkkänen, 2013)

Inpatient services are provided for those with the most serious psychiatric symptoms and significant functional impairments or for those at risk of causing harm to themselves or others (Evans et al., 2019). Mental distress is one of the major reasons for hospitalization in adolescents (Bardach et al., 2014; Chabra et al., 1999; Duong et al., 2021). Inpatient care is effective treatment for stabilizing acute distress in most adolescents hospitalized for reasons of mental health (Hayes et al., 2018; Kronström et al., 2021). However, only a minority of adolescents needing psychiatric care are in inpatient care and as an expensive treatment method, especially if it takes long time, inpatient care consumes a considerable proportion of all adolescent psychiatric resources (Chabra et al., 1999; Duong et al., 2021). Therefore, there has

been pressure to reduce the use of inpatient care, to shorten length of stay and to allocate more resources to outpatient care (Pirkola & Sohlman, 2005). Despite this, adolescent psychiatric inpatient admissions increased from the 1990s to the 2000s in Finland and worldwide (Blader, 2011; James et al., 2010; Laukkanen et al., 2003; Tuori et al., 2006). Compulsory admissions to inpatient care among adolescents (Kaltiala-Heino, 2004; Siponen et al., 2007).

In a nationwide study of child and adolescent psychiatric inpatient treatment in three distinctive years (2000, 2011 and 2018) Kronström et al. found that, in addition to an increase in admission rates, the characteristics of child and adolescent psychiatric inpatients also changed from 2000 to 2010 with an increase in the percentage of girls on adolescent wards associated with an increase in diagnoses that are more prevalent among girls than boys, such as depression, anxiety, and eating disorders. The share diagnoses of depression as the reason for inpatient care rose in adolescents from 21% in 2000 to 38% in 2011 and to 42% in 2018. At the same time there was decrease in psychosis diagnoses and conduct disorder diagnoses, especially between 2000 and 2011. Median length of stay in child and adolescent psychiatric inpatient care also decreased steadily by three quarters over the whole study period from a median of 82 days in 2000 to 39 in 2011 and 21 in 2018 (Kronström et al., 2016, 2021).

There have been concerns that shortening length of stay in inpatient care may lead to more readmissions and poorer overall prognoses, although there is also evidence that most health gains tend to occur early during admission and therefore, for the majority of young people, especially those with acute psychiatric illnesses, a relatively short stay could be feasible (Johannessen et al., 2009; Kronström et al., 2021; Meagher et al., 2012; Swadi & Bobier, 2005). In a large meta-analysis of 33 studies published between 1997 and 2018, investigating predictors of psychiatric hospital readmission among young people under 18 years old, Edcomb et al. found that 13% of the young people were readmitted during follow-up and that mean time to readmission was 13.1 (SD 12.8) months. Suicidal ideation at index hospitalization, psychotic disorders, prior hospitalization and being in residential care were specific risk factors. Longer length of stay was also associated with higher risk of readmission (Edgcomb et al., 2020). In a Finnish study 32% of adolescents admitted to inpatient care between 2001 and 2006 had three or more psychiatric hospitalizations before the age of 18. Risk factors were living in child welfare placement, having self-mutilating behaviour and affective disorders in girls. Psychotic disorder or other psychiatric disorders showed no association with revolving door phenomena (Similä et al., 2018). Kronström et al. noted that shorter length of stay may have contributed

to an increase in readmissions between 2000 and 2018, but also noted that it was not comparable to the substantially shorter hospital stays in child and adolescent psychiatry inpatients (Kronström et al., 2021).

2.4 Child welfare services in Finland

Child welfare and protection services in Finland are a part of the social services provided by municipalities to which children and families are entitled by law. The foundations of present-day child welfare services were laid in 1936, when the first Finnish Child Welfare Act came into force. It established regulations with regard to taking children into state care. However, the act did not define rights or interventions with great precision. Also, the spirit of the Act was to divide children into those who need support and care, and those who need discipline and punishment (Hietamäki, 2012). The second Child Welfare Act of 1983 adopted a broader understanding of child welfare and gave priority to preventive measures and other support methods than placing children in institutional care. However, the second act was still criticized for lacking precise instructions for when and how to intervene (Hearn et al., 2004; Hietamäki, 2012). The more recent third Child Welfare Act (417/2007), is more exact, detailed and more child-centric than its predecessors. It stipulates new obligations for co-operation between different authorities, for example health care has special obligations to children who are child welfare service users with the provision of expert assistance and the provision of health care and therapeutic services for the child.

According to the most recent Child Welfare Act (417/2007), child welfare services can be roughly divided into community-based child welfare interventions and decisions on taking into care. The community-based interventions are optional, of a preventative nature and should be used as a primary intervention. In the Child Welfare Act community-based child welfare services are specified as follows: 1) support for assessing a problem situation involving the child and family; 2) financial and other support for the child's schooling and in acquiring an occupational qualification, obtaining accommodation, finding work, in free-time pursuits, maintaining close human relationships and satisfying other personal needs; 3) care and therapy services supporting the child's rehabilitation; 4) family work; 5) family rehabilitation; 6) other services and supportive measures to support the child and family. Also, the child can be voluntarily in a placement outside the home (open care placement) as a support measure.

According to the current Child Welfare Act (417/2007), if a child's health and development are seriously endangered by lack of care or by the child themselves, for example, by substance use or criminal activity or otherwise risky behaviour and community-based child welfare interventions are not appropriate or have proved insufficient, then state care must be provided if taking into care is estimated to be in the child's best interest. Taking into care is usually done by placing the child outside the home in foster care, for example in a foster family or in an institutional care unit of which the latter is more common for adolescents. The decision on taking into care may be short-term (emergency placement) or longer-term (care order). Despite increasing emphasis on community-based child welfare interventions, the number of adolescents placed outside the home has steadily increased and the increase has been almost equal in both sexes, as is seen in Figure 2.

In contrast to children, in adolescents the main reason for placement outside the home is externalizing conduct or mental health problems of the adolescents themselves rather than family reasons or lack of care. (Kääriälä et al., 2021; Kestilä et al., 2012)

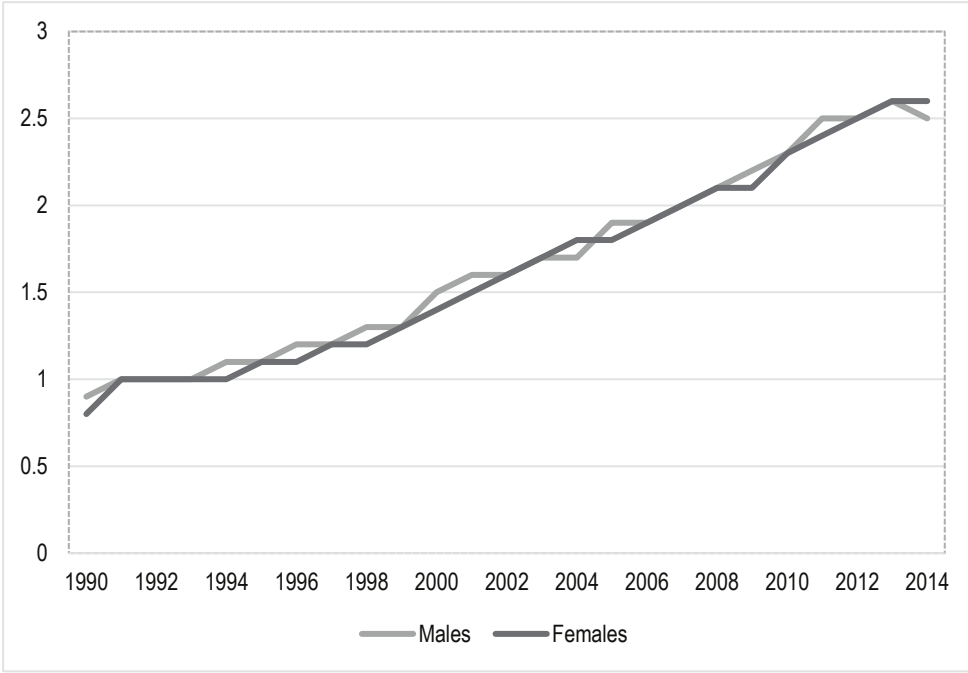

Figure 2. Young people aged 13-17 years placed outside the home, % of population of same age (Statistical information on welfare and health in Finland, sotkanet.fi, ind.5496)

2.5 Education in Finland

In Finland post-comprehensive education is roughly divided into upper secondary education (leading to a so-called matriculation examination in general upper secondary school and vocational education) and tertiary education (at universities and universities of applied sciences). As education is publicly funded up to tertiary education, higher education is not dependent on students' socioeconomic, ethnic or other backgrounds.

The foundations of the present education system were laid with the Basic Education Act of 1968 implemented throughout Finland between 1972 and 1977. Finland's rapid transition from an agrarian society to a rapidly developing industrial and welfare state in the 1950s and 60s required radical education reforms. The reforms led to the adoption of compulsory nine-year comprehensive school education for all. Further reforms followed, but these were more evolutionary than revolutionary. A major tertiary education reform was the foundation of the universities of applied sciences in the 1990s. The education reform limited compulsory education to nine years of comprehensive school or to the age of 16, whereas post-comprehensive education, although not obligatory, is strongly recommended and for example there are restrictions on unemployment benefits for those under 25 years without vocational education. In 2021 the school-leaving age was raised to 18 years and compulsory education extended to upper secondary education.

In addition to school reforms increased effort has been made to offer adequate support for pupils and students in school for learning and welfare for those in-need by improving access to pupil and student welfare services since the 1970's with efforts accelerated in the 2000's (Teittinen, 2010). Pupil and student welfare can be divided into communal and individual support (Table 2). An important part of pupil and student welfare services are school psychologists and school social workers, offering support and consultation, for instance, in learning and concentration difficulties, problems with schoolmates, behavioural problems, neglecting schoolwork, bullying, matters concerning mental health and acute crises connected to attending school. Also, the reform of basic education in the 1970's increased the amount of special education offered to those with special needs while changes in the legislation, resources and education policy every decade thereafter have extended the provision of support to new groups of pupils resulting in the highest number of pupils receiving special education in the 2000's (Figure 3). Support has evolved from

separate special education to be more part-time support for learning and school attendance (Lintuvuori et al., 2017).

Table 2. Pupil and Student welfare

Communal student welfare:
Culture and collaborative activities to promote students' learning, health, wellbeing, safety and sense of inclusion in the whole student community.
Prevents problems from arising.
Individual student welfare:
School healthcare and student welfare services provided to individual students.
Collaborative activities, support, special education that supports learning, health and social and mental wellbeing of individual students.

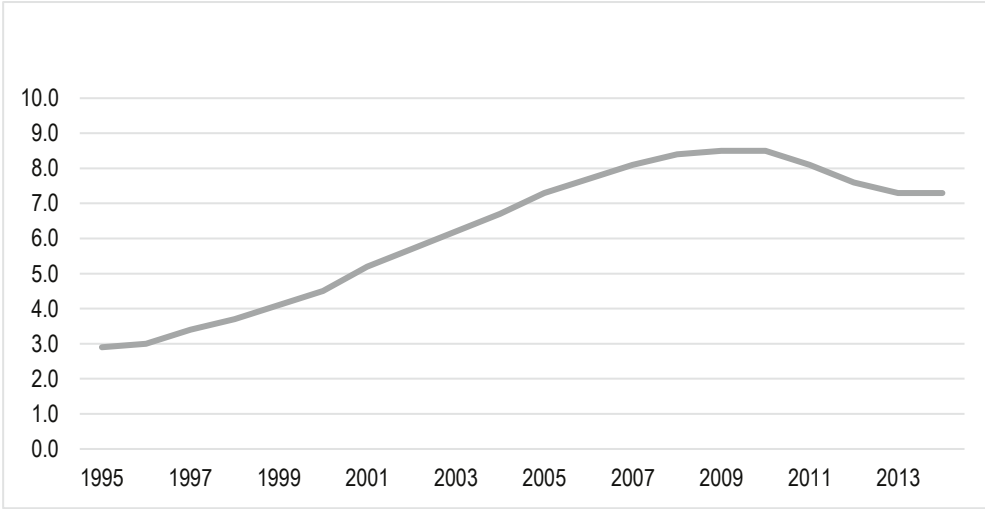

Figure 3. Share (%) of comprehensive school pupils having received special support in school between 1995 and 2014. (Official Statistics of Finland (OSF): Support for learning [e-publication].)

The educational level of the Finnish population has risen steadily. While at the beginning of the 1980s only 40% of those aged over 20 had completed at least upper secondary education and only 14% tertiary education, in the early 1990s these shares rose to 53% and 19%. At the beginning of the 2000s 63% of the population over 20

had completed upper secondary education and 25% tertiary education and in 2010 this reached 71% and 30% respectively. (Official Statistics of Finland (OSF): Educational Structure of Population [e-Publication]). Nowadays significantly over 90% of the those completing comprehensive school continue to upper-secondary education. (Kupiainen et al., 2009).

2.6 Outcome of mental disorders

Mental disorders in adolescence are a significant heath complaint in adolescence causing significant global burden of disease in young people (Patel et al., 2007). Mental disorders may have longlasting consequences, for example, impairing education, employment and therefore affecting socioeconomic status and are also associated with increased use of social and healthcare, hospitalization and constitute a risk for premature death (Asselmann et al., 2018; Fichter et al., 2009; Gibb et al., 2010; Kjelsberg & Dahl, 1998; R. S. C. Lee et al., 2017; S. Lee et al., 2018; Patel et al., 2007; Pelkonen et al., 1998). Behavioural disorders, depression and anxiety in particular are among the leading causes of illness and disability among adolescents (Erskine et al., 2015). Public concern about the negative effects of mental disorders has led to the development and increased availability of supportive services like adolescent psychiatric, social and school welfare services. This development was expected to result in better outcomes in different aspects of life.

2.6.1 Mortality

Mental disorders are among the most significant causes of death with an estimated 14% of deaths worldwide related to mental disorders causing potential loss of life from 10 to 25 years due to premature death (Nordentoft et al., 2013; Wahlbeck et al., 2011; Walker et al., 2015). It is estimated that those with mental disorders have overall at least a two to threefold risk of premature death compared to general population, depending on the study and the length of follow-up as those studies with over ten years' follow-up tend to report smaller risk ratios than those below (Walker et al., 2015). Although the majority of increased risk for deaths in mental disorders is attributable to unnatural causes (for example suicide, other external causes) with the risk being up to 70-fold for suicide, it is also due to different medical conditions (for example cardiovascular diseases, metabolic conditions) and overall poorer health

risk being 1.4 to 7-fold depending on the medical condition when compared to general population (Nordentoft et al., 2013). Inpatients in particular, who usually have more severe psychiatric conditions, have significantly higher mortality risk than those in outpatient care or who live in the community (Walker et al., 2015). Of all psychiatric disorders a clearly higher risk for premature death has been associated with substance use, psychotic and personality disorders, although affective disorders carry an especially high risk for suicide (Walker et al., 2015).

While much of the research on mortality has been done on patients with history of psychiatric care as adults, evidence on increased risk for premature death has been identified among those with adolescent-onset mental disorders. It has been estimated that those with child and adolescent psychiatric histories have at least a 2.8-fold risk for premature death (Kjelsberg, 2000).

In a study of Norwegian adolescent psychiatric inpatients admitted during the years 1963-1981 and followed up until 1996, 13.6% of the patients had died during follow-up. Males, those with substance use (21.9% with, 10.1% without had died) and those with poor impulse control were at especially high risk (Kjelsberg, 2000).

In a Swedish study focusing on mortality among former child and adolescent psychiatric patients (both inpatients and outpatients) with a follow-up of 12-33 years up until the end of 2003, 2.7% of former patients had died during follow-up, mortality being significantly higher than in general population. Fifty percent of all deaths occurred more than ten years after the initial treatment. Of the patients 75% of all deceased had died before the age of 30, unnatural causes of death, especially suicide, being the most common. Externalizing problems (behavioural problems, substance use) were important predictors for premature death (Engqvist & Rydelius, 2006).

In a study among Finnish adolescents who had been outpatients in the 1980s, 10.3% of males had died during follow-up (ca. 10 years) with suicide being the most common cause of death. A high risk for mortality persisted several years after psychiatric treatment (Pelkonen et al., 1996).

In another Finnish study focusing on 15-19-year-old Finnish delinquents referred to forensic psychiatric examination between 1980 and 2010, delinquents had an over eightfold risk (22% had died) for premature death compared to general population controls. Risk for unnatural death was especially high in both sexes. (Lindberg et al., 2017) In a study of Finnish adolescents treated in psychiatric inpatient care between 2001 and 2006, 3.9% of the study sample had died during follow-up (up to mid-2016) with mortality being higher in males (7.2% of males, 1.7% of females) and especially in those males with impulsive behaviour (Alasaarela et al., 2017).

In spite of a decrease in mortality among mental disorder patients in recent decades, due to more effective treatment, the mortality gap between people with mental disorders and general population may even have widened as the life-expectancy of general population has risen faster (Nome & Holsten, 2012; Saha et al., 2007; Walker et al., 2015). However, as the majority of studies on mortality among former psychiatric patients have been conducted on adults, there is a lack of information about the impact of increased availability and development of adolescent psychiatric services on mortality among adolescents with mental disorders.

2.6.2 Criminality

Criminal behaviour is associated with overall negative life course, for example social exclusion, poorer health and increased mortality in offenders (Elonheimo et al., 2014; Healey et al., 2004; Nilsson & Estrada, 2011; Stenbacka et al., 2019). Research has shown that many offenders (adolescents and adults alike) who have been incarcerated suffer from mental health problems. (Fazel et al., 2008, 2016; Underwood & Washington, 2016). Of incarcerated adolescents it has been estimated that 40 to 80% have at least one diagnosable mental disorder with half having a conduct disorder diagnosis, 10-30% ADHD, 10-30 % depression and about 3% psychotic disorder (Fazel et al., 2008; Underwood & Washington, 2016).

Norwegian study on adolescent psychiatric inpatients admitted during the period 1963-1981 it was found that 52% of the study population had acquired a criminal record during follow-up of up to 33 years. Males and those with conduct disorder or substance use disorder were especially at risk. (Kjelsberg & Dahl, 1999) While in a Swedish study of former child and adolescent psychiatry patients treated between 1975 and 1990 and followed up 38% had acquired a criminal record in follow-up up to 2003. Males and those who had required inpatient care were at especially higher risk as 55% of males and 44 % of the inpatients had a criminal record (Engqvist & Rydelius, 2007).

In more recent studies the proportion of former child and adolescent psychiatric patients acquiring criminal records has been somewhat lower and in a Danish study of child and adolescent psychiatry patients aged 4 to 15 with ADHD diagnosed between 1995 and 2005, 32% of those with ADHD had criminal convictions in follow-up until the end of 2014 compared to 15.6% of the cohort group without ADHD diagnosis (Mohr-Jensen et al., 2019). In a Finnish study of a regional sample

adolescents admitted to adolescent psychiatry inpatient care between 2001 and 2006, by the end of follow-up in 2012, 24% had committed crimes and 16% had committed violent crimes. In females, borderline personality disorders and conduct disorder were significant risk factors for violent criminality, while in males significant predictors were conduct disorder and substance use disorder (Arola et al., 2016).

Although a risk for subsequent criminal behaviour has been found to be lower in more recent study cohorts, the findings of these studies are not amenable to generalization due to studies focusing on regional samples or selective mental health problems. There is also a shortage in particular of recent studies covering a long enough period to observe the possible effects of the development of psychiatric and other support services on risk of criminal behaviour.

2.6.3 Education

Formal education has an ever-increasing role in society. It may have wide impacts on one's life as it affects later employment, social life and even mortality or overall health and life choices (Acacio-Claro et al., 2017; Cohen & Syme, 2013; de Ridder et al., 2013; Hoff et al., 2018; Killackey et al., 2017; Miech et al., 2011; Myhr et al., 2018; Phillips & Hempstead, 2017). Higher education is associated with healthier behaviours and overall health and may help to reduce social inequalities in health, although the causality is less straightforward (Cutler & Lleras-Muney, 2012; Hummer & Skalamera, 2016; Vable et al., 2018; Ward & Viner, 2016).

Mental disorders have been associated with school drop-out and lower educational attainment (Breslau et al., 2008; S. Lee et al., 2018; Veldman et al., 2014). It is estimated that those with mental disorders could be at 2-4-fold risk for school dropout in adolescence (age 17) or in young adulthood (age 21) when compared to general population or even to those with somatic illnesses (Mikkonen et al., 2018). Mental disorders may have a negative effect on education for various reasons. For example, impairment in cognitive functioning (difficulties in concentration, learning and memory), and in social functioning, lack of interest or motivation, fatigue and social anxiety may seriously impair learning and adjustment to school and lead to difficulties in attending school or truancy (Esch et al., 2014; Evensen et al., 2016; R. S. C. Lee et al., 2017; Leifker et al., 2009; McLeod et al., 2012; Melkevik et al., 2016).

The negative effect of externalizing disorders (like substance use, ADHD, conduct disorder, behavioural problems) on educational outcomes has been clearly established (Colman et al., 2009; Esch et al., 2014; Evensen et al., 2016; McLeod et

al., 2012). Externalizing cognitive (difficulties in concentrating) and motivational deficits challenge learning, easily leading to truancy and even to school dropout and therefore lower educational attainment (Barnett et al., 2009; Esch et al., 2014).

In schizophrenia group psychotic disorders, in addition to the well-known impairment caused by cognitive deficits (for example deficits in memory, executive functions, processing speed) impairment in social functions can also cause significant disability affecting the skills needed in school (Grover et al., 2019; Lay et al., 2000; Leifker et al., 2009; Puig et al., 2012). Adolescent (early) onset schizophrenia especially is considered to have poorer overall outcome than adult-onset schizophrenia (Grover et al., 2019; Immonen et al., 2017).

In contrast to externalizing disorders or schizophrenia group diagnoses, the findings on the associations between internalizing disorders and education have been less consistent. While in some studies, internalizing disorders have been associated with school problems such as underachievement, attendance problems or even drop-out (Bowman et al., 2017; Brännlund et al., 2017; Dupéré et al., 2018; Fletcher, 2009; Mojtabai et al., 2015; Pérez-Vigil et al., 2018; Veldman et al., 2014; Woodward & Fergusson, 2001), in others no association has been found or it has diminished when controlling for confounding factors such as family or behavioural factors (Brière et al., 2017; Fergusson et al., 2007; Melkevik et al., 2016; Tempelaar et al., 2017). Nevertheless, those with internalizing disorders face many academic and social difficulties. In the mood disorder diagnosis group, both bipolar disorder and depression have been associated with higher odds of acquiring no secondary or higher education (Berndt et al., 2000; Bowman et al., 2017; Dupéré et al., 2018; Fergusson et al., 2007; Hakulinen et al., 2019). Depression symptoms such as diminished interest, difficulties in concentrating, loss of energy, impairment in memory and executive functions could affect the ability to perform at school (Castaneda et al., 2008; Kovacs & Goldston, 1991). A similar pattern of cognitive impairment has been shown in bipolar disorder (G. Xu et al., 2012). In anxiety disorders, for example, lower social competence, negativity in interpersonal relationships, higher levels of victimization, problems concentrating on work or when performing tests may cause refusal to attend school, slow academic progress or failure to enter higher education (de Lijster M. et al., 2018; Ranta et al., 2016). In addition to other anxiety disorders, obsessive-compulsive disorder is also independently associated with pervasive academic underachievement at every academic level (Pérez-Vigil et al., 2018).

In eating disorders, the findings of an association between eating disorder and educational achievement have been inconsistent (Keski-Rahkonen et al., 2007;

Maxwell et al., 2011; Tabler & Utz, 2015) with those with anorexia nervosa diagnosis reporting less school impairment than those with bulimia (Ruuska et al., 2007). Especially in anorexia nervosa, frequently reported characteristics including strong work ethic, extreme perfectionism and reward-dependent traits may support high levels of academic performance (Bardone-Cone et al., 2007; Maxwell et al., 2011), while cognitive decline and impaired concentration may accompany starvation, especially in prolonged illness impairing academic performance (Green et al., 1996; Maxwell et al., 2011; Ruuska et al., 2007).

While mental disorders themselves hinder education, the stigma commonly associated with mental disorders may also have profound negative effects. Adolescents with mental disorders are considered to be more stigmatized than those with other health problems. Males have been found to be more stigmatized but also more stigmatizing than females (Kaushik et al., 2016). Stigma may manifest as general devaluation, underestimation, bullying and even outright social rejection. Stigma may impair well-being, inhibit willingness to seek help, impair treatment adherence and therefore have negative effects on treatment outcome. In adolescence it may have negative effects on adolescent development by influencing personal identity development, self-esteem and independence. (Hinshaw, 2005; Kaushik et al., 2016; Moses, 2010, 2014). Stigma may also lead to the consideration of mental disorders as some kind of disability, which may result in others having lower expectations and undervaluing such a sufferer's skills (Shifrer, 2013). Fortunately, the normalization of mental health problems and a more open and supportive generation of young people have led to the more ready acceptance of mental disorders and lessening of stigma (Kaushik et al., 2016).

Although the negative effect of mental disorders on educational achievement is clearly established, it is less clear if the development of adolescent psychiatric services and the increased availability of support in school have resulted, as expected, in better academic achievement despite psychiatric illness during adolescence.

2.7 Summary of the literature

Adolescence is a crucial time for establishing personal value or ethical systems, adopting socially responsible behaviour and making choices, for example, in the educational pathway possibly affecting the entire life trajectory. Mental disorders in adolescence may disrupt normal adolescent development and have long-lasting effects on life, for example by hindering educational attainment, being a risk factor for criminal behaviour, increasing the need for social and health services and finally increasing the risk of marginalization, and thereby causing a considerable burden on adolescents' health. Although adolescence is a period of life for the initial onset of many mental disorders, only a minority of adolescents suffering from poor mental health will receive adequate support for their needs. Efforts in social, educational and health policy have been made in Finland to increase the services and support available to those in need. In adolescent psychiatric services special emphasis had been placed on improving availability and developing outpatient care - especially in the 2000's although at the same time the number of beds available for inpatient care rose contradictory to the general trend for deinstitutionalization in psychiatry. This development, spanning decades and the increased availability of adolescent psychiatric services should ideally have led to improved prognoses and outcome in adolescents' mental disorders or to less severe mental health problems, for example by reducing the gap in academic achievement between those with mental disorders in adolescence and those without.

Research on adolescent mental disorders and adolescent psychiatric services is important as finding those in greatest need is crucial to improve prognoses by mitigating their impact on life and decreasing the risk of becoming marginalized. However, studies on the prognosis of adolescent onset mental disorders may only focus on a small part of life and therefore fail to evaluate the impact of disorders and the risks to later life as a whole. For example, there is a lack of studies on subsequent criminality after being in adolescent psychiatric care. In spite of a great interest in adolescent mental health, especially in recent years, the most severe mental disorders, for example schizophrenia and psychoses, have been less studied in adolescents than in adults or studies have been based on small and selected samples, making the results harder to generalize. Also, as mental disorders during adolescence are diverse and heterotypic continuity is common, focusing only on particular mental disorders may not represent the true impact and prognosis. Inpatient care may be seen as an

indicator of the severity of mental disorders or perhaps also of the adequacy of outpatient services and support. However, studies on inpatient care have focused on relatively small samples of adolescents or have focused on both child and adolescent psychiatric patients. As the Finnish adolescent psychiatric services have been developed independently and mainly separately from child and adult psychiatric services forming their own distinct speciality and services, this offers an excellent opportunity to study how services developed for a specific age and developmental phase affect the outcome of mental disorders, especially as adolescence is a period of onset for many mental disorders. Also, as earlier research has focused on a relatively short time span, making it hard to evaluate the development of adolescent psychiatric services, longitudal studies spanning years or even decades are needed to assess how and if the development of services has led to the desired improvements in the outcomes of mental disorders in adolescence.

3 AIMS OF THE STUDY

Objective of this study was to study adolescents requiring psychiatric inpatient care during adolescence and their later life situations. More specific questions to be answered were:

1. How was psychiatric inpatient care used among adolescents aged 13-17 in the period 1980-2010 and have psychopathology, length of stay and later use of psychiatric inpatient care changed over the years?

2. What is the incidence of schizophrenia and the stability of adolescent onset schizophrenia diagnoses among adolescents first admitted to psychiatric inpatient care at ages 13-17, and have there been changes in these from 1980's to 2010?

3. What are the educational and criminal outcomes and mortality among former adolescent psychiatric inpatients and how have outcomes changed over three decades.

4 METHODS

The Finnish national registers make it possible to study large patient groups and to collate information on different registers on an individual level by using the unique personal identity code assigned to each permanent resident in Finland.

The study population of this register-based study comprises all Finnish citizens who had their first ever psychiatric inpatient treatment at ages 13-17 between 1980 and 2010 in Finland. The study population was identified from the Patient Discharge Register and the Care Register for Health Care maintained by the Finnish Institute for Health and Welfare. After the index admission the subjects were followed up in registers until end of 2014. Personal identity codes provided by the Finnish Institute for Health and Welfare to other register authorities were used to link inpatient care data to other registers held by the Finnish Centre for Pensions for earnings- related pensions, the Social Insurance Institution of Finland and Statistics Finland.

4.1 Registers

Data from the following registers were used in this study

4.1.1 Crime (Study I)

Criminal history was obtained from the Register of Prosecutions, Sentences and Punishments maintained by Statistics Finland. These statistics contain data on the sentences passed and waived and on charges dismissed by the courts of first instance. In addition to the prosecutions at district courts and at courts of appeal acting as courts of first instance, the statistics also contain data on the summary penal fines imposed by the court and on petty fines imposed by the police, customs officials or border guard authorities. As a rule, a person is recorded in the statistics as many times as the aforementioned decisions have been made about him or her. Another main mode of recording applied in these statistics is the so-called principal offence rule, according to which each defendant or convicted person is described in terms

of the most serious offence under the severest punishment decision category of the court. For this study murder, attempted murder, manslaughter, attempted manslaughter, assault, aggravated assault, robbery, arson, fire-setting and sex crimes are categorized as violent crimes.

4.1.2 Death (Studies I, III, IV)

Date of death was retrieved from the Causes of Deaths register maintained by Statistics Finland, which is based on death certificate data and data on the deceased obtained from the Digital and Population Data Services Agency's Population Information System. By law a death must be reported immediately to a physician or the police. A unit operating in healthcare, or a physician must report the death to an administrative court which will enter it in the Population Information System.

4.1.3 Disability pensions (Study IV)

Information on disability pensions was gathered from the pension register data of the Finnish Centre for Pensions for earnings-related pensions and from the Social Insurance Institution of Finland for national pensions. The Finnish pension system comprises, broadly, of two statutory schemes providing respectively national pensions and earnings-related pensions. Disability pension may be granted if an individual's ability to work has been reduced for at least one year because of an illness, an injury or a handicap.

4.1.4 Education (Study III)

Information on highest attained post-comprehensive school education was obtained from the Register of Completed Education and Degrees maintained by Statistics Finland. All Finnish upper secondary and tertiary education options are covered by these statistics with harmonized concepts and classifications. Data are collected from the organizers of education. The Register of Completed Education and Degrees has been complemented with qualifications attained abroad, but the register still does not cover all qualifications attained abroad. Those completing education and degrees are classified by level of education according to the latest/highest vocational qualification. In the analyses, highest education obtained was classified as

comprehensive school only, upper secondary education (general upper secondary school and vocational qualifications) and tertiary education (university of applied sciences, university).

Information on enrolment in post-comprehensive school studies in 2014 was obtained from the Progress of Studies statistics of Statistics Finland, describing how new entrants to post-comprehensive school education progress in their studies up to the attainment of a qualification or degree. The statistics contain data on education begun, duration of education, change of education, and on what students have done if they have discontinued education. This information is obtained by combining Statistics Finland's individual-based total data on students.

Data on educational attainment of Finnish population was gathered from the Official Statistics of Finland: Educational structure of population. The statistics on the educational structure of the population describe the post-comprehensive school educational qualifications and degrees attained by the population aged 15 and over and are based on the Register of Completed Education and Degrees maintained by Statistics Finland.

4.1.5 Inpatient care (all studies)

Information on inpatient care in psychiatric hospital was obtained from the Patient Discharge Register and the Care Register for Health Care maintained by the Finnish Institute for Health and Welfare. The Patient Discharge Register (used between 1969 to 1993) and its replacement The Care Register for Health Care (from 1994) contain data on all patients discharged from any inpatient care facility of the in Finnish health services. The most essential data content with regard to providers of hospital services, speciality, patients' personal identity codes, admission and discharge and diagnoses has remained unchanged in these registers for years. Information on the Global Assessment Scale (GAS) was available as of 1996.

4.1.6 Population data (Study II)

Information on the size of the adolescent (13-17y) population in Finland in each corresponding year was obtained from the population structure statistics maintained by Statistics Finland enumerating Finnish and foreign citizens permanently resident in Finland at the turn of each year.

4.2 Diagnoses

Diagnoses in the Patient Discharge Register, the Care Register for Health Care and in the pension register data of the Finnish Centre for Pensions and the Social Insurance Institution of Finland were recorded according to the International Classification of Diseases (ICD); ICD-8 until 1986, ICD-9 in 1987-1995 and ICD-10 from 1996. The WHO conversion tables between ICD-8, ICD-9 and ICD-10 were used to recode ICD-8 and ICD-9 diagnoses as ICD-10 diagnoses (World Health Organization. Division of Mental Health, 1994).

The diagnosis entered as the primary diagnosis in the register data was used as the principal reason for inpatient care. For assessing the incidence and prevalence of schizophrenia (Study IV) a schizophrenia diagnosis as the primary diagnosis or in any secondary diagnoses was used as principal diagnosis.

For the analyses ICD-10 diagnoses were the main diagnostic groups with the exception of the F90-99 group, which was divided into F90-92 group and F93-99 group as an F90-92 diagnosis indicates more behavioural problems whereas F93-99 indicates more emotional problems. Otherwise, the most common main diagnostic groups are used with F20-29 representing schizophrenia group disorders, F30-39 mood disorders, F40-48 anxiety disorders and combined F10-19, F60-69 and F90-92 groups presenting externalizing disorders while the remaining F-group, Z-group and somatic diagnoses as main diagnoses form another diagnostic group or are used as individual groups depending on the study. In assessing schizophrenia, the broad definition of schizophrenia (Frazier et al., 2007) was used by combining F20 and F25 diagnoses.

4.3 Ethical considerations

The study was duly approved by the ethics committee of Tampere University Hospital (R15009). The study was granted the appropriate permissions to use register data by the appropriate register authorities, the Finnish Institute for Health and Welfare, the Finnish Centre for Pensions for earnings-related pensions, the Social Insurance Institution of Finland and Statistics Finland.

To protect individuals' privacy data were anonymised by Statistics Finland. For data protection reasons study data was stored by Statistics Finland as per requirements of register authorities and was available to researchers by a remote access system provided by Statistics Finland. To protect individuals' privacy, data

could only be published if based on at least three (unweighted) observations. For this the data were scrutinized by Statistics Finland before being published.

4.4 Statistical analyses

In statistical analyses the study population (N=17112) as a whole was used when studying use of psychiatric inpatient care and incidence of schizophrenia (Studies II and IV). When studying criminality (Study I), mortality and rehospitalization, those with no psychiatric (F-group) nor neurological (G-group) diagnoses were excluded (n=270). When studying educational outcomes (Study III) the statistical analyses included those aged 20-49 years with psychiatric diagnoses or organic, neurological (G-group), intellectual disability or developmental diagnosis or social reasons (Z-code) diagnosis as primary diagnosis at index admission and who were alive and with education information available in 2014 (N=14435). The lower age limit was chosen assuming that in Finland the vast majority would have completed upper secondary education by age 20 (OECD, 2018; Thomsen, 2015), while the upper age limit was chosen to ensure equal age groups. Depending on the study, subjects were followed-up until the end of 2014 or death. In addition, while studying criminality and ten-year mortality, a maximum follow-up time was ten years calculated from the end of the first inpatient care episode.

SPSS version 27 was used for the analyses except that MedCalc's comparison of proportions calculator, which uses the "N-1" Chi-squared test as recommended by Campbell [37] and Richardson [38], was used to compare educational attainment of the study population to that of general population (Study III). In the analyses a P-value of 0.05 was used as a threshold for statistical significance.

In all studies cross-tabulations with chi square statistics were used to assess basic demographic information.

4.4.1 Mean length of stay, GAS, rehospitalization (Study II)

Jonckheere-Terpstra test for ordered alternatives was used to test for a possibly statistically significant trend in mean length of stay and GAS rating on admission to first inpatient care episode. To compare rehospitalization during adolescence between sexes, age in first inpatient care, decade of index admission and between primary diagnosis groups first crosstabulations with chi-square statistics were used.

Multivariate associations were studied using logistic regression with Odds Ratios (95% confidence intervals) for rehospitalization during adolescence according to sex, age group, decade of index admission, diagnostic group and in addition, for those with first inpatient care during 1996-2010, GAS rating on arrival with mean value for the whole sample as a cut-off.

4.4.2 Incidence and stability of schizophrenia diagnosis (Study IV)

To investigate the incidence of schizophrenia (SCH) diagnoses in the study population information on first inpatient care and first disability pension with SCH before the index admission was obtained from the appropriate register data. For the later incidence of SCH diagnosis, those with no SCH diagnosis at index admission were followed in registers until first inpatient care with SCH diagnosis or the first day of disability pension with SCH diagnosis, date of death or end of 2014, whichever was first. The stability of SCH diagnoses in the study population was investigated in those for whom SCH was diagnosed in their first inpatient care period or who had been granted disability pensions with SCH diagnosis before their first inpatient care period by obtaining last inpatient care or disability pension (whichever was later) data from the appropriate register.

Cross-tabulations with chi-square statistics were used to investigate the incidence of SCH diagnosis and differences in incidence and stability of SCH diagnoses of index admissions between sexes and age at first inpatient care and decade of index admission. For predictors for subsequent SCH diagnoses cross-tabulations with chi-square statistics were first used to investigate associations of sex, age at first inpatient care period, main diagnosis group with later incidence of SCH diagnosis. Because the subjects had different follow-up times, Cox regression analysis was then used to study multivariate associations between time and covariate. Hazard ratios (95% confidence intervals) for SCH diagnosis after index admission recorded as diagnosis in subsequent inpatient periods or disability pension are given according to sex, age group, decade of index admission and primary diagnosis group in first inpatient care as covariates.

4.4.3 Mortality

Cross-tabulations with chi-square were used to investigate mortality in follow-up until the end of 2014 or up to ten years after discharge from inpatient care in ten-year follow-up in the abovementioned sample of the study population comparing mortality between sex, age group in index admission and primary diagnosis at index admission. Mortality rates are given (according to) per 1000 years of follow-up. For multivariate associations Cox regression analysis was used to take account of different follow-up times and shorter follow-up time in most recent cohort. Hazards ratios (with 95% confidence intervals for mortality were give according to sex, age group at index admission, decade of index admission and primary diagnosis groups. Information for calculating estimated mortality in general population was obtained from the Statistics on Death maintained by Statistics Finland.

4.4.4 Crime (Study I)

To assess criminality, subjects were followed-up for criminal outcome in the crime register until crime outcome, death, a maximum of ten years or until the end of 2014, whichever came first. First, cross-tabulations with chi-square statistics were used to compare crime outcome (any and violent crime) between sexes, age groups at index admission, primary diagnostic groups and those with and without crime register entries before the index admission. Cox regression analyses were used to assess multivariate associations with hazards ratios (95% confidence intervals) for crime outcomes (any and violent crime) given according to sex, age group, decade of index admission and primary diagnostic group. Crime register entry prior to the index admission was also controlled for. The analyses were run separately for any crime and for violent crimes.

4.4.5 Education (Study III)

Cross-tabulations with chi-square statistics with were used to investigate associations of sex, age, and primary diagnosis at first inpatient care to subject's post-comprehensive school education at the end of 2014. To take account of different amounts of time taken to attain education and the developments in education and psychiatric treatment, the study population was categorized into age groups (20-29, 30-39 and 40-49 years old) according to on subject's age at the end of 2014.

Differences in educational levels attained between former patients and general population were compared in sex and age groups using chi-squared test. Logistic regression analyses for each age group were used to assess odds ratios (with 95% confidence intervals) for no post-comprehensive school education (attained or pursued in 2014) with sex, categorized age at index admission and primary diagnosis at index admission used as covariates.

5 RESULTS

5.1 Demographic information

The size of the whole study population was 17112. Of these, 40.2 % (N= 6873) were males and 59.8 % (N=10239) females. In the 1980s there were more males among those first admitted as 54.1% (1401/2588) were males, but in subsequent decades females predominated as in the 1990s 55.7% (2008/3602) and in the 2000s 64.5% (7044/10922) were females. Basic demographic information at index admission is presented in Table 3.

Table 3. Proportion of males and females in early and middle adolescent age groups (N=17112) (Study II)

	1980–1989		1990–1999		2000–2010		1980–2010	
	13-14y (N=653)	**15-17y** (N=1935)	13-14y (N=1214)	**15-17y** (N=2388)	**13-14y** (N=3529)	**15-17y** (N=7393)	**13-14y** (N=5396)	**15-17y** (N=11712)
Males	61.3 %	51.7 %	45.1 %	43.8 %	38.1 %	34.3 %	42.5 %	39.1 %
Females	38.7 %	48.3 %	54.9 %	56.2 %	61.9 %	65.7 %	57.5 %	60.9 %

Table 4 presents the distribution of primary diagnoses at first inpatient care episode across the whole study period 1980-2010. In males diagnoses of externalizing disorders (consisting of F10-19. F60-69 and F90-92 group diagnoses) were the most common diagnostic group (28.9%), while in females mood disorders (F30-39) were most common (34.7%)

As seen in Figure 4, the proportion of adolescent population entering their first psychiatric inpatient care remained relatively stable in the 1980s and in the first half of the 1990s. Thereafter the proportion of adolescent population first admitted to psychiatric inpatient care began to rise steadily, being highest in 2008 in both sexes. However, in females the rise was more prominent than in males. Regarding the distribution of primary diagnoses in first inpatient care, there was increase in inpatient care episodes for externalizing disorder (F10-19, F60-69, F90-92) or mood

disorder (F30-39) diagnoses in males and while in females there was also an increase in episodes with externalizing disorder (F10-19, F60-69, F90-92) diagnoses, an increase in episodes with mood disorder (F30-39) diagnoses was much more prominent. Schizophrenia group (F20-29) diagnoses remained stable over time in both sexes

Table 4. Primary diagnosis in first adolescent psychiatric inpatient care 1980–2010 (N=17112)

	Males (N = 6873)	**Females** (N= 10239)	**p** (males vs. females)
Externalizing disorders (F10-19, F60-69, F90-92)	28.9 %	15.9 %	
Schizophrenia group (F20-29)	13.9 %	9.6 %	
Mood disorders (F30-39)	18.7 %	34.7 %	<0.001
Anxiety disorders (F40-48)	18.7 %	18.7 %	
Other diagnoses (comprising diagnoses below)	19.8 %	21.1 %	
Organic, intellectual disability and developmental (F00-09, F70-79, F80-89, G)	4.8 %	1.7 %	
Eating disorders (F50-59)	0.9 %	7.9 %	
Emotional disorders of childhood (F93-99)	7.8 %	6.8 %	
Social reasons (Z-code)	4.5 %	3.3 %	
Other non-psychiatric diagnosis	1.8 %	1.4 %	

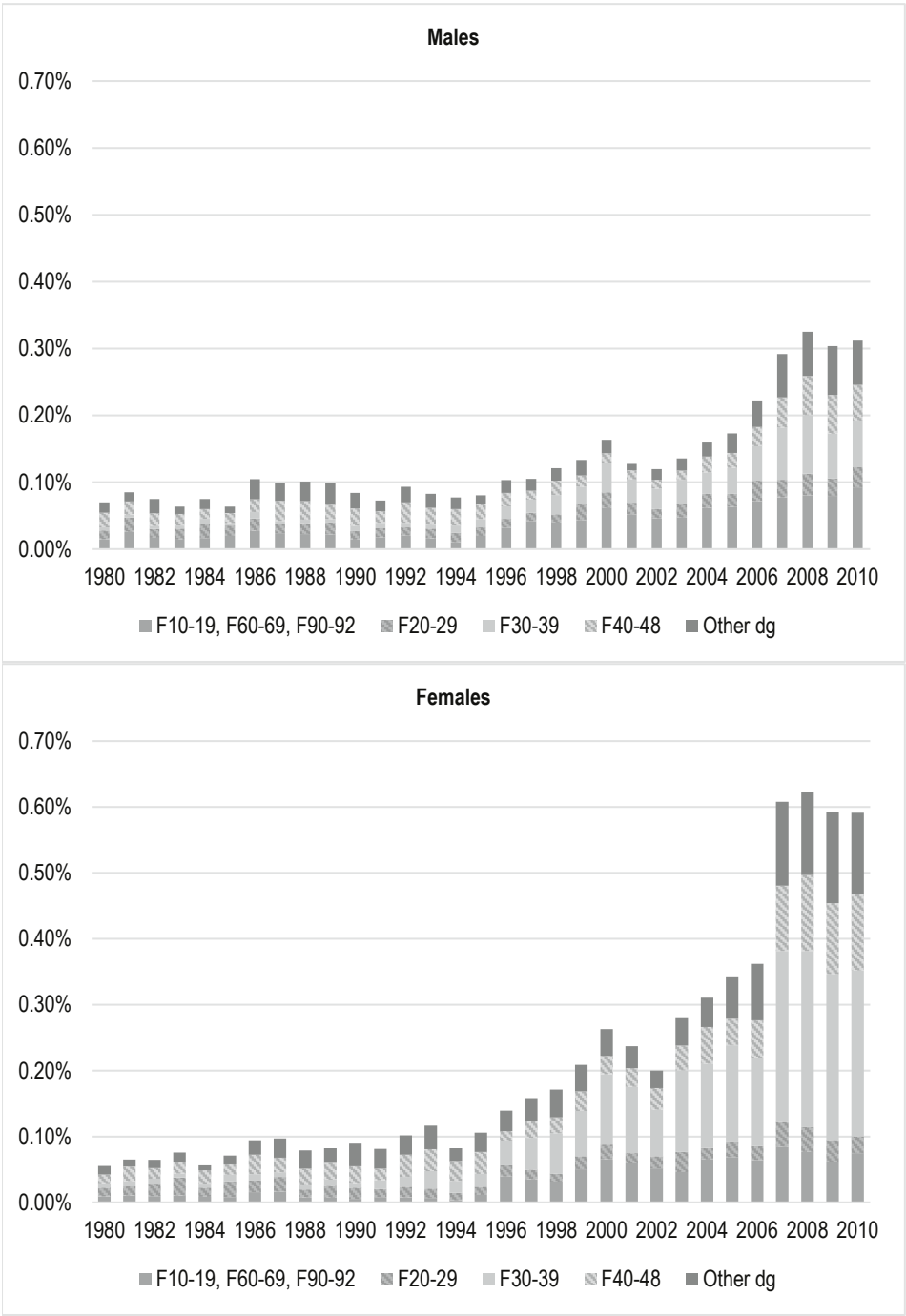

Figure 4. Percentage of adolescent population entering their first psychiatric inpatient care grouped by primary diagnosis

5.1.1 Length of stay (LOS) and Global Assessment Scale (GAS) scores of first inpatient care episode

Over the whole study period the mean duration of first inpatient care (LOS) was 43 days (SD 72, median 18). Over time, LOS decreased from 66 days (SD 111, median 28) in 1980-1989 to 46 days (median 19, SD 77) in 1990-1999 and 36 (median 16, SD 55) in 2000-2010. Mean LOS for each year from 1980 to 2010 and Global Assessment Scale (GAS) rating on arrival for each year from 1996 to 2010 are presented in Figure 5.

Mean GAS scores decreased, being lowest in 2010 for males (mean GAS 38) and in 2005 for females (mean GAS 35). (Study II, Table 3). Over time the number of inpatient periods increased and LOS decreased, while at the same time GAS decreased ($p < 0.001$).

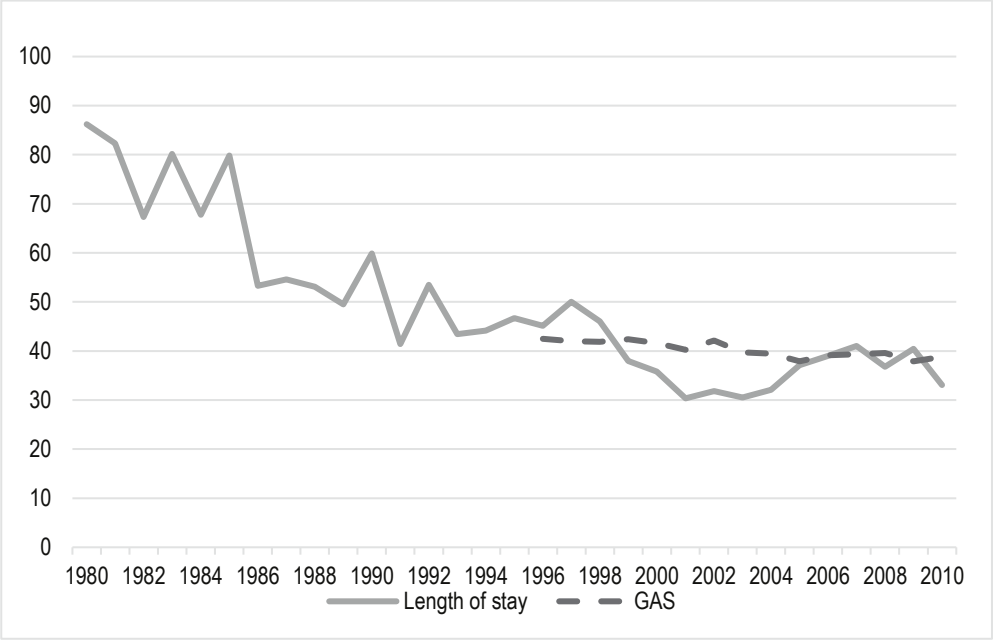

Figure 5. Mean (days) length of stay and GAS at arrival of first inpatient care episode

5.2 Incidence and stability of schizophrenia diagnoses

Of the study population 1.9% (n=320) had schizophrenia diagnoses (defined by F20 or F25 diagnoses) either as any diagnosis (primary or secondary diagnosis) at index admission (first inpatient care episode) or disability pension diagnosis before index admission. Schizophrenia diagnoses were more common among males than females (2.2% of males, 1.7% of females, p 0.015), among those who were middle adolescents (15-17y) at index admission (13-14y: 0.4%. 15-17y: 2.5%, p 0.001) or among those first admitted in the 1980s (1980-1989: 7.5%, 1990-1999: 1.2%, 2000-2010: 0.8%, p <.001).

Further 1.4% (242/16792) of those with not schizophrenia diagnosis at index admission received one during adolescence (before age 18). Later schizophrenia diagnosis during adolescence was more common in males (1.7%, 117/6723) than in females (1.2%, 125/10069) (p 0.01) and in those with first admitted in 1980-1989: 1980-1989 3.5% (84/2394), 1990-1999: 1.7% (64/3558), 2000-2010: 0.9% (94/10840) (p <0.001). There was no statistically significant difference between those having index admission in early adolescence or in middle adolescence.

Of those with no schizophrenia diagnosis at index admission, 10.7% (1800/16792) had one later as inpatient care or disability pension diagnosis. Later schizophrenia diagnosis was more common in males than in females (13.7 % of males, 8.7% of females, p<.001) (p<.001), among middle adolescents (15-17y) at index admission (13-14y: 5.5%, 15-17y: 13.2 %, p <0.001) and among those admitted in the 1980s (1980-1989: 23.0%, 1990-1999: 15.6%, 2000-2010: 6.5 %, p <.001).

Those with schizophrenia group (F20-29), other than F20 or F25, diagnoses as their primary diagnosis in first inpatient care (index admission) than had a significantly higher proportion of later schizophrenia diagnoses than other primary diagnosis groups as almost a half (46.3%) of them later received a schizophrenia diagnosis. (Table 5).

In multivariate analysis, using Cox Regression to account for different follow-up times, there was a higher risk for subsequent schizophrenia diagnosis in males and in those who were middle adolescents (15-17y) at the index admission. Those admitted during the last decade (2000-2010) were at lower risk than those admitted in the 1980s or 1990s. Of the primary diagnoses at index admission, schizophrenia group (F20-29) diagnoses other than F20 or F25, was the most prominent risk factor. (Table 6)

Table 5. Later schizophrenia diagnosis during follow-up after the index admission among patients admitted to psychiatric inpatient treatment for the first time at ages 13-17 between 1980 and 2010 in Finland. %. (N=16792)

	Males	Females
Age at index admission		
13-14 y [N= 2282 (males), 3090 (females)]	6.3 %	5.0 %
15-17 y [N= 4441 (males), 6979 (females)]	17.5 %	10.4 %
p (age)	<.001	<.001
Year of index admission		
1980-1989 [N= 1308 (males), 1086 (females)]	22.4 %	23.8 %
1990-1999 [N= 1572 (males), 1986 (females)]	18.8 %	13.0 %
2000-2010 [N= 3843 (males), 6997 (females)]	8.7 %	5.2 %
p (years)	<.001	<.001
Primary diagnosis at index admission		
Organic, intellectual disability, developmental (F00-09, F70-79, F80-89, G-group) [N= 331 (males), 179 (females)]	6.9 %	5.6 %
Externalizing disorders (F10-19, F60-69, F90-92) [N= 1984 (males), 1626 (females)]	8.0 %	4.7 %
Schizophrenia group psychoses, other than SCH (F21-24, F26-29) [N= 805 (males), 811 (females)]	50.9 %	41.7 %
Mood disorders (F30-39) [N= 1284 (males), 3558 (females)]	9.4 %	6.3 %
Social reasons (Z-code) [N= 310 (males), 335 (females)]	7.1 %	6.3 %
Anxiety disorders, eating disorders, emotional disorders of childhood (F40-48, F50-59, F93-99) [N= 1885 (males), 3415 (females)]	8.9 %	5.7 %
Other non-psychiatric diagnoses [N= 124 (males), 145 (females)]	15.3 %	8.3 %
p (diagnoses)	<.001	<.001

Table 6. Hazard Ratios (95% confidence intervals) for schizophrenia diagnosis after the index admission among those admitted for psychiatric treatment for the first time at age 13-17 in three decades. (Study IV)

	HR (95 % CI)	p
Sex		
female	ref	
male	1.4 (1.3–1.5)	<0.001
Age at index admission		
13–14	ref	
15–17	1.9 (1.7–2.2)	<0.001
Year of index admission		
2000–2010	ref	
1999–1999	1.6 (1.4–1.8)	<0.001
1980–1989	2.1 (1.8–2.3)	<0.001
Primary diagnosis at index admission		
Anxiety, eating and emotional disorders of childhood (F40-48, F50-59, F93-99)	ref	
Organic, intellectual disability, developmental (F00-09, F70-79, F80-89, G-group)	0.8 (0.6–1.2)	0.3
Externalizing disorders (F10-19, F60-69, F90-92)	0.9 (0.7–1.1)	0.35
Schizophrenia group psychoses, other than SCH (F21-24, F26-29)	7.6 (6.7–8.6)	<0.001
Mood disorders (F30-39)	1.4 (1.2–1.6)	<0.001
Social reasons (Z-code)	0.9 (0.6–1.2)	0.40
Other, non-psychiatric	1.0 (0.7–1.4)	0.97

5.2.1 Stability of schizophrenia diagnosis

Of those who had schizophrenia diagnoses at index admission, 92.5% (n=296/320) had later inpatient care admission or disability pension information in registers with a mean follow-up time of 24 years (SD 9.6, median 28.6). Of those with later information available, 91.2% had schizophrenia diagnoses in last inpatient care or disability pension entry. There was no statistically significant difference for the persistence of schizophrenia diagnosis between sexes or between different decades of index admission. Of those who were early adolescents (13-14y) and had schizophrenia diagnoses at index admission, 75.0% (15/20) had schizophrenia diagnoses in the latest register entry, while 92.4% (255/276) of middle adolescents (15-17y) had schizophrenia diagnoses at index admission.

Of those with schizophrenia diagnoses at index admission but not in follow-up (n=26), 15.4% had other schizophrenia group (F20-29) diagnoses, 19.2% bipolar disorder (F30-31), and the rest some other psychiatric diagnoses.

5.3 Need for rehospitalization

Of the study population, 39.7% were rehospitalized at least once during adolescence (age 13-17) and 55.0% during ten-year follow-up and 57.4% during full follow-up lasting until the end of 2014. Females aged 13-17 were rehospitalized more often than males during adolescence (38.3% of males, 40.6% of females, p 0.003), while in full follow-up males were rehospitalized more often (58.7% of males, 56.5% of females, p 0.005). There was no statistically significant difference between sexes at ten-year follow-up. Those of both sexes aged 13-14 when first admitted were more likely to be readmitted during adolescence and in ten-year follow-up and in full follow-up in females, while in males those aged 15-17 were more likely to be readmitted in follow-up beyond adolescence. Those first-admitted in the period 1980-1989 were more likely to be readmitted in every follow-up period than were those admitted in later decades. However, it should be noted that those admitted in the period 2000-2010 had shorter follow-up time. Those with schizophrenia group (F20-29) diagnoses as primary diagnosis at first inpatient episode were more commonly readmitted than other diagnostic groups at all follow-up time points. While there was significant increase in readmissions between adolescence and ten-

year follow-up, the increase was not so marked between 10-year follow-up and full follow-up even when considering earlier decades. (Table 7)

Those who had been rehospitalized at least once had a median of three (SD 9, median 3) psychiatric inpatient care episodes (including first episode) during ten-year follow-up, males had a median of four and females a median of three. For those who had first inpatient care in 1980-89 the median number of admissions at ten-year follow-up was six and for 1990-99 it was four and for 2000-2010 it was three. Of the primary diagnoses, those with schizophrenia group diagnoses (F20-29) had the greatest number of inpatient care episodes in ten-year follow-up with a median of five, those with social reasons diagnosis (Z-code) had a median of four while all other diagnostic groups had a median of three.

Table 7. Proportion of patients rehospitalized during adolescence, in 10-year follow-up, overall. (N= 16842)

	Adolescence		10-year		Overall	
	Males	**Female**	**Males**	**Femal**	**Males**	**Females**
Age at index admission:						
13-14y [N = 2249 (males), 3064 (females)]	45.4 %	50.6 %	51.6 %	56.6 %	54.3 %	58.4 %
15-17y [N = 4500 (males), 7029 (females)]	34.8 %	36.3 %	57.8 %	53.6 %	61.0 %	55.7 %
p (age)	<.001	<.001	<.001	0.006	<.001	0.02
Year of index admission:						
1980–1989 [N = 1315 (males), 1112 (females)]	43.3 %	43.1 %	66.0 %	64.5 %	73.2 %	72.8 %
1990–1999 [N =1574 (males),1969 (females)]	42.6 %	43.1 %	64.4 %	59.3 %	69.3 %	63.4 %
2000–2010 [N = 3860 (males), 7012 (females)]	34.9 %	39.6 %	48.7 %	51.6 %	49.5 %	52.0 %
p (years)	<.001	0.004	<.001	<.001	<.001	<.001
Primary diagnosis at index admission:						
Organic, intellectual disability, developmental (F00-09, F70-79, F80-89, G-group) [N = 332 (males), 179 (females)]	38.9 %	36.3 %	50.3 %	51.4 %	54.8 %	54.2 %
Externalizing disorders (F10-19, F60-69, F90-92) [N = 1985 (males), 1626 (females)]	33.5 %	35.2 %	50.2 %	49.1 %	54.5%	51.4 %
Schizophrenia group (F20-29) [N = 952 (males), 980 (females)]	48.3 %	47.0 %	80.5 %	77.3 %	83.1 %	79.4 %
Mood disorders (F30-39) [N = 1284 (males), 3558 (females)]	38.1 %	41.9 %	54.8 %	54.2 %	56.4 %	55.6 %
Anxiety disorders (F40-48) [N = 1282 (males), 1912 (females)]	39.6 %	38.3 %	53.5 %	50.6 %	56.5 %	53.6 %
Eating disorder (F50-59) [N = 65 (males), 809 (females)]	30.8 %	47.0 %	47.7 %	56.7 %	47.7 %	57.8 %
Emotional disorders of childhood (F93-99) [N = 539 (males), 694 (females)]	37.5 %	42.9 %	49.0 %	52.3 %	50.8 %	54.3 %
Social reasons (Z-code) [N = 310 (males), 335 (females)]	36.5 %	31.0 %	47.1 %	41.2 %	51.0 %	43.6 %
p (diagnoses)	<.001	<.001	<.001	<.001	<.001	<.001

5.4 Mortality

5.4.1 Overall mortality

During follow-up until the end of 2014, 5.2% (Mortality Rate 3.9 per 1000 follow-up years) of the study population died, 8.2% (MR 5.9) of males and 3.1% (MR 2.5) of females ($p<0.001$), while in same-aged general population 1.9% died during the follow-up time period, 2.7% of males and 1.0% of females. No information on mortality rates of general population was available.

Those who were middle adolescents (aged 15-17) at index admission had higher mortality than those who had been early adolescents (aged 13-14) as 5.9% (MR 4.4) of those aged 15-17 and 3.6% (MR 2.8) of those aged 13-14 at index admission had died during follow-up ($p <0.001$). Those with index admission in earlier decades had higher mortality: 15.7% (MR 5.8) of those with index admission in the period 1980-1989, 6.8% (MR 3.7) in the period 1990-1999 and 2.3% (MR 2.8) in the period 2000-2010, $p<.001$ had died during follow-up. However different follow-up times need to be taken into account.

Of diagnoses, those with social reasons (Z-code), schizophrenia group or externalizing disorder (F10-19, F60-69. F90-92) diagnoses as primary diagnosis in first inpatient care episode had highest mortality as the crude mortality for different diagnostic groups was: social reasons (Z-code) 7.1% (MR 4.5), externalizing disorders (F10-19, F60-69, F90-92) 6.7% (MR 5.1), schizophrenia group (F20-29) 6.9% (MR 4.2), mood disorders (F30-39) 3.6% (MR 3.4), anxiety disorders (F40-48) 5.7% (MR 3.9) and eating disorders (F50-59) and emotional disorders of childhood (F93-99) diagnoses 3.1% (MR 2.6) and organic, intellectual, developmental and neurological diagnoses (F00-09, F70-79. F80-89, G-group) 5.1% (MR 3.6), $p <.001$. In males social reasons diagnoses (Z-code) followed by schizophrenia group (F20-29) and externalizing disorders (F10-19, F60-69, F90-92) had the crude mortality, while in females organic, intellectual, developmental and neurological diagnoses (F00-09, F70-79. F80-89, G-group) groups had the highest crude mortality followed by schizophrenia group (F20-29) and externalizing disorders (F10-19, F60-69, F90-92). (Table 8)

5.4.2 Mortality in ten-year follow-up

During ten-year follow-up 2.8% (MR 3.4 per 1000 follow-up years) of the study population had died, 4.4% (MR 5.2) of males and 1.8% (MR 2.2) of females ($p<0.001$). Those who were middle adolescents (aged 15-17) at index admission had higher 10-year mortality than early adolescents (aged 13-14) as 3.3% (MR 4.0) of those aged 15-17 and 1.8% (MR 2.1) of those aged 13-14 had died during ten-year follow-up ($p <0.001$). Those with index admission in earlier decades had higher ten-year mortality: 5.6% (MR 5.8) of those with index admission in 1980-1989, 3.5% (MR 3.5) in 1990-1999 and 2.0% (MR 2.7) in 2000-2010, $p<.001$.

Those with externalizing disorders (F10-19, F60-69. F90-92) as primary diagnoses at first inpatient care episode had highest ten-year mortality as crude mortality for externalizing disorders (F10-19, F60-69. F90-92) were 4.0% (MR 4.6), schizophrenia group (F20-29) 3.8% (MR 4.3), mood disorders (F30-39) 2.4% (MR 3.1), anxiety disorders (F40-48) 2.4% (MR 2.5) and eating disorders (F50-59) and emotional disorders of childhood (F93-99) diagnoses 1.8% (MR 2.3) and organic, intellectual, developmental and neurological diagnoses (F00-09, F70-79. F80-89, G-group) 2.0% (MR 2.4), $p <.001$. In males schizophrenia group, externalizing disorders and mood disorders had the highest crude mortality, while in females organic, intellectual, developmental and neurological diagnoses group (F00-09, F70-79. F80-89, G-group) and externalizing disorders (F10-19, F60-69, F90-92) had the highest crude mortality (Table 8).

5.4.3 Multivariate analyses

In multivariate analysis being male, middle adolescent at index admission and being admitted in the 1980s and 1990s were risk factors for death during follow-up. Of primary diagnoses at index admission externalizing disorders (F10-19, F60-69, F90-92) had again the highest risk with mood disorder (F30-39) having the second highest risk when compared to eating disorders (F50-59) and emotional disorders of childhood (F93-99). There was no statistically significant risk for other diagnoses. In ten-year follow-up only externalizing disorders (F10-19, F60-69, F90-92) had a statistically significant risk. (Table 9).

Table 8. Mortality % (with mortality rates per 1000 follow-up years) in ten-year follow-up and in overall follow-up until the end of 2014 according to age at index admission, year of index admission and primary diagnosis group at index admission.

	10-year		Overall	
	Males	**Females**	**Males**	**Females**
Age at index admission:				
13-14y [N = 2249 (males), 3064 (females)]	2.7 % (3.2)	1.1 % (1.4)	5.9 % (4.3)	1.9 % (1.6)
15-17y [N = 4500 (males), 7029 (females)]	5.2 % (6.2)	2.1 % (2.5)	9.4 % (6.6)	3.6 % (2.9)
p (age)	<.001	0.001	<.001	<.001
Year of index admission:				
1980–1989 [N = 1315 (males), 1112 (females)]	7.2 % (7.5)	3.8 % (3.9)	19.9 % (7.5)	10.8 % (3.9)
1990–1999 [N =1574 (males),1969 (females)]	5.5 % (5.7)	1.8 % (1.8)	10.5 % (5.7)	3.9 % (2.1)
2000–2010 [N = 3860 (males), 7012 (females)]	3.0 % (3.9)	1.5 % (1.9)	3.3 % (4.0)	1.7 % (2.0)
p (years)	<.001	<.001	<.001	<.001
Primary diagnosis at index admission:				
Organic, intellectual disability, developmental (F00-09, F70-79, F80-89, G-group) [N = 332 (males), 179 (females)]	0.9 % (1.1)	3.9 % (4.7)	5.1 % (3.6)	5.0 % (3.4)
Externalizing disorders (F10-19, F60-69, F90-92) [N = 1985 (males), 1626 (females)]	4.9 % (5.7)	2.8 % (3.3)	8.9 % (6.5)	4.1 % (3.2)
Schizophrenia group (F20-29) [N = 952 (males), 980 (females)]	5.8 % (6.6)	1.9 % (2.2)	9.3 % (5.7)	4.6 % (2.7)
Mood disorders (F30-39) [N = 1284 (males), 3558 (females)]	4.8 % (6.0)	1.6 % (2.0)	7.2 % (6.5)	2.2 % (2.2)
Anxiety disorders (F40-48) [N = 1282 (males), 1912 (females)]	3.6 % (4.2)	1.6 % (1.9)	8.9 % (5.5)	3.6 % (2.6)
Eating disorders and emotional disorders of childhood (F50-59, F93-99) [N = 604 (males), 1503 (females)]	3.6 % (4.5)	1.1 % (1.3)	5.3 % (4.1)	2.2 % (1.9)
Social reasons (Z-code) [N = 310 (males), 335(females)]	3.5 % (4.1)	1.8 % (2.0)	11.0 % (6.6)	3.6 % (2.4)
p (diagnosis groups)	0.004	0.002	0.004	<.001

Table 9. Hazard ratios (95 % confidence intervals) for death in 10-year follow-up and for overall follow-up ending at the end of 2014.

	10-year		Overall	
	HR (95% CI)	**p**	**HR (95% CI)**	**p**
Sex				
female	ref		ref	
male	2.2 (1.8-2.7)	<0.001	2.2 (1.9-2.5)	<0.001
Age at index admission				
13–14	ref		ref	
15–17	1.8 (1.5-2.3)	<0.001	1.6 (1.4-1.9)	<0.001
Year of index admission				
2000–2010	ref		ref	
1990–1999	1.3 (1.1-1.7)	0.015	1.4 (1.1-1.6)	0.005
1980–1989	2.0 (1.6-2.5)	<0.001	1.9 (1.5-2.2)	<0.001
Primary diagnosis at index admission				
Eating disorders and emotional disorders of childhood (F50-59, F93-99)	ref		ref	
Organic, intellectual disability and developmental disorders, neurological diagnoses (F00-09, F70-79, F80-89, G)	0.7 (0.4-1.4)	0.347	0.9 (0.6-1.4)	0.65
Externalizing disorders (F10–19, F60–69, F90–92)	1.6 (1.1-2.3)	0.011	1.5 (1.1-1.6)	0.005
Schizophrenia group (F20–29)	1.2 (0.8-1.8)	0.299	1.1 (0.8-1.4)	0.731
Mood disorders (F30-39)	1.4 (1.0-2.0)	0.065	1.4 (1.0-1.8)	0.028
Anxiety disorders (F40-48)	1.0 (0.7-1.5)	0.992	1.4 (0.9-1.5)	0.341
Social reasons (Z-code)	1.1 (0.6-1.9)	0.83	1.3 (0.9-2.0)	0.124

5.4.4 Age and cause of death

The mean age for those who died in overall follow-up was 26 (SD 8, median 24) when they died. In males it was 27 (SD 8, median 8) and in females 26 (SD 8, median 23). Lowest age of death was in the mood disorders (F30-39) group, mean 23 (SD 6, median 22), while in other diagnoses the mean was 26 (SD 8, mean 24) in the externalizing disorders group (F10-19, F60-69, F90-92), 27 (SD 9, median 24) in the schizophrenia group (F20-29), 28 (SD 9, median 27) in anxiety disorders (F40-48), 29 (SD 5, median 29) in the social reasons (Z-code) group, 25 (SD 7, median 24) in eating disorders (F50-59) and emotional disorders in childhood (F93-99) and 29 (SD 9, median 28) in those with organic, intellectual disability and developmental disorders and neurological diagnoses (F00-09, F70-79. F80-89, G-group).

Unnatural causes (such as suicide, violence and accidents) were a much more common cause of death than natural causes (illnesses) as 74.5% of those who died had died due to unnatural causes. In general population ca. 49% had died due to unnatural causes. In the study population males were more likely to die due to unnatural causes than females (males 77.1%, females 69.8%, p. 0.017). Among the diagnostic groups, especially in mood disorders (F30-39), the proportion of deaths due to unnatural causes was exceptionally high at 82.0%, and 77.9% in the externalizing disorders (F10-19, F60-69, F90-92), 73.8% in the eating disorders (F50-59) and emotional disorders of childhood (F93-99) groups, 73.3% in the social reasons (Z-code) group, 72.0% in the schizophrenia group (F20-29), 70.9% in the anxiety disorders (F40-48) group with the lowest 32.0% in those with organic, intellectual disabilities and developmental disorders or neurological diagnoses (F00-09, F70-79. F80-89, G-group) (p 0.01).

5.5 Criminality

The criminality of the study population was studied in a subsample for 10-year follow-up after index admission. The subsample (N 16842) comprised those with psychiatric (F), neurological (G) or social reasons (Z) as the primary diagnosis at index admission. Of the subsample 40.1% were males and 59.9% females.

In the sample 30.5% (Incidence Rate (IR) 4.7 per 100 follow-up years) had committed crimes during ten-year follow-up. 48.8 % (IR 9.1) of males and 18.5% (IR 2.6) of females ($p<0.001$). There were no statistically significant associations between age at index admission and subsequent criminal activity. There was a higher

proportion of those acquiring criminal records among those admitted in 1980-1989 as 43.7% (IR 6.8) of them had committed crimes compared to 37.9% (IR5.3) admitted in 1990-1999 and 25.2% (IR 4.1) in 2000-2010, (p<.001). Of those who had committed crimes before the index admission 78.7 % (IR 26.6) had a criminal record after the admission, while 26.0 % (IR 3.8) of these had no previous criminal record (p< .001). In males the proportions were 84.4% (IR 34.5) and 41.6% (IR 7.1) (p< .001) and in females 59.9% (IR 13.4) and 17.0% (IR 2.3) (p <.001) respectively. Criminal activity after the index admission was most common among those with externalizing disorder diagnoses (F10-19, F60-69, F90-92). It was second most common among those admitted for social reasons diagnosis (Z-code). Criminal conduct after index admission was least common in females and second least common in males who had schizophrenia group (F20-29) diagnoses. (Table 10)

5.5.1 Violent crime

Of the sample 14.3 % (Incidence Rate (IR) 1.9 per 100 follow-up years) had recorded violent crime after the index admission, 25.2 % (IR 3.6) of males and 6.9% (IR 0.9) of females. Age at index admission had no statistically significant association with later violent crime. There was a higher proportion of those having committed violent crimes among those admitted in 1980-1989 (19.6%, IR 2.3) than in those admitted in 1990-1999 (18.3%, 2.1) or in 2000-2010 (11.7%, IR 2.7), (p<.001).

Of those with any criminal record before the index admission, 47.6% (IR 8.2) had committed a violent crime after the index admission, as had 14.9% (IR 2.0) of those without a prior record (p <.001). In males the respective proportions were 65.2% (IR 10.0) and 22.7% (IR 2.7) (p.<001) and in females 10.3% (IR 4.0) and 6.5% (IR 0.8) (p<.001). In both sexes having committed violent crimes after index admission was most common among those with externalizing disorder (F10-19, F60-69, F90-92) diagnoses. This was second most common among those with social reasons diagnoses (Z-code) given as a reason for the index admission. Those with schizophrenia group diagnoses (F20-29) had least commonly acquired a record for violent crime. (Table 10)

5.5.2 Multivariate analyses

In multivariate analyses, the likelihood of acquiring a criminal record of any kind and for a violent crime was increased in males, in those admitted in the 1980s or 1990s. The risk was increased in all diagnostic groups except in the group comprising those with organic, intellectual disability and developmental disorders (F00–09, F70–79, F80–89, G-diagnoses), when compared to those with schizophrenia group diagnoses (F20-29) at index admission. Those with criminal records before index admission were also at increased risk of acquiring subsequent criminal and violent crime records. (Table 11)

Table 10. Any crime and violent crime according to primary diagnosis, during the follow-up of maximum 10 years after the index admission among patients admitted to psychiatric inpatient treatment for the first time at ages 13–17 between 1980 and 2010 in Finland. (%) (incidence rate per 100 follow-up years). (N=16842)

	Crime		Violent crime	
	Males	**Females**	**Males**	**Females**
Age at index admission:				
13-14y [N = 2249 (males), 3064 (females)]	48.7 % (8.6)	19.0 % (2.6)	24.9 % (3.5)	7.6 % (1.0)
15-17y [N = 4500 (males), 7029 (females)]	48.5 % (9.4)	18.3 % (2.5)	25.4 % (3.7)	6.6 % (0.8)
p (age)	.19	.52	.29	.07
Year of index admission:				
1980–1989 [N = 1315 (males), 1112 (females)]	58.8 % (11.2)	25.9 % (3.3)	28.2 % (3.6)	9.4 % (1.0)
1990–1999 [N =1574 (males),1969 (females)]	57.4 % (10.4)	22.3 % (2.6)	31.2 % (4.0)	7.9 % (0.8)
2000–2010 [N = 3860 (males), 7012 (females)]	41.5 % (7.8)	16.2 % (2.4)	21.7 % (3.4)	6.2 % (0.9)
p (years)	<.001	<.001	<.001	<.001
Primary diagnosis at index admission:				
Organic, intellectual disability, developmental (F00-09, F70-79, F80-89, G-group) [N = 332 (males), 179 (females)]	23.2 % (3.4)	9.5 % (1.2)	10.5 % (1.4)	3.4 % (0.4)
Externalizing disorders (F10-19, F60-69, F90-92) [N = 1985 (males), 1626 (females)]	71.2 % (18.9)	39.1 % (6.2)	42.8 % (7.0)	16.4 % (2.1)
Schizophrenia group disorders (F20-29) [N = 952 (males), 980 (females)]	28.4 % (4.0)	8.4 % (1.0)	12.4 % (1.5)	2.8 % (0.3)
Mood disorders (F30-39) [N = 1284 (males), 3558 (females)]	38.0 % (6.5)	14.3 % (2.0)	17.1 % (2.4)	5.4 % (0.7)
Anxiety, eating and emotional disorders of childhood (F40-48, F50-59, F93-99) [N= 1886 (males), 3415 (females)]	44.8 % (8.0)	15.5 % (2.1)	21.1 % (2.9)	4.7 % (0.6)
Social reasons (Z-code) [N = 310 (males), 335 (females)]	59.7 % (12.6)	28.1 % (6.2)	26.1 % (3.6)	14.0 % (1.7)
p (diagnosis groups)	<.001	<.001	<.001	<.001

Table 11. Hazard ratios (95 % confidence intervals) for acquiring a criminal record for any crime and for committing a violent crime a maximum of ten years after index admission among those first admitted to psychiatric hospital at ages 13–17 in three decades. (Study I)

	Any crime		Violent crime	
	HR (95% CI)	**p**	**HR (95% CI)**	**p**
Sex				
female	ref		ref	
male	2.6 (2.5–2.8)	< .001	3.2 (3.0–3.6)	< .001
Age at index admission				
13–14	ref		ref	
15–17	0.9 (0.9–1.0)	.008	1.0 (0.9–1.1)	.49
Year of index admission				
2000–2010	ref		ref	
1990–1999	1.4 (1.3–1.5)	< .001	1.2 (1.1–1.3)	< .001
1980–1989	1.6 (1.5–1.7)	< .001	1.2 (1.1–1.3)	.001
Primary diagnosis at index admission				
Schizophrenia group (F20–29)	ref		ref	
Organic, intellectual disability, developmental (F00-09, F70-79, F80-89, G-group)	1.0 (0.8–1.2)	.91	(0.7–1.4)	.87
Externalizing disorder (F10–19, F60–69, F90–92)	4.1 (3.7–4.6)	< .001	4.5 (3.8–5.4)	< .001
Mood disorders (F30–39)	1.9 (1.6–2.1)	< .001	1.8 (1.5–2.1)	< .001
Anxiety, eating and emotional disorders of childhood (F40-48, F50-59, F93-99)	1.9 (1.7–2.2)	< .001	1.8 (1.5–2.2)	< .001
Social reasons (Z-code)	3.0 (2.6–3.6)	< .001	2.9 (2.3–3.7)	< .001
Crime committed before index admission				
no	ref		ref	
yes	3.6 (3.3–3.9)	< .001	3.5 (3.1–4.0)	< .001

5.6 Education

Education was studied in the subsample of study population comprising those being alive and 20-49 years old at the end of 2014 and having education information available in 2014, (N=14435). Of the subsample 38.8% were males and 61.2% females.

Of the sample, 50.0% had completed post-comprehensive education (42.9% upper secondary education and 7.1% tertiary education), while in general population 84.9% of Finns 20-49 years old had completed at least some kind of post-comprehensive education (49.7% upper secondary, 35.2% tertiary education) ($p<.001$). As seen in Table 12, the study population had lower educational attainment in every age group (age in 2014) in both sexes than those in general population and the proportion of those with no post-comprehensive education was much higher in the study sample.

Of those completing no post-comprehensive school education, 25.6% (1849/7224) were enrolled in upper secondary or tertiary education in 2014. Females were more often enrolled than males as 30.9% (1200/3881) of females and 19.4% (649/3343) of males ($p< 0.001$) were enrolled. Those in younger age groups were also more likely to be enrolled in post-comprehensive education
(Age 20-29: 35.8% (1654/4622), age 30-39: 10.4% (168/1608), age 40-49: 2.7% (27/994), $p<0.001$). No data on whole population were available.

5.6.1 Risk factors for having no post-comprehensive education

Altogether 37.2% of the sample had not completed nor were enrolled in post-comprehensive education in 2014. This was more likely among males (48.1% in males vs. 30.4 % in females, $p<0.001$) and in older age groups (age 20-29, 33.3%, age 30-39, 40.2%, age 40-49, 49.8%, $p <0.001$). In females those who had been in early adolescence (aged 13-14) at the index admission were slightly more likely not to have post-comprehensive education or to be enrolled in it than those first admitted during middle adolescence (aged 15-17). However, in the whole sample and in males age at first admission did not have statistically significant associations with later educational attainment. With the exception those with eating disorder (F50-59) diagnoses as the primary diagnosis at index admission, all other diagnostic groups had a higher proportion of no education after comprehensive school than in general population. (Table 13)

In multivariate analyses, conducted separately for each age group, males had higher risk for no further education. Every diagnostic group had a statistically significantly increased risk compared to those with eating disorder (F50-59) diagnoses at index admission. Those with organic, intellectual disability and developmental disabilities (F00-09, F70-79, F80-89, G-diagnoses) or externalizing disorders (F10,19, F60-69, F90-92) were at higher risk in every age group. (Table 14)

Table 12. Highest attained school education in the study population compared to whole population in different age groups. % (n)

Males	**20-29y**			**30-39y**			**40-49y**		
	Study population (N=3109)	Whole population (N=348782)	p-values	Study population (N=1507)	Whole population (N=360229)	p-values	Study population (N=987)	Whole population (N=342288)	p-values
Comprehensive school only	60.6 % (1883)	19.0 % (66346)	<0.001	56.9 % (857)	17.6 % (63492)	<0.001	61.1 % (603)	17.9 % (61314)	<0.001
Upper secondary education	37.4 % (1162)	67.4 % (235069	<0.001	38.0 % (572)	48.2 % (173659)	<0.001	32.1 % (317)	46.5 % (159285)	<0.001
Tertiary education	2.1 % (64)	13.6 % (47367)	<0.001	5.2 % (78)	34.2 % (123078)	<0.001	6.8 % (67)	35.6 % (121689)	<0.001
Females	**20-29y**			**30-39y**			**40-49y**		
	Study population (N=5803	Whole population (N=332869	p-values	Study population (N=2075)	Whole population (N=339857	p-values	Study population (N=954	Whole population (N=331708)	p-values
Comprehensive school only	47.2 % (2739)	14.9 % (49470)	<0.001	36.2 % (751)	10.4 % (35320)	<0.001	41.0 % (391)	10.4 % (34644)	<0.001
Upper secondary education	47.5 % (2755)	60.8 % (202432)	<0.001	47.8 % (991)	37.5 % (127194)	<0.001	41.1 % (392)	37.2 % (123246)	0.0128
Tertiary education	5.3 % (309)	24.3 % (80967)	<0.001	16.0 % (333)	52.1 % (177073)	<0.001	17.9 % (171)	52.4 % (173818)	<0.001

Table 13. No post-comprehensive education completed or pursued in 2014, by age and primary diagnosis at index admission and age in 2014 (%) (Study III)

	Males	**Females**
Age in first inpatient care:		
13–14 yrs (N= 1730 (males), 2389 (females))	46.7 %	32.1 %
15–17 yrs (N= 3873 (males), 6443 (females))	48.7 %	29.7 %
p (vs age groups)	0.168	0.026
Age in 2014:		
20–29 yrs (N= 3109 (males), 5803 (females))	42.6 %	28.3 %
30–39 yrs (N= 1507 (males), 2075 (females))	52.0 %	31.6 %
40–49 yrs (N= 987 (males), 954 (females))	59.3 %	40.0 %
p (vs. age groups)	<0.001	<0.001
Primary diagnosis at first inpatient care:		
Organic, intellectual disability and developmental (F00-09, F70-79, F80-89, G-diagnoses) (N= 270 (males), 145 (females))	54.4 %	46.9 %
Schizophrenia group (F20-29) (N= 793 (males), 860 (females))	49.1 %	38.1 %
Mood disorders (F30-39) (N= 1110 (males), 3128 (females))	39.2 %	25.4 %
Anxiety disorders (F40-48) (N= 1061 males, 1657 (females))	47.5 %	30.1 %
Eating disorders (F50-59) (N= 54 males, 708 females))	22.2 %	11.9 %
Externalizing disorders (F10-19, F60-69, F90-92) (N= 1614 (males), 1428 (females)	55.3 %	39.6 %
Emotional disorders of childhood (F93-99) (N= 448 (males), 608 (females))	44.2 %	36.5 %
Social reasons (Z-codes) (N= 254 (males), 299 (females))	45.8 %	40.8 %
p (vs diagnosis groups)	<0.001	<0.001

Table 14. No post-comprehensive education completed or pursued in 2014, by age and primary diagnosis at index admission and age in 2014 (%)

	20-29yrs		30-39yrs		40-49yrs	
	OR (95 % CI)	p	OR (95 % CI)	p	OR (95 % CI)	p
Sex						
Female	ref		ref		ref	
Male	1.6 (1.4–1.7)	<0.001	2.1 (1.8–2.4)	<0.001	2.0 (1.7–2.4)	<0.001
Age at index admission						
13-14yrs	ref		ref		ref	
15-17yrs	1.0 (0.9–1.1)	0.76	0.9 (0.8–1.0)	0.111	1.1 (0.9–1.4)	0.312
Primary diagnosis at index admission						
Eating disorders (F50-59)	ref		ref		ref	
Organic, intellectual disability and developmental (F00-09, F70-79, F80-89, G-diagnoses)	5.0 (3.5–7.2)	<0.001	5.2 (2.7–10.3)	<0.001	7.4 (3.1–17.5	<0.001
Externalizing disorder (F10-19, F60-69, F90-92)	4.9 (3.7–6.4)	<0.001	4.5 (2.9–7.2)	<0.001	6.7 (3.0–14.6)	<0.001
Schizophrenia group disorders (F20-29)	3.9 (2.9–5.3)	<0.001	3.4 (2.1–5.4)	<0.001	5.3 (2.4–11.4)	<0.001
Mood disorders (F30-39)	2.5 (1.9–3.3)	<0.001	2.6 (1.7–4.1	<0.001	3.2 (1.4–7.1)	0.006
Anxiety disorders (F40-48)	2.9 (2.2–3.9)	<0.001	3.1 (2.0–5.0)	<0.001	4.7 (2.2–10.2)	<0.001
Emotional disorders of childhood (F93-99)	3.9 (2.9–5.4)	<0.001	3.3 (1.0–5.4)	<0.001	3.7 (1.6–8.8)	0.003
Social reasons (Z-codes)	3.9 (2.9–5.4)	<0.001	4.6 (2.7–7.9)	<0.001	3.6 (1.6–8.5)	0.003

6 DISCUSSION

6.1 Use of psychiatric inpatient care

In this nationwide register-based study spanning three decades a considerable increase was observed in first admissions to psychiatric inpatient care during adolescence. Admissions remained stable during the 1980s and the first half of the 1990s, but the absolute and population-adjusted figures for adolescent psychiatric inpatient care started to increase in Finland in the late 1990s and grew considerably during the first decade of the 21st century. The development was so marked that over 60% of the study population comprised those first admitted between 2000 and 2010. Also, it was more pronounced among females, resulting in a clear overrepresentation of females in adolescent psychiatric inpatient care. The greatest increases were seen in admissions due to mood disorders in females, and due to externalizing and mood disorders in males. Hospitalizations due to schizophrenia group diagnoses remained stable although their proportional share decreased as a reason for inpatient care. Increased use of inpatient care in adolescents has also been observed worldwide (Blader, 2011; James et al., 2010; Meagher et al., 2012). A significant decrease in mean length of first inpatient stay was also observed with a decrease by almost two thirds between 1980 and 2010, being at its lowest in the early 2000s. This shortening was more due to changes and developments in treatment practices than to necessity due to increased use of inpatient care as the most marked decrease occurred in the 1980s and early 1990s. Also, while length of stay decreased over time, this did not manifest as increased rehospitalizations.

There may be many possible explanations for the increased use of inpatient care. It is possible that there has been increase in the prevalence of mental disorders severe enough to require inpatient care, especially in the 2000s when a major influx of adolescents with diagnoses like mood disorders and externalizing disorders into inpatient care was observed in the study. However, although there has been some reports on increased internalizing problems in girls (Bor et al., 2014), epidemiological studies have reported no evidence of an increasing trend for severe depression possibly requiring inpatient care (Jane Costello et al., 2006; Richter et al., 2008; Torikka et al., 2014). As externalizing problems have also steadily decreased both

internationally and in Finland (Bor et al., 2014; Elonheimo, 2014; Knaappila et al., 2019; Sourander et al., 2012; Svensson & Oberwittler, 2021), the increase cannot be explained by epidemiological reasons.

It is possible that there has been a reconceptualization (also known as medicalization theory) of adolescent emotional and behavioural turmoil, causing this to be interpreted as deviation from normal adolescent development and classified more as psychiatric symptoms and disorders, even requiring inpatient care. Especially towards the early 2000s the public debate was preoccupied by the allegedly increasing psychosocial problems and violent behaviour of adolescents (Kaltiala-Heino, 2004), possibly manifesting as increased use of inpatient care, but also increased use of child welfare services, especially placements outside the home. Medicalization of problems that were previously associated with normal adolescent development as psychiatric disorders requiring inpatient care should have led to hospitalization with milder symptoms and probably to shorter inpatient stays. Although the length of stay decreased remarkably over the study period, the most signinifcant decreased occurred in the 1980s and in the 2000s length of stay remained fairly stable. Nor was any decrease in symptom severity observed measured by GAS rating, findings corroborated by Kronström et al. who noted that the share of adolescent inpatients with the poorest general functioning had increased when compared to inpatient data from 2000 and 2010 (Kronström et al., 2016). Thus, no support is given to medicalization of normative developmental turmoil.

It is also possible that the lessening of stigma related to mental disorder together with increased availability of outpatient services, especially in the 2000's, have led to the realization of hidden need for care (Pylkkänen, 2003, 2013). This may have led to better recognition of severe mental disorders with a possible urge to treat them as effectively as possible, leading to increased use of inpatient care.

Another possible explanation is changes in society, with more demands imposed on young people, making coping harder and leading to more stress and poorer mental health (Bor et al., 2014). Lack of preventive services could also have led to manifestation mental disorders. In the first half of the 1990s Finland suffered a major economic depression with a profound impact on every socioeconomic level. Significant cuts were made to services, even family services, school welfare and healthcare, which are an important part of the preventive services supporting mental health of young people (Pylkkänen, 2003; Rimpelä, 2015). In spite of increased expenditure on child and adolescent psychiatry and other specialized level services in the 2000s, this hardly sufficed to offset the cuts of the 1990s, especially as the focus of funding was on more specialized level services. Economic problems in

families may also have affected children's and adolescents' mental health due to negative changes in family dynamics, parenting and family stress. It has been proposed that girls may be more sensitive to family stressors than boys, expressing first internalizing symptoms and possibly later externalizing symptoms (Fonseca et al., 2016; Solantaus et al., 2004). The economic recession may have had far-reaching consequences. Those who became adolescents in the mid and late 2000's were born during of the recession, and family stress may have adversely affected the crucial early development of children (Solantaus et al., 2004). Even after economic depression the child poverty rate has increased in Finland. (Härtull et al, 2017) Overall, those children and adolescents with low socioeconomic status suffer from multiple stressful life situations and are susceptible to a higher risk of developing mental health problems (Reiss et all, 2019). Also, in adults association has been observed between lower income and higher risk for psychiatric inpatient care (Suokas et al, 2020)

6.2 Incidence and stability of schizophrenia diagnoses

The number of first psychiatric inpatient care episodes during adolescence due to any schizophrenia group diagnosis remained quite stable over the time of study period from 1980 to 2010 although their proportion as a reason for care decreased due to marked increase of internalizing and externalizing disorders. Although some variation has been suggested in the incidence of schizophrenia group psychoses in other studies, no clear trend over time has been reported (Jongsma et al., 2019; Kirkbride et al., 2009). Although the incidence of schizophrenia group diagnoses remained stable, there were major shifts in the proportions of schizophrenia and other diagnoses in the schizophrenia group over the study period, with actual schizophrenia diagnoses used cautiously in the 1990's. This was probably more due to the fear of stigmatization (Copeland et al., 2009; González-Torres et al., 2007; Hinshaw, 2005) than to any real change in the incidence of schizophrenia as the lifetime incidence of schizophrenia in the study population remained quite stable.

Overall adolescents with mental disorders severe enough to require inpatient care were at higher risk of receiving schizophrenia diagnoses at some point of their lives. Over one tenth received such diagnoses during follow-up, which significantly exceeds the lifetime prevalence of schizophrenia in general population (ca 1.3%, (Perälä et al., 2007)). Those with schizophrenia group psychotic disorders other than schizophrenia were at highest risk of all for subsequent schizophrenia. However, it

should be noted that a considerable share, a half, of those schizophrenia group psychotic disorders other than schizophrenia did not convert to schizophrenia, thus reflecting the more transient nature of psychosis in adolescence, a finding shared with other studies (Ballageer et al., 2005; Castro-Fornieles et al., 2011; Correll et al., 2005; Fraguas et al., 2008). On the other hand, early-onset schizophrenia itself was a very stable diagnosis in this study as also has been reported elsewhere. (Hollis, 2000; Remberk et al., 2014; L. Xu et al., 2020). Affective disorders (F30-39) also yielded an increased risk for later schizophrenia, which may be due to both actual transition from mood disorders to schizophrenia or to overlap between mood disorders and prodromal symptoms (Consoli et al., 2014).

Although, psychotic disorders often exacerbate gradually over time and symptoms become easily recognisable by non-clinicians, hence leading to and requiring hospitalization, early recognition of schizophrenia may be difficult as milder symptoms may easily go unrecognized (Conrad et al., 2016; Correll et al., 2005). As the prodromal symptoms of psychotic disorders are diverse and have characteristics in common with other mental disorders, it is possible that some adolescents diagnosed with other disorders in their first inpatient care were actually going through the prodromal phase of schizophrenia but receiving the diagnosis only later. Therefore, it is important that possible risk symptoms for psychotic disorders are continuously screened, especially in those adolescents who have required psychiatric inpatient care. Although the outcome studies of treatment of prodromal symptoms are somewhat discouraging (Fusar-Poli et al., 2019), effective treatment and support should still be offered; even if these fail to prevent manifestations of psychotic disorder, they may alleviate the accompanying negative effects on patients' lives and also those of other mental disorders.

Overall, it seems that incidence of schizophrenia group psychoses and schizophrenia itself remains quite stable and is not affected by changes in time in society or in healthcare and other support services.

6.3 Mortality

Having a mental disorder severe enough to require inpatient care during adolescence was a risk for premature death as those in study population had threefold mortality compared to mortality in same-aged general population. This reflects the findings of earlier studies (Kjelsberg, 2000; Nordentoft et al., 2013; Walker et al., 2015). Higher mortality was prevalent in both sexes. Higher mortality in the study population can

be explained by the greater numbers of deaths due to unnatural causes, but death due to natural causes (illnesses) was also slightly higher in the study population than in general population as 1.4% of the study population had died due of natural causes compared to some 1.0% in general population. Increased risk of death due to natural causes has also been observed in other studies reflecting higher risks for various medical conditions (for example, cardiovascular diseases, metabolic conditions) and overall poorer health than in general population (Kjelsberg, 2000; Launders et al., 2022; Patel et al., 2007; Walker et al., 2015). Also, various medical conditions may be underdiagnosed among those with severe mental disorders, especially in those patients with schizophrenia diagnoses (Launders et al., 2022).

As in earlier studies, those with externalizing disorder diagnoses were at high risk for premature death especially due to unnatural causes. Impulsivity, risk-taking, violence, substance use and other risky behaviour and high-risk social environments commonly associated with externalizing disorders increase the risk for accidental death and death due to violence, but higher risk for suicide has also been observed in externalizing disorders (Engqvist & Rydelius, 2006; Kjelsberg, 2000; Lindberg et al., 2017). Those with externalizing disorders may not be the most motivated and willing to accept care and support and also there is a lack of effective, suitable and readily available treatment and support options for externalizing disorders.

Contradictory to other studies reporting an association between higher risk of death and psychotic disorders, no such obvious association was found in the present study. While a high proportion of those with schizophrenia group diagnoses had died in follow-up, in multivariate analysis there was no statistically significant risk for death compared to other diagnoses. This may be because in this study those treated in inpatient care due to schizophrenia group psychoses probably fall under increased surveillance and support, including outpatient care after inpatient care, while adult patients at high risk of death after inpatient care (Hoang et al., 2013), lack the support networks available to adolescents.

While in the study population those who had been in inpatient care in the 1980s were at the highest risk of death even in ten-year follow-up or observed by mortality rates, which are not so susceptible to different follow-up times or age-relating factors, those who had been in inpatient care in the 2000 nevertheless still had higher mortality than general population. More effective treatment methods and increased availability of outpatient care and other support, especially in adolescent psychiatry, may have reduced mortality in psychiatric patients in general (Johannessen et al., 2009), but there are also opposite findings as according to (Nome & Holsten, 2012), the higher risk for death remains prevalent in adolescents requiring psychiatric

inpatient care. However, in spite of concerns that shorter inpatient care would lead to poorer prognoses and increase the risk of death, this was not observed in the present study; LOS has decreased since the 1980s and so also has mortality.

6.4 Crime

Almost one third of the study population had committed crimes and received convictions in ten-year follow-up, and 14% had committed violent crimes. Similarly to earlier studies (Engqvist & Rydelius, 2007; Ivert et al., 2017; Kjelsberg, 2005) males were at especially high risk for criminal behaviour, as almost half of them had committed crimes and every fourth of them violent crimes, while in females only one fifth had commited crimes and only 7% violent crimes. When compared to criminality in a Finnish cohort study of general population aged 15-30, acquiring a criminal record was less common in the study population while violent crimes were more common: in the cohort study 60% of males and 25% of females were registered as offenders and 17% of males and 3% females had committed violent crimes (Elonheimo et al., 2014). However, it should be noted that the cohort study used a register in which the police register every offence they become aware of, thus more crimes are registered, while this study relies on data on convictions for crimes.

As in earlier studies, those with externalizing disorder (conduct, personality, substance use disorder) diagnoses at index admission had the highest risk for both any and for violent crime (Hodgins et al., 2009; Ivert et al., 2017; Kjelsberg, 2005; Knecht et al., 2015; Mohr-Jensen et al., 2019). Also, those having a social reasons (Z-code) diagnosis had the second highest risk. Although those with social reasons (Z-code) diagnoses could not be diagnosed with any mental disorder, they may have been admitted for observation due to the same kind disruptive behaviours as in those received externalizing disorder (F10-19. F60-69. F90-92) diagnoses. It could moreover denote familial or other socioeconomical factors associated with higher risk for criminal behaviour (Enqvist et al, 2007). In contrast to other studies (Naudts & Hodgins, 2006; Soyka et al., 2004; Taylor & Bragado-Jimenez, 2009), where psychoses have been associated with increased risk of violent offending, in this study the schizophrenia group (F20-29) diagnoses had the lowest proportion for perpetrating any and violent crime. It is possible that those who were in inpatient care in adolescence due to schizophrenia group diagnoses are provided with intensive care and support throughout adolescence and early adulthood, which may

reduce the risk for committing crimes. It is also possible that their violent behaviour does not lead to criminal convictions and therefore to a criminal record if it occurs in care institutions and is considered to be a symptom of illness (Kaltiala-Heino et al., 2014). In this study internalizing disorders (represented by mood, anxiety, eating disorders and emotional disorders of childhood) carried a higher risk for criminal behaviour than schizophrenia group disorders. Internalizing disorders have not often been considered a risk factor for criminal behaviour, although irritability, which is a common symptom of depression in adolescence, could possibly increase the risk of violence (Birmaher & Brent, 2007). It is also possible that internalizing disorders requiring inpatient care represent the more severe end of the disorder spectrum with poorer outcome compared to internalizing disorders or disturb normal adolescent development resulting in increased risk for criminal behaviour.

While those with psychiatric inpatient care during adolescence were at the risk for criminal behaviour, especially violent crime, a particularly notable finding was the decidedly high risk for subsequent crime among those with a criminal record before their first psychiatric inpatient care. In males the risk was double and in females over threefold when compared to those without criminal convictions before the index admission. Despite the extensive support and care usually available after inpatient care, these did not suffice to divert adolescents from criminal behaviour, especially if they had cumulative problems such as severe mental disorder and delinquency.

Although in those with first admitted in the 2000s the lower risk for criminality than in earlier decades could be attributed to the increased availability of support, it could be also associated with the increased amount of inpatient care due to internalizing disorders or with the significantly increased proportion of females in inpatient care, both of which carry a lower risk for criminal behaviour than externalizing disorders or males.

6.5 Education

The highest educational attainment among former adolescent psychiatric inpatients across age groups was considerably lower than among the Finnish population at large and there was no marked improvement during the study period despite increases in the availability of adolescent psychiatric services, pharmacological treatments and other support services like welfare services and special education in school. Only about 50% of the former inpatients had completed some kind of post-comprehensive education compared to about 85% of whole population. This could

be related to the nature of the disorders themselves, the stigma related to them or that despite the increased availability of support and treatment, society has still failed to adequately integrate those with mental health problems into education. As adolescence is a stage of life associated with the rapid acquisition of new information and making far-reaching choices (such as in education), those disorders with cognitive dysfunction may have particularly damaging long-lasting effects. Overall failure to attain education may have long-term negative impacts on integration into working life, social life, overall health and even mortality, therefore constituting a significant risk factor for becoming marginalized (Acacio-Claro et al., 2017; de Ridder et al., 2013; Hoff et al., 2018; Hummer & Skalamera, 2016; Myhr et al., 2018).

Those with externalizing disorder (F10-19, F60-69, F90-92) diagnoses were at very high risk of acquiring no post-comprehensive education, a finding also reported in many other studies (Colman et al., 2009; Esch et al., 2014; Evensen et al., 2016; McLeod et al., 2012). This may reflect the impact of the neurocognitive and motivational deficits associated with externalizing disorders (Barnett, Maruff, & Vance, 2009; Esch et al., 2014; Farkas, 2003). This risk was also prevalent in those with schizophrenia group (F20-29), anxiety (F40-48), or mood disorder (F30-39) diagnoses. Cognitive impairment, known to be prevalent especially in schizophrenia group psychoses, but also to be seen in mood disorders can cause significant disability (Castaneda et al., 2008; G. Xu et al., 2012). Also, the negative symptoms of schizophrenia and many core symptoms of depression, for example diminished interest, fatigue, could severely affect school performance (Castaneda et al., 2008; Kovacs & Goldston, 1991; Leifker et al., 2009) While cognitive impairment is considered to be quite persistent, especially in psychotic disorders and negative symptoms slow recovery, it has been proposed that in mood disorders the impact on education is more likely delaying than inhibitory in nature (Hakulinen et al., 2019). However, in this study lower educational attainment was also prevalent in older age groups, suggesting the more inhibitory nature. Interpersonal difficulties, victimization, social phobia related to impairment in social skills or even to the stigma related to mental disorders itself may have a significant impact on school performance and lead to refusal to attend school, to reluctance accept support and hence to lower academic performance (de Lijster M. et al., 2018; Kaushik et al., 2016; Moses, 2010; Ranta et al., 2016). Also, depression and anxiety may themselves be a consequence of preceding learning difficulties (Mammarella et al., 2016; Valicenti-McDermott et al., 2021). Familial and other socioeconomical factors may have a double impact on educational attainment, either directly itself or then through

exposing adolescents to increased stress and to the higher risk of mental health problems (Reiss et al, 2019; Su et al, 2022) .

6.6 Differences in outcomes over three decades of inpatient care

This study consisted of patients from three decades (the 1980s, 1990s and 2000s.) offering an unprecedented opportunity to observe how the development of adolescent psychiatric services has influenced the outcomes of mental disorders. Theoretically, the increased availability of outpatient services should have led to decreased use of inpatient care as identification and offering early interventions for mental health problems should have prevented them from deteriorating into disorders requiring inpatient care. However, as observed in this study, the opposite occurred. The same phenomenon can also be seen in child welfare services or in education; placements outside the home equivalent to inpatient care have increased as has number of pupils receiving special education, especially since the late 1990's.

The viewpoint of adolescents' problems has changed radically from the 1970s to the beginning of the 2000s. In the 1970s and 1980s problems were observed, for example, through Bronfenbrenner's Ecological Systems Theory, in which the development of the adolescent is affected by a complex system of relationships in the adolescent's surrounding environment. According to this, the adolescent's development and problems should be studied in interaction with the wider environment instead of focusing solely on the adolescent's immediate environment (Neal & Neal, 2013). In practice, while the public debate mentioned school dropouts, the feeble-minded, the ill-mannered, the antisocial, the problems were largely seen as problems of society rather than of the individual (Laitala, 2016). Over time, the term 'psychosocial problem' came to be used more frequently. In the 1980s, concerns about marginalization increased and problems were seen more and more as problems of the individual, a shift prevalent especially in the 1990s and 2000s. The problems were moreover defined through the viewpoint and interpretation of child protection and psychiatric diagnoses and services. This also led to a shift in focus from the development of basic community level services to more specialized services in social services and healthcare, which led to a developmental trajectory where basic local services had a role in the early recognition and prevention of mental disorders while directing those in need of treatment and rehabilitation to specialized health care. (Rimpelä, 2015; Rimpelä et al., 2018) This may have had a strong influence on the use of adolescent psychiatric inpatient care.

The development and increased availability of adolescent psychiatric and other supportive services should theoretically have led to better outcomes in mental disorders. This is perhaps most noticeable in the decreased mortality after the 1980s. Proportions of rehospitalizations and criminality have decreased in the 1990s and 2000s, but when taking absolute numbers into account, the difference between decades is not so clear. Educational attainment has likewise remained low among former adolescent psychiatric inpatients despite the development and increased availability of support in school, especially in the 2000s. This leads to the conclusion that the development and increased resources of adolescent services have not led to the anticipated significantly better outcomes. This may be due to the erroneous allocation of funding to speciality healthcare and social services instead of to basic level community services. The division between these services may also have led to stagnation of roles as the separation of those who recognise and those who treat led to patients often being sent to special services, thereby increasing the use of the latter and consequently increasing the need for resources. (Rimpelä, 2015; Rimpelä et al., 2018)

6.7 Methodological considerations

The definitive strength of this study is the large nationwide data with a long study period. Due to the nationwide data the study does not suffer from the distorting effects of regional differences in adolescent mental health and other support services, educational opportunities or in criminality. The long study period of over three decades makes it possible to observe possible trends in the development of adolescent psychiatric or other support services. The register data used in this study is mandatorily collected directly from healthcare, education authorities and the criminal justice system and high quality is ensured by strict statistical collection methods.

A first limitation is possible inaccuracies in the data. In diagnostic data the diagnoses were supplied by clinicians and may therefore contain clinician-related bias and risk of misinterpretation of symptoms. A large amount of nationwide data together with the use of the level of diagnostic main classes in the analyses serves to diminish the risk of individual clinician-related bias. Also, research has shown diagnostic work to be reliable in Finnish psychiatric inpatient care (Pihlajamaa et al., 2008; Sund, 2012). In the educational data there may be some deficiencies as education completed abroad may not have been comprehensively covered.

However, to ensure the quality of data Statistics Finald actively supplements its data collection through exchange with other countries.

A second limitation is that, as this study focused mainly on primary diagnoses, the possible effects of comorbid psychiatric symptoms were not evaluated. However, inpatient care usually focuses on the main psychiatric symptoms that are usually represented by the primary diagnosis, making it the best indicator of a patient's problems. Also, primary diagnosis is the only diagnosis mandatorily included in registers. Also, the crude categorization of diagnoses could possibly be another reason for erroneous conclusions. For example F50-59 group was labelled as Eating Disorders, although it also includes other behavioural syndromes associated with physiological disturbances and physical factors, such as F51 non-organic sleeping disorder, F52 Sexual dysfunction, F53 Mental and behavioural disorders associated with the puerperium, not elsewhere classified, F54 Psychological and behavioural factors associated with disorders or diseases classified elsewhere, F55 Abuse of non-dependence-producing substances and F59 Unspecified behavioural syndromes associated with physiological disturbances and physical factors. However, the great majority (96.5%) of those with F50-59 group diagnosis had an eating disorder (F50.0-F50.9) diagnosis. Also, including the F60-69 diagnosis (disorders of adult personality and behaviour) group in externalizing disorders (F10-19. F60-69, F90-92) could be somewhat problematic as it also contains diagnoses that do not include externalizing symptoms or behavioural symptoms like for example F60.5 Obsessive-compulsive personality disorder, F64 Gender identity disorders. However, the proportion of those diagnoses in the F60-69 group was negligible as it was mainly comprised of diagnoses referring to externalizing symptoms like antisocial, emotionally unstable, or unspecified personality disorders. Also, over the half of those with F60-69 diagnoses as the primary diagnosis, had been in inpatient care in the 1980's, it may be possible that adolescents with externalizing symptoms were diagnosed with personality disorder diagnoses instead of other externalizing diagnosis like conduct disorder, as the number of other externalizing diagnoses was smaller in the 1980's than in later decades.

A third limitation is the lack of data on any other clinical characteristics, family characteristics and problems, adverse childhood experiences, hereditary predispositions to psychiatric diseases etc. that might have an impact, for example, on admission to inpatient care, prognosis of mental disorders, educational attainment or criminal behaviour, as observed in many studies (Enqvist et al, 2017; Reiss et al, 2019; Su et al., 2022; Suokas et al, 2020). However, a large amount of data

with a focus on evaluating major trends in analyses somewhat mitigates the impact of missing background information.

As this study focuses on mental disorders requiring inpatient care that likely represent the most severe manifestations of psychiatric morbidity, the findings cannot be directly to be generalized to conditions with milder symptoms requiring only care in the community.

6.8 Implications

Mental disorders requiring psychiatric inpatient care have still quite a poor prognosis, increasing risk for mortality, antisocial behaviour and low education, and therefore constitute a significant risk factor for marginalization. It is thus important to identify those at greatest risk as early as possible so that effective treatment and support can be offered. However, while those with inpatient care due to externalizing disorders seemed to have the poorest prognosis among the diagnoses and are at high risk for antisocial development and marginalization, they usually have quite poor motivation and commitment to care and support and typically will not benefit, for example, from inpatient care. To ensure the optimal prognosis and use of resources, it is important to implement evidence-based treatments, for example system-oriented family therapies.

In spite of an increased focus on the prevention of mental disorders, it should be noted that not all mental disorders can be prevented as regarding the most severe disorders the results have been inconsistent. As the most severe mental disorders, usually those requiring inpatient care, have relatively poor prognosis with long-lasting effects on the adolescent's future, the resources for adequate treatment, rehabilitation and support in the everyday environment are needed to ensure as good a prognosis and integration into society as possible to prevent marginalization. While inpatient care itself is resource-intensive and therefore expensive, it is still needed in some situations as a protective, effective and intensive intervention in the most severe symptoms of mental disorders. However, inpatient care should be kept as short as possible, as shortening length of stay has not led to poorer prognoses. This would lead to the effective use of inpatient care and help to redirect the focus of treatment and support closer to the patient's normal social environment. Also, inpatient care should not be used as a substitute for lack of adequate outpatient care and other support in the social environment and in education.

While there has been profound increase in the availability of outpatient care and other support, especially in the 2000s, this has not led to decreased use for inpatient care, quite the opposite. Nor has there been any marked increase in the positive prognosis of those mental disorders requiring inpatient care. Therefore, more research is needed to develop treatments and rehabilitation for those with mental disorders to ensure the integration of a patient's inpatient and outpatient care with other support needed so that rehabilitation is as seamless as possible leading to the best achievable prognosis and the effective use of limited resources. More research is also needed on the background factors underlying the increase in inpatients, as this remains unexplained. This would help to identify those truly in need of inpatient care and help to develop suitable treatment pathways and wraparound services for those with mental health problems as those adolescents with mental health problems severe enough to require psychiatric inpatient care need individual and more supportive services than is available.

7 CONCLUSION

There has been an increase in the use of psychiatric inpatient care during adolescence since the mid-1990s, the growth being especially prominent in late 2000s leading to increasing numbers of adolescents being treated in psychiatric inpatient care. This growth has been especially marked among girls with a concurrent increase in mood disorders as the primary diagnostic reason for inpatient care. These cannot be explained by epidemiological reasons but instead by changes in society and health policies. Severe mental disorders requiring inpatient care during adolescence have a relatively poor prognosis, increasing risk for premature death, criminality and low educational attainment. Especially those with externalizing disorders, schizophrenia group psychoses are in a great risk. Despite development and increased availability of outpatient and other support services in recent decades, the outcomes have not improved markedly. As severe mental disorders endanger normal adolescent development and increase the risk for antisocial development and becoming marginalized, it is important to focus on adequate support in everyday life, the availability of psychiatric care and school welfare, especially in those adolescents who have been in psychiatric inpatient care. As shortening the length of inpatient care has not led to poorer outcomes, it might be beneficial to keep the inpatient care needed as short as possible and to keep the focus of an adolescent's care and rehabilitation to as close to the adolescent's regular environment as possible. More research is needed on the background factors affecting the increased use of inpatient care to identify those in genuine need of intensive psychiatric care as early as possible.

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> "Adolescence begins when children stop asking questions-because they know all the answers."

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PUBLICATIONS

PUBLICATION I

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Subsequent criminal participation among young people first admitted to psychiatric inpatient care during early and middle adolescence

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ABSTRACT

Adolescents brought before court suffer excessively of mental disorders. Less is known about subsequent criminal participation of adolescent psychiatric inpatients. Our register study comprised all subjects that had between 1980 and 2010 been admitted to psychiatric inpatient care in Finland for the first time in their lives at ages 13–17 (n = 16 842), identified in the Care Register for Health Care and followed up for up to 10 years in the Register of Prosecutions, Sentences and Punishments. Incidence of register entry for any crime was 2.4/100 person-years, 4.0 in males and 1.9 in females. Incidence of violent crime was 0.9/100 person-years, 1.5 in males and 0.3 in females. Greatest risk for subsequent crime was associated with diagnoses of conduct, personality and substance use disorders (F90–92, F60–69, F10–19). Schizophrenia group diagnoses (F20–29) were associated with lowest risk. Later criminality was manifold among those who already had a crime register entry before the index treatment. Need for psychiatric inpatient care during adolescence associates with a great risk of antisocial development. Treatment needs to address this risk by systematically implementing evidence-based interventions. Health and social policies need to ensure resources and skills to these treatments.

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KEYWORDS Adolescent psychiatry; inpatient treatment; criminality; register study

Background

Numerous studies have demonstrated that adolescents brought before court or seen in prison and probation services commonly suffer from mental disorders. In their meta-analysis comprising over 16000 detained juvenile delinquents, Fazel et al. (2008) found that just above a half of both boys and girls could be diagnosed with a conduct disorder. Major depression was detected in about one third of the girls and one-tenth of boys, ADHD in about

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one-fifth of the girls and one-tenth of the boys, and psychotic illness in about 3% of both sexes. These figures clearly exceed the prevalence of these disorders in general adolescent population (Birmaher et al., 2007; McClellan et al., 2013; Pliszka & Aacap Work Group on Quality Issues, 2007; Polanczyk et al., 2015). Juveniles in various punitive and corrective services also display a disproportional number of unmet needs and psychosocial adversities such as discord and violence in the family of origin, other traumatic experiences, educational needs, learning difficulties and neurocognitive deficits and relationship problems in their dating and steady relationships, and the psychosocial problems tend to persist to adulthood into the families of their own (Chitsabesan & Bailey, 2006).

The associations between mental disorders and delinquent behaviour in adolescence may have many causal pathways. Mental disorders may predispose to delinquent behaviour due to lowering behavioural controls, for example, because of impulsivity or aggression. Delinquency could, on the other hand, contribute to the development of mental disorders, for example, by negative influences on self-image and identity, or by bringing along a lifestyle that predisposes to trauma, or as a reaction to punitive consequences. Mental disorders and criminal behaviour also share in common many predisposing factors such as school problems, low socioeconomic status, family dysfunction and alcohol and drug abuse (Elonheimo et al., 2014; Engqvist & Rydelius, 2007; Yampolskaya et al., 2014). Finally, some diagnostic criteria of specific disorders such as conduct disorder are *per se* delinquent acts.

Less attention has been paid on later criminality in clinical child and adolescent psychiatric samples. Engqvist and Rydelius (2007) carried out a follow-up in registers of 1420 patients admitted to child and adolescent psychiatric (CAP)

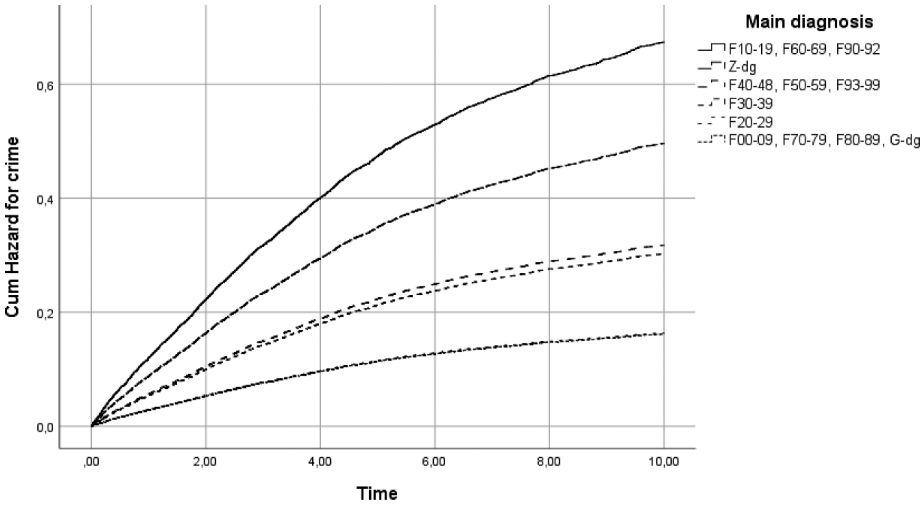

Figure 1. Cumulative hazard for any crime according to diagnostic groups.

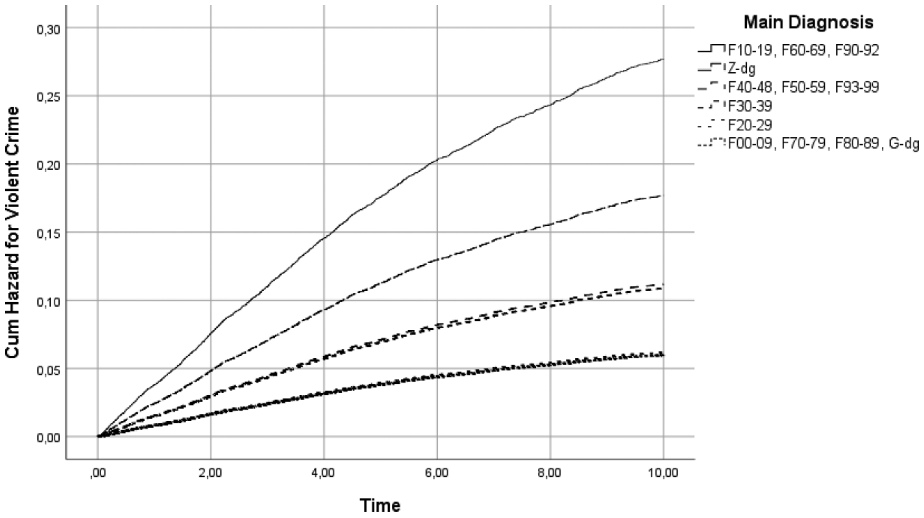

Figure 2. Cumulative hazard for violent crime according to diagnostic group.

services from a well-defined catchment area in Sweden in 1975–1990. The subjects were followed until 2003. Diagnostic distribution was reported according to ICD-10. In about a third, reason for the CAP contact was recorded with z-code. Of the psychiatric diagnoses, most common (22%) were emotional and behavioural disorders with childhood onset (F90–99), followed by neurotic stress-related and somatoform disorders (F40–49, 16%) and disorders of psychological development (F80–89, 4%). Of the former CAP patients, 38% obtained a crime record during the follow-up, 55% of the males and 22% of the females. Of all the males in the cohort, 17% had committed violent crimes, of females, 4%. Risk factors for later criminality among the former CAP sample were split family, problems at school, problems in social relationships, and behavioural problems as a reason for the CAP admission. In Norway, about a thousand adolescents who had been admitted to psychiatric inpatient care in 1963–1981 were followed in registers for on average 24 years (Kjelsberg & Dahl, 1998, 1999). During the index admission they were most commonly diagnosed with conduct disorder (45%), substance use disorder (36%) or psychosis (9%). About a half of the former inpatients had obtained a crime record during follow-up of 15–33 years, 63% of the males, and 39% of the females. Of all, 39% had committed crimes of violence. Crime record was predicted by certain diagnoses (conduct disorder, substance use disorder), rule-breaking in the school, aggressive communication style in the home, and substance use. In a Finnish follow-up study after adolescent psychiatric inpatient care (Arola et al., 2016), subsequent criminality was associated with obtaining a diagnosis of personality disorders by early adulthood. The risk was specifically associated with borderline PD in females and related to violent crime. In a study from Florida, subsequent juvenile justice system involvement was most common among those

adolescents placed in a residential psychiatric setting who could be characterized as multi-problem youth with a comorbid psychiatric diagnoses, psychosocial adversities and physical health complaints (Yampolskaya et al., 2014).

A large register study from Denmark (Walter et al., 2019) demonstrated that people first time discharged from psychiatric inpatient care at age 15 or more (median: 24 years) had an increased risk of a variety of negative outcomes including violent crime but also suicide and self-harm, accidental injuries and subsequent inpatient care. The discharged patients had a more than six-fold risk for violent convictions as compared to general population, the risk persisted high in a follow-up of over 10 years, and it was relatively greater in females than males. Negative outcomes were predicted by diagnoses related to substance use and personality disorders, and least common among patients with mood disorders. Unfortunately, no results stratified by age at discharge were given, thus specific aspects of adolescence cannot be addressed. An increased risk of violent offending after discharge from psychiatric inpatient care has been documented among adult people with schizophrenia (Doyle & Dolan, 2006; Fazel et al., 2010).

The later criminal activity of CAP patients appears increased in comparison to what comes to general population's acquiring a record by up to middle adulthood. From the UK, Piquero et al. (2007) reported that 40% of males born in 1953 admitted having been convicted for crime by age 40. In two Swedish studies, 31–38% of males and 6–9% of females had been registered by police for offending by age 25–30 (Stattin et al., 1989; Wikström, 1990). Of Finnish citizens born in 1959, 38% of males and 9% of females had a record in police register by age 27 (Pulkkinen, 1988). This comprises not only convictions but also being registered as a suspect. However more recently, Elonheimo et al. (2014) found that among those born in 1981 in Finland, 45% were recorded in police register were suspected for crimes between ages 15 and 30, 60% of males and 25% of females. Of the males, 17% had a register entry due to violent (including sexual) crimes, of females, 3%. Ivert et al. (2017) directly compared criminal participation of about 6000 former patients whose CAP contact had terminated in 2003–2005 with those in matched population controls and found that twice as many former CAP patients were registered for crimes at a mean age of 21.4 compared to the controls. The over-representation was larger for crimes of violence. Among the former CAP patient males, 38% had at least one entry in the crime register, compared to 22% of control males. The corresponding percentages for females were 24% and 13%. Later criminality was associated with problems characterised as externalising at admission to the index CAP treatment. In Walter et al.'s (2019) data, discharged psychiatric patients had more than six-fold more commonly convictions for violent crime in a follow-up of over ten years than controls. Among men, a six-fold difference was seen, in women more than 10-fold, but the study was not limited to a CAP sample.

Engqvist and Rydelius (2007) compared their findings on later criminality of CAP patients with corresponding reports from earlier decades and noticed that in their data, later criminality was more common: it was twice as common in males, and a seven-fold increase was seen among females. They suggested that these changes could be due to increasing alcohol consumption in the society, and such changes in school system that may leave children with special needs less supported. In the Norwegian study, secular trends in later criminality of former adolescent psychiatric patients were analysed among those diagnosed with conduct disorder (Kjelsberg, 2005). In females, but not in males, an increasing trend over time was found in overall criminal participation. In females, an increasing trend was also seen when focusing on violent crime only.

In sum, both studies focusing on mental health of juvenile delinquents and criminality of CAP patients yield a correlation and associate crime primarily with conduct disorder and externalizing (behavioural) problems. Studies on later criminality of CAP patients are scarce, and more recent data is also needed. Little is known about later criminality of CAP patients diagnosed with internalizing disorders and psychosis. Secular trends in criminal behaviour of former CAP patients also warrant further study. It is important to study these relationships to obtain information that can guide development of services to children and adolescents towards appropriately meeting their needs. The present study aims to explore later criminality of adolescents admitted to psychiatric inpatient care in 1980–2010 in Finland. In more detail we aim to analyse

(1) How commonly do adolescents admitted to psychiatric inpatient care obtain a crime record during 10 years after the first psychiatric inpatient treatment, and how soon after the index treatment do they start committing crimes?
(2) What are the primary diagnoses bearing the greatest risk for obtaining a subsequent crime record?
(3) Are there differences in the risk for obtaining a subsequent crime record among adolescents admitted to psychiatric inpatient care in 1980s, 1990s and 2000s?

Methods

The design of the present study is a register-based follow-up of a large national sample of CAP inpatients.

Register data

Subjects admitted into psychiatric inpatient treatment for the first time in their lives at ages 13–17 between 1980–2010 in Finland were identified in the Care Register for Health Care of the National Institute for Health and Welfare. The register is in operation since 1967 (Gissler & Haukka, 2004). All inpatient treatment periods in any health care institution are reported to this register, recording the treating institution, medical specialty, dates of admission and discharge, discharge diagnoses and in some cases specialty-specific additional information (for example: in psychiatry information of involuntary treatment). Altogether 17 112 adolescents aged 13–17 had been admitted to psychiatric inpatient care for the first time in their lives in 1980–2010. Of these 270 did not have a psychiatric (F) nor neurological (G) diagnosis and were excluded. This, the studied sample comprised 16 842 patients. Of them, 40.1% were males and 59.9% females.

Criminal history was obtained from the Register of Prosecutions, Sentences and Punishments kept by Statistics Finland. These statistics contain data on the sentences issued and waived, and charges rejected by courts of first instance. In addition to the prosecutions at district courts and at courts of appeal acting as courts of first instance, the statistics also contain data on the summary penal fines imposed by the prosecutor and on petty fines imposed by the police, customs officials or frontier guard authorities. As a rule, a person is recorded in the statistics as many times as aforementioned decisions have been made about him or her. Another main mode of recording applied in these statistics is the so-called principal offence rule, according to which each defendant or convicted person is described by the most serious offence under the severest punishment decision category of the court. Register entries after the index admission during follow-up of up to 10 years from the index admission were used as the outcome variable in the present study and register entries before the index admission were used as a covariate.

The study was duly accepted by the ethics committee of Tampere University Hospital and obtained appropriate permissions from the National Institute of Health and Welfare and Statistics Finland.

Measures

A subject's first admission to psychiatric inpatient care at age 13–17 years was studied as the index admission. For this, dates of admission and discharge, primary diagnosis and the patient's sex and age were recorded. More than one diagnoses can be recorded for an inpatient treatment period. They are

assumed to be recorded in such order that the diagnosis indicated first describes the most important reason for why the treatment period was needed. Therefore, we use the first indicated diagnosis as primary diagnosis.

Since 1996, diagnoses are recorded according to ICD-10 (World Health Organization, 1992). Earlier, psychiatric classification according to ICD-8 (World Health Organization, 1965) served in clinical practice between 1969 and 1986, and between 1987 and 1995 the diagnoses were reported to the register according to ICD-9 (World Health Organization, 1977). In the present study, diagnoses according to the earlier versions of diagnostic classification are converted to the current ICD-10. In the present study, primary diagnoses were grouped as follows: organic, intellectual disability and developmental disorders, including the few cases where a neurological (G) diagnosis was recorded as primary diagnosis (F00–09, F70–79, F80–89, G-diagnoses), schizophrenia group diagnoses (F20–29), severe mood disorders (F30–39), substance use disorders, personality disorders and conduct disorders (F10–19, F60–69, F90–92); eating, anxiety and childhood onset emotional disorders (F40–49, F59–59, F93–99) and Z-codes as the reason for the index admission.

For criminal conduct, date and title of the crime were recorded. The analyses were run separately for any crime and for violent crime including murder, attempted murder, manslaughter, attempted manslaughter, assault, aggravated assault, robbery, arson, fire-setting, sex crimes.

Statistical analyses

Incidence rates for (a) any, and (b) violent crime per 100 person years were calculated taking into account the competing risks and attrition within the 10-year time frame: each person was followed up until the first incident of the outcome of interest or to maximum 10 years, or to death, whichever occurred first. Incidence rates were compared between males and females, those in early (13–14-years-old) and middle (15–17-years-old) adolescence at index admission, between those with index admission at 1980s, 1990s and 2000s, between those with and without an entry in the crime register before the index admission and between diagnostic groups. Multivariate associations were studied using Cox regression which assesses relationship between survival time and covariates. Hazard ratios (95% confidence intervals) for a) any crime, and b) violent crime are given according to diagnostic group, sex, age group and decade of index admission, controlling also for whether or not the subject had a crime register entry before the index admission. Hazard curves are presented. Mean (sd) and median times (interquartile ranges (IQR) with 25^{th} percentile (Q1) and 75^{th} percentile (Q3) values) to defined a) any crime and b) violent crime after the discharge from the index admission are

Table 1. Primary diagnoses among subjects admitted to psychiatric inpatient care for the first time at ages 13–17 in 1980–2010 in Finland.

	All %	Males %	Females %	
	(n = 16 842)	(n = 6749)	(n = 10 093)	
				males vs. females $p < .001$
organic, intellectual disability and developmental (F00–09, F70–79, F80–89, G-diagnoses)	3.0	4.9	1.8	
schizophrenia group (F20–29)	11.5	14.1	9.7	
severe mood disorders (F30–39)	28.7	19.0	28.7	
substance use, personality and conduct disorders (F10–19, F60–69, F90–92)	21.4	29.4	21.4	
anxiety, eating and emotional disorders of childhood (F40–49, F59–59, F93–99)	31.9	27.9	31.5	
z-codes	3.8	4.6	3.8	

given for diagnostic groups. Due to large data size, cut-off for statistical significance is set at $p < 0.01$.

Results

Primary diagnoses

The distribution of primary diagnoses in the whole sample is seen in Table 1. Across decades, the proportion of severe mood disorders (F30–39) increased, from 8.7% in 1980–1989 to 21.0% in 1990–1999 745 and 35.7% in 2000–2010. The proportion of schizophrenia group diagnoses (F20–29) decreased across decades (23.4% vs. 13.4% vs 8.2%). The greatest stability was seen in the proportion of the group comprising substance abuse, personality disorders and conduct disorders (F10–19, F60–69, F90–92): 21.0% vs. 21.1% vs. 21.7%.

Criminal participation

In the whole sample, incidence rates for any criminal participation per 100 follow-up years were 9.1 for males and 2.6 for females ($p < 0.001$). Age at admission did not have statistically significant associations with later criminal participation. For the males who did not have any crime record before the index admission, incidence rate was 7.1, and for those who had a criminal record before index admission, 34.5 ($p < 0.001$). For females, the incidence rates were 2.3 and 13.4/100 person years, respectively (in both, $p < 0.001$).

Criminal conduct after index admission was in both sexes most common among those with primary diagnosis of substance use, personality or conduct

Table 2. Incidence rates for any crime and violent crime according to primary diagnosis, during the follow-up of maximum 10 years after the index admission among patients admitted to psychiatric inpatient treatment for the first time at ages 13–17 between 1980 and 2010 in Finland. (per 100 follow-up years).

	F00-09, F70-79, F80-89, G-diagnoses	F20–29	F30–39	F10–19, F60–69, F90–92	F40–49, F59–59, F93–99	Z-code
ANY CRIME						
all	2.6	2.4	3.0	11.5	3.9	7.2
males	3.4	4.0	6.5	18.9	8.0	12.6
females	1.2	1.9	2.9	6.2	2.1	3.9
p (males vs females)	< .001	< .001	< .001	< .001	< .001	< .001
VIOLENT CRIME						
all	1.0	0.9	1.1	4.5	1.4	1.9
males	1.4	1.5	2.4	7.0	2.9	3.6
females	0.4	0.3	0.7	2.1	0.6	1.7
p (males vs females)	0.004	< .001	< .001	< .001	< .001	< .001

disorder (F10–19, F60–69, F90–92). Second most commonly criminal conduct was recorded among those whose index admission had been recorded with Z-code. Smallest incidence of later criminal conduct was in the whole sample seen among those with schizophrenia group diagnoses (F20–29). (Table 2)

Violent crime

In males, violent crime incidence rate per 100 follow-up years was 3.6 and in females 0.9 ($p < 0.001$). Age at admission did not have statistically significant associations with later violent crime. In the males who did not have any crime record before the index admission, violent crime incidence rate was 2.7 per 100 follow-up years, and in those without prior criminal record, 10.0 ($p < 0.001$). In females, the incidence rates were 0.8 per 100 person years and 4.0 per 100 person years, respectively ($p < .001$).

Record of violent crime after index admission was in both sexes most common among those with primary diagnosis of substance use, personality or conduct disorder (F10–19, F60–69, F90–92). Second most commonly violent crime was recorded among those for whom a Z-code instead of a psychiatric diagnosis was given as reason for the index admission. Smallest incidence of later violent crime was in the whole sample seen in those with schizophrenia group diagnoses (F20–29) (Table 2)

Multivariate analyses

In multivariate analyses accounting for the shorter follow-up time in the latest cohort, the risk for obtaining a record for any crime as well as for a violent crime was statistically significantly increased in all other diagnostic groups except in the group comprising organic, intellectual disability and developmental disorders (F00–09, F70–79, F80–89, G-diagnoses), as compared to those with a diagnose in schizophrenia group (F20–29). In addition, both any and violent crimes after the index admission were recorded more commonly for males, for those with a prior crime record, and among those admitted in 1980's and 1990's as compared with the latest admitted group. Subsequent record for any crime as well as for violent crime was obtained more commonly by those who already had an entry for crime before the index admission. Adolescents admitted in middle adolescence slightly less commonly obtained a record for any crime than adolescents admitted in early adolescence. (Table 3, Figure 1, Figure 2)

Mean(sd)/median (IQR, Q1;Q3) time from discharge from the index admission to committing the first crime was 2.52(2.2)/1.94 (2.96, 0.75;3.71) years among males and 3.25(2.5)/2.74 (3.68, 1.16;4.84) years among females. Mean(sd)/median (IQR, Q1;Q3) time from discharge from the index admission to committing the first violent crime was 3.47(2.5)/3.03 (4.53, 1.62;6.15) years

Table 3. Hazard ratios (95% confidence intervals) for obtaining a crime record for any crime and for violent crime in maximum ten years after the index admission among those admitted psychiatrically for the first time at ages 13–17 in three decades.

		Any crime		Violent crime	
		HR (95% CI)	p	HR (95% CI)	p
Sex					
	female	reference		reference	
	male	2.6 (2.5–2.8)	< .001	3.2 (3.0–3.6)	< .001
Age					
	13–14	reference		reference	
	15–17	0.9 (0.9–1.0)	.008	1.0 (0.9–1.1)	.49
Year of index admission					
	2000–2010	reference		reference	
	1990–1999	1.4 (1.3–1.5)	< .001	1.2 (1.1–1.3)	< .001
	1980–1989	1.6 (1.5–1.7)	< .001	1.2 (1.1–1.3)	.001
Primary diagnosis at index admission					
	F20–29	reference		reference	
	F00–09, F70–79, F80–89, G	1.0 (0.8–1.2)	.91	(1) (0.7–1.4)	.87
	F30–39	1.9 (1.6–2.1)	< .001	1.8 (1.5–2.1)	< .001
	F40–49, F50–5, F93–99	1.9 (1.7–2.2)	< .001	1.8 (1.5–2.2)	< .001
	Z-code	3.0 (2.6–3.6)	< .001	2.9 (2.3–3.7)	< .001
	F10–19, F60–69, F90–92	4.1 (3.7–4.6)	< .001	4.5 (3.8–5.4)	< .001
Registered crime before index admission					
	no	reference		reference	
	yes	3.6 (3.3–3.9)	< .001	3.5 (3.1–4.0)	< .001

Note: HR = Hazard ratio; CI = Confidence interval

among males and 3.53(2.5)/3.08 (4.46, 1.51;5.97) years among females. Area limited by Q1 and Q3 of median time to any crime and to violent crime overlapped between all diagnostic group among both sexes, revealing that differences in median times were not statistically significant. (Table 4)

Discussion

Male former CAP inpatients displayed a greater risk for subsequent criminal participation than females, about three-fold regarding both crime in general and violent crime. This is in accordance with earlier studies among former CAP inpatients (Engqvist & Rydelius, 2007; Kjelsberg & Dahl, 1998, 1999) and with studies in the general population (Elonheimo et al., 2014; Pulkkinen, 1988; Stattin et al., 1989; Wikström, 1990). Compared to the males who did not have any crime record before the index admission, incidence rate for subsequent crime after CAP inpatient treatment was almost five-fold among those who had a crime record before index treatment. Incidence for violent crime was almost four-fold among those males who already had a crime

Table 4. Mean(sd) and median (IQR, Q1;Q3) time in years to the first crime and the first violent crime after discharge from the index admission.

	Diagnostic groups						Total
	F00–09 F70–89 F80–89 G-diagnoses	F20–29	F30–39	F10–19 F60–69 F90–92	Z-code	F40–48 F50–59 F93–99	
Time to (first) crime (years)							
Males							
Mean(sd)	2.98(2.1)	3.04(2.5)	2.88(2.3)	2.18(2.0)	2.51(2.4)	2.69(2.2)	2.52(2.2)
Median	2.91	2.32	2.34	1.64	1.8	2.1	1.94
IQR	3.29	3.25	3.31	2.60	2.89	2.90	2.96
Q1	1.13	1.03	0.96	0.59	0.71	0.93	0.75
Q3	4.42	4.28	4.27	3.19	3.6	3.83	3.71
Females							
Mean(sd)	3.85(2.4)	3.73(2.8)	3.42(2.4)	3.04(2.4)	3.12(2.4)	3.26(2.6)	3.25(2.5)
Median	3.83	2.87	3.14	2.62	2.79	2.65	2.74
IQR	2.48	4.46	3.72	3.4	3.61	3.72	3.68
Q1	2.43	1.63	1.26	1.06	0.87	1.18	1.16
Q3	4.91	6.09	4.98	4.46	4.48	4.98	4.84
All							
Mean(sd)	3.14(2.2)	3.2(2.6)	3.15(2.4)	2.49(2.2)	2.72(2.4)	2.91(2.4)	2.79(2.3)
Median	2.98	2.4	2.68	1.87	2.11	2.35	2.19
IQR	3.31	3.51	3.65	3.02	3.19	3.23	3.26
Q1	1.19	1.11	1.08	0.68	0.77	0.99	0.87
Q3	4.5	4.62	4.73	3.7	3.96	4.22	4.13
Time to (first) violent crime (years)							
Males							
Mean(sd)	3.84(2.3)	3.71(2.6)	3.58(2.5)	3.32(2.4)	3.6(2.6)	3.61(2.6)	3.47(2.5)
Median	3.59	3.19	3.2	2.89	3.34	3.16	3.03
IQR	3.77	3.82	3.88	1.49	3.51	3.59	3.59
Q1	1.99	1.62	1.50	1.37	1.42	1.62	1.48
Q3	5.76	5.44	5.38	4.86	4.93	5.21	5.07
Females							
Mean(sd)	2.27(1.5)	4.76(2.8)	3.58(2.5)	3.37(2.6)	3.72(2.4)	3.47(2.5)	3.52(2.5)
Median	2.28	4.33	3.29	2.92	3.49	3.09	3.08
IQR	2.55	5.09	3.96	3.74	4.35	3.64	3.79
Q1	0.93	2.63	1.39	1.30	1.50	1.46	1.41
Q3	3.48	7.72	5.35	5.04	5.85	5.10	5.20
All							
Mean(sd)	3.61(2.3)	3.91(2.6)	3.68(2.4)	3.33(2.5)	3.68(2.5)	3.57(2.5)	3.49(2.5)
Median	3.27	3.45	3.23	2.89	3.44	3.07	3.05
IQR	3.04	3.77	3.91	3.53	3.90	3.57	3.67
Q1	1.60	1.77	1.45	1.35	1.47	1.58	1.46
Q3	4.64	5.54	5.36	4.88	5.37	5.15	5.13

record before the index treatment. In females with a prior record, incidence rate for any crime was about six-fold, and for violent crime five-fold among those with a prior crime record as compared to those without a prior record. Thus, adolescent psychiatric inpatient treatment and subsequent adolescent

and later adult psychiatric care that will be offered after inpatient treatment was not successful in diverting adolescents with early onset criminal behaviour and severe mental disorders from criminal participation. Proceeding to criminal participation was not uncommon among those with no earlier delinquency, either, despite that after inpatient treatment adolescents will have been offered extensive support and follow-up from adolescent psychiatric services.

It has been suggested that inpatient care may even be harmful for adolescents with psychiatric disorders (Yampolskaya et al., 2014), resulting in undesired iatrogenic effects such as exacerbating emotional and behavioural problems due to disruption of attachment bonds. Modelling of negative behaviours within peer group may also take place. Particularly adolescents with multiple needs remain at high risk of negative outcomes, including crime, after inpatient treatment (Yampolskaya et al., 2014).

Mean and median times to first criminal activity (any crime) were short, only 2–3 years, and standard deviations, interquartile ranges and areas between Q1 and Q3 of median times suggest that the onset of criminal participation concentrated in a relatively short time in late adolescence/early adulthood. Mean and median times to violent crime were slightly longer, 3–4 years, but violent crimes also first emerged in a period rather concentrated in late adolescence/early adulthood. Criminal participation in males at large peaks in late adolescence (Elonheimo et al., 2014), and in this, the CAP sample bears a resemblance to general population. However, in females in general population, criminal participation tends to persist low. Future studies need to explore whether criminal participation of former CAP patients also ceases after the active period in early adulthood or perhaps continues as suggested by Kjelsberg and Dahl (1998, 1999)).

As could be expected based on earlier studies focusing on mental health of juvenile delinquents as well as on criminal behaviour of CAP patients, risk for obtaining a record for any crime as well as on violent crime was the greatest among those diagnosed with conduct disorder, personality disorder or substance use disorder at index admission (Engqvist & Rydelius, 2007; Fazel et al., 2010; Ivert et al., 2017; Kjelsberg & Dahl, 1998, 1999). However, several other findings related to diagnostic groups appear more unlikely.

Firstly, schizophrenia group disorders displayed the lowest incidence of any and violent crime. Psychoses have been associated with increased risk of violence both among adolescents and adults (Gammelgård et al., 2008; Naudts & Hodgins, 2006; Taylor & Bragado-Jimenez, 2009), and ample evidence suggests that persons who have or will develop schizophrenia are at increased risk for violent offending (Naudts & Hodgins, 2006). Early and very early onset schizophrenia tend to have a more severe course than adult-onset schizophrenia (Schimmelmann et al., 2013), and the violent behaviours by adolescent inpatients with schizophrenia group diagnoses may take place in

care institutions (Kaltiala-Heino et al., 2014, 2013) without resulting in crime register entries. Adolescents diagnosed with schizophrenia group disorders already in the first inpatient treatment are likely among those with a severe course of early onset schizophrenia spectrum disorder and thus will be provided intensive care in subsequent years, which may reduce risk of committing crimes in the community.

Second, having a Z-code as the reason for the index treatment was associated with second highest risk of later criminality. These subjects could not be diagnosed with any mental disorder. However, they may have been admitted for observation due to disruptive behaviours which could *per se* be precursors of their future criminality if not of mental disorders.

Internalizing non-psychotic disorders comprising anxiety disorders, eating disorders, and emotional disorders with onset in childhood (F40–49, F50–59, F93–99) as well as severe mood disorders (F30–39) during index admission at age 13–17 were also associated with a greater risk of any as well as of violent crime than schizophrenia group disorders. Internalizing disorders have not often been discussed as risk factors for rule-breaking or violence, even though for example, depression can during adolescence primarily emerge as irritated, not depressed mood (Birmaher et al., 2007), which could increase the risk of violent behaviour. Our findings suggest that in such severe form as when warranting inpatient treatment they nevertheless represent such severe fracture in adolescent development that they bear along with a greater risk of subsequent criminality than schizophrenia spectrum disorders. In adults, inpatient treatment due to mood disorders had low risk of subsequent violent crime, as compared to other diagnoses (Walter et al., 2019). However, diagnostic stability may in adolescence also be poorer than among adults. Future research needs to explore to what extend internalizing disorders persisting in the non-psychotic internalizing range increase the risk of criminality, and to what extend the actual risk is associated with later evolving externalizing psychopathology.

The risk for later criminality was greater in the earlier cohorts than in the latest. Two explanations could be thought for this. Firstly, the latest cohort comprised a much greater proportion of depression and anxiety disorders that bear a lower risk for criminality than externalizing disorders. Secondly, during the time period when the latest cohort entered the service system, adolescent psychiatric outpatient services have vastly increased in Finland (Pylkkänen, 2013), and child welfare services have also increased manifold. This could be expected to support the positive development of adolescents who suffer from mental disorders, and to prevent adolescents with mental disorders from developing towards delinquency. However, there is obviously still a lot of room for improvement. Evidence-based treatments for tackling disruptive behaviours and preventing antisocial and aggressive development such as system-oriented family therapies (Baldwin et al., 2012) and the

applications of such approaches to foster care Green et al., 2014) and cognitive behavioural approaches that target both the cognitive distortions favouring antisocial behaviour and motivation and skills to apply pro-social solutions (Armelius et al., 2007; McGlynn et al., 2013) should be implemented systematically. Successful completion of developmental tasks of adolescence is important for favourable adjustment in later developmental stages (Havighurst, 1948; Scheiffge-Krenke & Gelhaar, 2008), and severe mental disorders delay it. Psychiatric treatment should focus not only in symptom reduction but also to successful completion of developmental tasks, to support pro-social integration to the society.

Methodological considerations

The present study is based on registers where all the incidents of interest are obligatorily reported by hospitals and by criminal justice systems. The data were therefore comprehensive, and it was also uniquely large, comprising all persons admitted to psychiatric inpatient care for the first time at ages 13–17 from three decades, with more than 16000 subjects. The large and comprehensive data are a strength of this study.

The diagnoses were used as given by the treating hospitals. It was not possible to assess the validity of the psychiatric diagnoses, but studies have shown that psychiatric diagnostic work is very reliable in psychiatric inpatient care in Finland (Isohanni et al., 1997; Pihlajamaa et al., 2008).

A limitation is that we would not include any other clinical characteristics of the CAP patients, like was done in the earlier studies from Sweden and Norway (Engqvist & Rydelius, 2007; Ivert et al., 2017; Kjelsberg & Dahl, 1998, 1999). It is also regrettable that incidence rates could not be compared to earlier studies on subsequent criminal participation among former CAP patients, as those studies reported crude percentages instead of incidence rates. The same reason hinders our comparison to general population studies.

Conclusion

Former adolescent psychiatric inpatients proceed to criminal participation very often, despite that after psychiatric inpatient care, all will be offered extensive adolescent psychiatric treatment aiming at supporting normative development. Adolescent psychiatric services like do not focus enough on prevention of deviation to antisocial pathway among adolescents with severe mental disorders. Severe mental disorders represent a breakdown in normative development with a considerable risk of antisocial development. In clinical adolescent psychiatry, more effort should be directed at diverting adolescents from development towards severe antisocial and aggressive behaviours. Evidence-based treatments for these comprise system-oriented family therapies and applications of

cognitive behavioural therapy, and these should be implemented more thoroughly. Health and social policies need to ensure not only resources but also orientation and skills of the professionals that have potential for tackling antisocial development. More research is needed to properly understand the role of internalizing disorders for the developmental trajectory towards criminal participation.

Declarations

The study was duly accepted by the ethics committee Tampere University Hospital and obtained appropriate permissions from the National Health Institute and Statistics Finland.

All the authors have accepted the submission of the manuscript in its present form to the JFPP and agree on publishing the work in the Journal, if it is accepted.

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Disclosure statement

The authors declare that they have no competing interests.

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Author contributions

The first author discussed the core ideas of the present study, planned the analyses together with the other authors, interpreted the findings and had main responsibility for drafting the manuscript. The second author discussed the core ideas of the present study, planned the analyses together with the other authors, carried out the statistical analyses, interpreted the findings and participated in drafting the manuscript. The third author discussed the core ideas of the present study, planned the analyses together with the other authors, interpreted the findings and participated in drafting the manuscript.

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PUBLICATION II

Factors behind a remarkable increase in adolescent psychiatric inpatient treatment between 1980 and 2010: a nationwide register study

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Factors behind a remarkable increase in adolescent psychiatric inpatient treatment between 1980 and 2010 – a nationwide register study

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ABSTRACT

Purpose: This register-based study aimed to evaluate trends in adolescent psychiatric inpatient care using nationwide data from three consecutive decades.

Methods: The study population (*N* 17,112) comprised all Finnish citizens aged 13–17 receiving their first-ever psychiatric inpatient treatment between 1980 and 2010 in Finland. Information on inpatient care in the psychiatric hospital was obtained from the Hospital Discharge Register and the Care Register for Health Care, which contains data on all patients discharged from all Finnish inpatient psychiatric health services.

Results: Inpatient admissions remained relatively stable until the early 1990s, after which a steady increase was seen, peaking in 2008 and more marked among females than males. In males, there was an increase in inpatient care episodes for externalizing disorder or mood disorder, and in females for mood disorder. Duration of first inpatient care decreased over time, but level of functioning on admission remained stable or even deteriorated. Females, patients first admitted in the 1980s or diagnosed with schizophrenia were more likely to be re-hospitalized during adolescence.

Conclusions: We reported an increase in adolescent psychiatric inpatient care from the latter half of the 1990s up to 2010, which could be explained by societal and policy changes. In particular, as the study period progressed a significant increase was seen in admissions of females and a global reduction of length of stay (LOS) with no concomitant increase in re-hospitalizations.

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Introduction

Adolescence is characterized by rapid changes in physical, cognitive, emotional, and social facets of development. These changes predispose adolescents to mental disorders that increase vastly from childhood to adolescence [1–6]. Mental disorders in adolescence impair educational achievement, employment, and socioeconomic status, and predict increased need for inpatient and social care and greater incapacity for work in later life. [4,6–13]. Thus, mental disorders are a significant health complaint in adolescence.

Finland is a Nordic country with a population of some five million, of whom 6–7% are adolescents (aged 13–17). The Finnish mental health services intended for adolescents first started to develop in specialist level health care in the 1960s. Adolescent psychiatry was acknowledged as a medical speciality in 1979, initially as sub-speciality of psychiatry or child psychiatry. In 1986, the National Administrative Medical Board required that all central hospitals should provide adolescent psychiatric outpatient services. The Mental Health Act of 1991 stated that those under 18 requiring psychiatric inpatient care should be treated separately from adults, which strengthened the development of adolescent psychiatric inpatient care. The law stipulated outpatient services as a priority. Adolescent psychiatry became an independent medical speciality in 1999. In 2001, the first guarantee of treatment under the legislation was enacted for child and adolescent psychiatry, with maximum acceptable waiting times.

In 2001–2002, a national audit of adolescent psychiatric services ('Nuotta') found that outpatient services were used by 1.8% of adolescents aged $13-22$, while the need was estimated at 4% [14]. Increases in adolescent psychiatric resources were recommended. A subsequent national audit in 2010 ('Nalle') reported that the share of adolescents in contact with adolescent psychiatric services had increased by 67%, now comprising 3% of adolescents aged 13–22. Resources in outpatient care had increased by 39% [15]. It was proposed that the latent need suggested by earlier research had changed into overt demand.

Adolescent mental health services in Finland are mainly provided by specialist-level health care comprising adolescent psychiatric outpatient and inpatient services in central hospitals (21 in the country). Since the 2000s local adolescent mental health outpatient services have been developed in primary care, particularly for the treatment of less severe mental health problems [14]. In addition, school and student

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health services and primary health care also cater for mental health-related needs. There has also been an exponential increase in private family care and rehabilitation homes operating under the child welfare legislation from the 1990s that has even been seen to constitute a risk of becoming an alternative system of adolescent psychiatric inpatient care [14].

Adolescent psychiatric services are mainly provided on an outpatient basis, as emphasized in the legislation (Mental Health Act 1116/1990 and Health Care Act 1326/2010). Inpatient services are provided for those with the most serious psychiatric symptoms and significant functional impairments or risk of causing harm to themselves or others [16]. Adolescent psychiatric inpatient admissions increased from the 1990s to the 2000s. At the same time, institutional placements of adolescents under the child welfare legislation increased [17,18]. Kronström et al. reported an increase in the incidence of psychiatric hospitalizations among Finnish adolescents between 2000 and 2010 [19]. This trend has been observed worldwide; psychiatric emergencies and hospitalizations of adolescents have also recently increased in other countries [20,21]. The characteristics of child and adolescent psychiatric inpatients also changed from 2000 to 2010, with an increase in the percentage of girls on adolescent wards associated with an increase in diagnoses that are more prevalent among girls than boys, such as depression, anxiety, and eating disorders. Kronström et al. concluded that this change may reflect both changes in diagnostic or referral practices and also true changes in the distribution of disorders among service users. In addition to these changes, length of stay (LOS) had decreased, possibly due to changes in treatment practices [19].

To summarize, health policy efforts have been made to increase the volume of adolescent psychiatric outpatient care, which has indeed been achieved. However, despite the emphasis on outpatient care and a general trend in psychiatry toward deinstitutionalization [22], adolescent psychiatric inpatient care appears to have increased. The number of psychiatric beds available to adolescents under 18 years rose steadily in the 1990s, notably in the early 2000s, when in two years there was a 27% increase (from 270 beds in 2000 to 342 in 2002) in beds available [14,23]. However, studies on the development of inpatient care have focused on a short-time span and relatively small numbers of participants, or these studies have been based on surveys that have depended on clinicians' response rate, have focused on both child and adolescent psychiatric patients or have focused on regionally delineated samples [19,24–27].

Aims of the study

The aim of this register-based study is to reliably evaluate trends in adolescent psychiatric inpatient care using nationwide data from three different decades.

More precisely, we set out to explore:

1. How have the absolute and population-adjusted figures of first-ever adolescent psychiatric admissions changed from the 1980s to 2010?
2. Has the diagnostic distribution, LOS, and level of functioning among patients admitted changed over time in first-ever adolescent psychiatric inpatient admissions?
3. Have there been changes over time in readmission rates?

Methods

Comprehensive and reliable Finnish national registers make it possible to study large patient groups and to link information on different registers on an individual level by using the unique personal identity code assigned to each permanent resident in Finland. For the present register-based study information on inpatient care in psychiatric hospital was obtained from the Hospital Discharge Register and the Care Register for Health Care. The Patient Discharge Register (used from 1969 to 1993) and its successor, the Care Register for Health Care (from 1994) contain data on all patients discharged from any inpatient care in the Finnish health services. The most essential data content with regard to providers of hospital services, speciality, patients' personal identity codes, admission, and discharge and diagnoses has remained unchanged in these registers over the years. The study population comprises all Finnish residents who between 1980 and 2010 had their first ever psychiatric inpatient treatment at ages 13–17 in Finland.

The National Institute for Health and Welfare was asked to identify study population from the Patient Discharge Register and the Care Register for Health Care. To protect individuals' privacy data was anonymized by Statistics Finland. After the index admission, the subjects were followed up in registers until the end of 2014. Information on subsequent psychiatric inpatient treatment periods was retrieved from the above-mentioned care registers.

To assess the rate of psychiatric inpatient care during adolescence in general population, information on the size of the adolescent (13–17 years) general population in Finland in each year studied was obtained from Statistics Finland's population structure statistics, which describe Finnish and foreign citizens permanently resident in Finland at the end of the year.

The data contains diagnostic information from three versions of the International Classification of Diseases (ICD). In Finland, ICD-8 was used in the period 1968–1986, ICD-9 in the period 1987–1995, and ICD-10 from 1996. The WHO conversion tables between ICD-8, ICD-9, and ICD-10 were used to convert ICD-8 and ICD-9 diagnoses to ICD-10 diagnoses [28]. The diagnosis entered as the primary diagnosis in the register data was used as the principal reason for admission to inpatient care. For the analysis ICD-10 diagnoses were the main diagnostic groups with the exception of the F90–99 group, which was divided into F90–92 group and F93–99 group as an F90–92 diagnosis indicates more behavioral problems, whereas F93–99 indicates more emotional problems. Otherwise, the most common main diagnostic groups are used with F20–29 representing schizophrenia group disorders, F30–39 mood disorders, and F40–48 anxiety disorders and combined F10–19, F60–69, and F90–92 groups

presenting externalizing disorders while the remaining F-group, Z-group, and somatic diagnoses as main diagnosis form another diagnostic group.

To assess the global functioning of patients with psychiatric disorders global assessment scale (GAS) value on arrival was obtained from the Care Register for Health Care. The GAS is a rating scale for evaluating the overall functioning of a subject during a specified time period on a continuum from psychological or psychiatric sickness to health. Research has shown it to have good reliability [29]. In Finland, it is mandatory to record GAS values on arrival and at the end of the psychiatric inpatient care period. Values are recorded by physicians according to on the basis of instructions provided by the National Institute for Health and Welfare. These values were available from the beginning of 1996.

Statistical analysis

For demographic information cross tabulations with chi-square were used for LOS and GAS value. Mean, median, and standard deviations were calculated with Jonckheere–Terpstra test for ordered alternatives were used to test for a possibly statistically significant trend. Multivariate associations were studied using logistic regression. Odds ratios (95% confidence intervals) for rehospitalization during adolescence are given according to sex, age group, decade of index admission, and diagnostic group. In addition, for those with first inpatient care during 1996–2010 GAS rating on arrival was used with mean value for whole sample as cut-off.

Results

The size of the study population was 17,112. Basic demographic information in different decades is presented in Table 1. In the 1980s, there were more males among those admitted, but in subsequent decades females predominated. The share of middle adolescents (aged 15–17) was about twice that of early adolescents (aged 13–14).

As seen in Figure 1, the proportion of adolescent population entering their first psychiatric inpatient care remained relatively stable in the 1980s and early 1990s. Thereafter the proportion of adolescent population first admitted to psychiatric inpatient care began to rise steadily, peaking in 2008. In females, the rise was more marked than in males.

Diagnostic distribution of first-ever adolescent psychiatric inpatient admissions

Table 2 presents the distribution of primary diagnoses in first inpatient care across the whole study period. In males externalizing diagnoses (F90–92) formed the most common diagnostic group (20.4%). In females, mood disorders (F30–39) were most common diagnoses (34.7%).

Numbers of adolescents in first-ever psychiatric inpatient care in each year of the study period grouped by primary diagnosis are presented in Figure 2. The number of adolescents with schizophrenia group (F20–29) diagnoses remained fairly stable over time. In males, there was an increase in inpatient care episodes for externalizing disorder or mood disorder diagnoses. In females, there was also an increase in episodes with externalizing disorder diagnoses, but a much more marked increase in episodes with mood disorder diagnoses.

Length of stay (LOS) and global assessment scale (GAS) scores of patients with psychiatric disorders

The mean duration of first inpatient care over the whole study period was 43 d (median 18, SD 72). Over time, LOS decreased from 66 d (median 28, SD 111) in 1980–1989 to 46 d (median 19, SD 77) in 1990–1999, 37 d in 2000–2009 (median 16, SD 56), and 33 d (median 16, SD 49) in 2010. LOS and GAS rating on arrival for each year from 1996 to 2010 are presented in Table 3. Mean GAS scores decreased, being lowest in 2010 for males and in 2005 for females. Over time the number of inpatient periods increased and LOS decreased, while at the same time GAS decreased ($p < .001$).

Need for rehospitalization

Of the study population, 39.6% were rehospitalized at least once during adolescence (age 13–17). As seen in Table 4, females were rehospitalized more often than males, those with F20–29 group diagnoses as primary diagnosis in first inpatient care more commonly than other diagnostic groups, and those first admitted in earlier decades more often than those first admitted 2000–2009.

In multivariate analysis (Table 5), the odds for being rehospitalized during adolescence were higher for females aged 13–14 at first inpatient care, for those with first inpatient care during the 1980s or having other than externalizing (F10–19, F60–69, and F90–92) diagnoses. Moreover, patients with lower GAS scores at their first admission during the period 1996–2010 presented a further risk for rehospitalization.

Discussion

In our comprehensive hospital register data covering all first-time inpatient adolescent psychiatric treatments between 1980 and 2010, we found a robust and steady increase in adolescent psychiatric first-ever inpatient admissions, meaning that an increasing share of adolescents were admitted to psychiatric inpatient care over time. These findings are in line with those of earlier studies, for example from Italy and the United States [20,21]. Associated changes were shorter stays, increasing proportion of females among those admitted, and increasing absolute figures and proportions of diagnoses other than schizophrenia group disorders. While the greatest increases were seen in admissions due to mood disorders in females and due to externalizing and mood disorders in males, the development was more marked among females, resulting in a clear overrepresentation of females in adolescent psychiatric inpatient care. While LOS diminished over time, this did not manifest as increased

Table 1. Proportion of males and females in early and middle adolescent age groups.

	1980–1989		1990–1999		2000–2010		1980–2010	
	13–14 years (*n* 653) (%)	15–17 years (*n* 1935) (%)	13–14 years (*n* 1214) (%)	15–17 years (*n* 2388) (%)	13–14 years (*n* 3529) (%)	15–17 years (*n* 7393) (%)	13–14 years (*n* 5396) (%)	15–17 years (*n* 11,712) (%)
Male	61.3	51.7	45.1	43.8	38.1	34.3	42.5	39.1
Female	38.7	48.3	54.9	56.2	61.9	65.7	57.5	60.9

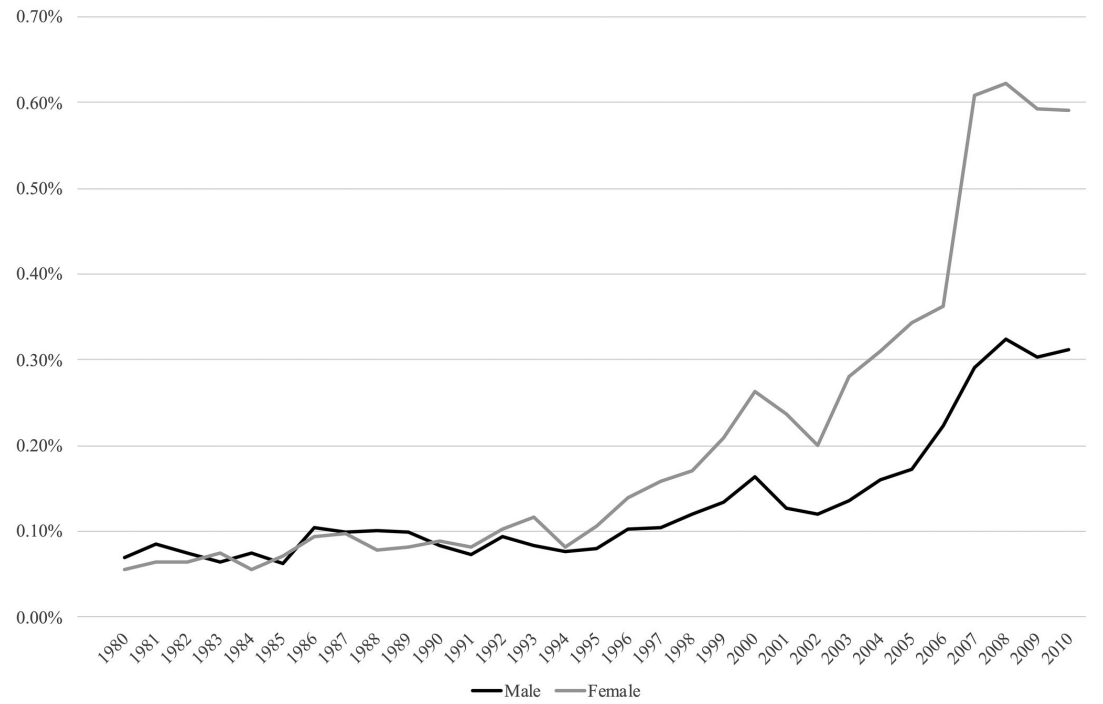

Figure 1. Percentages of adolescents (13–17 years) treated for the first time in psychiatric inpatient care.

Table 2. Primary diagnosis in first adolescent psychiatric inpatient care 1980–2010.

	Males ($n = 6873$) (%)	Females ($n = 10{,}239$) (%)	*p* (males *vs.* females)
F00–09 (organic)	0.5	0.2	<.001
F10–19 (substance use)	5.1	2.5	
F20–29 (schizophrenia group)	13.9	9.6	
F30–39 (mood disorders)	18.7	34.7	
F40–48 (anxiety disorders)	18.7	18.7	
F50–59 (eating disorders)	0.9	7.9	
F60–69 (personality disorders)	3.4	1.7	
F70–79 (intellectual disability)	1.0	0.6	
F80–89 (developmental)	2.9	0.8	
F90–92 (conduct disorders)	20.4	11.7	
F93–99 (emotional disorders of childhood)	7.8	6.8	
Z-codes	4.5	3.3	
Somatic diagnosis	2.2	1.6	

rehospitalizations. GAS ratings on arrival did not improve over time, suggesting that the increase in numbers of admissions was not due to a lower threshold for admission to inpatient care.

The increase in adolescent psychiatric inpatient care began in the latter half of the1990s. Increasing the resources and use of adolescent psychiatric outpatient care was an explicit policy in the 2000s [14,15], but numbers of inpatient beds were also increased [14,23]. Expanding the services and increasing service use likely have a reciprocal relationship resulting in an upward spiral in both. Such policies have likely been accompanied by an increasing awareness of psychiatric disorders and of the treatment options. This may have resulted in actual but previously unrecognized needs turning into an active demand for services, but it may also be that the perceived need for treatment followed a

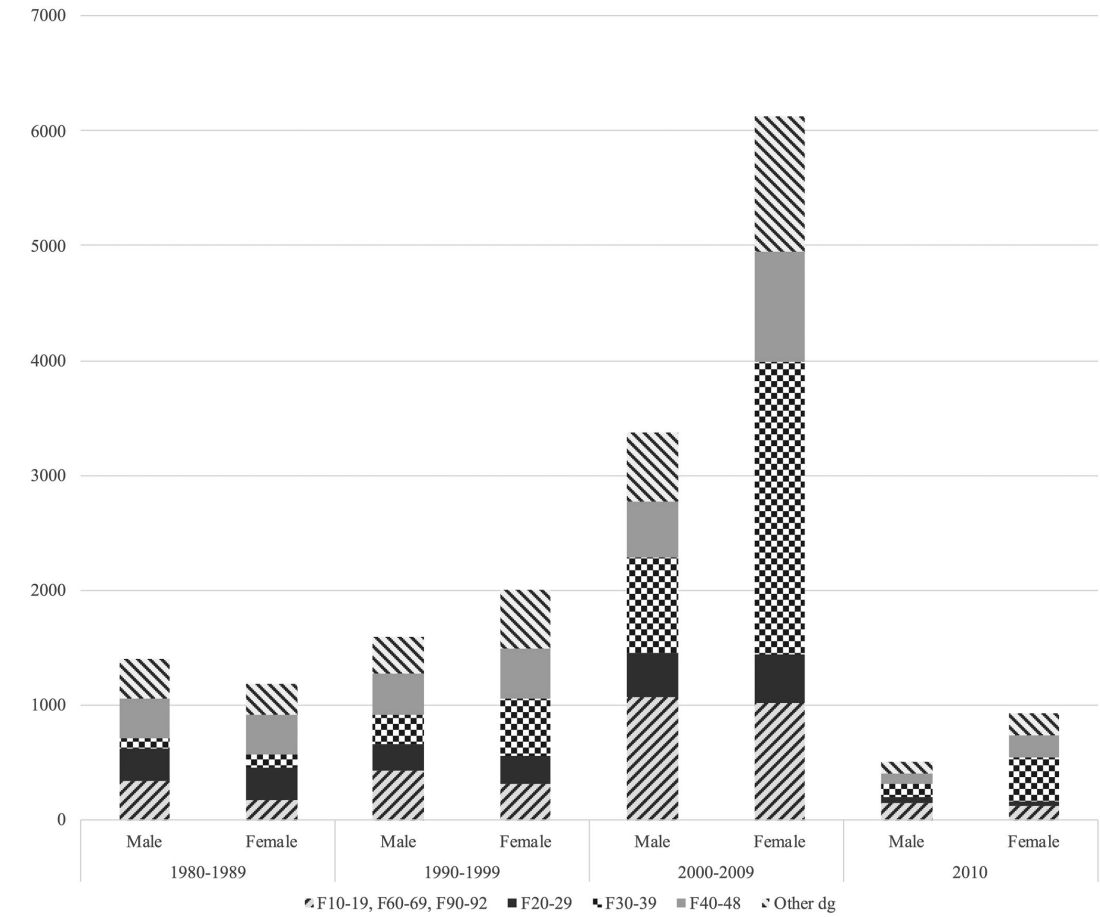

Figure 2. Absolute numbers of adolescents in first-ever psychiatric inpatient care in each year of the study period grouped by primary diagnosis.

Table 3. Mean (median; SD) duration (days) of first inpatient care and mean (median; SD) Global Assessment Scale rating on arrival.

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Male															
Duration	47 (24; 87)	45 (22; 70)	52 (17; 95)	38 (18; 67)	34 (18; 57)	34 (14; 59)	38 (15; 86)	28 (15; 38)	36 (18; 60)	34 (14; 64)	40 (16; 75)	40 (17; 55)	37 (19; 48)	38 (24; 47)	35 (20; 50)
GAS	43 (45; 15)	42 (40; 14)	43 (41; 12)	42 (41; 12)	42 (43; 12)	40 (40; 11)	42 (42; 12)	39 (40; 13)	40 (41; 14)	39 (40; 14)	39 (40; 13)	41 (41; 13)	39 (40; 12)	38 (40; 13)	38 (40; 13)
Female															
Duration	43 (17; 67)	53 (16; 93)	41 (18; 63)	38 (17; 56)	37 (16; 61)	28 (11; 41)	28 (11; 45)	32 (14; 54)	30 (12; 51)	39 (14; 62)	38 (15; 59)	42 (17; 55)	37 (18; 51)	42 (19; 60)	32 (15; 48)
GAS	38 (40; 13)	40 (41; 14)	39 (40; 13)	39 (40; 12)	40 (41; 13)	39 (40; 12)	41 (45; 10)	38 (40; 12)	38 (41; 13)	35 (38; 14)	38 (40; 13)	38 (40; 13)	39 (40; 13)	36 (37; 12)	39 (40; 12)

reconceptualization of adolescents as mentally ill in situations which in earlier decades were interpreted in some other way. It has been suggested that from the 1990s, a shift occurred in social and health policies, from a socio-ecological social approach in earlier decades to a more individual risk and psychopathology-oriented view and a tendency to resolve challenges with adolescents by treating and supporting individuals instead of focusing on an inclusive society [30]. This may have prompted the increase in adolescent psychiatric inpatient treatment as well as the similarly increasing trends in child welfare placements of adolescents [31] and in receiving intensified and special support in school [32].

In light of the present analyses, the origins of possible reconceptualizations may be traced back to the early 1990s, and to the general (better) recognition of female depression and male externalizing behaviors and depression. Epidemiological studies have shown no increasing trend in adolescent severe depression from the 1990s to the present, either internationally or in Finland, although some studies have reported an increased prevalence of self-reported

Table 4. Proportion of patients rehospitalized during adolescence.

	(%)	
Sex		
Male	40.5	p .003
Female	38.3	
Year of index admission		
1980–1989	42.5	$p < .001$
1990–1999	42.6	
2000–2009	37.6	
2010	40.2	
Primary diagnosis at index admission		
F10–19, F60–69, F90–92	34.3	$p < .001$
F20–29	47.7	
F30–39	40.9	
F40–48	38.8	
Other	39.7	

Table 5. Odd ratios with 95% confidence intervals for rehospitalization during adolescence.

	OR (95% CI)	p
Sex		
Male	Reference	Reference
Female	1.1 (1.1–1.2)	<.001
Age		
15–17 years	Reference	Reference
13–14 years	1.8 (1.7–2.0)	<.001
Year of index admission		
2010	Reference	Reference
2000–2009	0.9 (0.8–0.9)	.124
1990–1999	1.1 (1.0–1.3)	.062
1980–1989	1.2 (1.0–1.3)	.027
Primary diagnosis at index admission		
F10–19, F60–69, F90–92	Reference	Reference
F20–29	1.9 (1.7–2.2)	<.001
F30–39	1.4 (1.3–1.5)	<.001
F40–48	1.2 (1.1–1.3)	.001
Other	1.2 (1.1–1.3)	<.001
GAS on arrival (index admission in 1996–2010)		
40–100	Reference	Reference
<40	1.2 (1.2–1.3)	<.001

depressive symptoms [33–35]. Externalizing problems have decreased steadily both internationally and in Finland [36]. Thus, changes in the epidemiology of disorders obviously do not explain the changes in inpatient care. This leads to the conclusion that a reconceptualization of adolescent emotional and behavioral turmoil as psychiatric disorders may have taken place. Toward the early 2000s public discussion was concerned about allegedly increasing psychosocial problems and violent behavior among adolescents [17]. This may have been associated with interpreting externalizing symptoms as deviation from normal adolescent development, classifying them more as psychiatric symptoms than as behavioral problems and providing inpatient care as a solution. At the same time, inadequately resourced outpatient and preventive services may have led to an increased need for psychiatric inpatient care. To address increasing concerns about the right to receive treatment, the Parliament of Finland in the early 2000s repeatedly granted extra budgets to enhance adolescent psychiatric treatment [37].

Another possible answer to the above questions could be societal changes and a decline in preventive services. In the first half of the 1990s, Finland suffered a severe economic recession. This had a drastic impact at every socioeconomic level [38]. There were significant cuts across services, for example in family services, school support and healthcare, all important for the promotion of mental health, and the prevention of disorders [14,15]. In addition to cuts in preventive services, the economic recession may have had far-reaching consequences for those born in the early 1990s and reaching adolescence in the mid-2000s due to family stress [39–42].

The medicalization theory of mental disorders posits that the present findings are explained by an increasing tendency to regard behavior and phenomena which are part of normal adolescent development as psychiatric symptoms. However, our findings on GAS ratings on admission contradict this assumption. Despite increasing numbers of inpatient admissions, GAS ratings remained relatively stable or even fell over time, suggesting greater severity of symptoms. Further, the mean duration of first period of inpatient care remained relatively stable in the 2000s. Medicalizing normal adolescent development should manifest in improved GAS ratings on admission, and patients with milder symptoms would probably have shorter length of inpatient care. Thus, our data does not point toward the medicalization of normative adolescent development. This concurs with the findings of Kronström et al., who noted that the share of adolescent inpatients with the poorest general functioning had increased when comparing inpatient data from 2000 to 2010 [19].

It is also possible that, while adolescents in later cohorts share the same characteristics with earlier generations, the society around them has changed in a way that imposes more demands on them, making coping with those demands harder than before, eventually leading to seeking or being referred to psychiatric treatment [41,43,44].

There have been concerns that shortening LOS in inpatient treatment may lead to poorer prognoses followed by readmissions [45]. However, although LOS decreased over time in the present nationwide data, there was no increase in rehospitalizations during adolescence. This does not suggest any particular risk related to deinstitutionalization. Rehospitalization was predicted by schizophrenia group diagnosis and low GAS rating on admission, i.e. by greater severity of the disorder, as is appropriate. However, it should be noted that while the proportion of rehospitalizations remained the same, as the number of first-time inpatient admissions increased, so also did the absolute number of adolescents rehospitalized. This, however, should not be directly related to the shortening of LOS as in earlier studies. LOS has been found to be associated more with non-clinical factors than with any specific psychiatric diagnosis [26,46].

It remains unexplained why the increases in adolescent psychiatric inpatient admissions since mid-1990s concerned predominantly girls. There is no evidence that depressive disorders, more common among females, would have increased in prevalence in the adolescent population. However, depressive symptoms may be more severe in females, therefore, possibly increasing the need for inpatient care [47]. Externalizing symptoms and disorders, more common among boys, may also trigger child welfare interventions instead of psychiatric interventions. However, the simultaneous increase in adolescent placements under the Child Welfare Act has concerned boys and girls equally [48]. Thus, all in all, female

adolescents have been institutionalized more than male. This observation warrants further research.

Methodological considerations

The strength of this study is the large nationwide data over a long study period of three decades, making it possible to reliably observe possible trends in adolescent psychiatric inpatient care. The data suffers from no distorting effect of regional differences in adolescent mental health services. A limitation is that in clinician-supplied data there is risk of misinterpretation of adolescent symptoms and the possibility of diagnostic inaccuracies. However, diagnostic practices have been shown to be reliable in Finnish psychiatric inpatient care [49] and as we analyzed the data on the level of diagnostic main classes, the risk of individual clinician-related bias diminishes. The GAS rating has been found to have moderate to good reliability, depending on training [50]. The study is based on register data, which is mandatorily collected from every inpatient care period with well-established practices, making it decidedly reliable. As we studied both absolute and population-adjusted figures, the effect of possible changes in adolescent population size over time was also excluded. However, with register-based data it is possible to observe only broader trends, while more explicit analysis requires the examination of individual patient records. Therefore, many phenomena related to psychiatric admissions were not evaluated in this study, among them the contextual reasons for hospitalizations, the hereditary tendency of psychiatric diseases, the family problems, adverse childhood experiences (ACEs) in childhood and adolescence, etc., and possible secular changes therein.

Conclusion

We reported an increase in adolescent psychiatric inpatient care from the latter half of the 1990s up to 2010. Neither epidemiological findings on adolescent psychiatric morbidity nor medicalization of adolescent development can explain the increase in psychiatric inpatient care. Changes in family, school, and community environments that increase demands for coping may cause adolescents' need for treatment to increase even if morbidity remains stable. This warrants further research.

It is also possible that the shift from socio-ecological social policies in earlier decades to individual risk and psychopathology-oriented health and social policies from the 1990s has resulted in an increasing tendency to resolve challenges with adolescents by treating individuals instead of focusing on an inclusive society.

Over time, a global reduction of LOS without a concomitant increase in re-hospitalizations was observed. As the shortening of inpatient care episodes has not led to poorer prognoses, healthcare professionals and policy-makers should continue to develop the needed psychiatric inpatient care to be as short as possible by bringing the focus of treatment and rehabilitation closer to the patient's normal social environment.

The significant increase in admissions and more frequent readmissions among females remains unexplained in the light of current knowledge. Further research, both psychiatric and sociological, seems warranted to shed light on the phenomenon of increasing hospitalization of female adolescents.

Ethics approval

The study was duly accepted by the ethics committee of Tampere University Hospital and obtained the appropriate permissions from the National Institute for Health and Welfare.

Author contributions

All authors contributed to the study conception, design, and to the interpretation of the findings. Data preparation and analysis were performed by Timo Holttinen and Riittakerttu Kaltiala. The first draft of the manuscript was written by Timo Holttinen and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Disclosure statement

The authors declare that they have no conflicts of interest.

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Data availability statement

Availability of datasets used and/or analyzed in this study is subject to data permits from the Finnish register authorities. The corresponding author will provide further information at readers' requests.

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PUBLICATION III

Educational attainment of adolescents treated in psychiatric inpatient care: a register study over 3 decades

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ORIGINAL CONTRIBUTION

Educational attainment of adolescents treated in psychiatric inpatient care: a register study over 3 decades

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Abstract
Mental disorders may for various reasons impair educational attainment, and with far-reaching consequences given the impact of education on subsequent employment, social life, life choices and even health and mortality. This register-based study addresses trends in educational attainment among Finnish adolescents aged 13–17 with mental disorders severe enough to necessitate inpatient treatment between 1980 and 2010. Our subjects ($N = 14{,}435$), followed up until the end of 2014, were at greater risk of discontinuing education beyond compulsory comprehensive school or of lower educational attainment than their age-peers in general population. Only 50.0% had completed any post-comprehensive education compared to 84.9% in same-aged general population. Those at highest risk were males and those with organic, intellectual disabilities and developmental, externalizing disorders or schizophrenia group diagnoses. Despite improvements in adolescent psychiatric care, school welfare services and pedagogical support, risks have remained high. Greater effort in psychiatric treatment, school welfare and pedagogy are needed to combat this severe inequality.

Keywords Adolescent · Mental disorders · Education · Inpatient · Register study

Introduction

Adolescence is a crucial time for establishing personal values or ethical systems, adopting socially responsible behavior and making choices regarding one's educational pathway [1]. Education affects subsequent employment, social life and even health and mortality [2–7]. Adolescents dropping out of secondary school are at markedly increased risk for sickness and disability in young adulthood [3] and are more likely to smoke or take drugs, to report suicide attempts in the preceding year and to have been arrested on suspicion for crimes [8]. Higher education is associated with healthier behavior and overall health [2, 5, 9]. Formal education has an ever-increasing role in working life [10, 11] accompanied by pressure to shorten the time needed to qualify and enter working life [12]. These developments may exacerbate the negative impact of adolescent mental disorders on ultimate educational level and position in working life.

The Finnish education system

Education in Finland is publicly funded up to and including tertiary education and thus not contingent upon students' socioeconomic status, ethnicity, or other considerations. Since the 1970s, education has been compulsory for 9 years of comprehensive school or until age 16. In 2021, the school-leaving age was raised to 18 years and compulsory education extended to include upper secondary education. Post-comprehensive education includes upper secondary education and tertiary education (Fig. 1).

Over 90–95% of the age cohort continue to upper secondary education [13]; thus, the educational level in Finland has risen steadily. In 1980, only 40.4% of those over 20 had completed at least upper secondary education and only 14.1% tertiary-level education, whereas in 2010, this reached 71.2% and 30.0% (1990: 53.3%/19.4%; 2000: 63.2%/25.3%) [14].

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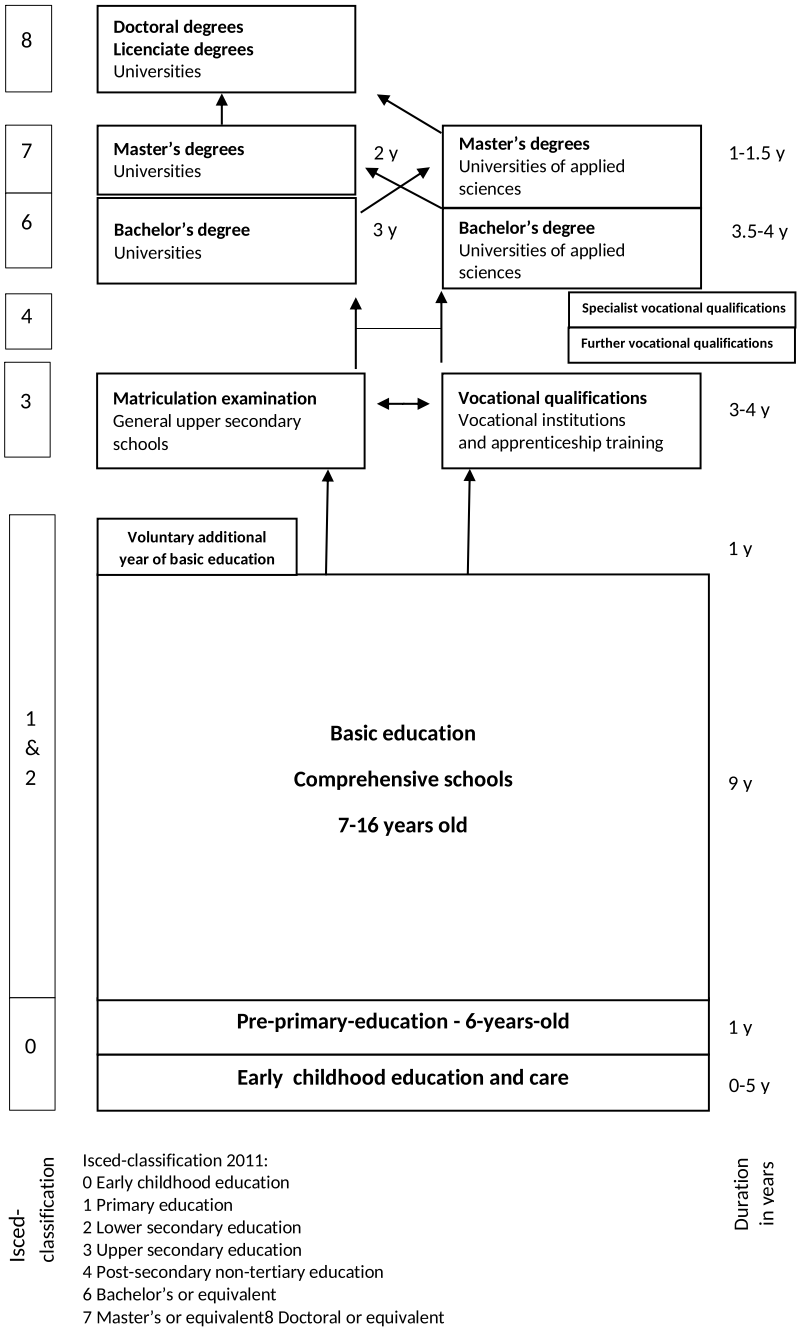

Fig. 1 Education system in Finland

Mental disorders in adolescence and education

Mental disorders may for various reasons impair educational attainment. In externalizing disorders (such as substance use disorders, conduct disorders and ADHD), truancy, lack of motivation and attention deficits [15–17] may affect school

attendance and dropping out of school. In internalizing disorders (such as depression and anxiety disorders), fatigue, lack of interest, and cognitive symptoms (difficulties in concentration, learning, memory and problems attending school) may seriously impair learning and adjustment to school [18]. In psychotic disorders, both positive and negative symptoms may impair learning and adjustment to school through impairment of cognitive and social functioning [19–21]

The association between externalizing disorders and negative educational outcomes such as school dropout and lower educational attainment is well established [15–17]. The findings on internalizing disorders have been less consistent. In some studies, internalizing disorders have been associated with underachievement at school, problems with school attendance and failure to complete school education [22–27]. However, in other studies, no association has been found or this has diminished after controlling for confounding factors like parents and family SES or externalizing symptoms [19, 28, 29].

Positive developments in the availability and variety of adolescent psychiatric services in Finland since the 1980s [30] may also have helped adolescents with mental disorders to achieve higher educational goals. For example, neuropsychological assessments and rehabilitation have been more readily available since the 1980s [31], likewise more easily obtainable medication for depression and especially for ADHD. Efforts have moreover been made since the 1970s to improve access to student welfare services in schools and these were accelerated in the 2000s [32]. The range of special education for those with special needs has increased, resulting in the highest number of pupils receiving part-time special education in the mid-2000s. Support has evolved from separate special education into more part-time support for learning and school attendance [33]. Despite the emphasis on outpatient care, the need for adolescent psychiatric inpatient care appears to have increased between the late 1990s and 2010. However, mean length of inpatient stay has simultaneously decreased from 66 days (median 28) in the 1980s to 36 days (median 15) in the 2000s [34]. Inpatient care is only warranted when patients' psychiatric symptoms are so severe (for example suicidality, psychosis, aggression) that outpatient services (including child protection services) do not suffice to ensure the safety of patients or others.

To summarize, increased and improved adolescent psychiatric services and school welfare services might have been expected to have resulted in better academic achievement despite psychiatric illness during adolescence. The policy to shorten the time spent in education and to transfer young adults earlier to working life may have counteracted the positive developments in services to help those with mental disorders. Need for inpatient treatment can be seen as an indicator of the severity of mental disorders. This register-based study aims to evaluate trends in educational attainment among adolescents aged 13 to 17 with mental disorders severe enough to warrant inpatient treatment for the first time between 1980 and 2010. Including study population from three different decades makes it possible observe the effects of the development in adolescent psychiatric services and school support systems. More specifically, we sought answers to the following questions.

1. Are psychiatric disorders requiring psychiatric inpatient care in adolescence differentially associated with lower educational attainment in later life?
2. What are the risk factors for not acquiring education beyond compulsory comprehensive school among those admitted to psychiatric hospital during adolescence?
3. Are there differences in educational attainment between adolescents hospitalized due to psychiatric disorders in different decades?

Methods

This is a register-based follow-up study, the study population comprising all Finnish citizens admitted between 1980 and 2010 for their first ever psychiatric inpatient treatment at age 13–17 in Finland. Information on inpatient care in psychiatric hospital was obtained from the Patient Discharge Register (used between 1969 and 1993) and the Care Register for Health Care (from 1994). Altogether 17,112 adolescents aged 13–17 were admitted to psychiatric inpatient care for the first time (in their lives) in 1980–2010. The subjects were followed up in registers until 2014.

The study data contains diagnostic information from three versions of the International Classification of Diseases (ICD). The WHO conversion tables were used to recode ICD-8 and ICD-9 diagnoses as ICD-10 diagnoses [35]. In the analyses, primary diagnoses according to ICD-10 were classified into organic, intellectual disability and developmental (diagnostic groups F00–09, F70–79, F80–89, G-diagnoses), Schizophrenia group (F20–29), mood disorders (F30–39) anxiety disorders (F40–48), behavioral syndromes associated with physiological disturbances and physical factors (F50–59), externalizing disorder (F10–19, F60–69, F90–92), emotional disorders of childhood (F93–99) and social reasons (Z-codes). Age at index admission was classified to early (13–14 years) and middle (15–17 years) adolescence.

Information on highest attained post-comprehensive school education was obtained from the Statistics Finland Register of Completed Education and Degrees. The statistics include all upper secondary and tertiary education options with harmonized concepts and classifications. In the analyses, highest education obtained was classified as comprehensive school only, upper secondary education

(general upper secondary school and vocational qualifications and tertiary education (university of applied sciences, university). Data on enrollment in post-comprehensive school studies in 2014 were obtained from the Statistics Finland Progress of Studies register.

For the present study, we included those aged 20–49 years who were alive and who had received psychiatric diagnoses or organic, neurological (G-group), intellectual disability or developmental diagnosis or social reasons (Z-code) diagnosis as the primary diagnosis at index admission. On 1.3% of these (197/14,632; demographic information in Supplementary Table 1), no education information was available in 2014 and they were excluded from the study. The lower age limit was chosen assuming that the vast majority would have completed upper secondary education by age 20 in Finland [12, 36]. This upper age limit was chosen to ensure equal age groups. Because subjects had different follow-up times and, therefore, different amounts of time to attain education, the study population was categorized into age groups based on subjects' age at the end of 2014. These age groups were 20–29, 30–39 and 40–49 years. To compare the educational attainment of the study population to that in sex- and age-matched general population, information on the educational attainment of Finnish population was gathered from the Official Statistics of Finland: Educational Structure of Population [14].

Statistical analyses

Cross-tabulations with Chi-square statistics with effect sizes were used to investigate associations between sex, age and primary diagnosis at first inpatient care and a subject's attainment of a university degree or pursuit of post-comprehensive school education at the end of 2014. The highest educational levels attained were compared between former patients and general population in sex and age groups using cross-tabulations and Chi-square statistics.

Logistic regression analysis was used to assess the odds ratios for no post-comprehensive school education (attained or pursued in 2014). Sex, categorized age at index admission and psychiatric primary diagnosis at index admission were used as covariates. Sex and primary diagnosis interactions were also examined to ascertain if sex moderated the association between diagnosis and education attainment using sex as a moderator. Logistic regression analyses were performed separately for each age group as psychiatric treatment and education have constantly developed over the years.

SPSS 27.0 version and MedCalc's comparison of proportions calculator were used for statistical analyses. P-value 0.05 was used as a threshold for statistical significance.

Results

Of the study population ($n = 14{,}435$), 38.8% ($n = 5603$) were males and 61.2% ($n = 8832$) females. Information on the age of the study population age at first admission to inpatient treatment and in 2014 and primary diagnoses in first psychiatric inpatient care are presented in Table 1.

Education attained

As Fig. 2A shows, 50.0% of the study population had no post-comprehensive school education, 42.9% had completed upper secondary education and 7.1% had completed tertiary education in 2014. In general population, 84.9% of Finns aged 20–49 had completed at least some kind of post-comprehensive school education (49.7% upper secondary education and 35.2% tertiary education). In every age group (age in 2014) and among both males and females, the proportion of those with no post-comprehensive school education was much higher in the study population than in general population and was highest in the youngest age group (Fig. 2B). In addition, highest educational level attained was lower in every age group in the study population. More precise numerical information is presented in Supplementary Table 2.

Of those with comprehensive school education only ($n = 7224$), 25.6% were enrolled in upper secondary or tertiary education in 2014, females more often than males (30.9% (1200/3881) vs. 19.4% (649/3343), $p < 0.00$, phi 0.131) Being enrolled in post-comprehensive school education was more common in younger age groups (age 20–29: 35.8% (1654/4622), 30–39: 10.4% (168/1608), 40–49: 2.7% (27/994), $p < 0.001$, Cramer's V 0.315). No data were available on the whole population.

Risk factors for not achieving post-comprehensive school education

Altogether 37.2% of the study population had not completed or were not enrolled in post-comprehensive school education in 2014. As seen in Table 2, this was more likely among males (48.1% (2694/5603) vs. 30.4% (2681/8832) in females ($p < 0.001$, phi 0.13) and in older age groups. In females, those entering psychiatric inpatient care for the first time in early adolescence (13–14 years) were slightly more likely to have no post-comprehensive school education or not to be enrolled in it than those first admitted during middle adolescence (15–17 years). In males, age at first admission to psychiatric inpatient treatment was not associated with subsequent educational attainment.

Table 1 Age in first inpatient care and in 2014 and primary diagnosis in first psychiatric inpatient care % (*n*)

	Male (*N* 5603)	Female (*N* 8832)	*p* value (Cohen's *h*)
Age at first inpatient care episode			
13–14 years	30.9% (1730)	27.0% (2389)	< 0.001 (0.09)
15–17 years	69.1% (3873)	73.0% (6443)	< 0.001 (0.09)
Age in 2014			
20–29 years	55.5% (3109)	65.7% (5803)	< 0.001 (0.21)
30–39 years	26.9% (1507)	23.5% (2075)	< 0.001 (0.08)
40–49 years	17.6% (987)	10.8% (954)	< 0.001 (0.2)
Primary diagnosis in first psychiatric inpatient care			
Organic, intellectual disability and developmental (F00–09, F70–79, F80–89, G-diagnoses)	4.8% (270)	1.6% (145)	< 0.001 (0.19)
Schizophrenia group (F20–29)	14.2% (793)	9.8% (869)	< 0.001 (0.14)
Mood disorders (F30–39)	19.8% (1110)	35.4% (3128)	< 0.001 (0.35)
Anxiety disorders (F40–48)	18.9% (1061)	18.6% (1647)	0.65 (0.01)
Behavioral syndromes associated with physiological disturbances and physical factors (F50–59)	1.0% (54)	8.0% (708)	< 0.001 (0.37)
Externalizing disorders (F10–19, F60–69, F90–92)	28.8% (1614)	16.2% (1428)	< 0.001 (0.3)
Emotional disorders of childhood (F93–99)	8.0% (448)	6.9% (608)	0.01 (0.04)
Social reasons (Z-codes)	4.5% (253)	3.4% (299)	< 0.001 (0.06)

*p values (Cohen's h effect sizes) for categorical proportion differences between sexes

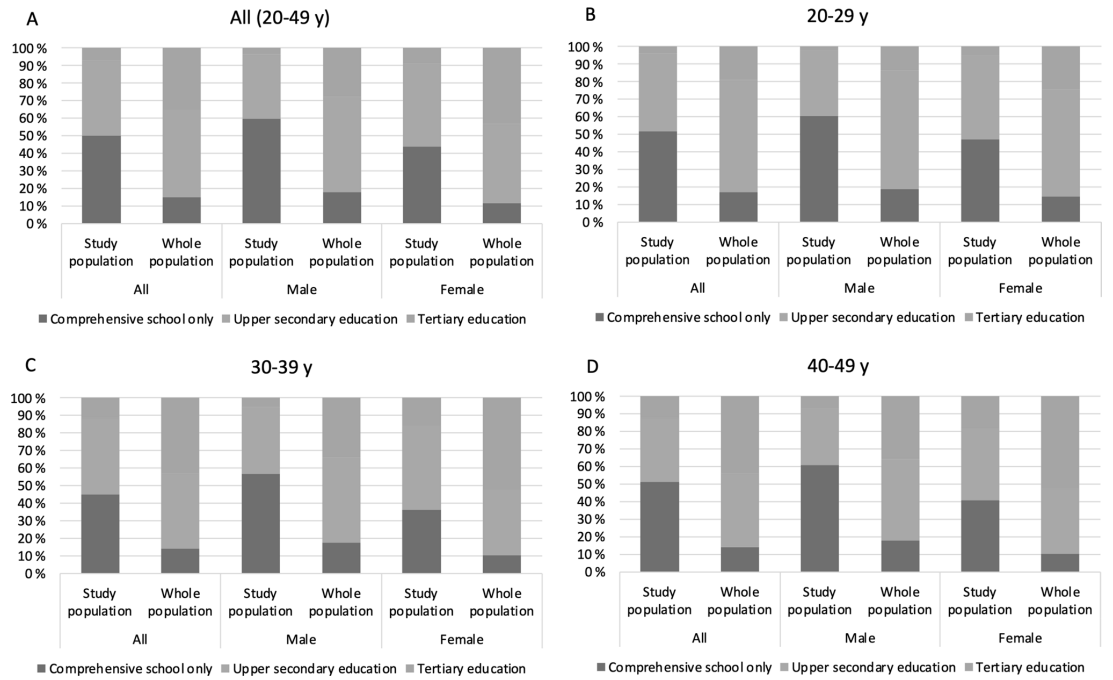

Fig. 2 Highest school education completed in study population in 2014 compared to that of whole population by age group

Table 2 No post-comprehensive education completed or pursued in year 2014, by age and primary diagnosis at index admission and age in 2014 (% (*n*/*N*))

	Males	Females	All
Age at first inpatient care			
13–14 years	46.7% (808/1730)	32.1% (768/2389)	38.3% (1576/4119)
15–17 years	48.7% (1886/3873)	29.7% (1913/6443)	38.8% (3799/10316)
p (Cramer's *V* effect size) *for categorical proportion difference of age groups in first inpatient care	0.168 (0.018)	0.026 (0.024)	0.107 (0.013)
Age in 2014			
20–29 years	42.6% (1325/3109)	28.3% (1643/5803)	33.3% (2968/8912)
30–39 years	52.0% (784/1507)	31.6% (656/2075)	40.2% (1440/3582)
40–49 years	59.3% (585/987)	40.0% (382/954)	49.8% (967/1941)
p (Cramer's *V* effect sizes) *for categorical proportion differences of age groups in 2014	< 0.001 (0.131)	< 0.001 (0.079)	< 0.001 (0.119)
Primary diagnosis in first inpatient care			
Organic, intellectual disability and developmental (F00–09, F70–79, F80–89, G-diagnoses)	54.4% (147/270)	46.9% (68/145)	51.8% (215/415)
Schizophrenia group (F20–29)	49.1% (389/793)	38.1% (331/869)	43.3% (720/1662)
Mood disorders (F30–39)	39.2% (435/1110)	25.4% (793/3128)	29.0% (1228/4238)
Anxiety disorders (F40–48)	47.5% (504/1061)	30.1% (496/1647)	36.9% (1000/2708)
Behavioral syndromes associated with physiological disturbances and physical factors (F50–59)	22.2% (12/54)	11.9% (84/708)	12.6% (96/762)
Externalizing disorders (F10–19, F60–69, F90–92)	55.3% (893/1614)	39.6% (565/1428)	47.9% (1458/3042)
Emotional disorders of childhood (F93–99)	44.2% (198/448)	36.5% (222/608)	39.8% (420/1056)
Social reasons (Z-codes)	45.8% (116/253)	40.8% (122/299)	43.1% (238/552)
p (Cramer's *V* effect sizes) *for categorical proportion differences of diagnosis groups	< 0.001 (0.128)	< 0.001 (0.178)	< 0.001 (0.194)

The former patients with primary diagnoses of behavioral syndromes (F50–59) were the only patient group where the proportion of those with no education beyond comprehensive school was lower than in general population (Fig. 2A and Table 2).

In logistic regression analyses (Table 3), male sex was a risk for no further education in each age group. There was no significant difference according to age at index admission. All other diagnostic groups were at significantly higher risk than those with behavioral syndromes group (F50–59) diagnoses as the primary diagnosis at index admission. Those with organic, intellectual disability and developmental (F00–09, F70–79, F80–89) diagnoses, externalizing disorders (F10–19, F60–69, F90–92) or schizophrenia group diagnoses (F20–29) were at highest risk. In addition, those with internalizing disorder diagnoses (mood disorders F30–39 or anxiety disorders F40–48) were at higher risk than those with behavioral syndromes group (F50–59) diagnoses.

Discussion

Highest educational attainment among former adolescent psychiatric inpatients across age groups was considerably lower than among Finnish general population. The study population included an especially high proportion of those who had only completed comprehensive school education, with a significantly large difference from general population, especially in males. Except for behavioral syndromes group (F50–59), every diagnostic group had a two- to threefold greater proportion of those who had completed only comprehensive school education when compared to general population. Especially in males, those with externalizing disorder (F10–19, F60–79, F90–92) diagnoses differed from those with other diagnoses. These findings are more noticeable when compared to studies on general psychiatric problems or general population [18, 19,

Table 3 Odds ratios (95% confidence intervals) for no post-comprehensive education completed or pursued in 2014 ($N = 14,435$)

	20–29 years ($n = 8912$)		30–39 years ($n = 3582$)		40–49 years ($n = 1941$)	
	OR (95% CI)	p	OR (95% CI)	p	OR (95% CI)	p
Sex						
Female	Ref		Ref		Ref	
Male	1.6 (1.4–1.7)	< 0.001	2.1 (1.8–2.4)	< 0.001	2.0 (1.7–2.4)	< 0.001
Age at index admission						
13–14 years	Ref		Ref			
15–17 years	1.0 (0.9–1.1)	0.760	0.9 (0.8–1.0)	0.111	1.1 (0.9–1.4)	0.312
Primary diagnosis in index admission[a]						
Behavioral syndromes associated with physiological disturbances and physical factors (F50–59)	Ref		Ref		Ref	
Organic, intellectual disability and developmental (F00–09, F70–79, F80–89, G-diagnoses)	5.0 (3.5–7.2)	< 0.001	5.2 (2.7–10.3)	< 0.001	7.4 (3.1–17.5)	< 0.001
Externalizing disorders (F10–19, F60–69, F90–92)	4.9 (3.7–6.4)	< 0.001	4.5 (2.9–7.2)	< 0.001	6.7 (3.0–14.6)	< 0.001
Schizophrenia group (F20–29)	3.9 (2.9–5.3)	< 0.001	3.4 (2.1–5.4)	< 0.001	5.3 (2.4–11.4)	< 0.001
Mood disorders (F30–39)	2.5 (1.9–3.3)	< 0.001	2.6 (1.7–4.1)	< 0.001	3.2 (1.4–7.1)	0.006
Anxiety disorders (F40–48)	2.9 (2.2–3.9)	< 0.001	3.1 (2.0–5.0)	< 0.001	4.7 (2.2–10.2)	< 0.001
Emotional disorders of childhood (F93–99)	3.9 (2.9–5.4)	< 0.001	3.3 (1.0–5.4)	< 0.001	3.7 (1.6–8.8)	0.003
Social reasons (Z-codes)	3.9 (2.9–5.4)	< 0.001	4.6 (2.7–7.9)	< 0.001	3.6 (1.6–8.5)	0.003

[a]Sex was not a statistically significant moderator of associations between diagnosis and educational attainment (p values 20–29 years group: 0.08, 30–39 years: 0.36, 40–49 years: 0.06)

37–49]. While mental health problems predispose to lower educational attainment, those with psychiatric symptoms severe enough to require inpatient care are at greater risk. The failure of former adolescent psychiatric inpatients to attain educational levels comparable to same-aged general population could be related to the nature of the disorders themselves or to the stigma related to psychiatric morbidity, but may also signify that, despite increases in the availability and variety of adolescent psychiatric services and welfare services in school and special education and other support for learning, society has failed to adequately promote the integration of adolescents with mental disorders into education, with long-term negative implications for their integration into working life.

With the exception of those with organic, intellectual disability and developmental group diagnoses (F00–09, F70–79, F80–89, G-diagnoses), those with externalizing disorders were at highest risk of having no post-comprehensive school education. This concurs with the findings of earlier studies [15, 16, 39] and may reflect the impact of neurocognitive and motivational deficits associated with externalizing disorders [16, 40, 41]. These deficits may also characterize those whose index admissions were due to diagnoses in the emotional disorders of childhood group (F93–99) and the social reasons group (z-codes) as these diagnoses are often set in the absence of other obvious psychiatric problems. The risk persisted in the youngest age groups even though the pharmacological treatment of attention deficits and hyperactivity, for example, improved vastly during the 2000s [42].

In addition to the well-known impairments caused by cognitive deficits found, for example, in schizophrenia group (F20–29) diagnoses, impaired social functioning, seen in many mental disorders, may also have a negative effect on the skills needed for education [21, 43–45]. Adolescents with anxiety disorders (F40–48), especially social phobia, face many academic and social difficulties and experience higher levels of peer victimization, which may lead to refusal to attend school, slow academic progress or failure to enter higher education [46, 47]. Adolescence is a stage of life associated with the rapid acquisition of new information and making far-reaching choices, for example, in education. Mood disorders (F30–39) are often associated with cognitive dysfunctions persisting beyond symptom recovery [48, 49], and this may have particularly damaging and long-lasting effects on education. It has been proposed that the impact of mood disorders on educational attainment may be to delay, rather than to prevent, completion of higher education [24]. However, in this study, the risk of exclusion from higher education was present in every age group. In this case, lower educational attainment compared with same-aged general population might well no longer be seen in the oldest age groups, which was not the case in the present study.

In addition to the negative effect of the symptoms, mental disorders may also have a negative impact on educational attainment due to the accompanying stigma. Stigma may

reduce willingness to seek help and impair treatment adherence, undermine treatment outcome, impair well-being and, especially during adolescence, influence personal identity and independence in the long term [50–53]. Adolescents with mental disorders are deemed more stigmatized than peers with other health problems [52]. Stigma may manifest in general devaluation, bullying, being underestimated by others or outright social rejection, which may impair adolescents' willingness to pursue education [50]. In addition, adolescents with mental disorders may be branded as having a disability, which may lead to lower educational expectations on the part of parents and teachers. For example, Schifrer [54] found that among similarly achieving and behaving adolescents the odds of teachers expecting a bachelor's degree education or higher for adolescents labeled as having a learning disability were 82% lower than for adolescents without this and that adolescents' educational expectations are partially mechanized through parents' and particularly teachers' lower expectations. Therefore, while learning difficulties associated with many mental disorders may require support from special education services, those services may, while improving students' opportunities to learn, engender stigma.

This study represents 3 decades of development of adolescents' mental health services and the education system. Subjects aged 40–49 years in 2014 were in adolescent psychiatric inpatient care mainly in the 1980s, those aged 30–39 in the 1990s and those aged 20–29 in the 2000s. In spite of considerable improvement in support services for those in need in both education and mental health services [13, 30, 33] those adolescents with psychiatric disorders requiring psychiatric inpatient treatment in the 2000s were nevertheless at similar risk for not pursuing higher education to those in inpatient care in the 1980s. This may be because psychiatric disorders impair academic performance so profoundly that even if support is arranged at school, it does not suffice to alleviate the effects of psychiatric symptoms. Another possibility is that the focus on adolescents' social environments and skills and the kind of support needed is still inadequate. Third, stigma related to mental disorders may hinder functioning at school and the readiness to offer and accept support. Systematically lowered educational attainment across diagnostic categories and across decades is not only a matter of persistent inequality. Given the importance of education today, lack of post-comprehensive school education may impair employment prospects, lead to lower socioeconomic status and so to poorer physical and mental health [3, 4, 55].

Methodological considerations

The strength of this study is the large nationwide data covering a long study period of 3 decades. The data suffer from no distorting effect of regional differences in adolescent mental health services or educational opportunities. The Finnish national register data used in this study are of high quality and collected directly and mandatorily from healthcare and education authorities. The Finnish national registers make it possible to study large patient groups and to collate information on different registers on an individual level using the unique personal identity number assigned to each permanent resident in Finland.

A first limitation is the risk of inaccuracies in both diagnostic and education data. Diagnoses were supplied by clinicians and may, therefore, contain clinician-related bias. For example, inpatients with ADHD diagnoses are often treated for associated conduct problems although no conduct disorder has been diagnosed. However, diagnostic practices have been shown to be reliable in Finnish psychiatric inpatient care [56] and as we analyzed the data on the level of diagnostic main classes, the risk of individual clinician-related bias is reduced. As this study focused solely on primary diagnoses, the effects of comorbid psychiatric symptoms (e.g., intellectual disabilities) were not explored. However, as inpatient care usually focuses on the main psychiatric symptoms, the primary diagnosis is the best indicator of patients' problems and is the only diagnosis invariably recorded in registers. In addition, services required by most of those with intellectual disabilities are provided by separate intellectual disability services. As this study focused on adolescents aged 13–17, some diagnostic phenotypes might not have been fully apparent, causing misinterpretation of subsequent psychiatric disorders. Education completed abroad may not be comprehensively covered in the registers studied. However, Statistics Finland actively supplements data on education, for example through information exchange with other countries, and on the other hand, there is no reason to assume that former patients would have more commonly completed education abroad than the same-aged general population.

A second limitation is that register-based data only enable the observation of rough trends in educational attainment. A more detailed analysis of the impact of psychiatric symptoms or neurocognitive factors on school performance would entail examining individual patient records. In addition, the study subjects' parents' educational status was unfortunately not known in the present study. In some studies, parental socioeconomic status has been thought to have a greater impact than psychiatric disorders on offspring's attained education [16, 57], while in some studies, the impact has not been so clear [20, 23, 58]. However, as the social reasons diagnosis group (Z-code) contains diagnoses of socioeconomic factors influencing health, and in this study, those with social reasons diagnoses (Z-code) as primary diagnoses at index admission were at higher risk for no further education than those with mood disorder

diagnoses, it is possible that socioeconomic factors also affect other diagnostic groups.

It should moreover be noted that psychiatric disorders warranting inpatient care likely represent the most severe end of the continuum of psychiatric morbidity. Conditions only requiring care in the community may have less impact on educational attainment.

Conclusion

Adolescents with psychiatric disorders requiring inpatient care are at considerable risk for not continuing their education beyond compulsory comprehensive school or of attaining lower educational levels than their age-peers in general population. This has not changed over time despite improvements in adolescent psychiatric care, school welfare services and pedagogical support. The risk for low educational attainment among former adolescent psychiatric inpatients is particularly pronounced among males. Greater effort in psychiatric treatment, school welfare and pedagogical effort are needed to tackle this severe inequality. Psychiatric symptoms, cognition, social integration and stigma all need to be considered.

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Availability of data and materials Availability of the datasets used and/or analyzed in this study is subject to data permits from the appropriate Finnish register authorities. More information from the corresponding author upon request.

Declarations

Conflict of interest The author declares that they have no conflict of interest.

Ethics approval The study was duly approved by the ethics committee of Tampere University Hospital. Appropriate permissions were obtained from the Finnish Institute for Health and Welfare and Statistics Finland.

Informed consent Not applicable.

Consent to publication Not applicable.

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PUBLICATION IV

Schizophrenia among young people first admitted to psychiatric inpatient care during early and middle adolescence

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Submitted manuscript