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Longitudinal Outcomes in Young Violent Offenders

Criminal Behaviour, Morbidity, and Mortality

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Longitudinal Outcomes in Young Violent Offenders

Longitudinal Outcomes in Young Violent Offenders

Criminal Behaviour, Morbidity, and Mortality

André Tärnhäll

LUND UNIVERSITY

DOCTORAL DISSERTATION

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Title and subtitle: Longitudinal Outcomes in Young Violent Offenders: Criminal Behaviour, Morbidity, and Mortality

Abstract: Violent offenders constitute a minor segment of the general population but have significant societal impact. Research indicates that these individuals represent a marginalized and vulnerable group, and often have a history of early-life risk factors, such as childhood adversity and early-onset psychiatric conditions, predisposing them to adverse outcomes. This dissertation explores the longitudinal outcomes of young adult male violent offenders in terms of criminal behaviour, morbidity, and mortality.

Using data from the Development of Aggressive Antisocial Behaviour Study (DAABS), a Swedish representative closed-cohort study of 266 offenders sentenced for violent and/or sex crimes when aged 18–25, assessed comprehensively during an ongoing prison sentence 2010–2012. In addition, ambidirectional register-based data was sourced from national registers throughout 2017 for the cohort and a matched general population comparison group (*n* = 10,000).

Findings reveal that by age 28, the DAABS cohort, representing less than 1% of their matched peers, committed an average of 33 crimes, 22% of which were violent and 1% sexual. A majority of the cohort, distinguished by elevated levels of early-life risk factors, persisted in criminal behaviour throughout their 20s. The DAABS cohort faced high levels of prospective psychiatric morbidity. However, their healthcare utilization patterns were atypical, characterized by low rates of specialized outpatient care but high rates of inpatient care. Persistent offending, among other risk factors, was associated with increased incidence of healthcare utilization. Notably, 25% of the cohort had experienced serious mental illness up until young adulthood (SMIy). Its development was associated with several modifiable early-life risk factors. The SMIy group exhibited higher rates of prospective adverse outcomes. The mortality rate was 7% in the DAABS cohort versus 0.5% in the comparison group.

Improved health in offenders is a public health priority with potential to reduce criminal recidivism. This will require new preventive interventions and treatments in collaboration between service providers, for example, in prison–community transitions. Prison serves as a juncture to access necessary healthcare. Barriers, including reluctance, to the use of healthcare resources may worsen this group's longitudinal course. Those imprisoned with SMIy represent a particular vulnerable group.

Key words: prisoners, antisocial behaviour, trajectory, risk factors, conduct disorder, severe mental illness, neurodevelopmental disorder, healthcare utilization, prescription drugs, medical care continuity

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To Noa and Viggo

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Abstract

Violent offenders constitute a minor segment of the general population but have significant societal impact. Research indicates that these individuals represent a marginalized and vulnerable group, and often have a history of early-life risk factors, such as childhood adversity and early-onset psychiatric conditions, predisposing them to adverse outcomes. This dissertation explores the longitudinal outcomes of young adult male violent offenders in terms of criminal behaviour, morbidity, and mortality.

Using data from the Development of Aggressive Antisocial Behaviour Study (DAABS), a Swedish representative closed-cohort study of 266 offenders sentenced for violent and/or sex crimes when aged 18–25, assessed comprehensively during an ongoing prison sentence 2010–2012. In addition, ambidirectional register-based data was sourced from national registers throughout 2017 for the cohort and a matched general population comparison group (n = 10,000).

Findings reveal that by age 28, the DAABS cohort, representing less than 1% of their matched peers, committed an average of 33 crimes, 22% of which were violent and 1% sexual. A majority of the cohort, distinguished by elevated levels of early-life risk factors, persisted in criminal behaviour throughout their 20s. The DAABS cohort faced high levels of prospective psychiatric morbidity. However, their healthcare utilization patterns were atypical, characterized by low rates of specialized outpatient care but high rates of inpatient care. Persistent offending, among other risk factors, was associated with increased incidence of healthcare utilization. Notably, 25% of the cohort had experienced serious mental illness up until young adulthood (SMIy). Its development was associated with several modifiable early-life risk factors. The SMIy group exhibited higher rates of prospective adverse outcomes. The mortality rate was 7% in the DAABS cohort versus 0.5% in the comparison group.

Improved health in offenders is a public health priority with potential to reduce criminal recidivism. This will require new preventive interventions and treatments in collaboration between service providers, for example, in prison–community transitions. Prison serves as a juncture to access necessary healthcare. Barriers, including reluctance, to the use of healthcare resources may worsen this group's longitudinal course. Those imprisoned with SMIy represent a particular vulnerable group.

Populärvetenskaplig sammanfattning

Antisocialt beteende är vanligt. Tidigare forskning har visat att det är så pass vanligt att det kan anses normativt i tonåren att uppvisa normbrytande beteenden. Även våldsamt beteende är vanligt. Många småbarn agerar ut fysiskt men detta beteende avtar hos de flesta under de tidiga skolåren. Att bli dömd för brott är också vanligt. Till exempel döms varannan man för ett brott under sitt liv. Trots detta är det en liten grupp som står för majoriteten av allt brottsligt beteende. Mindre än 5% av befolkningen står för majoriteten av all kriminalitet, medan så lite som 1% av befolkningen bestående av återfallsförbrytare har visat sig stå för nästa två tredjedelar av alla våldsbrott. Denna förhållandevis lilla grupp består ofta av män med tidig debut i våldsbrott kombinerat med annan brottslighet och karakteriseras ofta av psykiatriska problem, särskilt missbruk och personlighetssyndrom. En förbättrad förståelse av brottsliga banor hos unga vuxna män dömda för våldsbrott är väsentlig för ett effektivt brottsförebyggande arbete och användning av samhällets resurser.

Etablerade förklaringsmodeller av utvecklingen av aggressivt och antisocial beteende pekar på att personer som redan i barndomen uppvisar höga nivåer av dessa beteenden, och som fortsätter med detta in i tonåren och vuxenlivet, skiljer sig från de som börjar uppvisa sådana beteenden i tonåren. Det som främst skiljer ut grupperna från varandra har föreslagits vara olika biopsykosociala faktorer som påverkar både den tidiga utvecklingen såväl som senare utfall i vuxenlivet. Till exempel kan faktorer som temperament och neurokognitiva förutsättningar påverka förmågan att kontrollera bland annat sitt beteende och därmed även sådant som studier, arbete och relationer. Trauma, dåliga sociala förhållanden, skolproblem och missbruk, är exempel på vanligt förekommande tidiga riskfaktorer bland våldsbrottsdömda. En återblick i livet hos våldsbrottsdömda visar alltså ofta på en problemfylld utveckling men däremot är det svårare att förutsäga framtidsutsikter för de barn och unga som är knutna till sådana tidiga riskfaktorer. För att effektivt identifiera de som mest behöver stöd för att tidigt motverka för utvecklingen av ett ihållande brottsligt beteende krävs djupgående kunskap om deras bakgrund.

Tidigare forskning har visat att fängelsedömda ofta drabbas av psykisk ohälsa tidigare i livet och dessutom i högre grad av allvarliga psykiatriska tillstånd än andra. För de som dömts till fängelse är livet efter avtjänat straff också ofta präglat av psykiatriska besvär men också somatiska sjukdomstillstånd och skador. Studier har pekat på att de som uppvisar ett ihållande kriminellt beteende är särskilt drabbade och till och med åldras snabbare än andra. Vidare har tiden efter fängelse funnits innebära en mycket hög risk för död, där vanliga dödsorsaker inkluderar yttre faktorer såsom överdos, suicid och våldsutsatthet. Däremot vet vi mindre om hur sjukligheten och överdödligheten ser ut bland just unga våldsbrottsdömda.

Trots denna höga sjukdomsbelastning och överdödlighet vet vi ganska lite om hur fängelsedömda interagerar med sjukvården. Baserat på tidigare forskning verkar det som att denna grupp använder sig av mer sjukvård än andra, men sjukvårdssökandet motsvarar inte deras indikerade sjukvårdsbehov. Dessutom har studier visat att olika psykiatriska behandlingar kan ha god effekt på att förbättra framtidsutsikter och minska risken för återfall i brottslighet, men hur dessa behandlingar används inom gruppen är mer oklart.

Uppföljningsstudier: the Development of Aggressive Behaviour Study

Denna avhandling fokuserar på män dömda för våldsbrott. Syftet med avhandlingen var att djupgående undersöka kriminellt beteende, psykiatrisk och somatisk sjuklighet samt dödlighet bland män som dömts till och avtjänade fängelsestraff för våldsbrott under ung vuxen ålder. Målsättningen var också att identifiera faktorer relaterade till ihållande kriminellt beteende, allvarlig psykisk sjukdom samt psykiatriskt och somatiskt vårdsökande.

Avhandlingen baserades på the Development of Aggressive Antisocial Behaviour Study (DAABS), en svensk kohortstudie av 266 män som mellan 2010 och 2012 satt i fängelse för vålds- och/eller sexbrott med fysisk kontakt i åldrarna 18 till 25 år. Dessa män genomgick en omfattande semistrukturerad undersökning, ledd av legitimerade psykologer, som inkluderade både fullständig psykiatrisk diagnostik och neuropsykologisk bedömning. Denna datainsamling har redan resulterat i flera vetenskapliga publikationer som belyst den höga förekomsten av såväl social marginalisering, som belastande och traumatiska upplevelser under uppväxten, utvecklingsrelaterade funktionsnedsättningar samt psykiatrisk sjuklighet inom gruppen.

Drygt fem år efter den initiala datainsamlingen följdes DAABS kohorten upp genom svenska register som berör lagföringar, sjukvårdskontakter, läkemedelsuttag och dödsfall fram till och med 2017. Uppföljningen inkluderade även en registerbaserad jämförelsegrupp på 10 000 unga vuxna män ur normalbefolkningen. Denna avhandling kombinerar den ursprungliga kliniska informationen med longitudinella uppföljningsdata för både DAABS-gruppen och jämförelsegruppen.

Avhandlingens resultat i korthet

I *Artikel I* framkom att deltagarna i DAABS, från det att de blev straffmyndiga till att de i snitt var 28 år gamla, hade dömts för i genomsnitt 33 brott var. Av dessa brott utgjorde mer än var femte ett våldsbrott, vilket stod i skarp konstrast till jämförelsegruppen där deltagarna i genomsnitt hade begått ett brott var, med ännu färre våldsbrott under motsvarande period. Endast 77 av de 10 000 personerna i jämförelsegruppen uppfyllde inklusionskriterierna för DAABS, dvs. att ha dömts

till fängelse för vålds- och/eller sexbrott i ung vuxen ålder. Således bedömdes DAABS-gruppen representera mindre än 1% av unga vuxna män när studien startade.

Analysen fortsatte med att utforska utvecklingsvägar av kriminellt beteende inom DAABS-gruppen, genom att undersöka antalet domar per år. Resultaten indikerade att två tredjedelar av DAABS-gruppen uppvisade ett ihållande kriminellt beteende under uppföljningsperioden. De med ett ihållande kriminellt beteende skiljde sig från de vars kriminella beteende avtog, bland annat hade färre klarat av skolan, fler hade blivit placerade i familjehem och institution, uppvisade tidigare debut i missbruk och fler symtom på uppförandestörning före 15 års ålder. Däremot noterades ingen skillnad i förekomsten av neuropsykiatriska funktionsnedsättningar eller kognitiv förmåga mellan grupperna.

Avhandlingens delstudier riktade ett särskilt fokus mot den vård, psykiatrisk och somatisk, som deltagarna fått under uppföljningstiden (*Artikel II, III & IV*). Trots tidigare forskning som belyst en hög förekomst av psykiatrisk sjuklighet bland DAABS-deltagarna, visade resultaten i *Artikel II* att det var det ovanligt med psykiatrisk öppenvård i DAABS-gruppen från den initiala datainsamlingen 2010–2012 till slutet av 2017. Däremot noterades att 36% av DAABS-deltagarna hade vårdats inom psykiatrisk heldygnsvård, att jämföra med endast 4% inom jämförelsegruppen. Normalt sett skulle en slutenvårdsinläggning inom psykiatrin följas upp av öppenvård, men för DAABS-gruppen var sådan eftervård mycket sällsynt. I samband med de psykiatriska vårdkontakterna, inom både öppen- och slutenvård, hade DAABS-deltagarna ofta fått diagnoser såsom substansbrukssyndrom, ADHD, ångestsyndrom och psykostillstånd (*Artikel II*). När det gäller somatisk vård visade sig diagnoserna inte skilja sig nämnvärt mellan DAABS-gruppen och jämförelsegruppen. Dock noterades att en mindre andel av DAABS-deltagarna behandlades för skador relaterade till olyckor, medan en större andel mottog vård för konsekvenser av våldsutsatthet och självskadande beteende (*Artikel IV*). Ett ihållande kriminellt beteende var kopplat till ökad förekomst av såväl psykiatrisk som somatisk vård (*Artikel II & IV*). Vidare var placering i familjehem under uppväxten, tidigare psykiatrisk vårdkontakt, låg kognitiv förmåga, ångestdiagnos vid undersökningstillfället, och en hög grad av psykopatiska drag associerade med högre antal psykiatriska vårdtillfällen (*Artikel II*), medan låg utbildningsnivå och familjehemsplacering var kopplade till högre antal somatiska sjukhusvårdstillfällen (*Artikel IV*).

Under uppföljningstiden hade mer än två tredjedelar av DAABS-gruppen förskrivits läkemedel riktade mot nervsystemet, i jämförelse med strax över 40% inom jämförelsegruppen. De största skillnaderna mellan DAABS- och jämförelsegruppen återfanns i förskrivningen av läkemedel avsedda för behandling av beroende, epilepsi, psykossjukdom samt centralstimulerande medel (*Artikel II*). Inga andra läkemedelskategorier visade på ökad förskrivning. Däremot noterades en lägre

förekomst av förskrivningar av läkemedel för matsmältningsorgan och ämnesomsättning samt blod och blodbildande organ i DAABS-gruppen (*Artikel IV*).

Fram till och med datainsamlingsperioden 2010–2012 uppfyllde 25% av deltagarna i DAABS-gruppen kriterierna för allvarlig psykisk sjukdom enligt studiens definition, vilket inkluderar en historik av psykossjukdom, bipolär sjukdom typ I, upprepade och allvarliga suicidförsök eller psykiatrisk tvångsvård. En lång rad av faktorer som kunde misstänkas bidra till utvecklingen av allvarlig psykisk sjukdom undersöktes. Resultaten visade att erfarenhet av att ha blivit mobbad, erhållit stödinsatser i skolan, samt en tidig debut av uppförandestörning var associerat med en ökad risk för senare utveckling av allvarlig psykisk sjukdom fram till och med ung vuxen ålder. Vidare utforskades olika utfall efter datainsamlingsperioden. Det framkom att de individer inom DAABS-gruppen som hade en historik av allvarlig psykisk sjukdom i högre utsträckning återföll i våldsbrott jämfört med övriga deltagare. Dessa individer hade däremot inte i större utsträckning sökt vård vid specialistmottagningar, men de hade getts mer inneliggande vård. Överraskande var dock att denna vård inte främst var psykiatrisk utan snarare somatisk (*Artikel III*).

Studien avslutades med en särskilt alarmerande observation: 7% av deltagarna i DAABS-gruppen dog fram till och med 2017, jämfört med endast 0,5% i jämförelsegruppen. Detta innebar en sexton gånger ökad risk för död under uppföljningsperioden (*Artikel IV*).

Resultatens innebörd och avhandlingens slutsatser

Resultaten uppmärksammar att män som i ung vuxen ålder döms till fängelse för våldsbrott utgör en mycket liten, men komplex och kostsam, del av befolkningen, representerade av mindre än 1%. Inom denna grupp hade en stor majoritet inlett en brottslig bana tidigt i livet, en bana de oftast fortsatte även efter det att de avtjänat straff för brott som ledde till inklusion i DAABS. Ett folkhälsoperspektiv på våld och kriminalitet understryker att mycket kan förebyggas genom strategiskt arbete. För att bryta utvecklingen behövs tidiga insatser. Det är väl känt att högriskgrupper för utveckling av ihållande aggressivt och antisocial beteende oftare än andra kommer från social marginaliserade familjer med begränsade resurser. Därför blir de samhällskontakter som dessa personer möter under sin tidiga utveckling särskilt viktiga: interaktioner med sjukvården eller barnavårdscentraler, stödinsatser i skolan, kontakter med barn- och ungdomspsykiatrin och socialtjänsten. Dessa kontakter kan bli särskilt viktiga hållplatser för att arbeta såväl förebyggande som att tidigt sätta in behandlande insatser på olika nivåer och i samverkan mellan involverade parter. Uppförandestörning med tidig debut eller med många symtom tycks vara en särskilt viktig markör för behov av sådana insatser, inklusive självrapporterad tidig debut av kriminellt beteende samt alkohol- och droganvändning. DAABS belyser också att det är förhållandevis vanligt att de som senare döms för våldsbrott som barn och unga tagits ur sitt sammanhang och i

perioder getts insatser såsom placeringar utanför hemmet samt att sådana erfarenheter på olika vis är associerade med kriminellt beteende och sjukvård. Dessa intensiva insatser utanför hemmet bör fyllas med evidensbaserade behandlingsinterventioner, bland annat riktade mot just uppförandeproblem. Då många med antisociala problem inte kommer till sjukvården som förväntat i vuxenlivet ges unika möjligheter att bedöma och behandla psykiatriska och somatiska tillstånd i fängelse.

Resultaten understryker även att individer som dömts till fängelse ofta lider av en komplex psykiatrisk problematik, ett mönster som här blev ännu tydligare bland de som döms för vålds- och/eller sexbrott i ung vuxen ålder. Trots den uppenbara psykiatriska belastningen tenderade denna grupp inte att söka psykiatrisk vård på det sätt man skulle kunna förvänta sig. Vårdkontakterna var i huvudsak begränsade till de mest akuta sjukdomsfaserna, vilket noterades genom en förhöjd grad av inläggningar inom psykiatrisk heldygnsvård. Detta mönster av vårdanvändning lyfter fram möjligheten att vårdsystemet idag brister i att möta dessa individers behov. Det påvisar ett angeläget behov av förbättringar som inte bara handlar om att erbjuda effektiva och anpassade vårdinsatser för denna grupp, utan också skapa ett system där gruppen kan motiveras till att etablera och upprätthålla kontinuerliga vårdkontakter. En god vård av psykiatriska tillstånd kan minska risken för återfall i brottslighet. Vidare pekar avhandlingens resultat också ut en tidig debut av uppförandestörning och mobbing som riskfaktorer för allvarliga psykiska tillstånd, något som i sin tur sågs leda till ytterligare försämrade framtidsutsikter. Detta understryker vikten av att ett effektivt arbete för de med tidigt debuterande uppförandestörning och mot mobbing bedrivs. Resultaten indikerar också på att unga personer som begått vålds- och/eller sexbrott även söker primärvård för psykiatriska tillstånd i vuxenlivet, åtminstone för förskrivning av läkemedel. Kompetens att möta gruppens behov såväl som frågor berörande kriminalitet och våldsproblem bör integreras både i psykiatrisk bedömningsverksamhet och i primärvård. När det gäller personer med allvarlig psykiatrisk problematik på anstalter, vilka ökar i antal, står det klart att de står inför sämre framtidsutsikter och ett större personligt lidande än andra fängelsedömda. Resultaten antyder att detta inte bara är en risk för de berörda individerna utan även för samhället i stort. När möjligheterna till rehabilitering och tillgången till behandlingsprogram riskerar att försämras – i takt med den i Sverige snabbt växande fängelsepopulationen – är det viktigt att värna om adekvata insatser till just denna grupp.

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André Tärnhäll

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List of Papers

Paper I

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Paper II

Tärnhäll, A., Björk, J., Wallinius, M., Gustafsson, P., Billstedt, E., & Hofvander, B. (2023). Healthcare utilization and psychiatric morbidity in violent offenders: Findings from a prospective cohort study. *Social Psychiatry and Psychiatric Epidemiology, 58*, 617-628. https://doi.org/10.1007/s00127-022-02408-6

Paper III

Tärnhäll, A., Björk, J., Wallinius, M., Billstedt, E., & Hofvander, B. Development of serious mental illness in young adult violent offenders: Risk factors and long-term adverse outcomes [Manuscript under review in Psychiatry Research].

Paper IV

Jakobsson, J., Tärnhäll, A., Billstedt, E., Wallinius, W., Hofvander, B. Adverse health outcomes in violent offenders: Risk factors for somatic inpatient health care utilization [Manuscript submitted for publication in BMC Public Health].

Author's contribution to the papers[1]

Paper I

Conceptualization, Methodology, Software, Validation, Formal analysis, Data collection, Data curation, Submission & journal correspondence, Writing – original draft, Writing – review & editing, Visualization, Funding acquisition

Paper II

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Paper III

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Paper IV

Conceptualization, Methodology, Software, Validation, Formal analysis, Data collection, Data curation, Writing – review & editing, Visualization, Funding acquisition

[1] In accordance with the Contributor Roles Taxonomy (CRediT) (Brand et al., 2015) author statement.

Abbreviations

ACSCs	Ambulatory care sensitive conditions
ADHD	Attention-deficit/hyperactivity disorder
CDR	Cause of Death Register
CI	Confidence interval
DAABS	Development of Aggressive Antisocial Behaviour Study
DSM	Diagnostic and Statistical Manual of Mental Disorders
GAI	General Ability Index
GBTM	Group-based trajectory modelling
HCU	Healthcare utilization
HR	Hazard ratio
ICD	International Classification of Diseases
IRR	Incidence rate ratio
NCR	National Crime Register
NDD	Neurodevelopmental disorder
NPR	National Patient Register
OR	Odds ratio
PDR	Prescription Drug Register
SCID	Structured Clinical Interview for DSM-IV
SMI	Serious mental illness
SMIy	Serious mental illness up until young adulthood
SPPS	Swedish Prison and Probation Service
SUD	Substance use disorder
TPR	Total Population Register
WHO	World Health Organization

Introduction

> *Since the crimes which are annually committed seem to be a necessary result of our social organization, and since the number cannot diminish without the causes which induce them undergoing previous modification, it is the province of the legislator to ascertain these causes, and to remove them as far as possible. (Quetelet, 1842, as cited in von Hofer, 2011, p. 223)*

Five key findings of previous research inform this dissertation on antisocial behaviours, crime, and violence. First, aggressive and antisocial behaviours are common (Moffitt, 1993; Tremblay, 2015). Second, almost all antisocial behaviour in adulthood can be linked to antisocial behaviour in childhood, although, most children who exhibit antisocial behaviours do not do so in adulthood (De Brito et al., 2021; Moffitt, 2018; Robins, 1978). Third, while childhood maltreatment elevates the risk of adult criminal behaviour and can contribute to a 'cycle of violence', most individuals maltreated in childhood does not commit violent crimes, nor have all violent offenders experienced maltreatment in childhood (Braga et al., 2018; Frisell et al., 2011; Widom, 1989; Fitton et al., 2020). Fourth, violent crimes are rarer than nonviolent crimes, even in violent offenders (Loeber et al., 1993; Piquero, Carriaga et al., 2012; Piquero, Jennings & Barnes, 2012). Fifth, a small group of individuals is responsible for a disproportionately large burden of total crime (Beaver, 2013; Martinez et al., 2017; Vaughn et al., 2011), and an even smaller group for the majority of violent crime (Falk et al., 2014).

Background and context of this dissertation

Imprisoned at a young age, marked by the consequences of antisocial behaviours and a background characterized by adversity, personal turmoil, or a childhood spent in the margins of society; the studied young offenders are a reminder of the interplay between individual actions and systemic failures with pervasive influence on the developmental course into adulthood (Billstedt et al., 2017; Hofvander et al., 2017; Wallinius et al., 2016). This dissertation aims to investigate the long-term development of offenders imprisoned during young adulthood due to violent and/or 'hands-on' sexual offences, focusing on criminal behaviour and psychiatric morbidity as well as factors linked to their development. Here, forensic psychiatry

is defined as psychiatry addressing individuals involved in the criminal justice system. This focus area encompasses the study of developmental trajectories, prevention, and psychiatric interventions in those within the criminal justice context and adopts an epidemiological approach to forensic psychiatry (Fazel et al., 2009), analysing the prevalence of criminal behaviour, morbidity, healthcare interactions, and mortality among violent offenders. It explores risk factors linked with adverse outcomes, aiming to inform prevention strategies and perhaps offer a piece of the explanatory puzzle, to support policy-making in addressing criminal behaviour. This dissertation centre on one cohort of violent offenders, imprisoned in young adulthood, and is designed to capture a population at a high risk of persistent criminal behaviour and of a wide range of other adverse outcomes, including specialized psychiatric care. The ambition of this dissertation is to describe and explore this cohort comprehensively and to derive, for the field, clinically relevant implications.

Antisocial behaviours are behaviours that violate norms (interpersonal, social, or cultural) of what is generally considered adequate behaviour (DeWall & Anderson, 2011), for example, by violating the basic right of others (Calkins & Keane, 2009). As such, antisocial behaviours include criminal behaviour, i.e. law-breaking behaviour punishable upon conviction (Morizot & Kazemian, 2015), as well as behavioural symptoms included in several clinical diagnoses (van Goozen et al., 2022). Thus, the study of the development of antisocial behaviours is multifaceted, concerning the full life course of a highly heterogeneous group (Piquero, 2023; van Goozen et al., 2022) from early development (Tremblay et al., 2018) through maturity (Arnett, 2000; Beauchaine & McNulty, 2013), to the end of a life (Laub & Sampson, 2003). It even extends across generations, involving both ancestral and future lines (Besemer et al., 2017; Wilderman & Sampson, 2024), as it unfolds in changing historical and social contexts (Neil & Sampson, 2021, von Hofer, 2011). Of note, violent offending seldom emerges without preceding signs during the developmental phase (Fairchild et al., 2019; Loeber et al., 1993; Moffitt, 2018; Piquero, Carriaga et al., 2012; Piquero, Jennings & Barnes, 2012).

This dissertation studies violent offenders with varying degrees of vulnerability: individuals who have often continuously faced societal scrutiny, stigma, and judgment. Leading marginalized lives, sometimes overlooked by society, with limited opportunities for rehabilitation and little voice to advocate for their well-being (De Brito et al., 2021); they lead lives further complicated by the moral implications of their criminal acts. The ethical rational this dissertation stands on is the need to understand and address the complex challenges faced by this generally vulnerable and marginalized group, while also focusing on public health and safety and on reducing the societal costs imposed by this group (Kinner & Wang, 2014; Krug et al., 2002; The Lancet, 2009; Waters et al., 2005).

I hope that the following introduction will offer a nuanced picture of the study population, describing the life course development, with its twists and turns, of

individuals exhibiting aggressive and antisocial behaviours leading to incarcerations before 25 years of age. The introduction will start by presenting a concise overview of the development of antisocial and criminal behaviours and related psychiatric disorders, concentrating on disruptive behaviour disorders. Then, it will summarize the relevant research on psychiatric and somatic morbidity as well as services interactions, including the link between persistent antisocial behaviour and premature death, with a focus on the Swedish national context.

Development of antisocial behaviours

> *...I should like to come back to the question of whether antipersonality* is *a psychiatric disorder. I am not sure I know exactly what kinds of disconfirmatory evidence one could amass to show that it is not. (Robins, 1978, p. 621)*

Epidemiology and concentration of crime

Studies in the Nordic context have suggested that roughly every other male is registered for a crime, i.e., a felony or misdemeanour, during his life-course (Carlsson & Sivertsson, 2021; Elonheimo et al., 2014). Historically, 85-95% of convictions have resulted in fines (von Hofer, 2011). Recently, Skardhamar (2014) found that over 15% of Norwegian males were convicted of a felony (excluding misdemeanours) during their life course. Although criminal behaviour in the general population is rather common, substantial evidence indicates that a small proportion of the general population contributes to the majority of the overall crime burden (e.g., Martinez et al., 2017). Studies consistently show that the group engaging in serious or persistent antisocial activities makes up about 5% or less of the overall population and is responsible for a considerable portion of the total crime burden (Dalteg & Levander, 1998; Elonheimo et al., 2014; Falk et al., 2014; Jolliffe et al., 2017a; Vaughn et al., 2011; 2014). Similarly, crime has been found to concentrate in families (Beaver, 2013) with substantial transmission between generations (Besemer et al., 2017; Wildeman & Sampson, 2024). This familial concentration has been suggested to be partly heritable (Beaver, 2013; Frisell et al., 2011; Långström et al., 2015), akin to the disruptive behaviour and antisocial disorders (Fairchild et al., 2019; Faranoe et al., 2024; Hawes et al., 2023; Krueger et al., 2021; Rosenström et al., 2017; Tuvblad et al., 2016).

Most of those with a registered onset of criminal behaviour will have criminal careers under a decade from the first to last offence (Blumstein & Cohen, 1987; Whitten et al., 2017). However, an early onset of criminal behaviour has consistently been associated with longer criminal careers and with a greater frequency, seriousness, and variety of criminal behaviour, and a life complicated by health problems (Moffitt, 2018; Sourander et al., 2007; Piquero, Carriaga et al., 2012).

Central theories and concepts

Age is associated with crime (Farrington, 1986; Sweeten et al., 2013). This established association is often depicted through the aggregated 'age–crime curve', i.e., criminal behaviour tends to have an onset in late childhood or early adolescence, peak in late adolescence, rapidly decrease in young adulthood, and dwindle in mid-adulthood. However, the age-crime curve masks the existence of multiple offending trajectories, each influenced by a mixture of risk factors and temporal within-person change (Farrington, 2005; Jennings & Reingle, 2012; Jolliffe et al., 2017a; Moffitt, 1993; 2018; Nagin, 2005; Piquero, 2008).

The developmental taxonomy

Perhaps the most widely acknowledged theory regarding the development of antisocial behaviour is Moffitt's (1993, 2018) developmental taxonomy. Moffitt (1993) proposed two developmental trajectories of antisocial behaviours, i.e., one labelled the life-course persistent (LCP) and the other the adolescence-limited (AL) trajectory, thus explaining meaningful heterogeneity within the aggregated age–crime curve. She suggested that the LCP trajectory is characterized by an early-onset of antisocial behaviours and a relatively consistent level of antisocial behaviours through childhood and adolescence on into adulthood. The AL trajectory, on the other hand, was suggested to follow the aggregated age–crime relationship rather closely, characterized by an onset of antisocial behaviours in early adolescence and desistance from such behaviours before or during the early 20s.

Central to Moffitt's (1993) proposal were the aetiological differences between the LCP and AL developmental trajectories. While the criminally active AL group is a fairly normative group that only trivially differs from those who abstain from antisocial behaviours in terms of early-life risk factors, the LCP group's chronic course was proposed to be marked by early-life neuropsychological deficits. These deficits, in turn, were associated with a myriad of risk factors unfolding in childhood, adolescence, and later, for example, difficult parent–child interaction that may worsen already present behavioural and temperamental issues. These risks, in turn, increase the possibility of later adverse outcomes, such as, educational failure and unemployment.

Moffitt (1993) suggested that the 'maturity gap', a nearly universal experience during adolescence in which individuals feel a disconnect between their biological maturity and societal roles, is a key factor driving norm-breaking or criminal behaviour in adolescence. This maturity gap is identified as the primary risk factor for antisocial behaviours in the AL group, in contrast to the LCP group, in which antisocial behaviours are primarily attributed to neuropsychological deficits. Further

incarceration, drug abuse, and parenthood in adolescences can have ensnaring effects, binding the person to the embarked-on antisocial course into adulthood with diminishing chances to change the lifestyle. These developmental 'snares' influence and maintain the cycle of the LCP path. Such snares also have an incremental and prolonging effect on desistance in individuals following the AL path, in making it more difficult to escape an antisocial way of life.

Despite probably being the leading theory in understanding the development of antisocial behaviours, and by extension criminal behaviours, the developmental taxonomy has endured much criticism. It has been called for a revision of the taxonomy due to that the difference between the AL and LCP groups seem to be quantitative, not qualitative, i.e., that the groups are not differentiated by specific risk factors, but rather by the magnitude of early-life risks (Fairchild et al., 2013).

Furthermore, evidence of an adult-onset offending trajectory has been presented together with suggestions for expanding the taxonomy (e.g., Eggleston & Laub, 2002; Sivertsson et al., 2024; Whitten et al., 2017). However, these suggestions have largely been disregarded, and Moffit (2018) and colleagues (Beckley et al., 2016) have argued that such expansion is redundant since actual criminal behaviours are often not captured by the juridical system and that the proposed adult-onset group had previously gone undetected.

Age-graded theory of informal control on criminal behaviour

Separate from Moffitt's (1993) developmental taxonomy, Sampson and Laub (1993) introduced a broad theory of life-course offending with less emphasis on distinct offender categories and the proposed associations with specific early-life risk factors. They posited that criminal behaviour is influenced by consistent individual traits along with significant life milestones or 'turning-points', such as marriage and employment, which have the power to alter one's life (Elder, 1998). Sampson and Laub's (1993) age-graded theory suggests that informal social controls, such as relationships with family, work, and community, play a crucial role in criminal behaviour across the individual's lifespan. These informal social controls, the importance of which vary at different life stages, can either constrain or fail to prevent criminal behaviour. Ten years later, Laub and Sampson (2003) published the most extensive longitudinal study of offending at the time, tracking a group of males until they were 70 years old. They found predicting life-course-persistent offending based on specific early-life risk factors to be challenging. In their research and theory, Laub and Sampson (2003) employed life-course theory, highlighting the importance of considering the entire lifespan across diverging times and contexts, including the timing of life events and individual agency. Furthermore, they acknowledged cumulative disadvantages and their potential importance on ongoing adversities (Sampson & Laub, 1997; Elder, 1998).

Desistance from and persistence in criminal behaviour

Desistance is often understood as a process, transforming an offender into a non-offender (Kazemian, 2007), as distinguished from an 'event', i.e., the termination of criminal behaviour. Desisters are individuals with substantial crime-free periods, who work at maintaining this cessation – temporary or lasting – of criminal behaviour. Notably, Sampson and Laub (2003) suggested that the general trend in almost all offenders is to move towards desistance, however, challenged by empirical findings of small groups that continue offending throughout the life course (Blokland et al., 2005; Farrington, 2019a). The noteworthy but relatively small group that does not desist from criminal behaviours (Falk et al., 2014; Moffitt, 2018; Vaughn et al., 2011) persist in crime.

Definitions of persistence vary considerably in the literature and the terms 'antisocial behaviour' and 'criminal behaviours' are often used interchangeably (Jolliffe et al., 2017a). Persistence in criminal behaviour is typically defined by the length, duration, onset, and frequency of criminal behaviour during a criminal career (Whitten et al., 2017), and is here considered a concept related to duration (McGee et al., 2021), representing a criminal career markedly protracted compared to the average length.

Emerging adulthood and offending

Nearly 25 years ago, Arnett (2000, 2015) denoted the developmental phase connecting late adolescence and adulthood as *emerging adulthood*, frequently operationalized as the period between 18 and 25 years of age. Arnett (2000, 2015) depicted emerging adulthood as a distinct and intensely transformative developmental phase, characterized by the exploration of identity, self-focus, instability, and an optimistic outlook, but also by a sense of being in-between life phases. As emerging adults might engage in intensive self-exploration, shaping their subsequent identity, they also make related choices that can alter their life course, such as decisions related to education, careers, relationships, and personal values. In this phase, persons tend, more often than in later life phases, to prioritize personal growth and defer certain adult responsibilities, which can have long-lasting consequences for the course of life (Nelson, 2021; Sampson & Laub, 1993). Emerging adulthood is a developmental phase with high levels of criminal activity on the aggregated level (Farrington, 1986; Kessler, 2020; Nelson, 2021; Piquero, 2023) and a period that separates desisters from persisters (Moffitt, 1993). Those who persist in crime past emerging adulthood are more likely to also continue their criminal career into later adulthood (Arnett, 2000; Moffitt, 2018; Piquero et al., 2007; Sampson & Laub, 2003; Sweeten, et al., 2013). Due to social change, most reach the milestones linked to adulthood later in life today than 30 years ago. Furthermore, new knowledge regarding this phase's importance for

neurodevelopment has emerged (Arnett, 2015; Nelson, 2021). In this light, Moffitt (2018) has acknowledged emerging adulthood as an protracted adolescence, and projected enduring antisocial paths for individuals following the AL trajectory into emerging adulthood (Arnett, 2000).

Trajectories of antisocial behaviours and risk factors

To study the developmental taxonomy (Moffitt, 1993) and the occurrence of meaningful heterogeneity within the aggregated age–crime curve, researchers have adopted group-based modelling approaches (Nagin & Land, 1993; Piquero, 2008). These approaches capture the timing, degree, and nature of the longitudinal development of criminal behaviour at the within-person level (Nagin, 2005). Empirical studies of offending trajectories have meaningfully described heterogeneity within the aggregated age–crime curve and identified varying numbers of trajectories, generally ranging from two to seven trajectory groups, mostly, including trajectories reflecting the two paths proposed by Moffitt (1993; Jennings & Reingle, 2012). These trajectory findings have been replicated in general population, high-risk, and prison samples (Jennings & Reingle, 2012; Piquero, 2008). However, the described prevalence of the LCP versus AL trajectory groups in the general population varies considerably in the literature and according to definitional approach. In a review of 55 relevant longitudinal prospective studies, Jolliffe et al. (2017a) found identified prevalences of LCP offenders ranging from 3% to 17%, and of AL offenders from 4% to 82%. Building on that systematic review of offending trajectories (Jolliffe et al., 2017a), Jolliffe and colleagues (2017b) reviewed risk factors related to specific offending trajectories. They found scarce evidence of specific early-life risk factors being linked to the LCP and AL trajectories. Instead, what distinguished the groups was a higher number of risk factors in the LCP than the AL group. This mirror previous suggestions of that the differences between the trajectories might not be categorical, but could be better understood as quantitative rather than qualitative (Assink et al., 2015; Fairchild et al., 2013; Jolliffe et a., 2017b; Moffitt, 2018).

As projected (Moffitt, 1993), at age 18, no difference was found between the LCP and AL groups in the registered number of crimes; however, the difference did become apparent after adolescence (Moffitt et al., 2002) and increased as participants grew older, with individuals in the LCP group being convicted of many more crimes than their AL counterparts (Moffitt, 2018). Persistent offending is indicative not only of enduring criminal careers and frequent offending but also of more serious offences (Liu et al., 2011; Whitten et al., 2017). Individuals on a path of desistance generally experience outcomes more closely aligned with their non-offending peers than do those who persist in criminal behaviour, although desisters may still encounter long-term challenges (Moffitt, 2018).

Violence in criminal careers

In 1993, Loeber and colleagues proposed a theory of the developmental course towards violent offending. The theory postulates three developmental pathways for disruptive behaviour: overt, covert, and authority conflict. Each pathway consisted of several developmental steps ordered by age of onset, with more children expected to exhibit the earlier steps and fewer to exhibit the later steps. For example, the overt pathway suggests initial behaviours of minor aggression early in life (e.g., bullying, and annoying others), followed by physical fighting, with a minority then taking the step into acts of criminal violence in adolescence or early adulthood. Each step along a pathway is usually accompanied by parallel advancement along other paths, and combinations of pathways were suggested to be more predictive than the simple additive effect. Not all offenders follow this specified developmental course (Loeber et al., 1993), but Loeber and colleagues' (1997) suggested that violent offenders who persist over long periods tend to follow it more closely than do nonviolent criminals. Furthermore, in a high-risk sample, psychopathic traits have been identified as a strong indicator of persistent general offending (Corrado et al., 2015; Lussier et al., 2022) and are further associated with assignments to a trajectory group characterized by persistent violent offending (McCuish et al., 2015).

In contrast to nonviolent crimes, violent crime is rare (Piquero, Jennings & Barnes, 2012) and most violent crime in men are committed after age 25 (Carlsson & Sivertsson, 2020). On an aggregated level, arrests due to violent crimes diverge from the age–crime curve, in that violent crime has been found to remain at a stable level from late adolescence until around the age of 30 (Piquero, 2023). While sex crimes often exhibit violent features, the behaviour might be aetiologically distinct from other forms of violent offences (Frisell et al., 2011; Långström et al., 2015).

The duration of criminal careers in violent offenders tends to be much longer than in other offender groups and violent offenders seem to constitute a particularly crime-prone population (Blokland et al., 2005; DeLisi, 2006; Farrington, 2019a; 2019b; Piquero et al., 2004; Piquero, Jennings & Barnes, 2012). In a review of violence in criminal careers, Piquero, Jennings & Barnes (2012) presented several key conclusions, including (1) nonviolent crimes are more common than violent ones in violent offenders; (2) generally violent offenders do not specialize in violence; (3) violent recidivism is rare, while recidivism in nonviolent crime is common; and (4) convictions for nonviolent crimes often come before convictions for violent crimes. Notably, a very small group in society, corresponding to 1% of the total population and characterized by three or more convictions for violent crimes has been found to account for two-thirds of all registered violent crimes (Falk et al., 2014).

Early-onset aggressive and antisocial behaviours

Antisocial behaviour is universal in early childhood, but as children age, they learn socially appropriate behaviours (Tremblay, 2015). Children showing high levels of aggression and other antisocial behaviours early on are more likely to persist and progress in their antisocial engagements over time (Burt, 2022; Lahey et al., 2005; Loeber et al., 1993; Moffitt, 1993; Piquero, Carriaga et al., 2012; Tremblay et al., 2018). Aggressive antisocial behaviours and non-aggressive antisocial behaviours are types of antisocial behaviours that differ not simply in their manifestation, but also in their aetiology (Burt, 2009). Aggressive antisocial behaviours are distinguished from their non-aggressive counterparts by earlier onset, stability, and a stronger genetic influence (Burt, 2009, 2022; Tremblay et al., 2018). Psychical aggression has its beginnings in the earliest stages of life and generally peaks in early childhood (Hay, 2017; Tremblay et al., 2018). However, physical aggression in early childhood is typically unstable, and most children who exhibit aggressive behaviours desist as they develop (Côte et al., 2007; Tremblay et al., 2018). Studies have found a minority of children, around 5–15%, display high levels of physical aggression throughout childhood (Côte et al., 2007) and into adolescence (Nagin & Tremblay, 1999; Tremblay et al., 2018). Research suggests that individuals with high aggression levels during their development often present a second peak of aggression during early adolescence, a peak not observed in those with low to moderate aggression levels (Tremblay et al., 2018). For those who display the highest levels of early aggressive behaviour, the continuity of aggression is most pronounced (Piquero, Carriaga et al., 2012; Tremblay et al., 2018). Furthermore, high levels of physical aggression are frequently accompanied by high levels of indirect aggression (Côte et al., 2007). Aggression as a part of pattern of early conduct problems has been linked to worse outcomes compared with early non-aggressive conduct problems (Burt, 2009). Findings of a cohort study that followed participants from age 8 to 48 years indicated that those persisting in physical aggression faced worse life success, more criminal behaviour, and worse psychosocial functioning by age 48, than did their peers (Huesmann et al., 2009).

Disruptive behaviour disorders and their progression

Externalizing psychopathology is a dimensional construct, characterized by syndromic disinhibited and/or antagonistic behaviours (Krueger et al., 2021). Disinhibited behaviours include impulsive actions, not considering consequences, and rule-breaking behaviours including excessive substance use. Antagonistic behaviours include hostility and conflict in interpersonal situations and/or intentionally harming others with little regard for them. Psychiatric disorders closely aligned with disinhibited behaviours are substance use disorders (SUDs) and attention-deficit/hyperactivity disorder (ADHD). Antisocial behaviours and their

related disorders, e.g., oppositional defiant disorders, conduct disorder, and antisocial personality disorder, includes both disinhibited and antagonistic behaviours in varying degrees. Notably, externalizing psychopathology is currently the leading cause of psychiatric burden in children aged 0–14 years (GBD 2019 Mental Disorders Collaborators, 2022),

The principal disruptive behaviour disorders, i.e., oppositional defiant disorders and conduct disorder (Frick & Nigg, 2012; Tolan & Leventhal, 2013), are characterized by early-onset syndromic disinhibited and antagonistic behaviours in combination (Krueger et al., 2021). Oppositional defiant disorder with a typical onset before eight years of age is characterized by angry and irritable mood, argumentative and defiant behaviour, and vindictiveness (Hawes et al., 2023). Conduct disorder, on the other hand, is defined as a frequent and persistent pattern of behaviour in which the basic rights of others or major age-appropriate societal norms or rules are violated through various symptom criteria (e.g., aggression, destruction, deceitfulness or theft, and rule breaking; American Psychiatric Association, 2013; Fairchild et al., 2019). The life-course prevalence of conduct disorder in males is more pronounced than in women, and is estimated to 3-4% (Fairchild et al., 2019; Polanczyk et al., 2015). To differentiate the rather heterogenic conduct disorder, a childhood-onset specifier has been introduced to indicate symptom onset before 10 years of age (American Psychiatric Association, 2013; Lahey et al., 1998). This specifier has been central in the understanding of disruptive behaviour disorders and their psychopathological progression as well as to the study of criminal behaviour (DeLisi & Piquero, 2011; Fairchild et al., 2019; Frick & Nigg, 2012).

While mostly not defined as a disruptive behaviour disorder but as a neurodevelopmental disorder (NDD), ADHD is a primarily genetically driven disorder, central to our understanding of the development of subsequent disruptive behaviour disorder (Beauchaine et al., 2017; Fairchild et al., 2019; Faraone et al., 2024; Faraone & Larsson, 2019; Hawes et al., 2023). ADHD is common in offenders and associated with violent criminality, but much of the association between ADHD and criminal behaviour might be explainable through co-occurring conduct problems (Beaudry et al., 2021; Fairchild et al., 2019; Fazel & Favril, 2023; Lahey et al., 2005; Lilienfeld & Waldman, 1990; Lundström et al., 2014; Mohr-Jensen et al., 2019; Mohr-Jensen & Steinhausen, 2016; Satterfield et al., 2007).

Disruptive behaviour disorders are dimensional constructs and not entirely distinct in categorization or origin from other externalizing disorders (Beauchaine et al., 2017; Krueger et al., 2021; Lahey & Waldman, 2012). Rather, these disorders share the same developmental course marked by high trait impulsivity/hyperactivity, a course that captures most on the path of persistent antisocial behaviours (Beauchaine et al., 2017; Moffitt, 1993). This path typically starts with hyperactivity and/or impulsivity and oppositional defiant behaviours in early childhood, progresses to conduct problems in late childhood, escalates to substance abuse and delinquency during high school, and in a minority, culminates in incarceration,

recidivism, and antisocial personality in late adolescence or early adulthood (Beauchaine et al., 2017). This shared progression suggests that these behaviours and disorders may share common causes and considerably elevated heritabilities have indeed been indicated in disruptive problems (Beauchaine et al., 2017; Faranoe et al., 2024; Krueger et al., 2002, 2021; Wakschlag et al., 2018), with significant overlap between disorders (Krueger et al., 2021).

Many scholars have suggested that disruptive behaviour disorders and antisocial personalities do fulfil the criteria for NDDs, i.e., onset in or before childhood, delayed development and abnormalities stemming from the biological maturation of the central nervous system, and following a stable trajectory that persists throughout development (Bishop & Rutter, 2008; De Brito et al., 2021; Moffitt, 1993; Raine, 2018; van Goozen et al., 2022; Wakschlag et al., 2018), particularly conduct disorder with childhood-onset and/or by psychopathic traits (Fairchild et al., 2019; Moffitt, 1993). A neurodevelopmental perspective might affect early interventions, criminal justice practices, and public policy, suggesting a shift towards more therapeutic and less punitive interventions for disruptive behaviours (Fairchild et al., 2019; Raine, 2018).

A disorder not considered in this progression of externalizing disorders (Beauchaine et al., 2017) is autism. This NDD is, however, associated with elevated rates of other psychiatric disorders, including disruptive behaviour disorders and severe adult psychopathologies (Collins et al., 2023; Lai et al., 2014). A study has found positive correlation between autistic traits and early-onset antisocial behaviours, independent of ADHD and conduct disorder (Geluk et al., 2012). Twin studies have indicated that the genetic and environmental factors associated with autistic traits also contribute to disruptive behaviour disorders (Kerekes et al., 2014; Lundström et al., 2011).

For those who progress to antisocial personality disorder in adulthood, it is the *pattern* of pervasive disregard for and violation of the rights of others that differentiates it from antisocial behaviours, coupled with conduct disorder as a precursor (American Psychiatric Association, 2013). The diagnostic features include criminal behaviour, deceitfulness and fraud, impulsivity and lack of planning, aggression and violence, reckless disregard for safety, irresponsibility, and lack of remorse. Psychopathy is also a personality disorder, although not included in any standard diagnostic manual. It is defined by a collection of affective, interpersonal, lifestyle, and antisocial traits (Hare & Neumann, 2008). Thus, most individuals with psychopathy meet the diagnostic criteria for antisocial personality disorder but not vice versa. The affective (e.g., lack of empathy, guilt, or remorse; callousness; and shallow and poor affect) and interpersonal features (e.g., grandiosity, arrogance, deceit, and manipulativeness) differentiate psychopathy from the broader and more common antisocial personality disorder (De Brito et al., 2021).

Environmental risk factors in disruptive behaviour disorders

Exposure to the same risk factor might influence vulnerability to different negative outcomes and might cause wide-ranging vulnerabilities, rather than causing disorder-specific outcomes (Cicchetti & Rogosch, 1996). In line with this, non-disorder-specific but well-established risk factors, such as adverse childhood experiences, abuse, bullying, and deficiencies in the environment early in life have been linked to the development of disruptive behaviour disorders (Fairchild et al., 2019; Krueger et al., 2021; Hawes et al., 2023). Conduct disorder stands out among psychiatric conditions for having documented evidence of meaningful shared environmental influences, i.e., family conditions such as coercive or harsh parent–child interactions, in addition to non-shared environmental factors (Fairchild et al., 2019; Hawes et al., 2023; Kendler et al., 2013). Additionally, low socioeconomic status and poverty have been found to influence the development of disruptive behaviour disorders (Fairchild et al., 2019; Hawes et al., 2023). Effects of several environmental risk factors, such as maltreatment and low socioeconomic status, on antisocial progression have been identified and seem incremental for individuals at high genetic risk of disruptive problems (Braga et al., 2018; Fairchild et al., 2019; Hawes et al., 2023; Krueger et al., 2021; Moffitt, 2018). Environmental adversities may affect the structure and function of cortical emotion-regulating systems and through this relationship, externalizing behaviour might be intensified and altered during maturation (Beauchaine et al., 2017). One compelling condition in which pre-existing vulnerabilities interact with exposure to adversities is substance abuse with its neurotoxic consequences. Underdeveloped medial brain structures tend to increase the affinity for the abuse of substances, abuse that in turn might lead to grey matter loss and decreased proliferation of white matter (Koob & Volkow, 2016). Fairchild and colleagues (2013) have argued that the difference between childhood-onset conduct disorder, anticipated to follow an LCP path (Moffitt, 1993), and its adolescent-onset counterpart is not related to specific risk factors but rather to their magnitude. Furthermore, environmental risks that heighten the likelihood of following the syndromic progression from early childhood impulsivity towards antisocial personality disorder are developmentally and time sensitive (Beauchaine & McNulty, 2013).

Adverse outcomes of disruptive behaviour disorders

Dalteg and Levander (1998) conducted retrospective assessments of 75 persistent male juvenile offenders sampled from Sweden's, at the time, sole maximum-security unit for juveniles. In their explorative study they found that all had conduct disorder and two-thirds ADHD. Before age 30, the members of the enriched cohort had accumulated on average 162 registered crimes each, and the authors estimated that the participants at the time, when including unregistered criminal behaviour, likely had committed approximately one thousand crimes

each. Dalteg and Levander (1998) underscored the importance of early-onset disruptive behaviour disorders, finding that persistent hyperactivity from childhood to adulthood in combination with conduct disorder was associated with the highest levels of criminal behaviours. Later, Kim-Cohen and colleagues (2003) found that most adult psychiatric disorders are extensions of child or adolescent disorders; this was particularly true of conduct disorder as it was found to be linked to all studied adult psychiatric conditions in a large birth-cohort study. These results seem to indicate that conduct disorder might be considered a key target for prevention of further psychiatric disorder and not simply a precursor of antisocial personality disorder. In another birth-cohort study, Fergusson and colleagues (2005) found that conduct problems in childhood were correlated with a range of adverse longitudinal outcomes in young adulthood, including criminal behaviour, substance abuse, psychiatric disorders, and violence, even when adjusting for key confounding factors (e.g., childhood adversities, attention problems, anxiety, and cognitive ability). The study underscored the necessity of increased investment in interventions targeting childhood conduct problems with its rather provocative title 'Show me the child at seven', indicating the strong link between childhood and adulthood for disruptive behaviour disorders.

Subsequently, studies with varying designs have repeatedly shown that disruptive behaviours, especially when accompanied with childhood-onset conduct problems and persistent symptoms, exhibit a strong association with adverse outcomes in adulthood, such as persistent psychopathologies, mortality, crime, and violence (Fairchild et al., 2019; Kretschmer et al., 2014; Lichtenstein et al 2019; Wertz et al., 2018).

In addition, ADHD have been linked with higher rates of psychiatric and somatic morbidity, and healthcare utilization (HCU) as well as worse socioeconomic outcomes, especially in individuals whose ADHD persists into adulthood (Agnew-Blais et al., 2018; du Rietz et al., 2020; Instanes et al., 2018), and in those with comorbid disruptive behaviour disorders (e.g., Nordström et al., 2013).

Comorbid externalizing and internalizing problems (e.g., depression, and anxiety) during childhood are associated with even higher levels of early-life risk factors, such as adversity, and serve as a strong predictor of violent and nonviolent convictions, psychopathology, and psychiatric inpatient HCU in emerging adulthood (Commisso et al., 2024; Gyllenberg et al., 2010; Sourander et al., 2007).

Out-of-home care and disruptive behaviour disorders

Research indicates that children in out-of-home care often experience psychiatric disorders, with disruptive behaviour disorders being most prevalent (Engler et al., 2022). A comprehensive body of evidence highlights the association between out-of-home care placements and various adverse long-term outcomes, including lower educational achievement, employment challenges, both psychiatric and somatic

morbidity, HCU, injuries, and criminal behaviour (Brännström et al., 2017; Gypen et al., 2017, Yoon et al., 2018). Placements in an institution compared with a foster home are further indicative of adverse outcomes (Li et al., 2019; Sariaslan et al., 2022). Out-of-home placements have also been found to be associated with persistent offending in adulthood (Brännström et al., 2024; Yang et al., 2021).

Morbidity, healthcare use, and mortality in antisocial populations

> *The majority of children and young people who have offended, or who are likely to, have more health needs than those who have not offended. These needs span a range of physical, emotional and mental health areas and substance misuse problems, and are potentially linked to crime. (Walker, 2009, as cited in* The Lancet*, 2009, p. 603)*

The association between offending and adverse outcomes presents a compelling case for enhancing health and healthcare services aimed at offender populations (Engguist et al., 2014; Fazel & Baillargeon, 2011). Improving health outcomes for offenders arguably not only improves personal well-being but also serves the broader goals of reducing recidivism, enhancing community safety, and mitigating related costs (Kinner & Wang, 2014). The public sector bears significant excess costs due to antisocial behaviours, with interpersonal violence alone costing around 3% of the global gross domestic product (Iqbal et al., 2021; Waters et al., 2005). Estimating the total cost of crime presents challenges (Brå, 2017; Wickramasekera et al., 2015). Nevertheless, a recent estimate placed the annual cost in the USA at a total cost that exceeds its healthcare spending (Anderson, 2021). In particular, early-onset disruptive problems have been linked to increased public expenditures (Goulter et al., 2024; Rissanen et al., 2022; Scott et al., 2001), and persistent offending has been found to incur the greatest costs concerning crime, HCU, prescription drugs, and social benefits (Cohen et al., 2010; Day & Koegl, 2019; Piquero et al., 2013; Rivenbark et al., 2018). Evidence suggests that the most cost-effective solution is to introduce effective interventions early during the life course (Christenson et al., 2016; Sampaio et al., 2024; Waddell et al., 2018).

Psychiatric morbidity in offender populations

Psychiatric disorders are significantly more common among prisoners than the general population (Fazel et al., 2016). In male prison populations, systematic reviews and meta-regressions have found prevalence rates to be approximately 3–4% for psychotic disorders, 9–12% for major depressive disorders, 4–38% for

ADHD, 3% for autism, 61–68% for personality disorders, and 22–38% for SUDs (Collins et al., 2023; Fazel & Danesh, 2002; Fazel et al., 2016, Fazel, Yoon & Hayes, 2017; Fazel & Favril, 2023; Young et al., 2015). Specifically, antisocial personality disorder and psychopathy are overrepresented in prisons and in turn are related to other morbidity (De Brito et al., 2021; Fazel & Danesh, 2002; Raine, 2018). A Swedish register-based study reported on 43,840 male prisoners who served sentences between 2000–2009 and noted that prisoners often had low employment rates (20% with employment at the year of release), limited education (46% completed only mandatory schooling), a history of violent convictions (55%), and received a psychiatric disorder in contact with specialized healthcare services (42%) during their life course, with SUDs being the most prevalent disorder (Chang et al., 2015). Recently, another large four-year register-based follow-up study found that the most common disorders in Swedish prisoners at contact with specialist healthcare providers were SUDs (39.1%), ADHD (11.8%), depressive disorder (10.5%), and adjustment disorders and post-traumatic stress disorder (8.8%; Bukten et al., 2024). High comorbidity levels of SUDs and other psychiatric disorders often complicate the clinical picture of inmates (Baranyi et al., 2022; Wilton & Stewart, 2017). Studies suggest that comorbid SUDs increase the risk of a multitude of adverse outcomes, including recidivism, morbidity, and HCU, after release compared with those without such comorbid conditions (Baillargeon et al., 2010; Wilton & Stewart, 2017; Young et al., 2018).

Post-release, substantial levels of psychiatric disorders often persist, found Bebbington and colleagues (2021) when studying ex-prisoners in a large random survey sample of the general English population. Ex-prisoners were overrepresented in all categories of disorders. Furthermore, Thomas and colleagues (2016) measured levels of psychological distress in prison and repeatedly over six months after release. They found that, although half of prisoners reported low levels of distress following release, a considerable portion reported high or very high levels of distress. However, only a quarter of those with high levels of distress utilized psychiatric services the year following release and those who did had few contact hours. In reviewing common psychiatric disorders across offending trajectories in community samples, Reising and colleagues (2019) found that assignment to an offending trajectory group was associated with anxiety and depression, and noted that this association was stronger in the LCP than the AL trajectory groups.

Serious mental illnesses and their prevalence in prisoners

Serious mental illnesses (SMIs) generally refer to psychiatric disorders marked by severe and enduring psychiatric symptoms and functional disabilities (Substance Abuse and Mental Health Services Administration, 2009), including psychosis and bipolar disorders among other serious psychiatric conditions that often require specialized psychiatric care and may necessitate compulsory care at times. SMIs are partly heritable and share genetic backgrounds (Bipolar Disorder and Schizophrenia

Working Group of the Psychiatric Genomics Consortium, 2018; Cross-Disorder Group of the Psychiatric Genomics Consortium, 2019; Lichtenstein et al., 2009; Turecki et al., 2019). NDDs have been associated with SMIs (Collins et al., 2023; Di Lorenzo et al., 2021; Khoury et al., 2023; Larsson et al., 2013; Nourredine et al., 2021; Selten et al., 2015). SMIs developmental courses are influenced by early-life risk factors, such as adverse childhood experiences, substance use, and psychiatric comorbidities, including NDDs (Bortolato et al., 2017; Kahn et al., 2015; McIntyre et al., 2020; Vargas & Mittal, 2022). Exposure to violence, bullying, and educational problems early in life elevates the risk of subsequent SMIs (Agnew-Blais & Danese, 2016; Arsenault, 2018; Kahn et al., 2015; Kelleher et al., 2013; Turecki et al., 2019). Additionally, early-onset antisocial behaviours, such as childhood-onset conduct disorder, and substance abuse may be linked to their development (Burt, 2022; Degenhardt et al., 2018; Lichtenstein et al., 2020; Meier et al., 2016; Tesli et al., 2024).

Like other psychiatric disorders, SMIs seem more prevalent in prisoners than in the general population (Fazel & Seewald, 2012). The cumulative incidence of psychotic and bipolar disorders in prisoners at contact with Swedish specialist healthcare services 2010–2013 was 3.6% and 1.8%, respectively (Bukten et al., 2024). In the general adult male prison population, a systematic review estimated the prevalence of suicide attempts in prison at 8.6% (Favril et al., 2022). Prisoners with SMIs often have previously been imprisoned and have a heightened risk of violent reoffending compared with those without SMIs (Baillargeon et al., 2009, 2010; Chang et al., 2015).

Association between psychiatric disorders and criminal behaviour

Psychiatric conditions are associated with violent and nonviolent crime and recidivism (Ogilvie et al., 2023; Whiting et al., 2021), but also with violence victimization (Sariaslan et al., 2019). In particular, psychotic disorders, personality disorders, and SUDs are related to violent crime perpetration (Whiting et al., 2021). Compared with a few per cent in the general population, the lifetime absolute risk of a violent conviction in those with SMIs is estimated to 11–23%, although, aggravated violence is rare in the group (Whiting et al., 2021). Comorbid SUDs may increase the risk of violence incrementally in SMIs (van Dorn et al., 2012).

Somatic morbidity in offender populations

Although the incidence rate of somatic morbidity inevitably varies throughout the life course, accumulating evidence demonstrates that offenders seemingly face an increased risk of developing such conditions (Fazel & Baillargeon, 2011; Reingle et al., 2014; Skinner et al., 2020). Incarcerated individuals face heightened risks of infectious diseases and chronic conditions compared with the general population

(Fazel & Baillargeon, 2011). Likewise, the physical health of offenders outside of secure settings also appears to be poor (Skinner & Farrington, 2023).

Findings from one cohort suggested that male persistent offenders had a lower rate of somatic morbidity at 32 years of age (Shepherd et al., 2004), but at age 48 were twice as likely to suffer from somatic morbidities as were desisters and non-offenders (Skinner et al., 2020). Thus, although the risk of somatic morbidities was higher in this population, the risks were not evident until middle age. Furthermore, Reingle and colleagues (2014) found that offenders who persists in violence are at a particular risk of chronic somatic diseases, even in young adulthood; moreover violence has been shown to increase the risk of morbidity, inpatient HCU, disability, and physical injuries (Piquero et al., 2011, 2012; Shepherd et al., 2004). More than a quarter of persistent offending men had suffered injuries between the ages of 27 and 32 years, and a fifth between the ages of 43 and 48 years (Piquero et al., 2011), with persistent offenders being more prone to specific accidents and assault injuries than was the general population (Shepherd et al., 2004). A systematic review have found that most offenders have suffered traumatic brain injury (O'Rourke et al., 2016).

The participants in a large birth cohort underwent magnetic resonance imaging to assess average cortical surface area and cortical thickness (Carlisi et al., 2020). The results indicated reduced surface area in most analysed brain areas and thinner cortex in some areas in adults classified as displaying LCP antisocial behaviours than in the AL group as well as those with low antisocial expressions. Furthermore, Langevin and colleagues (2022) concluded that the primary driver of disease, the biological aging process, seemed to progress faster among persistent offenders, on average, adding over four years of biological aging between the ages of 25 and 45 years compared with those with a low level of antisocial behaviour.

Healthcare utilization in offenders

In the five years before incarceration, one study found that a majority of prisoners had engaged with psychiatric healthcare services at least once (Kurdyak et al., 2022). In prison, inmates appear to use both primary and specialist care more often than the general population (Feron et al., 2005; Kouyoumdjian, Cheng, Fung, Orkin, McIsaac et al., 2018, Kouyoumdjian, Cheng, Fung, Humphreys-Mahaffey et al., 2018; Spycher et al., 2021). Furthermore, studies have found that HCU is elevated in recently released prisoners (Alan et al., 2011; Frank et al., 2013, 2014; Kouyoumdjian, Cheng, Fung, Orkin, McIsaac et al., 2018; Tuinema et al., 2020) and psychiatric disorders and injuries contribute to most inpatient days (Butler et al., 2020; Carroll et al., 2017). Levels of out- and inpatient psychiatric HCU have been found to be elevated in LCP trajectory groups relative to other trajectory

groups (Rivenbark et al., 2018). However, and as for somatic disease, inpatient care at age 32 have been noted lower in persistent offenders than in others, but shifted by the age of 48, when the incidence was elevated (Shepherd et al., 2004; Skinner et al., 2020). A birth-cohort study focusing on violent offenders found that 30% had received psychiatric inpatient care by age 32, compared with 5% of non-offenders and 24% of non-violent offenders (Timonen et al., 2003). In the same cohort, violent offenders utilized more somatic inpatient care than non-violent offenders and among the violent offenders diagnosed with SMI, hospitalization at somatic hospitals for psychiatric reasons was found (Timonen et al., 2000).

Prison healthcare and psychiatry

Criminal justice sentencing generally aims to be both punitive and rehabilitative. However, the current global emphasis on punishment overshadows rehabilitation efforts (Vanstone & Priestley, 2023). Healthcare in prison does not equate to criminal justice rehabilitation. According to the principle of equivalence of care, healthcare within prisons should mirror community standards (United Nations, 1990). This includes standardized psychiatric assessments and adherence to community-based treatment guidelines for psychosocial and pharmacological interventions. Dressing and Salize (2009) found that the routes to psychiatric care during acute episodes varied considerably in Europe, involving referrals to prison hospitals or medical wards, secure forensic hospitals, or general psychiatric hospitals, driven by diverse national laws and regional service accessibility.

As the burden of psychiatric disorders at current is significantly higher in prisons than in the community (Fazel & Baillargeon, 2011), the World Health Organization (WHO) has recommended that prisons should be well equipped to deal with these conditions (Engguist et al., 2014). Yet, mental health and substance use services have often received insufficient attention and, in numerous nations, have been isolated from conventional healthcare, lacking the necessary resources to address the associated challenges adequately. Dressing and Salize (2009) reported that screenings upon entry and throughout imprisonment were found to substantially deviate from established quality standards in European prisons.

Psychiatric treatments for prisoners

Hassan and colleagues (2014) found that male prisoners were over five times more likely to receive prescriptions for psychotropic drugs than were members of the general population. Psychotropic prescriptions in prison settings may not always be aligned with clinical guidelines, extending indications beyond current recommendations (Hassan et al., 2016), including polypharmacy, high-dose therapy, and prolonged treatment durations (Griffiths et al., 2012). However,

prescription practices for offenders should generally adhere to the same guidelines as apply to others, although the large comorbidity with SUDs often complicates psychotropic therapies as many of the medications include risks of abuse and require long-term adherence to therapy (e.g., Young et al., 2018).

By following all prisoners released from Swedish prisons in the 2005–2010 period to the end of 2013, Chang and colleagues (2016) found that utilization of psychotropics such as antipsychotics, psychostimulants, and treatments for SUDs was associated with a significant decrease in the rate of violent reoffending. This result mirrored previous findings suggesting that persons with ADHD have lower rates of general criminal behaviour when on psychostimulant medication (Lichtenstein et al., 2012). Subsequent results have found that medication for SUDs indeed reduced violent and nonviolent crime in the general population (Molero et al., 2018) and offender cohorts alike (Russolillo et al., 2017).

Interventions aimed at reducing recidivism and treat mental health conditions through psychological programmes, in prison as well as community services, have shown some promise (Koehler et al., 2013; Kriminalvården, 2014; Yoon et al., 2017). Meta-analytic evidence indicates that despite divergent results of primary studies, psychological treatments for violent offenders generally reduce levels of reoffending at a statistically significant level (Papalia et al., 2019). Few studies have investigated interventions aimed at mental health for those with SMI within the criminal justice system, however, promising results for such target interventions have been suggested (Hailemariam et al., 2024).

The juxtaposition of inpatient psychiatric care and prison

Psychiatric care has undergone major reforms in recent decades (Fakhoury & Priebe, 2002). Marked by the closing of large hospitals in favour of community-based care, and emphasizing patient rights and self-determination, these reforms have aimed to integrate individuals with psychiatric disorders into society and reduce stigma. However, the reforms have faced challenges stemming from, for example, resource allocation and implementation complexity. The effects of this reform have been observed in the decreasing number of beds in psychiatric hospitals, while concurrently, the number of individuals treated at forensic units and prisons has increased (Chow & Priebe, 2016; Priebe et al., 2008). The reasons behind this shift are not clear. Although, ‘the Penrose law’ propose an inverse relationship between psychiatric bed availability and prison population size (Penrose, 1939). The deinstitutionalization process has likely benefited many psychiatric patients but possibly led those with serious externalizing disorders and additional concurrent psychiatric comorbidities to alternative settings, such as prisons (Baillargeon et al. 2009; Shenson et al., 1990; Sisti et al., 2015).

Medical continuity in the transitions between prison and community

Before sentencing, many prisoners have been in contact with healthcare for psychiatric concerns (Kurdyak et al., 2022), but the transition from community to prison can incur risks of medical discontinuity. In US prisons, over half of the prisoners who were receiving psychopharmacological treatments upon entry did not continue them during their incarceration (Gonzalez & Connell, 2014). However, imprisonment can also serve as an opportunity to treat previously untreated conditions, and one study found that most prisoners had not been taking previously prescribed psychopharmacological treatment at arrest but reinitiated treatment in prison (Wilper et al., 2009).

Release of prisoners involves challenges in creating opportunities for appropriate post-release care. The WHO (2019) highlighted the negative impacts of re-entering the community after incarceration, emphasizing the shared risk factors for psychiatric morbidity, somatic morbidity and imprisonment, and criticizing the lack of healthcare continuity between prison and community healthcare. For example, one study found that prompt healthcare for psychiatric disorders post-release may reduce the risk of reimprisonment (Palis et al., 2022). The challenges of maintaining medical continuity include difficulties engaging ex-prisoners with mental health problems in outpatient care after release (Hopkin et al., 2018; Kouyoumdjian et al., 2015). Addressing the transition from prison to the community of individuals with psychiatric disorders can enhance their engagement with healthcare services (Hopkin et al., 2018). There is a clear need for targeted interventions spanning incarceration, transition, and the post-release period for individuals with psychiatric disorders, particularly SMIs, focusing on both psychiatric and criminogenic needs and outcomes (Baillargeon et al., 2009; Brooker et al., 2023; Hopkin et al., 2018; Parisi et al., 2022). Despite multiple efforts to develop interventions to improve health and interaction with healthcare after release, few evidence-based interventions have emerged to date (Brooker et al., 2023; Hopkin et al., 2018; Kouyoumdjian et al., 2015).

The effects of prison on offending and health

Imprisonment entails risks for health (Massoglia & Pridemore, 2015) and recidivism (Kazemian & Walker, 2018; Wermink, Blokland et al., 2023). However, it is important to note that the effects of prison time are complex. Studies have indicated that the initial incarceration period often leads to a decline in mental health, which then generally shows improvement over time (Walker et al., 2014). While some inmates experience stable psychological distress throughout their incarceration, others display improvements during their prison sentence (Dirkzwager & Nieuwbeerta, 2018). A Swedish study (Hjalmarsson & Lindquist, 2022) examined the health effects of a prison reform that extended the amount of time inmates had

to serve and found that increased time served did not negatively impact post-release health and even lowered mortality risk in some. The authors suggested that this positive effect might be a result of increased in-prison HCU and participation in psychological treatment programmes (evaluated in Kriminalvården, 2014).

The Swedish context

The 'Swedish model' (Finansdepartementet, 2017) aims to increase prosperity for all, while safeguarding the independence and autonomy of citizens as a strategy for inclusive growth. The model's general welfare policy suggests universal access to high-quality healthcare. This approach aims to make the healthcare system accessible and equitable for all citizens, regardless of socioeconomic status, while providing welfare services to reduce the burden of socioeconomic factors, e.g., associated with criminal behaviour. The emphasis on equitable healthcare and social support aligns with the rehabilitative approach of the Swedish Prison and Probation Service (SPPS), rather than a purely punitive model (Lardén, 2023).

Criminal justice system

The age of criminal responsibility in Sweden is 15 years (SFS 1962:700). The district court is the first instance of the general courts, followed by courts of appeal and the Supreme Court. The criminal justice system emphasizes social welfare and crime prevention, with provisions for offenders under 18 years of age, preferring alternatives to custody, such as secure care or community service (SFS 1962:700). Individuals sentenced to incarceration serve their time in prisons, with no distinction made between jails and prisons. Prisons in Sweden, administered by the SPPS, are not simply punitive, but also focus on the rehabilitation and reintegration of offenders, seeking to reduce recidivism through supportive, constructive measures (Kriminalvården, 2022). Lardén (2023) summarized this rational: 'a rehabilitation approach is also a call for a better society based on tolerance, inclusion, and humanity' (p. 571). The SPPS focuses on community integration and aims to prepare inmates for a return to society by means of various programmes, including education, vocational training, and a range of psychological treatment programmes during sentencing. Furthermore, the SPPS actively highlights the need for more effective transfers to the community (Lardén, 2023). Swedish efforts have focused on evidence-based approaches to rehabilitating inmates and reducing recidivism (Vanstone & Priestly, 2023). This rehabilitative and humane approach has been one epitome of 'Scandinavian exceptionalism', coupled with low crime and incarceration rates (Pratt, 2007).

Swedish prison population rates in 2017 (59 per 100,000, respectively) were similar to those in most other Northern and Western European countries, but lower than the global average (Walmsley, 2019). Among the Nordic countries, Swedish prison population rates are currently similar to the Danish and Finish rates, but higher than the Norwegian and Icelandic rates (Kristoffersen, 2022). Today, the prison conditions and system are changing rapidly. Penal reform policies have increased the pressure on the SPPS through increasing short- and long-term sentences, leading to a need for swift expansion of the prison system, and challenging the access to and quality of rehabilitative interventions (Kriminalvården, 2022). Consequently, the prison population in Sweden has risen in recent years (Fair & Walmsley, 2022; Kristoffersen, 2022) and the SPPS projects that the total incarcerated population will triple over the coming ten years (Kriminalvården, 2022).

In regards to recidivism, Yukhnenko and colleagues (2023) observed global recidivism rates of 18-55% two years after release, with Sweden at 33%. A Swedish report (Brå, 2023) noted higher recidivism among young and imprisoned men than among those older and with non-custodial sentences within a year of release, with the recidivist averaging three crimes with a median recidivism time of 112 days.

Healthcare system and psychiatric care

The Swedish healthcare system, generally characterized as efficient and providing a high standard of care, offers universal coverage and operates according to a decentralized model (Janlöv et al., 2023). The responsibility for healthcare largely rests on the county level, whereas municipalities provide limited healthcare. Private providers provide care under regulations similar to those that apply to public providers. Annually, Swedish residents average eight contacts with outpatient care, two-thirds of which are on the primary level and one-third on the specialized level (Sveriges Kommuner och Regioner, 2023a). As for somatic concerns, adults are initially directed to primary care for most mental health concerns. For mental health problems, adults are typically directed to initially seek primary care, where mild to moderate psychiatric disorders are assessed and treated (Janlöv et al., 2023).

Specialized psychiatric healthcare, part of the universal healthcare system, offers assessment and treatment for moderate to severe disorders through both public and private providers. Services involve inpatient and outpatient care in any of three areas of psychiatric care: child and adolescent, adult, and forensic. The most common reasons for contact with adult psychiatric outpatient care are SUDs, mood and anxiety disorders, ADHD, and behavioural disorders (Janlöv et al., 2023). Annually, roughly 5% of the general Swedish population is in contact with psychiatric care, mainly through outpatient services (Sveriges Kommuner och Regioner, 2023b). As in many other Western countries (Fakhoury & Priebe, 2002), Swedish psychiatric services have seen a falling number of psychiatric hospital beds and an increasing number of forensic psychiatric beds in conjunction to increased indirect costs related

to psychiatric disorders, for example, sick days (Chow & Priebe, 2016; Tiainen & Rhenberg, 2010).

Psychiatric care is delivered under the same legislations as other healthcare services (Janlöv et al., 2023), with the exception of compulsory and forensic psychiatric care (SFS 1991:1128; SFS 1991:1129). The Swedish criteria for involuntary psychiatric treatment (i.e., presence of a severe mental disorder, need for care, incapacity or unwillingness to make decisions, or danger to oneself or others) are aligned with international standards (Salize & Dressing, 2004; Saya et al., 2019), and aim to balance the significant ethical dilemma between need for intervention and respect for individual rights (SOU 2022:40). In a European context, Sweden has a moderate incidence rate of compulsory treatment admissions (Salize & Dressing, 2004).

The SPPS is de facto responsible for healthcare during the prison sentencing (Lardén, 2023). All prisons have a healthcare centre, staffed by nurses and a general practitioner attending a few days a week. Healthcare services in prisons are at the primary care level. Prison healthcare centres typically have regular visits from psychiatrists. Psychological and psychopharmacological treatments are provided in prison. If a prisoner becomes critically ill or needs other healthcare than what is accessible at the prison, the inmate is transported to an appropriate healthcare facility. Thus, prisoners with acute psychiatric needs may be transferred to psychiatric units or hospitals, either forensic or non-forensic.

Court-ordered forensic psychiatric care is an indefinite sentence, with the duration based on treatment efficacy and the related risk of recidivism, resulting from forensic psychiatric assessments confirming the influence of severe mental disorder on crime (HSLF-FS 2015:31; SFS 1991:1129; SFS 1991:1137). Unlike most other countries, criminal responsibility is not assessed or applied as a concept, so all those sentenced are deemed responsible for their crimes (Grøndahl, 2005). Annually, 200-300 people, mainly violent offenders, are sentenced to forensic psychiatric care (Swedish National Forensic Psychiatric Register, 2022). The Swedish rates of forensic psychiatric care admissions have been found to be higher than in other European nations (Salize & Dressing, 2007).

Mortality in offender populations

Mortality rates among offenders are significantly higher than in the general population (Elonheimo et al., 2017; Skinner & Farrington, 2020). The highest mortality rates are found in newly released prisoners (Binswanger et al., 2007), who face a 13-fold increased risk of death within two weeks of prison release, and in individuals released from high-security prisons (Bukten et al., 2022). Suicide rates and deaths from external causes, e.g. intoxication or injuries, are notably high among incarcerated youth and recently released prisoners, particularly those with

psychiatric disorders or convictions for serious violent crimes (Fazel, Ramesh & Hawton, 2017; Siponen et al., 2023; Bukten & Stavseth, 2021). One study found that almost all deaths within one year of prison release in young offenders were through intoxication or injuries (van Dooren et al., 2013).

Rationale and knowledge gaps

> *Healthcare for offenders is not what it should be – for adults and young people. This must change, not just because it is the right thing to do for individuals, but because it is the right thing to do if we are serious about addressing the causes of crime. (Walker, 2009, as cited in The Lancet, 2009, p. 603)*

Stopping the development of antisocial behaviours and violence (Krug et al., 2002; Loeber et al., 1993; Moffitt, 2018; Widom, 1987) is perhaps one of society's greatest challenges, of utmost importance to offenders, victims and the public alike. Improved health for offenders has the potential to reduce recidivism rates and the total societal impact (Kinner & Wang, 2014). In an effort to understand the full developmental processes of aggressive and antisocial behaviour, longitudinal studies of high-risk populations are required (Rutter & Sroufe, 2000). While studies using general population samples are invaluable, they might not fully capture the true impact on society, particularly concerning serious offenders, who are arguably particularly relevant to policy considerations (Piquero, 2023). Studying young adults who are already engaged in persistent or serious offending is important, as this group imposes the largest burden on public services, especially the prison system, over time (Cohen et al., 2010; Day & Koegl, 2019; Piquero et al., 2013; Rivenbark et al., 2018; Timonen et al., 2000, 2003). Through the identification of risk factors, early identification and interventions may be improved, in order to mitigate adverse long-term effects and improve outcomes (Fazel et al., 2009; Piquero, Jennings & Barnes, 2012; Skeem et al., 2014; Waddell et al., 2018). This study focuses on young male individuals convicted of violent, serious enough to warrant a prison sentence in emerging adulthood.

Emerging adulthood serves as a demarcation between individuals leaving an initiated antisocial path and those who will persist on a path characterized by life course engagements in antisocial or criminal behaviour (Arnett, 2000; Moffitt, 1993). It also marks the time when almost all individuals who will experience a psychiatric disorder during their life course have experienced their first episode (Solmi et al., 2022), marking it as a key phase in understanding the psychiatric course in offenders. Given the impact of the dual taxonomy (Moffitt, 1993), further exploration of its nuances in young adult violent offenders and associated early-life

risk factors is warranted. As most convicted offenders are male (Walmsley, 2019), and serious crimes are significantly less common among women than men are (DeLisi & Piquero, 2011; von Hofer, 2011), the focus on male violent offender populations is crucial.

Epidemiological knowledge of adverse outcomes, pertaining to factors contributing to morbidity, mortality and criminal behaviour, among incarcerated individuals is limited (Fazel et al., 2009; *The Lancet*, 2009; Skinner & Farrington, 2023), especially in populations of enriched offender groups. Epidemiology in forensic psychiatry offers two key benefits: identifying the prevalence of psychiatric disorders in offenders to highlight needs and resource gaps; and providing insights into risk factors for adverse outcomes, which can aid in prevention (Fazel et al., 2009). Arguably, the inclusion of a sample of young male prisoners with serious and persistent psychiatric and social problems (Billstedt et al., 2017, Hofvander et al., 2017; Wallinius et al., 2016), captures the breadth of the disruptive behaviour psychiatric phenotype and implies higher levels of psychiatric comorbidity (Hawes et al., 2023; Fairchild et al., 2019; Mofitt, 2018). Thus, significant disparities persist in psychiatric health and healthcare accessibility between offenders and the general population, underscored by almost all prisoners experiencing at least one psychiatric disorder during their life course and as many as one in ten experiencing an SMI (*The Lancet*, 2009). This psychiatric burden is further problematized by reports of male offenders displaying a reluctance to seek healthcare (Howerton et al., 2007; Morgan et al., 2007), making studies of HCU and medical continuity important. Data regarding interactions with service providers may further improve the prevention, treatment, and management of the psychiatrically burdened violent offender group, and have the potential to help decision makers shape effective policies. Furthermore, national statistics regarding the prevalence of psychiatric disorders among prisoners or the regularity and accessibility of psychiatric treatments during or after a prison sentence seem rarely reported (Dressing & Salize, 2009). Thus, providing a composite picture of the natural course of violent offenders' interactions with healthcare services is relevant. Additionally, the reduction of psychiatric inpatient services with a concurrent rise in prison populations over the past half-century (Chow & Priebe, 2016; Sisti et al., 2015) underscores the need for a comprehensive understanding of the development and long-term consequences of SMI in those incarcerated for violent offences. Furthermore, adverse somatic health outcomes and somatic HCU remains unsatisfactorily researched, being relatively unexplored (Fazel & Baillargeon, 2011; Skinner & Farrington, 2023). Studying mortality in violent offenders is important in order to understand the long-term consequences of aggressive and antisocial behaviours (Skinner & Farrington, 2020), while also providing insights into the health inequality faced by offenders compared with the general population.

Aims

General aim

The overall purpose of this dissertation was to longitudinally investigate three important outcome areas – criminal behaviour, morbidity, and mortality – in offenders imprisoned during young adulthood due to violent and/or 'hands-on' sexual offences.

Specific aims

(1) To describe life-course criminal behaviour in violent offenders compared with a general population comparison group; identify offending trajectories in violent offenders; compare criminal behaviour and early-life risk factors across trajectory groups. (*Paper I*)

(2) To describe psychiatric morbidity, HCU, and psychotropic drug use in violent offenders compared with a general population comparison group and across offending trajectory groups; explore risk factors for psychiatric HCU in violent offenders. (*Paper II*)

(3) To explore the effect of early-life risk factors on the development of SMI in young adulthood among violent offenders; describe adverse prospective outcomes across SMI. (*Paper III*)

(4) To describe somatic morbidity, HCU, prescription drug use, and mortality in violent offenders compared with a general population comparison group; explore risk factors for prospective somatic inpatient HCU in violent offenders. (*Paper IV*)

Methods

Participants and procedures

The Development of Aggressive Antisocial Behaviour Study

This dissertation is based exclusively on data from the Development of Aggressive Antisocial Behaviour Study (DAABS). DAABS is a Swedish closed-cohort study that included 269 individuals from February 2010 to July 2012. The cohort consists of male violent offenders aged 18–25 at inclusion. At the time of inclusion in the study, all were imprisoned for violent and/or 'hands-on' sexual offences. Inclusion due to violent crime was based on homicide, manslaughter, assault, robbery, threats, violence against an officer, interference in legal proceedings, gross integrity violations, abuse, unlawful coercion and threats, kidnapping, illegal confinement, arson, or extortion. Inclusion due to sexual offences was based on conviction of a crime with direct contact with the victim (i.e., rape, sexual abuse and coercion, sexual exploitation of a minor, intercourse with child or sibling, and purchase of sexual services).

During the inclusion period, 420 individuals were serving sentences for violent and/or 'hands-on' sexual offences at any of nine correctional facilities in the western region of the SPPS. These nine prisons accounted for about one fifth of the Swedish prison population at the time, with prisons covering all security levels (i.e., from high-security to open facilities). Among these 420 individuals, 42 were excluded due to language proficiency issues (n = 23) or insufficient remaining time at the prison (<4 weeks) for assessments (n = 19). Participants excluded due to the language criterion, but not the time criteria, differed in having elevated rates of sexual index crimes (n = 12; 52%). Additionally, 109 prisoners (29% of the remaining 378) declined to participate or discontinued their participation. Decliners did not differ in age or type of index offence from participants. Hence, the cohort reflects the demographic of Swedish young male violent imprisoned offenders during that time period and is as such considered sufficiently representative for a total population study (Wallinius et al., 2016). Three participants could not be followed up due to problems in identifying accurate personal identity numbers, rendering a total of 266 participants in the follow-up study this dissertation is based on.

The catchment area operated just one small women's prison. Since the number of women meeting the inclusion criteria was too small for meaningful statistical analysis, the DAABS cohort did not include female offenders.

Conception of Development of Aggressive Antisocial Behaviour Study

Henrik Anckarsäter, professor in forensic psychiatry, and colleagues conceived the initial project in 2005, then named DIS-CAT (Early onset behaviour DIS-orders across diagnostic CATegories). The project was based on the assumption that early-onset disruptive behaviour disorders, i.e., conduct disorder and oppositional defiant disorder, and NDDs, i.e., ADHD and autism, contribute to the development of severe aggressive and persistent antisocial behaviour in adulthood. It further hypothesized that these disorders affect the prevalence and expression of psychiatric disorders throughout the lifespan. Initially, the project was aimed at comparing individuals with and without early-onset disruptive disorders and NDDs who were in contact with either forensic or general psychiatric services or in-prison services (Hofvander et al., 2009).

Subsequently, the SPPS expressed interest in a similar project, leading to an agreement with its western region to refocus the study exclusively on young adults incarcerated for violent or sexual offences (DIS-CAT 2.0). Framed as a total population study of young violent offenders in the western region, Eva Billstedt and Björn Hofvander acted as principal investigators and revised the study design and protocol to fit the setting. First Märta Wallinius and then Therese Olsson were designated as project coordinators and played central roles in the study.

The revised and final study protocol consisted of three parts: (1) baseline assessments, (2) a genetic add-on study,[1] and (3) a register-based follow-up study.

Procedure of the baseline assessments

After comprehensive briefings of the SPPS by the researchers, prison wardens appointed site managers for each prison. These site managers received training by the project coordinator and attended regular meetings for updates and coordination. Recruitment and subsequent data collection adhered to a structured protocol. During the inclusion period, the appointed site managers continuously identified eligible participants using the specified criteria and informed participants about the study through both text and face-to-face meetings. The site managers gathered signed informed consent forms from offenders interested in participating. Consenting offenders underwent baseline assessments in the prison, following an extensive and structured protocol. These baseline assessments included self-rating questionnaires,

[1] Not used in this dissertation. For the genetic study, DNA samples were collected from saliva and stored in a biobank. The material remains unanalysed and available for pooled collaborative studies.

semi-structured diagnostic interviews, and neuropsychological evaluations. Four licensed psychologists with expertise in the field and training in the assessment instruments took turns individually conducting the clinical evaluations during six- to seven-hour sessions. To improve interrater reliability, training sessions were performed for these psychologists, before study initiation and mid through the data collection period.

Before a face-to-face assessment, the assessing licensed psychologists had carefully reviewed all available file information from the SPPS, including prison healthcare journals, previous living circumstances, criminal history, and incidents during ongoing sanctions. The site manager handed out the self-rating questionnaires and participants were asked to complete the questionnaires before the assessments.

Psychosocial background data was collected through file review and a structured interview protocol. This information covered marital status, geographical origins, conditions during upbringing, early-life adversity, education, employment, out-of-home placements, history of substance use and criminal behaviour, criminal motives and behavioural analysis, as well as intimate partner violence. The level of missing information was generally low at approximately 1% (Wallinius et al., 2016).

Similarly, comprehensive medical and psychiatric histories were obtained through file review and interviews, covering hereditary liabilities, prior service interactions, assessment outcomes, treatments (pharmacological and psychological), subjective treatment responses, as well as current neuromuscular functions and neurological status.

Diagnostic psychiatric assessments were conducted using the Swedish translation of the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) and for Axis II Disorders (SCID-II) (First, 1997a, 1997b). Additionally, a lifetime symptom checklist from the Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV) for disorders not covered by SCID-I and -II (e.g., NDDs, impulse control disorders, and sexual) disorders was included (American Psychiatric Association, 2000), as was information regarding self-harm and suicide attempts. Drawing from this comprehensive information, the lifetime presence of disorders was determined following DSM-IV criteria. This process was carried out in consensus between the clinical psychologist and principal investigators based on the Longitudinal, Expert, All Data (LEAD) principle (Spitzer, 1983).

Neuropsychological assessment was conducted using the Wechsler Adult Intelligence Scale – Third Edition (Wechsler, 2002) and the Cambridge Neuropsychological Test Automated Battery (Cambridge Cognition Ltd., Cambridge, UK) to assess intellectual and executive functioning, respectively.

Consent was sought from the participants to conduct a blinded telephone interview with a parent or someone closely familiar with the early development of the

participant. This part of the procedure was discontinued six months into the study, due to difficulties in obtaining the participants' consent.

Furthermore, based on interviews with participants, file review, and when available, an interview with a relative, family trees charting relevant familial factors were created in collaboration with the participants (n = 219). These charts included information regarding parental criminal and psychiatric background.

Register-based follow-up study

This dissertation project initiated a subsequent register-based follow-up study to supplement existing baseline data. This involved the ambidirectional tracking of participants from baseline, utilizing Swedish national registries from first point of availability of data (specified below) until the end of 2017. Thus, this dissertation is based on data from the baseline assessment and register-based data sources. The follow-up did not necessitate any active involvement of the participants other than their informed consent.

Every resident in Sweden is assigned a unique personal identity number, enabling data linkage between baseline and follow-up data sources (Ludvigsson et al., 2016).

The matched register-based general population comparison group

As part of the follow-up study, a comparison group (n = 10,000) from the general population, matched in age and gender, was randomly selected by Statistics Sweden. The primary purpose of this group was to serve as a randomized approximation of the population of Swedish men born between 1984 and 1993. The comparison group was followed prospectively from 15 February 2010, corresponding to the commencement date of DAABS and, as for the violent offender cohort; the comparison group were followed through 2017.

Register-based data sources

For both cohorts, national register-based information was collected from three register holders: Statistics Sweden (Statistiska Centralbyrån), the National Board of Health and Welfare (Socialstyrelsen), and the Swedish National Council for Crime Prevention (Brottsförebyggande Rådet; data sources are visualized in Figure 1).

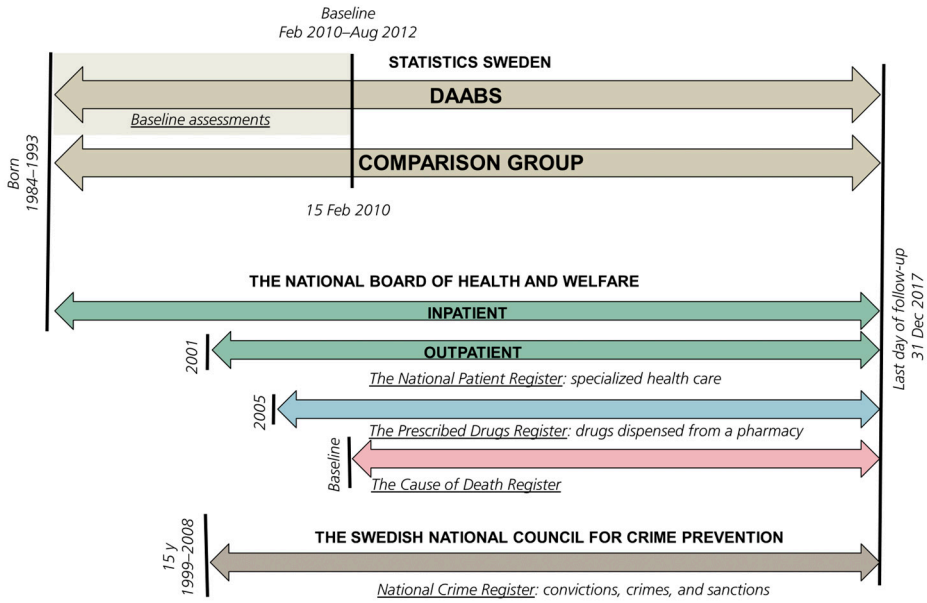

Figure 1. Schematic of cohorts and data sources in the DAABS register-based follow-up study.

Statistics Sweden

The Total Population Register (TPR), maintained by Statistics Sweden, in theory includes information on all individuals in Sweden (Ludvigsson et al., 2016). Country of birth is registered in the TPR. Children born abroad are often registered as born in Sweden if this mirrors their mother's birth country. Those staying abroad for an extended period should register this and are usually deregistered, while newcomers to Sweden meeting specific criteria are recorded if planning a stay of over a year. Each occasion of migration is registered in the TPR. The data in the TPR is of high quality, though migration data accuracy varies due to individual reporting, mitigated by regular audits (Ludvigsson et al., 2016).

The Longitudinal Integration Database for Health Insurance and Labour Market Studies (LISA) covers all Swedes over 15 years of age. Participation in LISA is mandatory. Information regarding employment, education and income (which is automatically collected in LISA) with which to assess socioeconomic background and status was extracted. The quality of the register is high, although the number of individuals with low education is likely overestimated (Ludvigsson et al., 2019).

The National Board of Health and Welfare

The Swedish National Board of Health and Welfare oversees healthcare, social services, and public health policies, and holds a large number of national registers.

For this study, we collected information from the National Patient Register (NPR), Prescription Drug Register (PDR), and the Cause of Death Register (CDR).

The NPR compiles data from both public and private specialized healthcare services in Sweden regarding patients and their hospital visits, along with related medical information (Socialstyrelsen, 2022a). The register consists of two arms, one covering specialized inpatient care and another one covering visits to a medical doctor in a specialized outpatient setting. Neither arm holds information regarding primary care. The inpatient arm records virtually all hospital discharges since national coverage was achieved in 1987. The register claims nearly total national coverage, but due to the lack of comparison data, the extent of coverage cannot be quantified (Ludvigsson et al., 2011; Socialstyrelsen, 2022a). The outpatient arm of the NPR has been active since 2001. Data delivery to the NPR is mandatory. Despite the national mandate, the register lacks certain data, such as diagnostic information, but completely missing visits are uncommon (Socialstyrelsen, 2022a). Diagnoses in the NPR are coded using the Swedish adaptation of the WHO International Classification of Diseases (ICD; WHO, 1993) system, currently ICD-10-SE.

The inpatient arm of the NPR has been validated, and a systematic review reported high positive predictive value for diagnoses but lower sensitivity, meaning that accurate diagnoses are more common in patients with severe conditions (Ludvigsson et al., 2011).

The PDR holds information about all prescribed drugs that have been dispensed from Swedish pharmacies. Similar to the NPR, reporting is mandatory (Socialstyrelsen, 2021). The PDR data serves as the basis for the reimbursement of benefit amounts, providing strong incentives to record accurate information. The data collection process is automated and data acquisition is instantaneous. The data is reliable, without notable attrition or measurement inaccuracies. Annually, the PDR has included over six million individuals and 100 million prescription records since it was launched in its current form in 2005 (Socialstyrelsen, 2021). Healthcare providers can requisite drugs that they then dispense directly to patients at the healthcare facility; in such cases, the PDR does not hold that information. The PDR has been validated in numerous studies (Wallerstedt et al., 2016).

Mortality data were sourced from the CDR. The register records all deaths in Sweden, including those of registered citizens dying abroad, and their causes based on the death certificate (Socialstyrelsen, 2022b). The information in the CDR is deemed high in quality and reliability, offering nearly full coverage of deaths and causes of deaths (Brooke et al., 2017).

The Swedish National Council for Crime Prevention

The National Crime Register (NCR), held by the Swedish National Council for Crime Prevention, contains records of all criminal convictions, including custodial and non-custodial convictions, starting from the age of criminal responsibility (15

years of age). All criminal district court convictions are captured, omitting potential decisions from courts of appeal. Virtually no data are missing from the register (Brå, 2018). Each conviction can involve multiple crimes and sanctions resulting from a court decision, abstention from prosecution, or summary imposition of a fine. The register also covers those convicted of a crime committed under the influence of a severe mental disorder, and sentenced to forensic psychiatric care. Plea bargaining is not an option in Sweden, so there is no risk of crimes being omitted from the NCR for this reason.

Descriptive characteristics

The average age of the studied DAABS cohort (n = 266) was 21.8 years (SD = 1.9), ranging from 18 years and 7 months to 25 years and 11 months at baseline. Eighty-six per cent of cohort members had been convicted at least once before the baseline conviction and 37% had earlier experience of imprisonment (Wallinius et al., 2016). None had received court-order forensic psychiatric care, but 10% of the cohort had been given forensic psychiatric care for reasons other than court-ordered care (Hofvander et al., 2017), for example, compulsory treatment during an on-going prison sentence (SFS 1991:1129). Baseline characteristics of the DAABS cohort have been described in numerous publications (e.g., Billstedt et al., 2017; Hofvander et al., 2017; Wallinius et al., 2016), as summarized in Table 1.

Table 1. Baseline characteristics of the DAABS cohort (n = 266).
[a]Autistic disorder n = 2, Asperger syndrome n = 18, atypical autism n = 6.

Variables	*n* (%)	continued.	*n* (%)
PSYCHOSOCIAL BACKGROUND		**PSYCHIATRIC DISORDERS**	
Born in Sweden	195 (73)	**Anxiety disorder**	134 (51)
Single at baseline	185 (70)	**Major depressive disorder**	127 (48)
Unemployed before baseline conviction	163 (61)	**Substance use disorder**	224 (84)
Not finished high school	204 (77)	**Personality disorder**	173 (65)
Previous child and adolescent psychiatric care	106 (40)	**Early-onset conduct disorder**	71 (27)
NEURODEVELOPMENTAL DISORDERS		**PREVIOUS PSYCHOTROPIC TREATMENT**	
ADHD in childhood	166 (63)	**Antidepressant**	72 (27)
ADHD in adulthood	112 (43)	**Antipsychotics**	25 (9)
Autism	26 (10)[a]	**Stimulants**	30 (11)

In the comparison group (n = 10,000), the average age at inclusion was 21.4 (SD = 2.0) years, slightly lower than in the DAABS cohort. Additionally, 8710 (87%) were

born in Sweden, 1906 (19%) had not completed high school, and 8845 (88%) had been registered as either a student or worker before the inclusion date.

Follow-up time

Three per cent in both the DAABS cohort (n = 8) and in the comparison group (n = 297) emigrated during the follow-up period. Emigration was determined based on the last recorded emigration event in the absence of any registered re-immigration during the observation period. In total and taking emigration and mortality into account, the duration of prospective follow-up was significantly longer for the comparison group, averaging 7.7 (SD = 0.8) years, compared with 6.2 (SD = 1.3) years for the DAABS cohort. The participants were on average aged 28.0 (SD = 2.3) years in the DAABS cohort and 28.4 (SD = 2.0) years in the comparison group at the end of follow-up. Although the DAABS cohort was incarcerated at the time of inclusion, it was anticipated that a significant proportion of the follow-up period would concern time in the community. The average baseline conviction length was 23.0 months (SD = 17.6, Mdn = 20, interquartile range = 20) and generally two-thirds of sentenced time is served in prison. However, specific start and end dates of sentences were not available.

Measures

Grouping variables and their definitions

Persistence and desistance (Papers I & II)

Persistence in criminal behaviour was defined as assignment to a trajectory group with a registered criminal career length exceeding that of the criminally active part of the comparison group by at least one standard deviation (Whitten et al., 2020, as cited in McGee et al., 2021). Desistance was defined by assignment to a trajectory group showing a decline or near cessation of criminal activities (Kazemian, 2007), not meeting persistence criteria.

Serious mental illness up until young adulthood (Paper III)

SMI up until young adulthood (SMIy) was defined based on the presence of a life-course diagnosis of psychotic syndromes (primary and substance-induced) or bipolar I disorder at baseline assessment. Participants with a history of repeated suicide attempts with definite intent or substantial risk of fatality or involuntary treatment, including forensic psychiatric care, were also included.

This approach defines SMIy from a need-of-care perspective, rather than based solely on categorical psychiatric diagnoses. It differentiates SMIy from the medico–

legal construct of severe mental disorders used in decisions regarding compulsory and forensic psychiatric care (SFS 1991:1128; SFS 1991:1129).

Early-life risk factors

An early-life risk factor was defined as a risk factor occurring before age 15.

Neurodevelopmental disorders

Using semi-structured clinical interviews, self-rating questionnaires, medical records, in some cases collateral interviews, and the clinician's assessment of the participant, diagnoses of NDDs were determined, based on DSM-IV criteria (American Psychiatric Association, 2000) after consensus was reached between the assessor and senior clinician/researcher (Spitzer, 1983). In the assessment of autism, the Asperger Syndrome/High Functioning Autism Diagnostic Interview (Gillberg et al., 2001) was used. Additionally, the participants were screened for atypical sensory perceptions. For participants who potentially met the diagnostic criteria for autism, an extensive examination was conducted (Lord et al., 2000; Wing et al., 2002). The assessment of ADHD was further informed by the Wender Utah Rating Scale questionnaire (Ward et al., 1993) and the assessment of intellectual disability was informed by the General Ability Index (GAI; Tulsky et al., 2001) from the Wechsler Adult Intelligence Scale – Third Edition (Wechsler, 2002) and the Global Assessment of Functioning score (American Psychiatric Association, 2000).

Socioeconomic and educational background

Regarding country of birth, baseline information was used. Immigrant status was defined as born outside of Sweden and/or baseline information that both parents were born outside of Sweden. The criterion for low education level among the participants was absence of high school completion in the baseline data.

Using LISA, low income during upbringing was estimated using register of the family's disposable income per consumption unit. To establish a level for low income, the lowest quartile of family income at age 16 was used in the comparison group. This information was then used to establish a dichotomized variable for low family income during upbringing in the DAABS cohort.

Adverse experiences and out-of-home placements

Based on file review, interviews and, in the cases in which the participant filled out the Childhood Trauma Questionnaire (Bernstein & Fink, 1997), review of self-ratings, adverse childhood experiences were assessed following the structured protocol. This assessment took account of information regarding having been exposed to recurrent domestic violence as a witness or victim, and having encountered parental substance abuse as well as bullying.

Furthermore, information regarding previous placement in either a foster home or institutional care was employed. In Sweden, there are two primary reasons for out-of-home placements: serious deficits in parental care or destructive individual behaviour, such as criminal behaviour. Foster home placements result from decisions made by social services, while institutional care either follows a decision by social services or, in those aged 15-17, may be imposed as a sanction from a court conviction in a criminal case (SFS 1962:700; SFS 1998:603). Social services base their decisions on social investigations, either in collaboration with caregivers (SFS 2001:453), or through compulsory measures (SFS 1990:52). After administrative court confirmation, social services decide on placements like foster homes or institutions for compulsory cases, while caregivers participate in non-compulsory placement decisions.

Parental background

To define parental migration background, baseline information that both parents were born outside of Sweden was used. Parental criminality was assessed through the charts of family liabilities collected at baseline assessment.

Low parental education was defined as both parents not having completed high school, based on LISA. In 47 cases, information about only one parent was available, so this was taken to represent the parental educational level.

Early-onset antisocial behaviours

The number of conduct disorder symptoms represents the total DSM-IV conduct disorder symptoms at age 15 (American Psychiatric Association, 2000), ranging from zero to 15. Consistent with DSM-IV (American Psychiatric Association, 2000), a childhood-onset conduct disorder was defined by the presence of at least one symptom before age 10 among participants who met criteria for conduct disorder, and was coded as a binary variable. Additionally, baseline information about having bullied others was employed.

Early-onset substance use

Based on file-review and interview, information on the onset of substance use before age 15 was used to define early-onset of alcohol, cannabis, and other drug use.

Additional risk factors

Somatic background

Self-reported information related to somatic health was gathered at baseline. This included data on traumatic brain injury, a composite variable concerning chronic somatic illnesses, and data on the prevalence of deliberate self-harm and/or repeated suicide attempts.

Never employed

Never employed was defined as not having any recorded history of employment by any employer prior to the baseline assessment, based on the LISA information all Swedish employers are required to report. This variable was refined using educational data, as participants who had been registered in any education after high school level were excluded from this definition.

Intellectual functioning

Intellectual functioning was assessed using the GAI (Tulsky et al., 2001) of the Wechsler Adult Intelligence Scale – Third Edition (Wechsler, 2002). The GAI comprises the Verbal Comprehension Index with the Information, Similarities, and Vocabulary subtests, as well as the Perceptual Organization Index with the Block design, Matrix reasoning, and Picture completion subsets.

Aggression and psychopathy

The Life History of Aggression scale (Coccaro et al., 1997) was used to assess aggressive behaviours. This scale rates the frequencies of 11 types of aggressive and antisocial behaviours on a five-point scale (range 0–55) over the life course. The scale comprises three subscales: Aggression, Antisocial behaviour, and Self-directed aggression. The Life History of Aggression scale was administered as a clinician-rated instrument, with assessors basing their ratings on all available information from interviews and files.

To evaluate psychopathic traits, the Psychopathy Checklist – Revised (PCL-R; Hare, 2003) was used (range 0–40). PCL-R is a 20-item tool with a three-point rating scale applied across four facets of traits (i.e., interpersonal, affective, lifestyle, and antisocial). Assessments were based on interviews, observations, and file review.

Longitudinal outcomes

Criminal behaviour

Comprehensive records of criminal behaviours were compiled from the NCR. All categories of crimes and convictions encompassed both attempted and aggravated forms, as applicable. Violent offences included acts of homicide, manslaughter, assault, robbery, threats, violence against an officer, interference in legal proceedings, gross integrity violations, unlawful coercion and threats, kidnapping, illegal confinement, arson, and extortion. This definition closely followed the inclusion criteria for violent offences in DAABS as well as previous Swedish criteria for violent crime (e.g., Falk et al., 2014; Fazel et al., 2014), and is in line with the standards of the United Nations Office on Drugs and Crime (2015). Murder and voluntary or involuntary manslaughter defined homicidal violence. Aggravated violence encompassed aggravated assault, kidnapping, and

aggravated robbery. Sex crimes included all sex crimes specified in the Swedish penal code (chapter 6; SFS 1962:700, e.g., rape, sexual abuse, coercion and exploitation, and intercourse with child or sibling). Seven additional categories encompassing non-violent/non-sexual crimes were formulated and classified as follows: (1) theft, (2) vandalism, (3) traffic-related offences, (4) weapons-related offences, (5) drug-related offences, (6) fraud and economic offences, and (7) other crimes.

A crime variety index was established, representing the cumulative sum of nine crime categories each offender was convicted of at least once (range 0–9). The months of sentencing represents the cumulative duration of sentencing by the court. Duration of criminal careers was defined as the time between the first and last conviction. Lastly, self-rated report of onset of criminal behaviour, encompassed crimes committed before reaching the age of criminal accountability. When offenders reported earlier onset or more criminal behaviour than the records showed, the interview information was used for analysis if deemed credible by the assessor.

Morbidity and healthcare utilization

Prospective count data on visits to outpatient and inpatient specialist care were gathered from the NPR. If an outpatient visit led to an inpatient admission at the same hospital, resulting in identical diagnoses on the same day, only the inpatient visit was counted. Diagnoses made during specialist post-baseline HCU were extracted from the NPR using ICD-10-SE codes (definitions in Appendix). These diagnoses were documented as binary variables, representing cumulative incidences. Every diagnosis from each healthcare visit was examined.

To study somatic HCU related to ambulatory care sensitive conditions (ACSCs), a binary variable was used and categorized into three subgroups: chronic, acute, and vaccine-preventable diseases (definitions in Appendix; Satokangas et al., 2021). ACSCs are health conditions for which effective outpatient care and early intervention have the potential to prevent hospitalization (Purdy et al., 2009). ACSCs serve as markers of primary and specialized outpatient healthcare quality and accessibility as they are conditions that should not typically require hospital admission if properly treated or managed at an early stage.

Prescription drugs

Prescription drugs dispensed after baseline were identified using the PDR and categorized under the Anatomical Therapeutic Chemical classification system (definitions in Appendix; WHO, 2019). Binary variables in this context indicate any occurrence of prescription drug dispensing, while the total dispensed prescription drugs in each drug category during the follow-up period is represented by defined daily doses. The defined daily dose generally represents the average maintenance dose of a medication used for its primary indication in adults (WHO, 2019).

Mortality

A death registered in the CDR was considered for all-cause death. A cause-specific death was defined using the using ICD-10-SE codes, including somatic death, accidents, suicide, assault, and undetermined intent (definitions in Appendix).

Analytic approach

All statistical analyses were conducted using Stata statistical software (versions 15 and 17). The threshold for statistical significance was set to $p < .05$. All confidence intervals (CIs) are reported at a 95% level of confidence.

Comparative tests

In Paper I, the Mann–Whitney *U* rank-sum test, the Kruskal–Wallis equality-of-populations rank test, and Pearson's X^2 test were used to analyse criminal history and early-life risk factors across trajectory groups. In Paper II, HCU, cumulative incidence of morbidity and dispensed prescription drugs, as well as this information across trajectory groups, were analysed using similar tests with associated effect sizes.

In Papers III and IV, statistical tests were used to gain a comparative overview of the longitudinal outcomes. For variables involving count data, i.e., HCU, defined daily doses of dispensed prescription drugs, and criminal behaviour, zero-inflated Poisson regression models were applied and incidence rate ratios (IRRs) reported. These models took into account the follow-up time adjusted for mortality and emigration. Longitudinal research using count data often challenges the assumption of independence between observations (Atkins et al., 2013), and to mitigate the risk of false positives, the studies employed a mixed-model extension estimator of variance in all analyses using zero-inflated Poisson regression. In the analysis of HCU, the follow-up time was further adjusted by considering the number of psychiatric and somatic inpatient days. For binary information on cumulative incidences, logistic regression was used, and odds ratios (ORs), including CIs, were reported. For all-cause mortality, a Cox proportional hazard model was employed, from which a hazard ratio (HR) was reported. The conceptual approach to the analyses in each paper is presented in Figure 2.

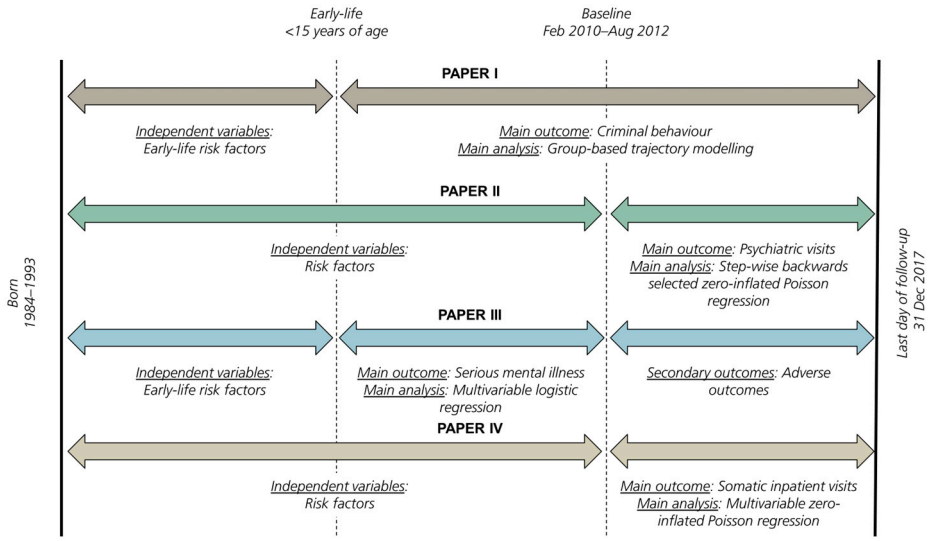

Figure 2. Overview of main analytic approaches.

Group-based trajectory modelling (*Paper I*)

Group-based trajectory modelling (GBTM; Nagin, 2005) was applied in investigating the longitudinal trajectories of offending. GBTM, a semiparametric mixed Poisson model first developed for the longitudinal analysis of criminal behaviour (Nagin & Land, 1993), identifies clusters of individuals with similar trajectories using a single outcome variable over time. GBTM does not assume a fixed number of groups. Instead, population variability is captured through group differences in trajectory shapes and levels. GBTM employs a polynomial link function between age and outcome to identify latent strata, or developmental trajectories, based on preceding behaviours.

The primary outcome was number of crimes per participant and year, starting at the criminal responsibility age of 15. Due to participants' broad age range leading to higher levels of missing data after 30 years of age, the analysis was limited to the period between 15 to 29 years of age. Data were adjusted for emigration and premature death, as recommended when handling elevated offending rates (Piquero, 2008). In the event of death or emigration, the yearly count was censored. A zero-inflated Poisson model was used. As per Nagin's (2005) suggestion, one to six groups were allowed in the model, and the Bayesian information criterion and conceptual clarity, were used to determine the best-fitting model. Subsequently, model diagnostic analyses were performed (Nagin, 2005). Sensitivity analyses were conducted with prison sentence length as a covariate (Piquero et al., 2001). The available data only indicated the sentencing day (i.e., not the starting date of the

sentence) and sentence time (i.e., not the actual sentenced time served) on a district court level (i.e., not the final court in the case of appeal). Due to the uncertainty about incarceration timing, this covariate was not used in the main analysis. The results of these sensitivity analyses indicated negligible impact on model results. Trajectory groups were categorized by shape and level, representing persistence or desistance in criminal behaviours in accordance with set definitions.

Risk factors and psychiatric healthcare use (*Paper II*)

The associations between the primary outcome (i.e., number of psychiatric healthcare visits), and trajectory group, and each risk factor in six categories (i.e., psychiatric background, socioeconomic background, adverse experiences and out-of-home placements, intellectual functioning, conduct problems, and aggressive behaviours and psychopathic traits) were univariably explored within the DAABS cohort. After investigating potential multicollinearity, a sequence of stepwise backward-selected multivariable zero-inflated Poisson regression analyses ensued, using all risk factors, but excluding trajectory groups, passing the set threshold (p <0.3) for univariable analyses. The final multivariable models included risk factors that fulfilled p <0.1. Two multivariable models are presented, one excluding and one including information on the offending trajectory group assignment.

Early-life risk factors and severe mental illness (*Paper III*)

Logistic regression was employed to estimate the effects of early-life risk factors on SMIy. As a first step, the univariable effect of each early-life risk factor was investigated. Then, age-adjusted multivariable analyses were performed in three steps: first, estimating the direct effects of NDDs on SMIy; second, estimating the total effects of NDDs and, in turn, of each category of early-life risk factors on SMIy and; third, estimating the total effects of all categories of early-life risk factors on SMIy. Risk factors that had displayed a significant effect in previous multivariable models were included in the final multivariable model. The analytic approach was guided by a directed acyclic graph at the category level (Figure 2; Shrier & Platt, 2008), illustrating the analytic approach and helping identify concerns about potential bias (Figure 3). Additionally, a complete directed acyclic graph was created to identify a minimal set of covariates (Sauer & VanderWeele, 2013).

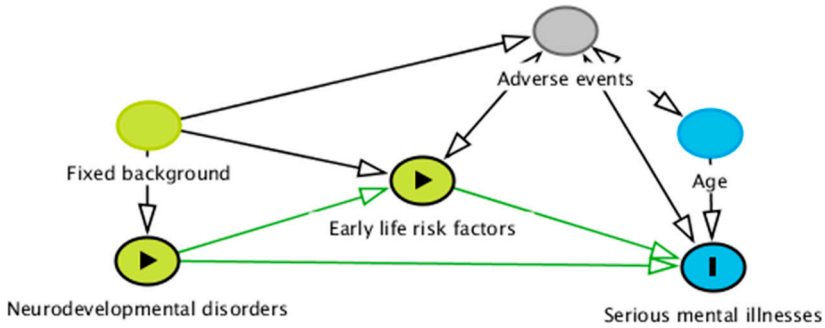

Figure 3. Directed acyclic graph mapping the effect of neurodevelopmental disorders and early-life risk factors on the development of severe mental illness up until young adulthood.

Risk factors and somatic inpatient healthcare use (*Paper IV*)

In the DAABS cohort, the univariable effects of psychiatric background, somatic background, social background and previous offending trajectory group assignment (*Paper I*) on somatic inpatient HCU were explored with zero-inflated Poisson regression. As outliers might substantially effect zero-inflated Poisson distributions, a 90% Winsorization technique (Yang et al., 2011) was implemented to adjust for outliers in the main outcome in the positive range of the sample. This adjustment resulted in a range of 0–9 ($M = 1.0$, $SD = 1.9$) somatic inpatient visits. Subsequently, we explored the direct effect of each category of risk factors on somatic inpatient HCU (models 1–3) in multivariable analyses. Last, we added the trajectory groups from model 4 to variables that exhibited a non-trivial effect (z-value > 1.5) on somatic inpatient visits in previous models.

Ethical considerations

During the baseline phase, great care was taken to address the ethical challenges that arise in research involving incarcerated individuals. The research group remained fully independent of the SPPS personnel and maintained confidentiality towards them. The participants were informed that participation in the study would not affect the sentence or its execution. Risks in the study were considered negligible. Identified risks included the psychological impact on participants and their families of improved knowledge of the participants' conditions and associated heritability as well as the potential for the identification of genetic variants or anomalies within families. All study participants were given oral and written information about the study and were asked to sign an informed consent form concerning participation in the baseline, genetic add-on, and register-based follow-

up studies. A comprehensive summary of results was provided to the participants upon request. Participants who displayed signs of severe psychopathology were offered a referral to the prison psychiatrist for further assessment and treatment. Participants in the baseline study were compensated with a payment of SEK 200 (approximately EUR 18). This relatively low compensation replaced the inmates' daily compensation otherwise given for participation in work or studies.

Examining the representativeness of the population entails describing attrition. Decliners and excluded individuals' gender, age, index offence, and psychiatric treatment needs were collected through a brief structured protocol but without gathering any personal information.

The follow-up study did not impose any additional burdens on the research participants in terms of time or resources; neither did it offer any specific compensation or advantages to individual participants beyond an improved understanding of their development and longitudinal outcomes. The potential risks associated with the follow-up study concerned the privacy intrusion resulting from registry searches. Exposure to research findings may elicit emotional reactions, a fact acknowledged by the participants. Although DAABS aims to identify needs and risk markers for targeted interventions, there is a minor risk of inadvertent stigmatization. Furthermore, the participants were explicitly informed of their right to withdraw consent at any time, leading to the prompt destruction of their data. The creation of a comparison group carried no specific risk for the included individuals since it was established solely from anonymous registry data and subjected to group-level analysis.

This dissertation adheres to the principles of the Declaration of Helsinki (World Medical Association, 2013). Approval for DAABS was obtained from the Research Ethics Committee at Lund University (registration numbers 2005/698, 2009/405, and 2018/626).

Results

Criminal behaviour (*Paper I*)

Epidemiology of criminal behaviour

In the DAABS cohort, the 266 participants had been convicted of 8728 crimes, i.e., on average 32.8 (*SD* = 30.5) crimes each, including 7.2 (*SD* = 6.3) violent crimes and 0.3 (*SD* = 1.1) sex crimes from age of responsibility to the end of the follow-up period (M_{age} = 28 years). Thus, violent crimes accounted for 22% of the total crime burden in the DAABS cohort, while sex crimes accounted for 1%. Following violent crimes, most crimes committed were related to drugs (*M* = 8.3, *SD* = 10.0) and traffic (*M* = 6.1, *SD* = 10.9). On average, DAABS participants were convicted in five (*SD* = 2) out of the nine categories in the crime variety index. Furthermore, 8% (*n* = 21) had been convicted of a homicidal violent crime, 43% (*n* = 115) an aggravated violent crime, and 13% (*n* = 34) a sex crime during the life-course. DAABS participants had on average been convicted 11 (*SD* = 8) times, with four (*SD* = 2) convictions involving violent crimes. On average, they had been sentenced on three (*SD* = 2) occasions to prison, averaging 39 (*SD* = 32) months of sentencing. Their registered criminal careers during the study period spanned an average of nine years (*SD* = 4), starting with a first registered conviction at age 17 (SD_{years} = 2) and concluding with a last registered conviction at age 26 (SD_{years} = 3).

In contrast, a quarter (*n* = 2371) of the matched comparison group had been registered for a crime during the studied period, totalling 12,326 crimes in the 10,000 participants. On average, the comparison group had been convicted of fewer crimes (*M* = 1.2, *SD* = 6.1), spent less time in prison (*M* = 0.5 months, *SD* = 5.3), and those who had been convicted had shorter criminal careers (*M* = 2.7 years, *SD* = 4.0), than the DAABS cohort. The IRR of total crimes between the DAABS cohort and the comparison group was 26.6 (25.9–27.4).

Representativeness of the DAABS cohort

At the median inclusion date for the DAABS cohort (30 May 2011), under 1% (*n* = 77) of the 10,000 participants in the comparison group mirrored the inclusion criteria for DAABS, i.e., sentenced to imprisonment and committed violent or sexual crimes. This subgroup of 77 individuals committed about 23% of total registered crimes in the comparison group. Comparisons between this subgroup and

the DAABS cohort did not reveal significant differences in total, violent, or sex crimes. However, similar comparisons between the DAABS cohort and violent offenders without prison history in the comparison group revealed significant differences.

Trajectories of criminal behaviour

Based on offending ages 15–29 years in the DAABS cohort, five trajectory groups were identified. The five-group model was chosen for its conceptual clarity over a four-group model, which obscured a trajectory group with a high-rate and late peak, as well as a six-group model, which maximized the Bayesian information criterion score but disrupted the conceptual clarity observed in earlier models by capturing only a very small and highly active trajectory group.

The final five-group cubic model is depicted in Figure 4, which shows the trajectories of criminal behaviour within the cohort. Approximately 31% (n = 83) of the participants, labelled Low-rate Desisters (L-D), displayed a pattern of declining and relatively low rates of criminal behaviour from their peak at age 18–20 years to trivial levels in their late twenties. A third of the cohort (n = 91), labelled Moderate-rate Persisters (M-P), exhibited a similar but persistent trajectory, with a slow but gradual decline from a peak similar that of to the L-D trajectory group, but the M-P trajectory group sustained relatively moderate offence rates throughout the study period. High-rate Late-peak Persisters (H-LP), constituting nearly 15% of the cohort (n = 39), displayed a pattern characterized by high offending rates at age 18–25 years, peaking at age 21 and persisting throughout the follow-up period. High-rate Early-peak Persisters (H-EP) comprised about 14% of the cohort (n = 36) and already displayed elevated offence rates at the age of criminal responsibility, peaking at age 16, and sustained a consistent but slightly declining pattern of offending throughout the study period. The smallest group, High-rate Inclining Persisters (H-IP), around 6% of the cohort (n = 17), displayed an inclining trend in criminal behaviours throughout the study period, peaking at age 28 with the highest yearly offence rates recorded across the trajectory groups.

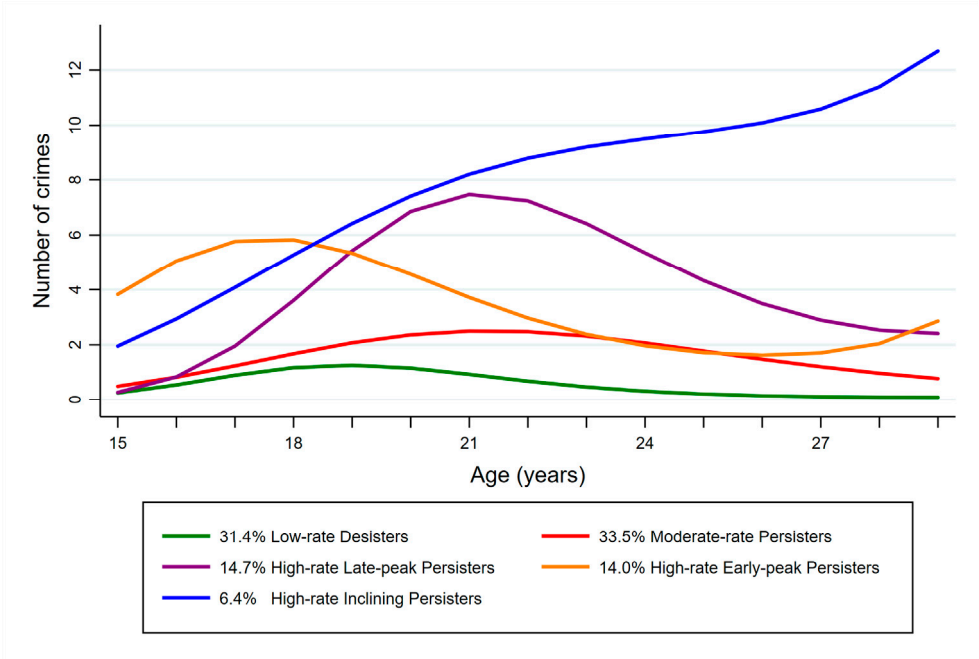

Figure 4. Trajectories of criminal behaviour.

Model diagnostic tests, i.e., average posterior probabilities, odds of correct classification and estimated assigned proportions of trajectory groups, confirmed the high accuracy of the trajectory group assignments.

All variables related to criminal behaviour and imprisonment across the five trajectory groups varied, indicating a significantly higher burden of criminal behaviour across the life-course in the persistent trajectory groups (see Table 2).

Table 2. Life-course criminal behaviour across trajectory groups.
L-D: Low-rate Desisters; M-P: Moderate-rate Persisters; H-LP: High-rate Late-peak Persisters; H-EP: High-rate Early-peak Persisters; H-IP: High-rate Inclining Persisters.

Variables	L-D (*n* = 83)	M-P (*n* = 91)	H-LP (*n* = 39)	H-EP (*n* = 36)	H-IP (*n* = 17)
			M (*SD*)		
Total crimes	8.1 (4.8)	24.5 (9.3)	55.0 (19.5)	49.7 (15.5)	111.4 (37.1)
-Violent	3.1 (2.6)	6.8 (4.5)	10.2 (7.0)	11.7 (6.3)	13.5 (10.4)
-Sex	0.4 (1.1)	0.4 (1.5)	0.1 (0.4)	0.03 (0.2)	0.2 (0.7)
Criminal career, yrs	5.2 (3.6)	9.9 (3.1)	9.4 (3.0)	11.3 (3.0)	11.9 (2.7)

Early-life risk factors across trajectories of criminal behaviour

Early-life risk factors associated with antisocial and criminal behaviours were analysed across the trajectory groups. Parental criminal history, participant education level, out-of-home-care placements (i.e., foster home and institutional care), number of conduct disorder symptoms, truancy, age of onset of alcohol and drug use, and self-reported criminal offending varied significantly among the five trajectory groups. Regarding these variables, the L-D trajectory group generally exhibited lower levels of the early-life risk factor in question than did the persistent trajectory groups.

Notably, there were no statistically significant differences in neurocognitive ability and NDDs among the trajectory groups. Additionally, immigration status, low family income, and adverse childhood experiences, including being a witness or victim of recurrent domestic violence or having parents with substance abuse, displayed no variation across the trajectory groups.

Psychiatric morbidity (*Papers II & III*)

Psychiatric healthcare utilization

The DAABS cohort had fewer total prospective healthcare visits (M = 3.6, SD = 7.3) than the comparison group (M = 5.7, SD = 9.6). However, and as reported in Table 3, total psychiatric HCU was overrepresented in the DAABS cohort compared with the comparison group. In the DAABS cohort, psychiatric HCU mainly involved inpatient care, in contrast with the comparison group, in which outpatient care was more common. This was further emphasized by analyses demonstrating that, in the DAABS cohort, 36% (n = 95) had utilized any psychiatric healthcare and 30% (n = 80) had been admitted to a psychiatric hospital during the follow-up period, in contrast to 13% (n = 1300) and 4% (n = 365) in the comparison group, respectively. Only seven (9%) of the DAABS participants who had been psychiatric inpatients also utilized psychiatric outpatient care. In contrast, 329 (90%) individuals in the comparison group who had been psychiatric inpatients had also received psychiatric outpatient care.

Table 3. Prospective healthcare utilization in the DAABS cohort compared with a matched general population group.

Variables	DAABS (n = 266)	Comparison group (n = 10,000)
	M (*SD*)	
Total psychiatric visits	1.6 (3.8)	1.1 (5.5)
Psychiatric outpatient visits	0.2 (0.9)	1.0 (4.9)
Psychiatric inpatient visits	1.4 (3.7)	0.1 (1.1)

Across the trajectory groups of criminal behaviour, the L-D trajectory group exhibited lower levels of HCU (M = 1.3, SD = 1.7) than did the persistent trajectory groups which varied between an average of 2.5 (SD = 3.3) and 10.2 (SD = 8.7) visits. Additionally (see Table 4), total psychiatric HCU, and inpatient psychiatric HCU varied on a statistically significant level, but outpatient psychiatric HCU did not.

Table 4. Prospective healthcare utilization across trajectory groups
L-D: Low-rate Desisters; M-P: Moderate-rate Persisters; H-LP: High-rate Late-peak Persisters; H-EP: High-rate Early-peak Persisters; H-IP: High-rate Inclining Persisters.

Variables	L-D (*n* = 83)	M-P (*n* = 91)	H-LP (*n* = 39)	H-EP (*n* = 36)	H-IP (*n* = 17)
			M (*SD*)		
Total psychiatric visits	0.3 (0.5)	1.9 (4.5)	2.1 (4.2)	1.2 (2.4)	5.4 (6.5)
Psychiatric outpatient visits	0.1 (0.3)	0.2 (0.8)	0.03 (0.2)	0.2 (0.9)	0.9 (2.7)
Psychiatric inpatient visits	0.2 (0.5)	1.7 (4.5)	2.1 (4.25)	1.0 (2.3)	4.5 (6.1)

Psychiatric diagnoses

Prospectively in the DAABS cohort, 37% (n = 99) received any psychiatric diagnosis versus 14% (n = 1350, OR 3.8 [2.9–4.9]) in the comparison group. All categories of psychiatric disorders diagnosed in contact with specialized healthcare were statistically significantly more common in the DAABS cohort than the comparison group, except for mood disorders, autism, and intellectual disability. The psychiatric morbidity in the DAABS cohort was largely represented by drug (n = 72, 27%) and alcohol use disorders (n = 28, 11%), ADHD (n = 33, 12%), anxiety disorders (n = 29, 11%), and psychotic disorders (n = 22, 8%).

Fewer participants in the L-D trajectory group (17%) had received psychiatric diagnoses than in the persisting trajectory groups, which varied between 40% (M-P) and 76% (H-IP). Although the prevalence of most psychiatric diagnoses varied significantly between trajectory groups, it did so in accordance with the level of psychiatric HCU, i.e., more HCU was associated with higher prevalence rates of psychiatric diagnoses.

Psychotropic prescription drugs

Prescription drug dispensing captured a composite picture of the psychiatric morbidity of the groups regarding primary and specialist healthcare. Prospectively, all categories of psychotropic drugs had been dispensed more often to DAABS participants than to the comparison group. In the DAABS cohort, 67% (n = 178) had been dispensed a psychotropic drug at a pharmacy versus 41% (n = 4100) in the comparison group (OR 2.9 [2.2–3.8]). The largest differences between the groups

were found in drugs used in the treatment of alcohol (OR 7.1 [4.0–12.7]) and opioid use disorders (OR 12.7 [4.3–37.7]), antiepileptics (OR 7.2 [5.1–10.0]), antipsychotics (OR 6.6 [4.8–9.2]), and psychostimulants (OR 6.1 [4.3–8.5]).

Trajectory group analyses revealed that the levels of psychotropic drug dispensing varied for antiepileptics, antipsychotics, antidepressants, and psychostimulants, with generally the lowest levels of dispensing in the desisting trajectory group and the highest levels in the persistent trajectory groups, especially the H-IP trajectory group.

Risk factors for psychiatric healthcare utilization

Initially, the univariable associations between trajectory group assignment, risk factors, and prospective total psychiatric healthcare visits were explored in the DAABS cohort. The results indicated a higher incidence of prospective psychiatric HCU among individuals assigned to persistent trajectory groups (IRR 5.4 [2.8–10.5] to 14.0 [7.8–24.9]) than among those assigned to the L-D trajectory group. Furthermore, anxiety (IRR 2.8 [1.1–7.0]) and mood disorders (IRR 2.4 [1.1–5.5]) at baseline as well as prior psychiatric HCU (IRR 4.3 [1.4–13.0]) increased the incidence of psychiatric HCU. Additionally, having experienced family-related physical violence during childhood (IRR 1.8 [1.1–3.1]), being placed in a foster home (IRR 2.7 [1.6–4.6]), never being employed (IRR 1.9 [1.0–3.4]), as well as low GAI (IRR 0.97 [0.95–0.99]) and high PCL-R scores (IRR 1.04 [1.01–1.08]) were significantly linked to prospective psychiatric HCU.

Subsequently, stepwise backward-selected multivariable zero-inflated Poisson regression analyses were performed, including variables passing the threshold set (p <0.3) in previous univariable analyses (see Table 5). Considering the backward-selected variables in model 1, the incidence of psychiatric HCU increased among the DAABS cohort with the presences of baseline anxiety disorders, prior psychiatric HCU, placement in a foster home, and with each additional PCL-R point, while it decreased with each additional GAI point. In model 2, including offending trajectory groups, all associations except for prior psychiatric HCU remained significant. Additionally, assignment to three out of the four persistent trajectory groups increased the incidence of psychiatric HCU on a statistically significant level.

Table 5. Multivariable zero-inflated Poisson regression model using follow-up time to explain total psychiatric healthcare visits through risk factors and trajectory groups in the DAABS cohort.
IRR: incidence rate ratio; CI: confidence interval

	Model 1	Model 2
RISK FACTORS	IRR (95% CI)	
Anxiety disorders	2.4 (1.2–4.7)	2.1 (1.2–3.7)
Prior psychiatric care	2.1 (1.0–4.2)	1.6 (0.9–3.1)
Placement in a foster home	2.6 (1.5–4.4)	2.3 (1.4–3.8)
General Ability Index score	0.97 (0.95–0.99)	0.97 (0.95–0.99)
Psychopathy Checklist–Revised score	1.06 (1.02–1.10)	1.06 (1.01–1.11)
TRAJECTORY GROUPS		
Low-rate Desisters		(reference group)
Moderate-rate Persisters		4.0 (2.0–8.0)
High-rate Late-peak Persisters		2.7 (1.3–5.6)
High-rate Early-peak Persisters		1.8 (0.8–4.2)
High-rate Inclining Persisters		3.6 (1.3–9.7)

Serious mental illness up until young adulthood

At the baseline assessment, 66 participants (25%) in the DAABS cohort fulfilled the criteria for SMIy. Within this subgroup, 23 individuals (9%) were diagnosed with a psychotic disorder, while four (2%) were diagnosed with bipolar I disorder. Furthermore, 22 individuals (8%) had a history of two or more suicide attempts, seven (3%) had experienced involuntary treatment at a non-forensic psychiatric facility, and 26 (10%) had received non-court-ordered forensic psychiatric care.

Early-life risk factors in the development of SMIy

Univariable analyses of early-life risk factor estimated effect on SMIy were performed. Statistically significant associations were indicated between SMIy and victim of repeated abuse by family member (OR 2.4 [1.4 – 4.3]), bullying (OR 2.2 [1.2 – 4.0]), special educational support (OR 3.4 [1.5 – 7.9]), each additional symptom of conduct disorder (OR 1.1 [1.0 – 1.2]), childhood-onset conduct disorder (OR 2.9 [1.6 – 5.3]), having bullied others (OR 2.3 [1.3 – 4.1]), and early-onset alcohol use (OR 2.1 [1.2 – 3.7]).

The age-adjusted estimated effects of NDDs, followed by NDDs and each separate category of other early-life risk factors, on SMIy were examined in a series of multivariable regression analyses. The multivariable analyses revealed no statistically significant estimated effect of NDDs on SMIy in any model. In addition to NDDs, all early-life risk factors that had displayed a significant estimated effect on SMIy in previous multivariable analyses were included in a final multivariable analysis assessing the total estimated effect of all considered categories of early-life

risk factors on SMIy. A history of having been bullied in school, having been a recipient of special educational support, and childhood-onset conduct disorder remained statistically significantly associated with a moderate estimated effect on SMIy (see Table 6).

Table 6. Final multivariable model exploring early-life risk factors estimated effect on serious mental illness up until young adulthood in the DAABS cohort.
aOR: age-adjusted odds ratio; CI: confidence interval

Early-life risk factors	aOR (95% CI)
ADHD, persistent	1.0 (0.5–2.1)
ADHD, remitters	0.8 (0.3–1.9)
Autism	1.4 (0.5–3.8)
Bullied in school	2.7 (1.3–5.4)
Special educational support	2.7 (1.1–6.7)
Childhood-onset conduct disorder	2.1 (1.1–4.1)
Alcohol use <15 yrs	1.5 (0.8–3.0)

Prospective adverse outcomes of SMIy

In the DAABS cohort, tracking participants prospectively from baseline assessments to the end of the follow-up period, individuals with SMIy tended to have a higher rate of total crimes (IRR 1.4 [1.0–1.9]), violent crimes (IRR 1.5 [1.0–2.2]), and reconvictions leading to imprisonment (IRR 1.5 [1.1–2.0]) than did those without SMIy.

As shown in Table 7, the SMIy group in the DAABS cohort had a notably higher incidence rate of somatic inpatient HCU than did others. However, there were no significant differences in rates of outpatient psychiatric and somatic HCU between the SMIy and non-SMIy group. Regarding the cumulative incidence of HCU, a significantly higher proportion of individuals with SMIy had received psychiatric inpatient care (47% vs. 24%) and had been reconvicted for violent offences (57% vs. 43%) than those without SMIy; however, not in the cumulative incidence of psychiatric outpatient care (8% vs. 9%) or prison resentencing (63% vs. 51%). Moreover, the cumulative incidence of prospective forensic psychiatric care contacts was higher in the SMIy group than the non-SMIy group (15% vs. 4%). Only 23 individuals (0.2%) in the comparison group had utilized forensic psychiatric care prospectively.

Table 7. Prospective healthcare utilization in the DAABS cohort with and without serious mental illness up until young adulthood, as well as in a general population comparison group.
IRR: incidence rate ratio; CI: confidence interval

Variables	SMI (*n* = 66)	no SMI (*n* = 200)	IRR (95% CI)
	M (*SD*)		
Psychiatric outpatient visits	0.2 (1.4)	0.2 (0.7)	1.9 (0.4–7.0)
Psychiatric inpatient visits	2.5 (4.3)	1.0 (3.4)	1.2 (0.7–2.1)
Somatic outpatient visits	0.6 (1.4)	0.6 (1.2)	1.0 (0.6–1.7)
Somatic inpatient visits	2.7 (8.4)	1.1 (2.5)	2.5 (1.1–5.5)

The SMIy group exhibited significantly increased prospective cumulative incidence rates of personality disorders (OR 6.2 [2.0–19.1]), alcohol use disorders (OR 3.6 [1.6–8.0]), drug use disorders (OR 3.1 [1.7–5.7]), and psychotic disorders (OR 2.8 [1.1–6.8]) in comparison with other participants in the DAABS cohort. No significant differences were found in the cumulative incidence rates of major depressive disorder, bipolar disorder, autism, and intellectual disability between these groups. The dispensed daily doses of psychotropic prescription drugs did not differ significantly between the groups. Yet, the SMIy group tended to receive a higher number of defined daily doses than did other DAABS participants.

Somatic morbidity (*Paper IV*)

Somatic healthcare utilization

The DAABS cohort displayed reduced somatic outpatient HCU, but notably higher somatic inpatient HCU, than did the comparison group (see Table 8). In the comparison group, 73% (*n* = 7345) used outpatient somatic care prospectively, but only 26% (*n* = 70) in the DAABS cohort did so. Conversely, 43% (*n* = 114) of the DAABS cohort utilized inpatient somatic care, but only 18% (*n* = 1804) of the comparison group did so.

Somatic diagnoses

The odds of presenting specifically vaccine-preventable ACSCs were higher in the DAABS cohort (OR 3.1 [1.5–6.4]) than the comparison group; however, no significant difference was noted in the cumulative incidence of total, acute, or chronic ACSCs.

In total, the cumulative incidence of HCU related to injuries was lower in the DAABS cohort than the comparison group, primarily due to reduced HCU

following accidents (OR 0.6 [0.4–0.7]). However, HCU due to violence victimization (OR 1.8 [1.1–3.0]) and, especially, self-harm (OR 8.4 [5.1–13.8]) was greater in the DAABS cohort.

Table 8. Prospective somatic healthcare utilization and diagnoses in the DAABS cohort compared with a matched general population group.
CI: confidence interval; IRR: incidence rate ratio; OR: odds ratio

Variables	DAABS (*n* = 266)	Comparison group (*n* = 10,000)	Effect size
	M (SD)		IRR (95% CI)
Somatic outpatient visits	0.6 (1.2)	4.1 (6.3)	0.2 (0.1–0.3)
Somatic inpatient visits	1.5 (4.8)	0.3 (1.1)	2.3 (1.8–2.8)
	n (%)		OR (95% CI)
Ambulatory care sensitive condition, any	16 (6)	533 (5)	1.1 (0.7–1.9)
Injury, any	83 (31)	3,735 (37)	0.8 (0.6–1.0)

Prescription drugs

Except for the elevated incidence rate of the use of prescription drugs affecting the nervous system (IRR 1.9 [1.4–2.6]), the DAABS cohort displayed no significantly elevated rates of dispensed daily defined doses of prescription drugs over the observation period. However, decreased incidence rates of drugs affecting the alimentary tract and metabolism (IRR 0.3 [0.2–0.4]), blood and blood-forming organs (IRR 0.2 [0.1–0.5]), and skin (IRR 0.4 [0.3–0.7]) were observed compared with the comparison group.

Risk factors for somatic inpatient healthcare utilization

After performing univariable analyses and a series of multivariable analyses in which the association of each risk factors category – psychiatric, somatic, and social background – with somatic inpatient HCU was separately explored, the final model included all previously analysed categories of risk factors that had exhibited a marked estimated effect on the outcome. In line with these preceding analyses, the final model indicated that low educational attainment, a history of being placed in a foster home, and assignment to a persistent offending trajectory group were associated with prospective somatic inpatient HCU (see Table 9).

Table 9. Final multivariable zero-inflated Poisson regression model using follow-up time to study the estimated effects of categories of risk factors on total somatic inpatient healthcare visits in the DAABS cohort.
CI: confidence interval; IRR: incidence rate ratio

	IRR (95% CI)
RISK FACTORS	
Low educational attainment	0.5 (0.3–0.7)
Placement in a foster home	1.8 (1.2–2.6)
TRAJECTORY GROUPS	
Low-rate Desisters	(reference)
Moderate-Rate Persisters	2.9 (1.6–5.2)
High-rate Late-peak Persisters	4.1 (2.3–7.4)
High-rate Early-peak Persisters	2.0 (1.1–3.8)
High-rate Inclining Persisters	5.9 (3.0–11.7)

Mortality (*Paper IV*)

All-cause mortality

Throughout the study period, the risk of all-cause death was substantially greater in the DAABS cohort than the matched general population group (HR 16.1 [9.4–27.8]). In the DAABS cohort, 18 individuals (7%) died, while 54 individuals (0.5%) died in the comparison group.

Cause-specific mortality

In both the DAABS group and the comparison group, death due to somatic disease was rare. However, accidents were the most common cause of death, accounting for 4% (n = 10) and 0.2% (n = 23) of deaths, respectively. In the DAABS cohort three participants died due to suicide (1%) compared with thirteen (0.1%) in the comparison group. A stark contrast was observed in deaths due to violence: while the comparison group had no such instances, three death in the DAABS cohort were attributed to violence victimization.

Summary of main findings

Criminal behaviour (*Paper I*)

Offenders imprisoned due to violent and/or 'hands-on' sexual crimes in young adulthood displayed enduring and high levels of registered criminal behaviour from the age of criminal responsibility into their early 30s. Based on the inclusion criteria, the DAABS cohort was found to be representative of under 1% of the young male Swedish population. Members of the cohort were found to commit high rates of violent crimes during extended criminal careers. Furthermore, most had committed crimes in several crime categories and recidivated repeatedly.

Five trajectory groups of criminal behaviour were identified. Of these, four fulfilled the criteria for persistence, which encompassed two-thirds of the cohort, while one trajectory group showed desistance from criminal behaviours. Significant differences in criminal behaviour were evident across the trajectory groups in all analysed aspects, with the persistent trajectory groups committing more total and violent crimes, including higher levels of aggravated and homicidal violence, but having fewer sex crime convictions, alongside a wider range of criminal behaviours compared with the desisting trajectory group.

The persistent trajectory groups displayed higher levels of early-life risk factors, particularly conduct problems and experiences of out-of-home placements, than did the desisting group. However, no difference was observed concerning neurocognitive ability and NDDs among the trajectory groups.

Psychiatric morbidity (*Papers II & III*)

Prospectively, the DAABS cohort displayed heightened psychiatric HCU compared with the comparison group. However, the psychiatric HCU in the DAABS cohort predominantly involved inpatient visits, whereas outpatient care was the norm in the comparison group. Lower levels of psychiatric HCU were found in the desisting trajectory group than in the persistent trajectory groups.

The cumulative incidence of psychiatric diagnoses was significantly higher in the DAABS cohort than the comparison group, largely represented by SUDs, ADHD,

anxiety disorders, and psychotic disorders. Moreover, the odds of psychotropic drug dispensing, particularly of drugs used in treating SUDs, antipsychotics, and psychostimulants, was notably higher among DAABS participants than the comparison group, with further increased levels in the persistent offending trajectory groups compared with the desisting trajectory group.

In exploring risk factors for prospective psychiatric HCU in the DAABS cohort, multivariable analyses indicated that the presence of baseline anxiety disorders, prior psychiatric HCU, foster home placement, and higher PCL-R scores were associated with increased psychiatric HCU among the DAABS cohort, while higher GAI scores were linked to reduced HCU. When introducing offending trajectory groups, all associations except prior psychiatric HCU remained significant, and assignment to three of the four persistent trajectory groups was significantly associated with increased psychiatric HCU.

In the DAABS cohort, one-quarter had a background of SMIy at the baseline assessment. In multivariable analyses, estimating the total effect of categories of early-life risk factors on the development of SMIy, a history of bully victimization, special educational support, and childhood-onset conduct disorder were found to have a statistically significant effect, moderate in size, on the outcome.

Prospectively, individuals with SMIy in the DAABS cohort exhibited higher crime rates, including violent crimes and reimprisonments, than did those without SMIy. Furthermore, somatic inpatient HCU was notably higher in participants with SMIy, but there were no significant differences in outpatient psychiatric and somatic HCU. Moreover, while the incidence rate for total inpatient psychiatric HCU did not differ significantly, a higher proportion of individuals with SMIy had been admitted to a psychiatric hospital compared with those without SMIy. During the follow-up period, the SMIy group had elevated cumulative incidence rates of personality disorders, SUDs, and psychotic disorders compared with others in the DAABS cohort, but dispensed daily doses of psychotropic prescription drugs did not significantly differ between the SMIy and other groups.

Somatic morbidity (*Paper IV*)

The DAABS cohort displayed higher somatic inpatient but lower outpatient HCU than did the comparison group. Despite a low prevalence of ACSCs in both groups, the DAABS cohort exhibited increased odds of presenting a vaccine-preventable condition. Reduced HCU due to accidents but increased HCU related to violence victimization and self-harm, primarily self-harm by poisoning, were evident in the DAABS cohort. An elevated incidence rate of defined daily doses of drugs affecting the nervous system was observed in the DAABS group, while reduced rates were noted for drugs affecting the alimentary tract, metabolism, blood-forming organs,

and skin compared with the comparison group. In studying risk factors with somatic inpatient HCU, low educational attainment, a history of being placed in a foster home, and assignment to a persistent offending trajectory group were associated the outcome in a final multivariable model.

Mortality (*Paper IV*)

Being a DAABS participant was associated with a substantially increased risk of all-cause mortality. During the approximately six years of follow-up, 18 participants, i.e., 7%, of the cohort had died. In contrast, in the comparison group, 0.5% died during the same period.

Discussion

> *In theory, criminal law applies to all. In practice, criminal law is directed primarily at … young men. If one looks at prison populations, the focus is still on socially disadvantaged men … It was previously a question of poor, unemployed, alcohol dependent, and vagrant property offenders. Today it is poor, unemployed, alcohol and drug dependent, homeless, violent, sex, and drug offenders. (von Hofer, 2011, p. 246)*

Criminal behaviour and offending trajectories (*Paper I*)

First, life course criminal behaviour in the DAABS cohort was described and compared with that in the matched general population comparison group. During the 13-year ambidirectional study period, from the age of criminal responsibility to the average age of 28 (*SD* = 2.3 years), participants had committed an average of 32.8 crimes (*SD* = 30.5). This rate is lower than what has been described in the most criminally active groups (Dalteg & Levander, 1998), yet it exceeds the rates found in many other enriched cohorts and in individuals on the LCP path (Jolliffe et al., 2017a). Notably, the DAABS cohort committed crimes at an increased rate of 27 (95% CI 25.9 – 27.4) compared with the comparison group (*M* = 1.2, *SD* = 6.1) during the studied period. Among members of the comparison group, fewer than 1% (*n* = 77) had a criminal history similar to that of the DAABS cohort, i.e. convicted of a violent or sex crime and experienced imprisonment by baseline. This makes the DAABS cohort representative of a very small fraction of the young adult male population, but one that contributes substantially to the overall crime burden, mirroring previous research (Elonheimo et al., 2014; Falk et al., 2014; Martinez et al., 2017, Vaughn et al., 2011).

Five offending trajectory groups were identified from age 15 to 29 (Jolliffe et al., 2017a; Piquero, 2008). One group, representing about a third of the cohort, exhibited a desisting pattern, while the remaining four groups persisted in registered offending from adolescence and then the DAABS baseline assessment, into later adulthood, suggesting the occurrence of paths similar to those of the two antisocial groups proposed by Moffitt (1993). The present study found that almost a quarter of the total convicted crimes represented violent crimes in the DAABS cohort, which is high in comparison with offenders in general who display violence in their criminal

careers (Liu et al., 2011; Whitten et al., 2017; Piquero, Jennings & Barnes, 2012). Still, members of the DAABS cohort engaged in a variety of crimes with a significant portion of their offences being non-violent. Total recidivism rates remained high across both violent and nonviolent categories (Loeber et al., 1993; Piquero, Jennings & Barnes, 2012; Yukhnenko et al., 2023). Many in the cohort exhibited early violent criminal behaviour and multiple violent convictions during the study period, supporting the notion that early involvement in violent crime is associated with extended criminal careers and high offending rates (Blokland et al., 2005; DeLisi, 2006; Farrington, 2019b; Piquero et al., 2004). Most trajectory groups displayed a trend of declining yearly offending rates, although, the patterns in the persistent trajectory groups suggested continued and significant offending rates into their 30s (Blokland et al., 2005; Farrington, 2019b; Jolliffe et al., 2017a; Sampson & Laub, 2003).

Last, in exploring early-life risk factors across offending trajectories, high levels of early-life risk factors were found across all the trajectory groups. These levels exceeded what is typically reported in persistent trajectory groups (Jolliffe et al., 2017b). Several differences were noted between persisting and desisting groups, particularly concerning conduct problems, with persistent trajectory groups displaying a history of more symptoms of conduct disorder and earlier onset of criminal behaviour and substance use, aligning with research linking early-onset conduct problems to adult criminal behaviour (Dalteg & Levander, 1998; Fergusson et al., 2005; Kretschmer et al., 2014; Lichtenstein et al., 2020; Loeber et al., 1993; Moffitt, 2018). These results were accompanied by high rates of out-of-home placements in the persisting trajectory groups (Brännström et al., 2024; Yang et al., 2021). The levels of NDDs were notably elevated across the trajectory groups. However, in the absence of analyses of the co-occurrence of the onset and severity of background conduct problems, no significant differences in NDDs could be identified across the trajectory groups (Beauchaine et al., 2017; Billstedt et al., 2017; Hawes et al., 2023; Hofvander et al., 2019; Lilienfeld & Waldman, 1990; Moffitt, 1993).

Psychiatric morbidity and healthcare use (*Paper II*)

In the DAABS cohort, levels of psychiatric healthcare were elevated, primarily due to the higher rate of inpatient psychiatric care use, compared with matched general-population individuals. Over a six- to seven-year period, only 4% of the comparison group had used any inpatient psychiatric care, versus 30% of the DAABS cohort, mirroring the violent offenders in Timonen and colleagues' (2000) birth cohort study. Despite this increase in psychiatric inpatient HCU, the DAABS cohort accessed less outpatient psychiatric care. The DAABS cohort's lower overall HCU likely does not reflect reduced healthcare needs but may result from various barriers

to accessing care often reported in offender populations (Binswanger et al., 2011; Fazel & Baillargeon, 2011; Howerton et al., 2007; Morgan et al., 2007).

In the DAABS cohort, the cumulative incidence of psychiatric disorders diagnosed in contact with specialized healthcare, was generally higher compared with the comparison group, as was the dispensation of all categories of prescription psychotropic drugs. This mirrors the established findings of extensive and serious psychiatric health burdens in offender populations (Bebbington et al., 2021; Bukten et al., 2024; Fazel et al., 2016; Hassan et al., 2014), though the levels were markedly lower than what was found at the DAABS baseline (Billstedt et al., 2017; Hofvander et al., 2017). The high prescription rates of psychotropic drugs suggest serious psychiatric morbidity but the composite picture indicates a reliance on primary care for mental health concerns. The prescription of drugs, such as psychostimulants and medications for SUDs, was previously associated with a reduction in recidivism rates (Chang et al., 2016; Lichtenstein et al., 2012; Russolillo et al., 2017); however, these drugs were prescribed at lower rates than indicated by the needs-level found in previous DAABS baseline studies (Billstedt et al., 2017; Hofvander et al., 2017). On the other hand, 19% of the DAABS cohort had been prescribed antipsychotics prospectively, notably higher than the 8% documented with a psychotic disorder in *Paper II* as well as the 10% receiving antipsychotics before the DAABS baseline (Hofvander et al., 2017), further signalling significant psychiatric morbidity in the cohort.

The DAABS participants assigned to a persistent trajectory group in *Paper I* displayed increased incidences rates of specialist HCU than did desisters (Piquero et al., 2011; Rivenbark et al., 2018). The desisting trajectory group used almost no healthcare prospectively. This could suggest either a multitude of barriers, including their own strong reluctance to seek healthcare, or lower healthcare needs than those of the general population, with the former being more probable (Fazel & Baillargeon, 2011; Howerton et al., 2007; Rivenbark et al., 2018). Additionally, the increased psychotropic prescription drug use in the persisting trajectory groups than the desisting group reinforced this possibility, while also suggesting elevated psychiatric morbidity in the persisting trajectory groups (Piquero et al., 2011; Rissanen et al., 2022; Rivenbark et al., 2018; Skinner & Farrington, 2023).

Several baseline risk factors, including psychiatric and socioeconomic backgrounds, adversities and trauma, intellectual functioning, and psychopathic traits, univariably predicted psychiatric HCU in the DAABS cohort. Notably, baseline psychotic disorders did not predict future psychiatric HCU in the cohort. The final multivariable model found that anxiety disorders, a history of foster home placement, lower intellectual functioning, higher psychopathic traits, and assignment to a persistent offending trajectory increased prospective psychiatric HCU. Anxiety disorders, particularly prevalent in those persisting in crime (Reising et al., 2019), pose challenges in post-release reintegration and recovery from SUDs. Foster home placements, previously linked to psychiatric morbidity (Engler et al.,

2022), significantly predicted psychiatric HCU, in contrast to institutional placements, which have previously been linked to psychiatric problems (Li et al., 2019; Sariaslan et al., 2022). The GAI score affected the incidence of psychiatric HCU negatively. This complements Gale and colleagues (2010) finding from military conscripts that lower intellectual functioning elevated the risk of psychiatric inpatient HCU in young adulthood. Contrary to a previous study (Schrader et al., 2018) each additional point on the PCL-R was here found to raise the likelihood of psychiatric HCU. Participants in *Paper I* assigned to a persistent offending trajectory group displayed a higher incidence rate of psychiatric HCU than did those in the desisting group, according to both univariable and multivariable analyses. This association between persistent criminal behaviour and psychiatric HCU mirrors previous findings (Piquero et al., 2011; Reising et al., 2019; Rivenbark et al., 2018) and further suggests an association between persistent offending and serious psychiatric needs.

Development of serious mental illness and its outcomes (*Paper III*)

The baseline prevalence of 25% with SMIy is clearly alarming, yet largely aligns with prior research on SMIs in offenders (Baillargeon et al., 2009; Falk et al., 2014; Favril et al., 2022; Fazel et al., 2016; Fazel & Seewald, 2012; *The Lancet*, 2009; Vaugh et al., 2011). Furthermore, SMIy was univariably associated with early-onset antisocial behaviours, victimization (i.e., domestic violence and bullying), special educational support, as well as early-onset alcohol use. In multivariable analyses, estimating the total effect of early-life risk factors on the development of SMIy, special educational support, bullying, and childhood-onset conduct disorder were associated with the outcome. But contrary to previous research (Khoury et al., 2023; Nourredine et al., 2021; Selten et al., 2015), no association between NDDs and SMIy was established in the DAABS cohort. A substantial body of evidence links bully victimization to later severe psychopathologies (Arsenault, 2018; Kelleher et al., 2013), including conduct disorder (Tesli et al., 2024). The results highlight the importance, as found in general population studies, of early-onset conduct disorder in a cohort convicted of violent offending in young adulthood for later serious psychopathology (Kim-Cohen et al., 2003; Lichtenstein et al., 2020; Moffitt, 2018), independent of NDDs and other investigated early-life risk factors.

Following baseline assessments participants with SMIy had worse outcomes. The incidence rate of violent crime recidivism was significantly greater in those with versus those without SMIy. Although violent crime perpetration is rare in individuals with SMIs (Fazel & Grann, 2006), SMIs are associated with a substantially increased risk of violence (Whiting et al., 2021), which the present

study underscored in a violent offender cohort. Substance-related morbidity was particularly prominent in the SMIy group (Baillargeon et al., 2010; Fazel et al., 2016). Concurrent substance abuse is a likely mediator of the increased recidivism rates (Baillargeon et al., 2010), but was not investigated here. Notably, almost half of those with SMIy utilized psychiatric inpatient care, yet their outpatient HCU was minimal. Similarly, the SMIy group used more somatic inpatient but not outpatient care. Ensuring medical care continuity, especially in outpatient services, remains a challenge (Hopkin et al., 2018; Kouyoumdjian et al., 2015). Furthermore, the low dispensing of psychotropics for SMI suggests underutilization of treatments that could reduce criminal behaviour (Chang et al., 2016; Lichtenstein et al., 2012; Russolillo et al., 2017). Overall, the results indicated that conventional outreach methods are inadequate for violent offenders with SMI. In effect, prisons may to some degree serve as an imposed alternative to psychiatric HCU for individuals with serious psychiatric needs (Baillargeon et al., 2009; Chow & Priebe, 2016; Jüriloo et al., 2017; Sisti et al., 2015).

Somatic morbidity and healthcare use (*Paper IV*)

The DAABS cohort exhibited lower usage of prospective outpatient somatic healthcare but significantly higher inpatient HCU. These findings diverge from earlier studies, which have indicated higher HCU in prisoners (Kouyoumdjian, Cheng, Fung, Orkin, McIsaac et al., 2018: Tuinema et al., 2020). Participants' relatively young age (Shepherd et al., 2004; Skinner et al., 2020) and barriers to care (Howerton et al., 2007) aid the understanding of this result. Additionally, previous research has indicated that violent offenders more often seek somatic healthcare due to acute conditions than does the general population (Timonen et al., 2000).

The DAABS cohort exhibited elevated cumulative incidence rates of vaccine-preventable ACSCs (i.e., influenza, pneumonia) – noteworthy, in light of Sweden's high vaccination uptake. This could be associated with backgrounds in marginalized families, a lacking of parental responsibility related to basic paediatric care, or late immigration from countries without the same vaccine coverage. Furthermore, the decreased incidence of accident-related injuries but higher incidence of self-harm and violent injuries compared with the comparison group should likely not be taken as indicative of a lower risk of accidents (O'Rourke et al., 2016; Skinner et al., 2020; Timonen et al., 2000), but rather reinforce the atypical HCU pattern. However, the elevated levels of defined daily doses of psychotropics reflects previous reports (Hassan et al., 2014; *Paper II*), while the prescription rates of drugs used for somatic disorders does not mirror previously described elevated somatic morbidity levels in offender groups (Fazel & Baillargeon, 2011; Reingle et al., 2014; Skinner et al., 2020; Skinner & Farrington, 2023).

Low educational attainment decreased the incidence rate of somatic inpatient HCU, while foster home placement and assignment to a persistent criminal trajectory increased it. This largely aligns with past research on morbidity and HCU in those with experience of out-of-home care, although the finding that institutional placement had no association with the outcome diverged (Brännström et al., 2017; Engler et al., 2022; Gypen et al., 2017, Sariaslan et al., 2022; Yoon et al., 2018). This suggests that violent offenders previously placed in foster homes not only display increased morbidity rates, but may also develop skills and attitudes linked to health-seeking behaviour compared with young violent offenders with experience of institutional placement. The association of persistent offending with somatic inpatient HCU aligns with previous findings (Rivenbark et al., 2018; Skinner et al., 2020).

Mortality (*Paper IV*)

The DAABS cohort exhibited substantially higher mortality than that of the comparison group. Increased mortality rates are commonly found in prisoners (Aldridge et al., 2020; Fazel, Ramesh & Hawton, 2017; Fazel & Baillargeon, 2011). However, the overall mortality rates in the DAABS cohort are comparable to those of persistent offenders (Fazel & Baillargeon, 2011) and to those found during the high-risk post-release period in an ex-prisoner sample the two weeks following release (Binswanger et al., 2007). This indicates an elevation of risk in young violent offenders compared with prisoners and ex-prisoners in general (Bukten & Stavseth, 2021; Fazel & Baillargeon, 2011). In line with previous studies, a significant proportion of deaths could be attributed to external causes such as accidents or overdose-related events (Aldridge et al., 2020; Siponen et al., 2023; van Dooren et al., 2013).

Strengths

In DAABS, skilled clinicians used gold-standard instruments and acquired full psychiatric diagnostic work-ups in a cohort that represents one of the more severe segments of violent offenders. That 266 offenders completed a full day of data collection, stresses the comprehensive nature of the DAABS methodology. This rich phenotypic data lends significant clinical value to this dissertation's studies, resulting in findings that systematic reviews may fail to capture in incarcerated individuals. As presented here, DAABS is one of the most comprehensive longitudinal clinical studies of a prison population in Scandinavia. The prospective naturalistic register-based component has offered a detailed, multi-faceted view of

the study population and of the interplay between criminal behaviour, health, and healthcare services over time. With inclusion of a large matched general population group enhanced the study's ability to contextualize the properties of the prison cohort.

Limitations

In selecting male participants who were imprisoned for violent and/or 'hands-on' sexual crimes between 18 and 25 years of age, DAABS has limited the generalisability of its results. Consequently, extending these findings to other offender groups and in contexts beyond the Nordic countries requires thorough consideration. Additionally, this dissertation did not distinguish between violent offenders with and without sex crime convictions. This reflects an intentional choice but also highlights that group-specific associations may have been masked. The study focused exclusively on male offenders due to the insufficient number of women incarcerated for violent offences in the recruitment area for meaningful statistical analysis, further limiting the cross-gender validity.

The design of the studies, i.e. including only cases and no controls at baseline, did not allow causality to be investigated. Furthermore, the study was limited by not considering genetic influences. Ideally, the aims would be explored through a genetically informed prospective high-risk cohort study, accompanied by a substantial general population control group and featuring multiple measurement points with the same clinical weight that DAABS has provided. Using a matched register-based general population for comparison is a positive step. However, contrasting the DAABS cohort with (register-based) at-risk groups or a total population comparison group could better highlight the factors influencing violent offending, its development, and outcomes.

The validity of the retrospective information could have been influenced by the partial dependence on self-reported data, potentially introducing biases such as underreporting of disorders. It is uncertain whether recall or social desirability biases might have influenced the reporting accuracy, potentially leading to both under- and over-reporting of background and risk factors. This limitation was mitigated by utilising gold-standard assessment tools and file review, conducted by experienced clinicians in accordance with the LEAD principle (Spitzer, 1983).

The sample size introduced statistical uncertainty, especially in conducting within-group analyses, while the use of multiple statistical tests increased the risk of Type I errors. Several confounders could have influenced the exploratory regression analyses. Potential confounders include, but are not limited to, the severity of psychopathology, comorbidities, as well as social and demographic variables. Furthermore, ongoing treatments might mediate effects, for example, adequately

treated ADHD might decrease the risk of developing SMIy or later adverse outcomes (e.g. Lichtenstein et al., 2012; Faranoe et al., 2024). No mediation or moderation analyses were conducted, for example, for SUDs. The lack of established associations between NDDs, persistent offending, and SMIy in the DAABS cohort introduces the question as to whether the clinical picture of disruptive behaviour disorders' or other psychiatric disorders' severities or courses may be obscuring the impact of NDDs on the investigated outcomes.

Register-based data sources do not capture the full spectrum of criminal behaviours or morbidity. Instead, they represent information gathered during services interactions. In the case of healthcare this may be affected by individual tendencies to seek healthcare, healthcare accessibility, and a physician's likelihood of seeing and/or admitting a patient. In the general population, it is expected that healthcare services will be utilized when a person is in need of care. However, in divergent groups, such as violent offenders with early imprisonments, it seems that one cannot rely on such interactions occurring as expected (Howerton et al., 2007; Morgan et al., 2007). Furthermore, official records of criminal behaviours often present discrepancies when compared with self-reported data (Moffitt et al., 2002). Thus, the NCR captures a subsection of criminal behaviour, with a bias towards more severe criminal acts. However, the concordance between official and self-reported data sources is often acceptable (*Paper I*; Piquero et al., 2014). Similarly, psychiatric morbidity data from the NPR might not fully capture disorder prevalence, as not everyone is diagnosed, with the NPR typically capturing more severe cases (Ludvigsson et al., 2011). Studies using register-based clinical data inherently suffer from the diagnostic errors of clinicians, translation errors (i.e., mismatches between register data and patient charts), as well as coding errors, in which incorrect diagnostic codes are inputted despite otherwise correct diagnoses (Ludvigsson et al., 2011). Furthermore, the absence of information on interactions with primary healthcare in the NPR and valid information on compulsory care decisions further limits our understanding of the offenders' interactions with healthcare. Register-based data for non-native Swedes are inherently delayed, potentially affecting the study's retrospective analyses. Furthermore, the study did not examine the influence of immigration status, which often is linked to lower socioeconomic status. As the study population did not interact with community services as expected, it is recommended that register-based data be used with caution and thoroughly contextualized when studying the health of adult populations with pronounced antisocial behaviours, especially in the study of smaller, as in the case of cohorts.

The restricted study period does not capture the entire duration of expected criminal careers. Thus, individuals classified in certain trajectory groups might exhibit different subsequent behaviours. No claims of 'true' desistance were made, as highly extended follow-up periods are needed to determine cessation from crime in serious offender groups (Farrington, 2019b; Sampson & Laub, 2003; Sivertsson et al., 2024). Moreover, information regarding the duration and timing of sentences

was limited to decisions from the district court level, without specific details on the actual periods of incarceration for the participants (Piquero et al., 2001).

Summary discussion and clinical implications

This dissertation provides evidence of broad and severe psychiatric morbidity as well as a heavy burden of early-life risk factors in violent offenders imprisoned during young adulthood. The results suggest that the medical continuity is low in this group, especially between inpatient and outpatient care. Despite signs of overwhelming healthcare needs, the DAABS cohort interacted with care predominantly in the most acute phases, i.e. through inpatient care. Enhanced outpatient programmes that engage this offender group in medically appropriate HCU could reduce the burden and improve outcomes. While systematic reviews of relevant interventions have been conducted (e.g., Hopkin et al., 2018; Kouyoumdjian et al., 2015), studied interventions have generally displayed low effectiveness and need refinement. The gap between suggested psychiatric needs and HCU highlights the considerable challenges of meeting violent offenders' psychiatric needs though current community services. Furthermore, while the DAABS cohort used less specialized psychiatric outpatient care, they received more psychotropics compared with the general population, suggesting primary care as the main treatment provider for their psychiatric disorders. Previous research have identified utilization of primary healthcare for those released from prison with psychiatric disorders as key service provider in reduction the risk of reimprisonment, emphasized by the finding that that every month that elapsed between prison release and HCU increased risk of reincarceration by 4% (Palis et al., 2022). Consequently, primary care needs primary-level tools to address the group's issues (SOU 2021:6) and may when indicated serve as an important link in facilitating long-term engagements with specialized care.

It is important to note that what are described as risk factors for HCU may be considered, either separately or simultaneously, as proxies for psychiatric morbidity as well as factors that *facilitate* healthcare-seeking behaviours. Consequently, individuals not presenting the here-identified risk factors may require further interventions designed to enhance their healthcare-seeking behaviours. Increasing health literacy through psychoeducation for offenders, for example in contact with criminal justice, could have minor mitigating effects on structural marginalization.

Experiences inside prison matter (Dirkzwager & Nieuwbeerta, 2018; Kriminalvården, 2014; Papalia et al., 2019). Prison presents an opportunity to identify and treat individuals who otherwise might have been difficult to engage in treatment in the community. The results underscored the importance of in-prison routine screening tools to identify psychiatric disorders, comorbidities, and specific

risk factors, including brief developmental histories, and applying this information in planning rehabilitative interventions and in to identifying those in need of further assessments or intensive treatment, prioritizing the identification of individuals with a history of SMIy.

A public health perspective on aggression and antisocial behaviours emphasizes their preventability (Krug et al., 2002). Early identification and outreach to at-risk individuals are vital for achieving healthcare equity – there is need to reach vulnerable individuals and their families at an early age (Sampaio et al., 2024; Skeem et al., 2014; Tremblay et al., 2018), but this might be complicated by frequently co-occurring social adversities (Beaver, 2013; Besemer et al., 2017; Frisell et al., 2011; Wallinius et al., 2016). The early identification and treatment of disruptive behaviour disorders is key and earlier diagnoses has been found to decrease the risk of adverse outcomes such as criminal behaviour (Campbell et al., 2019). Furthermore, interventions should be prioritized for those most in need. The current findings suggests that several early-life risk factors, i.e., early school problems or low educational attainments, a history of placement in out-of-home care, early-onset conduct disorder or a broad spectrum of its symptoms, including self-reported early-onset of criminal behaviour and substance use, are indicative of increased need of interventions. Additionally, early-life risk factors associated with the development of SMIy, i.e., bully victimization, recipient of special education support, and early-onset conduct disorder, particularly among those with disruptive behaviour disorders, should be areas of focus. These finding could serve as a resource for schools, social, services, child and adolescent psychiatric services, and the families involved. In this context, early implementation of effective preventive interventions against early-onset antisocial behaviours, including bullying, seem especially important (Arsenault, 2018; Waddell et al., 2018). Special educational support may serve as a valuable indicator of individuals at risk of serious psychiatric conditions. Furthermore, foster homes might serve as a venue of certain importance in implementing interventions. In this psychiatrically burdened group (Engler et al., 2022), foster home placements have the potential to make substantial contributions in improving the developmental course, for example, by facilitating skills or attitudes related to healthcare-seeking behaviour.

The results indicated no variations in NDDs, such as ADHD, across trajectory groups nor significant associations with the development of SMIy. As mentioned, this might be due to methodological limitations, yet it could suggest that these conditions play a minor role in these developmental courses relative to other co-occurring factors. Nevertheless, this does not diminish the importance of NDDs in this context. Rather, impulsivity and hyperactivity are almost axiomatic contributors in the common developmental trajectories towards persistent antisocial behaviours (Beauchaine et al., 2017; Moffitt, 1993; Wakschlag et al., 2018) and ADHD prevalent in prisoners (Billstedt et al., 2017; Fazel & Favril, 2023; Young et al., 2015). This knowledge emphasize their importance as well as the early diagnosis

and subsequent management, for example, within prison settings. However, early-onset and diversity of conduct disorder symptoms may provide a more distinct differentiation of within-group needs (e.g., Farrington et al., 2013; Lahey et al., 2005). Therefore, relevant services should extend their assessments beyond ADHD, to include multidimensional approach to assessments of disruptive behaviour disorders (Carter et al., 2013; Krueger et al., 2021), and apply this in their subsequent treatments. However, large national variations in the healthcare-registered prevalence of disruptive behaviour disorders and the evidently lower registered than estimated prevalence (Bachmann et al., 2024) suggests a risk of service providers underestimating the importance and utility of these diagnoses. Reinvigorated attention to disruptive behaviour disorders, and their divergent progressions during development (Beauchaine et al., 2017; GBD 2019 Mental Disorders Collaborators, 2022; Kim-Cohen et al., 2003; Moffitt, 1993) could lead to improved outcomes through early identification and interventions.

The found levels of psychiatric morbidity indicate that, in planning individual care for psychiatric concerns, questions eliciting history of aggressive and antisocial behaviours and their consequences should be standard in the screening phase. Targeted in-depth assessments in adults could map the development and pattern of antisocial behaviours and criminal justice involvements, differentiating between developmental trajectories (e.g., Loeber et al., 1993; Moffitt, 1993), in addition to assessment of standard risk factors, with the aim of improving the care plan and outcomes rather than just being utilized to assess risks. Cautionary, qualitative studies indicate that male offenders' reluctance to seek psychiatric care stems from fear of stigma, system mistrust, and past negative experiences (Howerton et al., 2007) and have suggested that an overemphasis on criminal history can lead to the overlooking of psychiatric disorders and needs, for example, in patients with forensic backgrounds in community HCU (Møllerhøj et al., 2016). Thus, these assessments require psychiatric care staff to skilfully identify risk factors, comprehend their impact on treatment, and respond empathetically. Furthermore, the rising number of new prisoners with psychiatric disorders and comorbid conditions, such as SUDs, as those found in the DAABS cohort underscores the urgent need for effective treatments for inmates with complex mental health needs (Bukten et al., 2024). Effective interventions require significant resources across remand, prison, and probation services, especially amidst a growing prison population (Lardén, 2023). However, deviating from these efforts could result in significant negative impacts on the affected and the public alike. Furthermore, effective short- and long-term interventions for violent offenders requires collaboration across multiple sectors – inside and outside, before, during, and after imprisonment. Collaboration is needed among the criminal justice system, healthcare services, and local community services, and often also the affected person's social network and peers to address these interconnected issues comprehensively. Perhaps especially pressing are long-term solutions for offenders with SMIs, in prison as well as in the community (Baillargeon et al., 2010; Brooker et al., 2023; Hailemariam et

al., 2024; Hopkin et al., 2018). Current approaches fail to engage violent offenders with SMIy in effective long-term psychiatric interventions. *Paper III* indicated the underutilization of prescription psychotropics for SMIy, marking their low use or continuity in treatments with the potential to improve health and reduce both recidivism and mortality (Lichtenstein et al., 2012; Chang et al., 2016; Li et al., 2024). Transitions between prison and community should include the establishment of lasting links with psychiatric outpatient care including interventions tackling factors that contribute to criminal behaviour. The elevated prevalence of SMI in the cohort and adverse outcomes suggests a need for alternatives to traditional prison sentences for patients with SMI (Jüriloo et al., 2017).

If reducing recidivism is the preferred outcome of public policies, punitive measures or their reform may not be the most effective strategy (Kazemian & Walker, 2018; von Hofer, 2011). Retribution (i.e. harm) as an outcome not only poses risks to individual health (Massoglia & Pridemore, 2015) but also incurs significant costs (von Hofer, 2011; Wermink, Been et al., 2023). This dissertation highlights that healthcare, particularly psychiatric care, is likely is underutilized by criminal-justice-involved individuals in need and has the potential to mitigate certain adverse outcomes, such as criminal behaviour, morbidity, and mortality, in violent offenders. Addressing these issues require change. Considering the adverse outcomes in this violent offender cohort with a high prevalence of psychiatric disorders and a background of disadvantages, it is tempting to argue for the redirection of funds from the criminal justice system to healthcare, education, and social welfare, addressing some, of many other, causes of crime (Quetelet, 1842, as cited in von Hofer, 2011). However, any change should be preceded by, or carried out alongside, thorough scientific evaluations assessing its consequences.

Future research and directions[1]

A key direction for future research involves the continued description and exploration of large cohorts of enriched offender populations. In-group comparisons as well as comparisons with the general population may advance our understanding of differences among the paths of criminal behaviour, HCU, and morbidity over the life course. Sensitivity to the timing and length of sanctions and the severity of psychopathology would improve studies. Furthermore, few studies have considered the cumulative excess cost related to crime and violence (Brå, 2017; Waters et al.,

[1] Currently, an additional wave of register-based follow-up has been initiated within DAABS. The participants are being followed through similar registers, adding information from the SPPS and the Board of Forensic Medicine, until the end of 2022. If you are a researcher in the field with skills and means to conduct relevant research, contact me or the principal investigators Björn Hofvander and Eva Billstedt for further information. There is much more to be learned from DAABS – this is a call for interdisciplinary collaboration.

2005). Large-scale studies exploring the long-term interplay between out-of-home placements, criminal behaviour, SMIs, and later HCU are relevant. Interdisciplinary research could focus on improving evidence-based preventative measures and interventions targeting psychiatric and criminogenic needs, concurrently addressing the development of antisocial behaviour, violence, and comorbidities (Chang et al., 2016; Hailemariam et al., 2024; Koehler et al., 2013; Papalia et al., 2019; Skeem et al., 2014; Yoon et al., 2017). Interventions potential effects on medical continuity, especially during the transition from prison to community, are relevant (Hopkin et al., 2018; Kouyoumdjian et al., 2015).

Additional qualitative research regarding HCU patterns, focusing on potential barriers and facilitators of healthcare-seeking behaviour, is called for. Exploring the shift from frequent engagement with psychiatric services in childhood and adolescence to decreased interactions in young adulthood could also benefit from qualitative research (Hofvander et al., 2017, Howerton et al., 2007; *Paper II*), focusing on the impact of relationships with specialist healthcare providers (Edge et al., 2020) during the transitions between incarceration and community (Binswanger et al., 2011).

Further investigation of the genetics and heritability of disruptive behaviour disorders, their risk factors and consequences, including in serious offender groups, may help pave the way for early interventions and prevention.

Furthermore, the development, outcomes, and treatment of SMIs in antisocial, high-risk populations merit further attention. Investigating the causes of the increasing prevalence of SMIs in prison populations in order to address the societal challenges posed by this group is suggested. Innovative humane person-centred approaches that transcend the traditional dichotomy between outpatient and inpatient psychiatric care for patients with SMI are called for (Fovet et al., 2023).

Somatic disease in emerging adulthood as well as its progression into later adulthood and old age should be further investigated (Langevin et al., 2022; Skinner & Farrington, 2023; Solares et al., 2020). Furthermore, gaining insight into Swedish primary care's interventions, beyond drug prescriptions, and their effects on this group is needed. In light of the mortality rates, further dynamic and clinically relevant individual and contextual risk factors should be identified to aid their amelioration (e.g. Borschmann et al., 2020).

Substantial policy changes such as the concurrent reformation of psychiatric care (Fakhoury & Priebe, 2002) and the SPPS (Kriminalvården, 2022), should be closely evaluated, examining their effects on health, and recidivism, particularly in the young with SMIs. Expansion of the prison system could lead to changes that further worsen the conditions for those with SMIs. However, this could also present an opportunity to implement reforms that could significantly improve their conditions. Nevertheless, any such changes should be systematically evaluated.

Conclusions

This dissertation has offered a comprehensive analysis of violent offenders, focusing on criminal behaviour, morbidity, and mortality. The sampled cohort represents an enriched antisocial population, constituting less than 1% of the general population yet responsible for a significant volume of crime. In this cohort of violent offenders, the 69% who had developed persistent criminal behaviour were more likely to have exhibited early-onset and a broad spectrum of conduct disorder symptoms. A notable proportion of the DAABS cohort has experienced clinically significant psychiatric disorders, although their HCU patterns diverged from anticipated healthcare-seeking behaviours, interacting with healthcare as inpatients rather than outpatients, and persistent offenders used healthcare at a higher rate than desisters did. Additionally, this study has pinpointed specific risk factors, such as bully victimization and early-onset conduct disorder, which can be addressed with preventive interventions aimed at mitigating the development of SMI. The clinical depiction suggests that interventions in young adulthood may arrive too late, as many have already established advanced patterns of criminal behaviour and substantial psychiatric morbidity that, in part, may drive criminal behaviour. The findings highlight that early and severe expressions of conduct disorder elevate the risk of adverse outcomes, underscoring they should be considered indicators for the prompt need of evidence-based interventions. By the average age of 28, after six years of follow-up, 7% of participants had passed away. The insights concerning HCU broadens our understanding of healthcare-related behaviours in violent offenders, which seem distinctly different from their extensive healthcare needs as suggested by their backgrounds. Moreover, tracking the true prevalence of morbidity within this population via register data poses challenges due to their atypical interactions with healthcare services.

Ensuring equitable and effective care for this group necessitates the introduction or enhancement of innovative interventions and collaborative efforts among prison, healthcare, and local municipalities. This population's low use of healthcare resources and the systemic challenges in meeting their needs may exacerbate individual conditions, leading to increased engagement with criminal justice system, distress and premature mortality.

The SPPS is amidst a largely politically driven expansion phase that creates challenges, including risks of overcrowding, prolonged waits for prison placements, and reduced access to psychological treatment programmes. Risk that might affect

prisoners with SMI most adversely. Nevertheless, this scenario also presents opportunities to improve the well-being of this group and support their well-being and individual desistance processes. Optimal care within a prison setting, tailored environments, and staff trained to manage severe psychiatric conditions in a rehabilitative spirit in collaboration with psychiatric services could improve outcomes. It is of utmost importance that the reforms effect on health and recidivism are closely monitored and evaluated. There is a pressing need for preventive strategies targeting those on a trajectory towards serious criminal behaviour from early-life, with interventions adaptable to evolving individual and societal contexts.

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Appendix

Ambulatory care sensitive conditions	ICD-10 codes
Acute	Primary diagnosis only: L03/L04 L080 L088 L88 L980 G40/G41 O15 R56 E86 K522 K528 K529 A690 K02/K06 K08 K098 K099 K12/K13 N10/N12 N136 N70 N73/N74 K250/K252 K254/K256 K260/K262 K264/K266 K270/K272 K274/K276 K280/K282 K284/K286 H66/H67 J02/J03 J06 J312 In any diagnosis field: R02
Chronic	Primary diagnosis only: I20 I240 I248 I249 J45/J46 J41/J44 J47 I110 I50 J81 E100/E108 E110/E118 E120/E128 E130/E138 E140/E148 I10 I119 D501/D509 E40/E43 E550 E643 Only when primary diagnosis in combination with J41/J44 J47 in any diagnosis field: J20
Vaccine-preventable	In any diagnosis field: A35/A37 A80 B05/B06 B161 B169 B180 B181 B26 G000 M014 In any diagnosis field and not D57 in any other diagnosis field: J09/J11 J13/J14 J153 J154 J157 J159 J168 J181 J188 J189
Psychiatric morbidity	
Major depressive disorders	F32-F39, F412
Anxiety disorders	F40-F42, F44-F48
Reaction to severe stress; adjustment disorders	F43

–Post-traumatic stress disorder	F43.1
Bipolar disorders	F30-F31
Psychotic disorders	F20-F29, F1x.5, F1x.7
–Primary psychotic disorders	F20-F29
–Substance-induced psychotic disorders	F1x.5, F1x.7
Alcohol use disorder	F10
Drug use disorders	F11-F19
Personality disorders	F60-F61
ADHD	F90
Autism	F84
Injuries	
Accident	V00/X59
Self-harm	X60/X84
Victim of violence	X85/Y09
Undetermined intent	Y10/Y34
Mortality	
Somatic disease	A00/R99
Accident	V00/X59
Suicide	X60/X84
Victim of violence	X85/Y09
Undetermined intent	Y10/Y34
Prescribed drugs	**ATC prefix**
Alimentary tract and metabolism	A
Blood and blood forming organs	B
Cardiovascular system	C
Dermatologicals	D
Gentio urinary systems and sex hormones	G
System hormonal preparations	H
Antiinfectives for systemic use	J
Antineoplastic and immunomodulating agents	L
Muscolo-skeletal systems	M
Nervous system	N
Antiparasitic products, insecticides and repellents	P
Respiratory system	R
Sensory organs	S
Various	V

Prescribed psychotropics	ATC code(s)
Drug-classified pharmaceuticals	National definition
Analgesics	N02A, N02B
Antiepileptics	N03
Antipsychotics	N05A (excluding N05AN01)
Anxiolytics	N05B
Antidepressants	N06A
Mood stabilizers	N05AN01, N03AG01, N03AX09, N03AF01, N03AF02
Psychostimulants	N06B
Drugs, alcohol use disorder	N07BB
Drugs, opioid use disorder	N07BC

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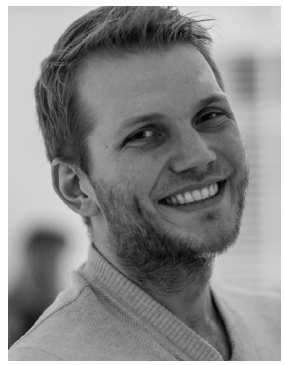
About the author



ANDRÉ TÄRNHÄLL is a licensed clinical psychologist with an interest in serious mental illnesses, psychiatric care, and the progression of antisocial behavior throughout the lifespan. He is dedicated to improving the well-being and outcomes of individuals with these problems. Currently, he works as a clinician at the Forensic Psychiatric Department in Region Skåne, providing assessment and treatment for patients in a forensic psychiatric outpatient setting. His dissertation offers a comprehensive investigation of the longitudinal outcomes of male offenders convicted of violent- and/or 'hands-on' sex crimes through the combination of clinical assessments and register-based follow-up data.

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