



Hanne Stevens  
PhD Thesis

# Crime and Mental Disorders



# **Crime and mental disorders**

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## List of papers

### Paper I

Stevens, H.; Nordentoft, M.; Agerbo, E.; Mortensen, P.B.: Dom til psykiatrisk behandling [Psychiatric treatment sentences]. *Ugeskr Laeger*. 2010 Aug 30; 172(35):2366-70.

### Paper II

Stevens, H.; Agerbo, E.; Dean, K., Nordentoft, M.; Nielsen, P.R.; Mortensen, P.B.: Offending prior to first psychiatric contact: a population-based register study. *Psychological Medicine*. 2012 Dec; 42(12): 2673-84.

### Paper III

Stevens, H.; Agerbo, E.; Dean, K.; Mortensen, P.B.; Nordentoft, M.: Reducing crime in first onset psychosis – randomized controlled trial of assertive specialized treatment versus standard care. *In press, Journal of Clinical Psychiatry*.

### Paper IV

Stevens, H.; Munk-Laursen, T.; Mortensen, P.B.; Agerbo, E.; Dean, K.: Risk of offending across the full spectrum of psychiatric disorders: a population-based longitudinal study. *In review, American Journal of Psychiatry*.





## **Introduction**

The association between crime and mental disorders has been the focus of research for many decades (Penrose 1939). The interest in this topic has grown parallel to the widespread deinstitutionalization in many Western countries, whereby mentally disordered persons are increasingly living in the community rather than in asylums (Aderibigbe 1997). The importance of this topic is undeniable – both in terms of the societal aim of reducing crime and spending resources in doing so wisely, and in terms of alleviating the individual consequences and expenses of those affected (Torrey 2011).

While most persons with mental disorders are not violent, and most violent people do not have mental disorders (Van Dorn et al. 2011), recurring high profile cases generate massive public attention and contribute to stigmatization of and prejudice against mentally disordered persons. The purpose of this thesis is to contribute to and expand the body of knowledge about crime and mental disorders and challenge some of the reigning conceptions about this association. It is my hope that the thesis will provide a sounder empirical basis for an important societal debate as well as indicating new areas for research.

In order to gain a deeper understanding of offending in mentally disordered populations, this thesis approaches the subject from different points using different quantitative methods; all of which take advantage of the unique Danish population based register data. Adopting a broad view has been a strategy to see some new patterns and perspectives and enables looking critically at the current understanding of the association. More specifically I will address the questions of whether levels of offending in mental disorders are increasing beyond what would be expected based on the population rates (Paper I); what the association looks like before and after presentation to secondary mental health services and across different diagnostic categories (Paper II & IV); and, whether improved treatment regimes in psychosis can reduce levels of offending (Paper III).

As an implication of the choice of data, the definitions of crime and mental disorder in this thesis are of a pragmatic nature, i.e. following the systems of registration. This will be evident in the subsequent sections, which contain a brief overview and definition of the host of different disorders that are covered by the term ‘mental disorder’; a section of the status of mental disorders in penal law; and a brief definition of crime/offending. The introduction concludes with a presentation of some of the existing research on the association between mental disorders and offending, which leads to the aims of the current thesis.

### ***Definition of Mental disorders***

To the extent that this thesis deals with individual disorders, rather than mental disorders as an overarching concept, the definitions are based on the International Classifications of Diseases. This system of classification is used across Europe, and like its American equivalent, the DSM-IV (American Psychiatric Association 1994), groups disorders according to similarities in regard to symptoms, prognosis, and treatment. In Denmark the 8<sup>th</sup> revision (WHO 1982) was used from 1969 to 1993, and from 1994 onwards the 10<sup>th</sup> revision (WHO 1992) has been in use. The main groups of disorders in the ICD-10 are listed in table 1.

***Table 1: Main groups of psychiatric disorders in ICD-10, Chapter V***

<b>F0</b>	Organic, including symptomatic, mental disorders <i>e.g. dementia</i>
<b>F1</b>	Mental and behavioural disorders due to psychoactive substance use
<b>F2</b>	Schizophrenia, schizotypal and delusional disorders
<b>F3</b>	Mood [affective] disorders
<b>F4</b>	Neurotic, stress-related and somatoform disorders <i>e.g. phobias, anxiety</i>
<b>F5</b>	Behavioural syndromes associated with physiological disturbances and physical factors <i>e.g. eating-, sleeping-, sexual disorders</i>
<b>F6</b>	Disorders of adult personality and behaviour
<b>F7</b>	Mental retardation
<b>F8</b>	Disorders of psychological development <i>e.g. autism</i>
<b>F9</b>	Behavioural and emotional disorders with onset usually occurring in childhood or adolescence <i>e.g. attention deficit hyperactivity disorder</i>

Source: (WHO 1992)

To varying degrees individual disorders entail abnormalities in regard to perception and cognition (e.g. psychosis), emotions and mood regulation (e.g. depression), ability to control behaviour (e.g. obsessive-compulsive disorder), and ability to relate to others as well as oneself (e.g. personality disorders) (Mullen 2008). While these factors all exist in wide variation in healthy people, symptoms must be present at a significant level of severity and persistency in order to be deemed pathological. The American Psychiatric Association gives a formal definition of mental disorders as

...a clinically significant behavioral or psychological syndrome or pattern that occurs in an individual and that is associated with present distress (e.g. a painful symptom) or disability (i.e. impairment in one or more important areas of functioning) or with a significantly increased risk of suffering death, pain, disability, or an important loss of freedom (cited in Eaton 2001, p. 50).

The term ‘disorder’ is used throughout this thesis rather than ‘illness’ or ‘disease’ since the latter two concepts imply a demonstrable pathology; i.e. a clear causal/etiological basis, which does not exist for the majority of mental disorders. Rather, the diagnoses in the classification systems are considered as non-etiological, descriptive psychopathologies. The two groups of disorders that are an exception to this, as clear causes form part of the definition, are organic brain syndromes (F0) and substance related disorders (F1) (Farmer and Jablensky 2008).

The reliance on register data in the empirical analyses means that only those who seek psychiatric treatment in secondary care are included; i.e. the symptoms are persistent and/or severe enough that the patient or his/her surroundings find treatment necessary. As some disorders are routinely dealt with in primary care and other disorders can go untreated for many years, the operational definition of mental disorder is stricter than that implied by the system of classification. The implications for the results – and the differential impact this limitation has on different disorders – are discussed toward the end of this thesis.

### *Mental disorders in penal law*

Legislation in most Western countries (Dahlin et al. 2009) takes into account that mentally ill persons cannot always be held accountable for their (criminal) actions, since a basic presupposition in law includes “free will, moral competence, and control of one’s actions at the

same time as there is wrongful intent” (Levander in Juth and Lorentzon 2010). The legal measures in different countries range from diverting mentally disordered offenders out of the criminal justice system and into treatment facilities at the time of arrest to acquitting on grounds of mental impairment or imposing special sanctions instead of regular punishment.

The Danish Penal Law (Straffeloven 2011) states:

§ 16

(1) Persons who, at the time of the act, were irresponsible on account of mental illness or a state of affairs comparable to mental illness, or who are severely mentally defective, are not punishable. Provided that the accused was temporarily in a condition of mental illness or a state of affairs comparable to mental illness on account of the consumption of alcohol or other intoxicants, he may in special circumstances be punished.

(2) Persons who, at the time of the act, were slightly mentally defective are not punishable, except in special circumstances. The same shall apply to persons in a state of affairs comparable to mental deficiency (Jensen et al. 2006: 14).

And in addition:

§ 69

Where the offender was, at the time that the punishable act was committed, in a condition resultant upon inadequate development or an impairment or disturbance of his mental abilities, although not of the character referred to in Section 16 of this Act, the court may, if considered expedient, decide upon the use of measures such as those referred to in the second sentence of Section 68 above, in lieu of punishment (Jensen et al. 2006: 23).

This corresponds to both cognitive and volitional criteria, such that punishment is not inflicted against those who do not understand what they are doing, those who do not understand the unlawfulness of their actions, and those who are unable to control their actions despite knowing them to be unlawful (Juth and Lorentzon 2010; Greve 1999: 162).

In contrast to some other countries such as the UK (Birmingham 2001) and the US (Callahan et al. 1991) where courts are able to apply rulings of “not guilty by reason of insanity”, the lack of responsibility does not keep the Danish courts from establishing guilt. But if a person is found to be not responsible according to section 16 or section 69 he/she will likely receive a sentence to treatment in lieu of usual punishment. This sanction should take into account the offender’s need

for treatment and the society's need for protection both in terms of the duration and institutional setting in which the treatment takes place, varying from one year to indefinitely and from outpatient treatment only to confinement in high security psychiatric hospitals.

Earlier versions of the penal code contained a section (70) on indefinite confinement for psychopaths justified through the assumption that punishment would not have any effect on them. The section still exists, but has since been changed and now only refers to the severity of the committed act and the dangerousness of the perpetrator without reference to any specific diagnosis (Greve 1999: 164). For reasons of legal rights, sentences to treatment are not considered in cases that would normally result in a fine; mentally disordered offenders can be fined like any other offenders, whereby high costs associated with producing psychiatric reports, prolonged trials, and subsequent administration of treatment orders are avoided in cases of petty crime (Rigsadvokaten 2007).

Translated to the diagnoses in ICD-10, section 16 is applicable to those suffering from psychotic disorders (predominantly F2) or mental retardation (F7), while section 69 in principle can be applied across the whole range of diagnoses, provided the court finds it likely that treatment will reduce the risk of recidivism (Rigsadvokaten 2007).

### ***Definition of Crime***

The terms crime and offending are used interchangeably throughout this thesis. Both terms refer to “a violation of a moral rule that has also been legally defined” (Dahlin et al. 2009: 380).

Adding a condition of unlawfulness to the normative element serves to demarcate a boundary of severity (deviance versus crime) (Christie 2000: 22-23), and, conversely, adding a condition of morality to the legal element serves to exclude the breach of those laws that are mere instrumental regulations directed at the practicalities of coordinating the increasingly complex social life (e.g. regulation of pollution, industrial safety, traffic, commercial transactions etc.) rather than enforcing a common normative standard (Downes and Rock 1998: 140). This distinction largely corresponds to the boundary between the Danish Penal Code (Straffeloven 2011) and various Special Acts – notable exceptions being the Euphoriant Act (Lov om

Euforiserende Stoffe 2008), the Special Act on Weapon and Explosives (Våbenloven 2009), and those sections of the Traffic Act (Færdselsloven 2011) dealing with impaired driving.

As an implication of the chosen definition of crime, certain forms of problem behaviour are not included. For instance, displays of overt aggression may be regarded as problematic – especially within an institutional setting – and have been the focus of some previous studies of mentally disordered populations (Steadman et al. 1998). However, it is only when escalated to the degree of threats or actual violence that this behaviour is unlawful. Conversely, acts that are in themselves considered illegal are not punishable if the perpetrator has not yet reached legal maturity (15 years) and are hence not registered, since Danish practice is for those cases to be dealt with by social services rather than the courts (Walgrave and Mehlbye 1998).

Where both the action is unlawful and the perpetrator is of suitable age there are of course instances where the act is never reported, a suspect cannot be found, or the evidence is not sufficient for conviction, and the question of whether there is bias between the committed crimes and the registered crimes arises. In general, more severe crimes, crimes with an identifiable victim, and crimes where the victim has an incentive to report (e.g. for insurance purposes) are more likely to be reported (Kyvsgaard 2003: 20). Similarly, a perpetrator's risk of detection depends on the degree of monitoring by authorities, which is higher for younger vs. older persons, males vs. females, recidivists vs. unconvicted persons, and possibly for those residing in troubled neighbourhoods along with visible minorities (Kyvsgaard 2003). It has also been suggested that there may be selection processes operating from detection to criminal charges and from criminal charges to convictions with regard to non-Danish (Holmberg and Kyvsgaard 2003) and female offenders (Wessely et al. 1994).

Of particular relevance to this thesis is the question of whether the mentally ill have the same detection rate as others and whether they receive differential treatment once they enter the criminal justice system. Given the approach by the Danish courts this issue must be assumed to apply primarily to less serious offending, where potential selection bias could go in either direction. On the one hand, some have argued that the police use their discretionary powers to divert the mentally ill to hospitals rather than press charges (Engel and Eric Silver 2001), on the

other hand, they may be more likely to be arrested for same offence than those without mental disorders (Teplin 1984).

### *Literature review*

The following overview is not an exhaustive literature review, but contains highlights and main themes regarding what is already known about the association between mental disorders and offending.

### *Psychosis and violence*

The bulk of the existing research on offending in mental disorders concentrates on the association between psychosis and violence. The relevance of this particular group of disorders is underpinned by their special status in Penal Law in Denmark and other Western countries (cf. above). While an association between psychosis and violence has been a consistent finding over the past decades of research (Monahan 1992), the strength of the association has varied considerably across individual studies. In a systematic review and meta-analysis Fazel et al. (2009a) have compared the results of 20 different studies including more than 18,000 psychotic persons and 1.7 million population controls and found a pooled crude OR of 4.0 for males and 7.9 for females. They found adjustment for socio-demographic factors to attenuate the association somewhat, and that particularly comorbid substance misuse had a large impact on the risk of violent offending. The included studies varied with respect to study design (longitudinal versus cross sectional/case-control versus nested case-control), geographical location and study period, diagnosis of case (schizophrenia and/or other psychoses), definition and measurement of violence (self-report and case notes or official records) and sample size, but none of these factors were statistically significant in trying to explain the variation in effect sizes (Fazel et al. 2009a). Although, as a general observation, small sample size, which was a feature of many of the included studies, implies lower precision in estimates and may in itself be a source of heterogeneity (Agresti and Finlay 1999: 131).

In an unselected Finnish birth cohort of more than 12,000 persons followed from birth to the age of 26, Tiihonen et al. (1997) found psychotic disorders to be associated with violent, but not non-



violent offending. In this cohort the comorbid misuse of alcohol or illegal substances was so prevalent that they were unable to obtain estimates of any elevated risk of violent offending in schizophrenia without comorbidity. Looking at a Danish birth cohort of 335,990 subjects, Brennan et al. (2000) found major mental disorders, defined as schizophrenia along with organic-, affective-, and other psychoses to be associated with elevated rates of violent offending. Once controlling for comorbid substance misuse the association disappeared in affective psychoses and for women additionally for organic psychoses, just as the association in women was moderated by socio-economic status. Also looking at a Danish birth cohort, Hodgins et al. (1996) studied violent and non-violent offending in those who had a history of psychiatric hospitalization by the age of 43 compared to those with no such history. In women, a psychiatric hospitalization was associated with a relative risk of any criminal conviction ranging from 3.1 (other mental disorders) to 11.3 (drug dependence disorders). The relative risk for men was slightly lower and in the range from 2.3 (major mental disorders) to 7.5 (drug dependence disorders) (Hodgins et al. 1996).

#### *Other mental disorders and offending*

Compared to psychotic disorders, the literature dealing with the possible association between other mental disorders and criminality is relatively scarce. In a small study of 100 felons, Small (1966) found that those who had lifelong central nervous system damage and/or brain injuries were more likely to be convicted of repeated theft than of violent or aggressive offences. More recently Grekin et al. (2001) were able to identify two distinct types of offenders with organic brain disease based on age at first arrest. Those with early convictions were often arrested before onset and showed more global and persistent patterns of offending than those who's offending started later. Apart from organic psychoses (cf. above), there doesn't seem to be any prior studies looking at offending rates in organic disorders compared to population controls.

Such a population comparison can be found for violent offending in bipolar disorder, where an elevated risk corresponding to an OR of 2.3 was found in a large Swedish study (Fazel et al. 2010). However, much of this association was driven by comorbid substance misuse, and in those subjects without comorbidity a more modest OR of 1.3 was found. Results for other types

of affective disorders are fewer and point in different directions; while there seems to be some consensus that major affective disorders are associated with a decreased risk of offending (Dean et al. 2007; Elbogen and Johnson 2009; Graz et al. 2009), this may not be true for minor affective disorders (Modestin et al. 1997).

The link between offending and antisocial personality disorder is unsurprising given the rather tautological definition, where part of the diagnosis is a “gross disparity between behaviour and prevailing social norms” (ICD-10) or “repeated acts that are grounds for arrest” (DSM-IV) (Davison and Janca 2012: 39). And while this particular type of personality disorder is thought to account for most of the relationship between offending and personality disorders, attempts have been made to link other particular types of personality disorders to particular offence types (Roberts and Coid 2010).

Recently, several studies have found ADHD to be very common in prison populations with 30-45% of male prisoners being affected (Retz et al. 2004; Young and Thome 2011). This disorder is commonly comorbid with conduct disorder in childhood, just as children with ADHD have high rates of antisocial personality disorder later in life (Retz and Rösler 2009). Again, comparisons to background populations are lacking, an endeavour which in this case is complicated by the fact that the use of the ADHD diagnosis is still undergoing major changes in many countries, whereby there is still considerable uncertainty about what the real rates in the population are (Winterstein 2012).

Finally, the misuse of alcohol and illegal substances is highly correlated with violent and non-violent offending. In Sweden, Grann and Fazel (2004) calculated the population attributable risk fraction for violent offending in substance misuse defined as a principal or secondary diagnosis from a psychiatric hospital, and found that 23% of the violent crimes could be attributed to persons with substance misuse, of which 16% were misusing alcohol and 11% were misusing other substances. Just less than 2% of the population had a hospital discharge with a principle diagnosis of substance misuse. No distinction was made between dependency, acute intoxication

or substance induced psychosis.<sup>1</sup> Substance misuse is a common comorbidity to other mental disorders, and has been shown to exacerbate the risk of offending in these groups (Elbogen and Johnson 2009; Fazel et al. 2009b).

Attempts have been made to compare the criminality in schizophrenia to that in other mental disorders. In one such study Wessely et al. (1994) compared 538 cases of schizophrenia to 538 age, gender and period matched controls admitted to psychiatric hospitals for other disorders. They found violent offending, but not other criminality, to be increased in the schizophrenic males. In females both violent and non-violent offending was found to be elevated in schizophrenia compared to other disorders (Wessely et al. 1994). The distribution of diagnoses in the control group were quite different in the two genders with depressive disorders and dementias being more common in the female controls, while the male controls were more frequently suffering from personality disorders and alcohol related disorders.

Analyzing data from the Stockholm Metropolitan cohort consisting of around 15,000 boys and girls who were born in 1953, residing in the Stockholm area in 1963 and followed to age 30, Hodgins and Janson (2002) compared criminal convictions in five groups, namely those with major mental disorders (defined as schizophrenia, bipolar disorder and major depression), alcohol or drug related disorders, mental retardation, other mental disorders, and those with no known disorders. Just shy of a third of the non-disordered males had a record of offending, which was also true for half of the males with major mental disorders, 93% of those with alcohol or drug disorders, 38% of those with other disorders and 57% of the mentally retarded. Offending rates in females were much lower but followed the same patterns as the males; 6% of the non-disordered, 16% of the mentally retarded, 19% of those with major mental disorders, 71% of those with alcohol and drug disorders and 12% of the females with other disorders had offended by age 30. Compared with the non-disordered, all groups of mental disorders had significantly elevated rates of offending, except for males with other disorders. Focusing on violent offending, the same patterns were seen, but more remarked. Compared to non-disordered,

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<sup>1</sup> Although an interesting topic for investigation, any elaboration on whether the association between crime and the use of drugs/alcohol varies with the choice of substance or the extent and character of the problem (problematic use/dependency/acute intoxication/withdrawal symptoms/induced psychosis/pathological intoxication) is beyond the scope of this thesis.

the relative risk was similar in major mental disorders and mental retardation (4.7 vs. 4.3 for males and 11.2 vs. 10.3 for females), and much greater in alcohol and drug related disorders (16.7 for males and 61.7 for females). Offending in other mental disorders did not differ significantly from the non-disordered in either gender (Hodgins and Janson 2002: 77ff).

### *Prison studies*

In a systematic review covering 62 studies in 12 different countries Fazel and Danesh (2002) charted the prevalence of psychotic disorders, personality disorders and clinical depression in incarcerated offenders. For all three types of disorders they found elevated rates compared to the background population; 4% of male and female prisoners suffered from psychotic disorders, 10% of male and 12% of female prisoners suffered from clinical depression, and 47% of male and 21% of female prisoners suffered from antisocial personality disorder. More recently, in an American study with almost 7,000 participants, Binswanger et al. (2010) reported that 44% of female and 22% of male jail inmates had any psychiatric disorder. Depressive and bipolar disorders were particularly prevalent, and especially so among women, but levels of psychotic-, posttraumatic stress-, other anxiety- and personality disorders were also considerable and consistently higher in female compared to male prisoners. In both genders more than half had problems of drug abuse or dependence (Binswanger et al. 2010). Similar results were found in a smaller Australian study, where female prisoners were found to have higher rates of both mental disorders and substance use disorders than their male counterparts. Overall prevalence was 43% for any mental disorder and 55% for any substance use disorder. In this study, psychotic, affective and anxiety disorders were included, while personality disorders were not (Butler et al. 2011).

Prison studies offer an insight in the host of various mental problems that do occur, and occur at a higher rate than in the background population, in incarcerated offenders, but the merits of these studies consist primarily of identifying the problems and treatment needs of offenders. Any causal link there may be between offending and mental disorders is difficult to address in these studies since it is not clear whether the presence of mental disorders has contributed to the person offending in the first place or whether it is rather the case that mental disorders have arisen as a

reaction to life in prison, just as the contribution from common causes cannot be addressed. Also, the various selection mechanisms, varying from country to country, diverting mentally ill persons out of normal correctional settings and into more appropriate institutions at different stages in the criminal justice process can affect the reported levels. Finally, the cross sectional design in this study type leaves it vulnerable to duration bias, also known as “the Clinician’s Illusion” (Cohen and Cohen 1984); i.e. any systematic differences in length of sentence between those with and without mental disorders can lead to over- or under-estimation of the true rates (Munkner 2004).

These issues are to some degree addressed by studies that focus on prisoners on remand, where the psychiatric interview has been administered within the first few days of the person being taken into custody, although even at this early stage the most acutely psychotic offenders have been diverted into treatment facilities. A Danish study of this kind (Andersen et al. 1996) found that within the month preceding remand, 7% of detainees met the criteria for a psychotic disorder, 10% for an affective disorder and 17% for antisocial personality disorder. In a similar English study of male remand prisoners 5% were found to have a psychotic disorder and 11% were found to have (any) personality disorder (Brooke et al. 1996). Both studies found very high rates of substance use disorders (44% in Denmark and 38% in England).

### *General population studies*

Studying general population samples rather than ones drawn from clinical settings can help overcome possible bias introduced by limiting to mental health services (i.e. risk of violence increases risk of admittance), and enables addressing the question of whether (and if so: how?) those who attend services differ from those who do not in terms of risk of violence. However, this study type has its own problems due to reliance on self-report for violence (recall bias and interviewer bias) and on lay assessment for psychiatric disorders (Swanson et al. 1990). Using data from the Epidemiologic Catchment Area study which included approximately 10,000 household sampled adult Americans, Swanson et al. (1990) examined the association with violence for schizophrenia, major depression, mania and bipolar disorder, alcohol abuse or -dependence, drug abuse or -dependence, OCD, panic disorders, and phobia. They found higher

rates of violence in all types of psychiatric disorders than those respondents who had no psychiatric disorders, although rates among those with anxiety disorders and depression were only slightly elevated. Those with schizophrenia and especially those with substance misuse disorders had substantially higher rates of violence. While the results for schizophrenia and substance misuse concur with those obtained in clinical settings, depressive disorders in clinical samples have tended to be associated with a reduced level of violence (cf. above).

In a survey of more than 8,000 people in British households Coid et al. (2006) looked at rates of self-reported violence during the past 5 years. Psychiatric morbidity was assessed by trained interviewers using screening tools, and included (any or anti-social) personality disorders, psychoses, neurotic disorders, and alcohol/drug dependence. They found all diagnostic categories to be associated with elevated levels of violence, and that anti-social personality disorders had the greatest risk of severe violence. Looking at population attributable risk, they found that more than half of the violence could be eliminated by targeting hazardous drinking (Coid et al. 2006).

Reporting results from the Dunedin study, which follows 1,037 children from age 5 and into adulthood, Arseneault et al. (2000) examined the link between mental disorders and violence by assessing past-year symptoms and past-year self-reported offending and registered convictions at age 21. They found alcohol dependence, schizophrenia spectrum disorders and especially marijuana dependence to be associated with an elevated risk of conviction for a violent offence, whereas no such association was found for depressive-, anxiety-, manic- or eating disorders. However, when looking at self-reported violence, only those with anxiety disorders did not have an increased risk compared to those subjects who had no psychiatric symptoms (Arseneault et al. 2000). At age 26 the difference in levels of violence between those without psychiatric symptoms and those with schizophrenia spectrum disorders were at a similar level (unadjusted OR at age 21: 4.6 and at age 26: 4.7) (Arseneault et al. 2003). Researchers tested whether adult violence in schizophrenia spectrum disorders could be predicted by childhood psychotic symptoms or childhood physical aggression, and although they did find reductions in the OR's when adding information on childhood aggression (OR: 3.8) and especially childhood psychotic symptoms (OR: 2.8) the confidence bands of the models overlapped considerably. With only 36

persons who were diagnosable with schizophrenia spectrum disorders, of which 9 were violent, the lack of precision is unsurprising.<sup>2</sup>

### *Pre-onset offending*

While historically, most studies have either disregarded the issue of timing or have focused exclusively on post-onset offending, there has recently been an emerging interest in looking at offending that predates the onset of psychotic mental disorders. In one such study Kooyman et al. (2012) investigated those 47% of the original UK700 trial cohort who had a criminal record before or after self-reported and retrospectively dated illness onset. In this study, 60% were defined as premorbid offenders. These were more likely male than those whose offending commenced subsequent to illness onset, but rates of violent offending were broadly similar in the two groups (Kooyman et al. 2012). In a similar study Jones et al. (2010) sampled 1,594 patients with schizophrenia who were admitted to a high security psychiatric hospital and compared those who had their first court conviction before their first psychiatric contact to those with the opposite timing. They found that around 54% had offended prior to their first service contact, and while there were no significant differences with regard to comorbid personality disorders, this group was more likely to be male, and be exposed to childhood risk factors for offending (paternal crime, large family size, younger age at first exposure to illegal drugs, smoking and separation from mother) (Jones et al. 2010). This latter study consisted of a highly selected group of patients who are deemed to be a significant risk to the safety of others, and it is not clear to what extent these findings are generalizable to less severe cases.

The comparisons of pre- and post-morbid offenders are useful for teasing out characteristics of the two types of offenders in psychosis. However, they do not shed light on how common violence and other offending prior to illness onset (or service contact) is. One such estimate can be found in the Aetiology and Ethnicity of Schizophrenia and Other Psychoses study (AESOP), where Dean et al. (2007) reported that 14% of 433 patients with a first episode psychosis had a history of violent offending. In a Danish study of 4,619 schizophrenia patients, Munkner et al.

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<sup>2</sup> Unfortunately, there is no attempt in this study to test whether psychotic symptoms in childhood are predictive of later violence in those who do not develop schizophrenia as adults.

(2003) found that 37% of males and 7% of females had at least one criminal conviction prior to their first presentation to mental health services, and that 13% of males and 1% of females had a conviction for a violent offence. None of the studies have compared offending rates to patients presenting with other mental disorders or to non-disordered peers.

### *Can treatment reduce offending?*

In recent years there has been an increased focus on how to manage and prevent violence in both criminal justice and mental health populations. Interventions can be divided into three main types: pharmacological, psychosocial and organisational, and further a distinction can be made between primary interventions aimed explicitly at violence reduction and secondary interventions where violence is seen as symptomatic of an underlying problem, and where this problem rather than the violence per se is the target of intervention (Hockenhull et al. 2012: 3). A systematic review and meta-analysis of interventions against violence identified 198 studies published 2002-2008. Of these, only 34 were randomized controlled trials in mental health populations, and a majority of these tested the effect of pharmacological interventions (Hockenhull et al. 2012: 46).<sup>3</sup>

Many of the primary interventions were conducted in hospital inpatient settings and aimed at short term (=hours) management of violence in the form of verbal de-escalation or rapid tranquilization (e.g. Alexander et al. 2004). Some other studies of this type had a somewhat longer term outcome (=weeks), but used measures of anger or aggression as proxies for actual violence (e.g. Krakowski et al. 2006; Volavka et al. 2004).

Secondary interventions in mental health populations are usually aimed at persons with schizophrenia or other psychotic disorders, and rest on the hypothesis that violence in this group to a large extent can be explained by certain symptoms, especially delusions and threat/control override symptoms (Link et al. 1998; Taylor 1985). In these patients better treatment

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<sup>3</sup> There were a total of 51 RCT's. The non-RCT studies were predominantly single group designs (before/after comparisons) or cross-sectional group comparisons. Additionally, the RCT's were of a better study quality with respect to reporting of baseline equivalence, blinding, and of analyzing data on an intention to treat principle (Hockenhull et al. 2012: 31).



adherence/compliance and reduction in psychotic symptoms have been shown to be associated with reductions in violence (Arango et al. 2006).

In one such study, the Schizophrenia Care and Assessment Program (SCAP), 229 patients receiving in- or outpatient treatment were followed for 2 years (6 month intervals) for community violence. Comparison between traditional neuroleptics and atypical antipsychotic medication showed the latter to be associated with significant reductions of violence measured through self-report, medical records and arrest records. The effect was found to be mediated through reductions in psychotic symptoms and substance misuse (Swanson et al. 2004). These findings were not replicated in the Clinical Antipsychotic Trials of Intervention Effectiveness (CATIE) where 1445 patients randomly assigned to 5 different types of antipsychotic medication were followed for 6 months with respect to community violence (Swanson et al. 2008). In this study an overall reduction of violence was seen (from 19% to 14% in intention to treat analysis), but no differences between types of medication were found.

The UK700 study (Walsh et al. 2001) was the only RCT exploring non-pharmaceutical interventions in mental health populations. In this study of 708 patients, intensive case management (caseload 10-15 patients) was compared to standard care (caseload 30-35 patients) in an attempt to investigate the effect of increasing the intensity of treatment in the community (Walsh et al. 2001). Using information from self-report, case notes, and interviews with carers no significant reduction of physical assault was found.

#### *Summary of literature review*

The pattern seems to be such that there is a consistent association between offending and mental disorder, and that it is stronger for violent than other crime (Hodgins et al. 1996), stronger for more rather than less severe violence (Dean et al. 2008; Large and Nielssen 2011), and stronger for women than men (Fazel et al. 2009a; Binswanger et al. 2010). The pattern is consistently found whether the focus is on offending among the mentally disordered, mental disorders among the offenders or the occurrence of offending and mental disorders in unselected general

populations. However, much of the current research is specific to the association between psychotic disorders and violence, which means that:

- Little is known about the risk of non-violent offending in psychosis
- Little is known about violent and non-violent offending in other mental disorders
- Little is known about offending patterns in different disorders relative to each other and their possible similarities and differences across diagnostic groups
- Little is known about the timing of offending relative to illness onset
- Little is known about the potential impact of treatment of mental disorders on offending

### *Aims of the thesis*

As initially stated, this thesis will address questions of whether levels of offending in mental disorders are increasing beyond what would be expected based on the population rates (Paper I); what the association looks like before and after presentation to secondary mental health services and across different diagnostic categories (Paper II & IV); and, whether improved treatment regimes in psychosis can reduce levels of offending (Paper III).



## **Methods**

The following section contains a brief description of the sources of data used for this thesis, followed by a short introduction to the population, design, statistics, and definitions employed in each of the three papers.

### *Data sources*

The four papers in the thesis all rely on data from national registers. While data are collected for administrative purposes, population acceptance of the system is very high, which means that coverage for many types of information is near 100%. Apart from the obvious advantages of having information on the entire population and the statistical accuracy which can be gained from large N's, this is particularly useful for studying people that are notoriously difficult to capture with other study methods as is often the case in the nexus between offending and mental disorders. In addition to register sources, baseline data from the OPUS-trial (Jørgensen et al. 2000) was used for Paper III.

#### *The Danish Civil Registration System (CRS)*

The backbone of all Danish register-based research is the Danish Civil Registration System. It was established in 1968, and all persons living and residing in Denmark at the time were assigned a unique 10-digit person identifier (the CRS number). Subsequently, all persons have been assigned such a number at birth or at first immigration to Denmark. Among other things, this register contains information on gender, date and place of birth, continually updated information on date of death, emigration or immigration and enables linkage to the person's parents if they have resided in Denmark for a shorter or longer period after 1968. The CRS number enables accurate linkage to all other Danish registers (Pedersen et al. 2006).

#### *The Central Psychiatric Research Register (PCRR)*

The Central Psychiatric Research Register contains information on all admissions to inpatient treatment since 1969 and all emergency room and outpatient contacts since 1995. In addition to dates of admittance and discharge, the register contains information on main and secondary

diagnoses of the patients. These are recorded in accordance to the ICD-8 (WHO 1982) from the beginning of the register up until and including 1993. From 1994 onwards the ICD-10 (WHO 1992) was used. The 9<sup>th</sup> edition of the ICD was never implemented in Denmark (Mors et al. 2011).

#### *The National Hospital Register (NHR)*

As the somatic equivalent to the PCRR, the National Hospital Register contains information on treatment in general hospitals. The register was initiated in 1977 from which time it contains information on inpatients' diagnoses, treatments and dates of admission and discharge, and in 1995 it was extended to also cover outpatient treatment and emergency room contacts (Andersen et al. 1999).

#### *The National Crime Register (NCR)*

The National Crime Register became electronic in November 1978, is managed by the Central Police authorities in Denmark and contains information on charges and decisions (in or outside of court) regarding all reported offences in Denmark. It is a working register and for reasons of legal rights of the Danish citizens, information in this register is deleted 10 years after the verdict or release from prison, or within 18 months of a person's death. However, every year, information is passed on to Statistics Denmark such that it is still possible to gain complete individual level information on criminal offending since 1980. The register hosted by Statistics Denmark contains information on date and type of crime and date and type of verdict (Kyvsgaard 2003: 26). The age of legal responsibility in Denmark was 15 years during the study periods covered in this thesis.

#### *Aggregated crime data from Statistics Denmark*

Each year Statistics Denmark produces tables containing aggregated crime data which are available to the general public ([www.statistikbanken.dk](http://www.statistikbanken.dk)). While these data are derived from the National Crime Register described above, they are cruder than the individual level data available to researchers in respect to types of crimes and types of verdicts. Additionally, the unit of

measurement is verdicts, which means that the same person can appear multiple times in each of the yearly tables.

#### *The IDA database (IDA)*

The IDA database (Integrated Database for Labour Market Research) is a collection of information from various different register sources. Originally developed for purposes of labour market research, it contains information on individual as well as business level. However, its collection of social and demographic information such as level of education, income and unemployment make it a convenient source for including socio-economic markers in other areas of research. Information is available from 1980 onwards (Danmarks Statistik 1991).

#### *The OPUS trial (OPUS)*

In the period 1998 to 2000 a randomized controlled clinical trial was conducted in Copenhagen and Aarhus, comparing standard outpatient treatment to assertive specialized treatment (AST) for patients suffering from a first onset psychotic disorder (Petersen et al. 2005). A total of 547 patients were randomized following informed consent. Inclusion criteria were: age between 18 and 45 years, no previous treatment for psychotic disorders (i.e. more than 12 weeks continuous use of antipsychotic medication), good command of the Danish language, and residence within the catchment area. Those who had comorbid mental retardation or organic mental disorder were excluded from the study along with those who were psychotic because of acute intoxication or withdrawal state. However, comorbid substance misuse was not in itself ground for exclusion. Only around 5% of the referred patients refused to participate (Thorup et al. 2007).

Treatment in the experimental group consisted of assertive community treatment, family involvement and social skills training. Patients saw their primary staff member usually on a weekly basis, and often in their own home for the two year duration of treatment. The caseload was 1:10 compared to an average of 1:25 in the treatment as usual group. Standard treatment took place in a community mental health clinic, where meetings were less frequent and there were no systematic offers of additional treatment elements. Anti-psychotic medication was administered in both treatment groups as indicated and in accordance with national guidelines

(Petersen et al. 2005). The patients were followed up after 1, 2 and 5 years with respect to psychiatric symptoms and various living conditions, and recently the 10 year follow-up sweep has been completed (Bertelsen et al. 2008).

### ***Study population, study design and statistical methods***

The four papers that form the basis of this thesis are quite different in respect to design and analytical methods used. Paper I is an ecological study, Paper II a nested case-control study, Paper III a randomized controlled trial, and Paper IV is a prospective cohort study.

#### *Paper I – Dom til psykiatrisk behandling [Psychiatric Treatment Sentences]*

Paper I is an ecological study where the unit of measurement is the number of yearly sentences. Comparisons are made between custodial and suspended sentences versus sentences to treatment. As described above (p. 9-10), the latter are used in cases where the perpetrator was in a psychotic state at the time of the offence or is mentally retarded. In some instances where the perpetrator was otherwise mentally not sound and where treatment is deemed likely to reduce risk of recidivism, sentences to treatment may also be invoked. The sole data source for this paper is the publicly available aggregated crime data from Statistics Denmark ([www.statistikbanken.dk](http://www.statistikbanken.dk)) regarding the years 1990-2006. For this paper the operational definition of mental disorder is legal rather than clinical, such that only those disorders that were deemed relevant for sentencing purposes were included. Similarly, the definition of offending was based on legal sanctions rather than the act committed. The majority of included offences related to the penal code, but transgressions against the Traffic Act and other Special Acts were also seen. Log-linear models with Poisson distributions were employed to test for differences in time trends.

#### *Paper II – Offending prior to first psychiatric contact*

Paper II is a nested case-control study where the cases consist of the total sample of Danish inhabitants born between 1965 and 1991 who had their first contact to a psychiatric hospital during the years 1995 to 2006. The cases were individually matched to a random sample of controls of same gender and with the same birthday as the case, such that the study population

contained all cases and 25% of those at risk. For this paper, data was drawn from the CRS, PCRR and NCR and analysed by conditional logistic regression where each case and matched controls formed a separate stratum. The calculated outcome measure was incidence rate ratios where the main exposures were any (penal code) and violent offending.

#### *Paper III – Reducing crime in first onset psychosis*

The study population in Paper III was the participants in the OPUS-trial described above. In this trial, patients in the assertive specialized treatment group were found to have significantly better clinical outcomes at the end of the two year treatment period (Petersen et al. 2005). The differences between treatment groups had equalized by the five year follow-up, however, the AST patients were still better off with regard to secondary outcome measures (Bertelsen et al. 2008). We combined information from the baseline interviews with register-based information on offending, vital status and any subsequent psychiatric hospitalizations. As such, data sources included the CRS, PCRR, NCR and OPUS. Data were analysed in a Cox's proportional hazards regression model, where patients were followed from the inclusion in the trial until first offence, death, emigration or end of follow-up (5 years) – whichever came first. Included offences related primarily to the penal code, however, transgressions against the weapons act, euforiant act, and the parts of the traffic act dealing with impaired driving were also included.

#### *Paper IV – Risk of offending across the full spectrum of psychiatric disorders*

Paper IV is a prospective cohort study based on a 25% sample of the entire Danish population. The cohort members were born between 1965 and 1995 and were residing in Denmark on their 15<sup>th</sup> birthday. Data was drawn from the CRS, PCRR, NHR and NCR and was analysed in a Poisson regression model, which is an approximation to a Cox's proportional hazards model that allows smooth handling of time-varying information. Participants were followed from age 15 to any or violent offending, and mental health status was entered in the models in a time-varying fashion.



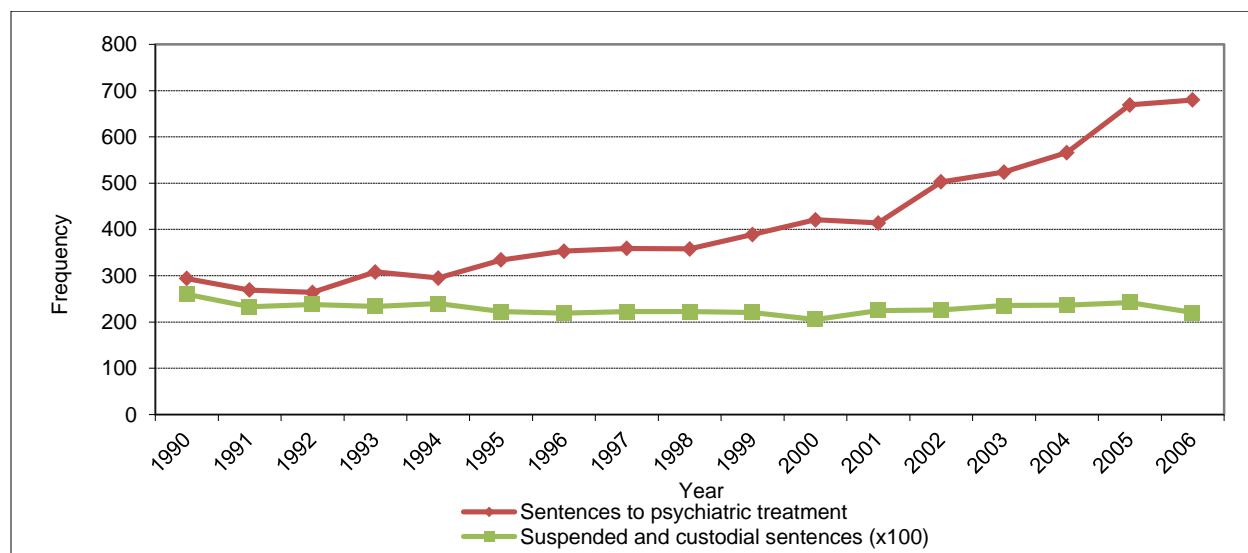


## Results

### *Paper I – Dom til psykiatrisk behandling [Psychiatric Treatment Sentences]*

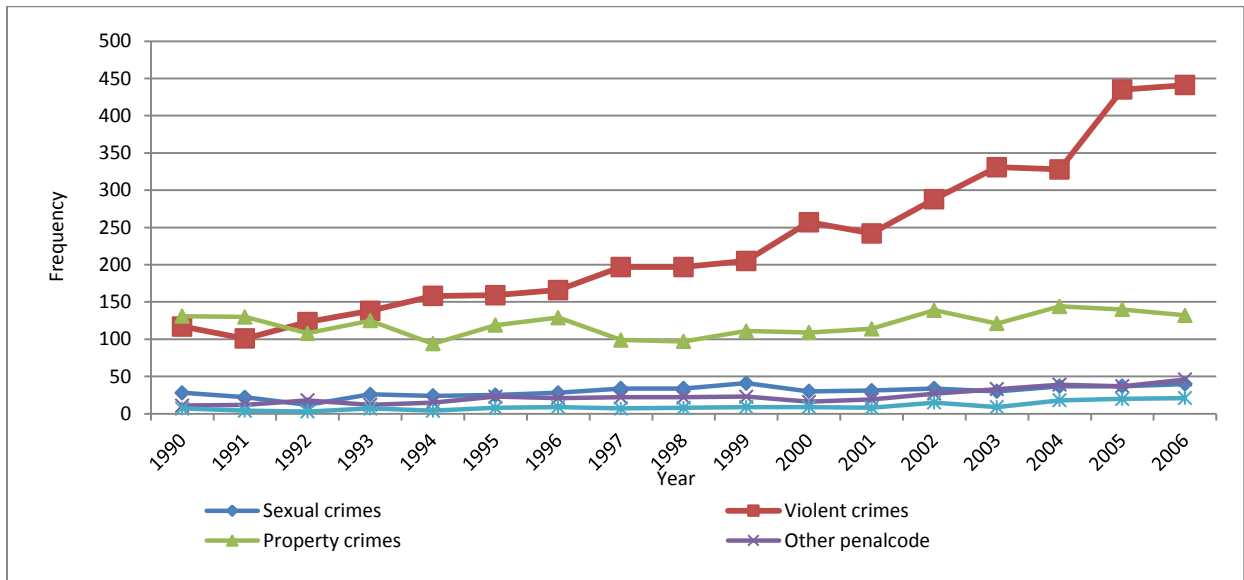
The aim of this paper was to compare temporal changes in conviction rates in general to conviction rates amongst those with severe mental disorders in order to assess whether levels of offending in mental disorders are increasing beyond what would be expected based on population rates. Using official crime statistics for the period 1990 to 2006 we extracted information on the annual number of sentences, subdivided according to type of sentence and type of offence. Suspended and custodial sentences (in the following referred to as custodial sentences) were compared to sentences to treatment according to section 16 or 69 of the penal law. Offending was grouped in the following categories: Violent (including robbery), sexual, acquisitive (excluding robbery), other penal code violations, and violations of special acts, including traffic violations. Violent offending was further subdivided in the following categories: homicide (including attempt), violence against private persons, threats, robbery, violence against public servant, and other violent offending.

*Figure 1: Number of sentences, all offence types, 1990-2006*



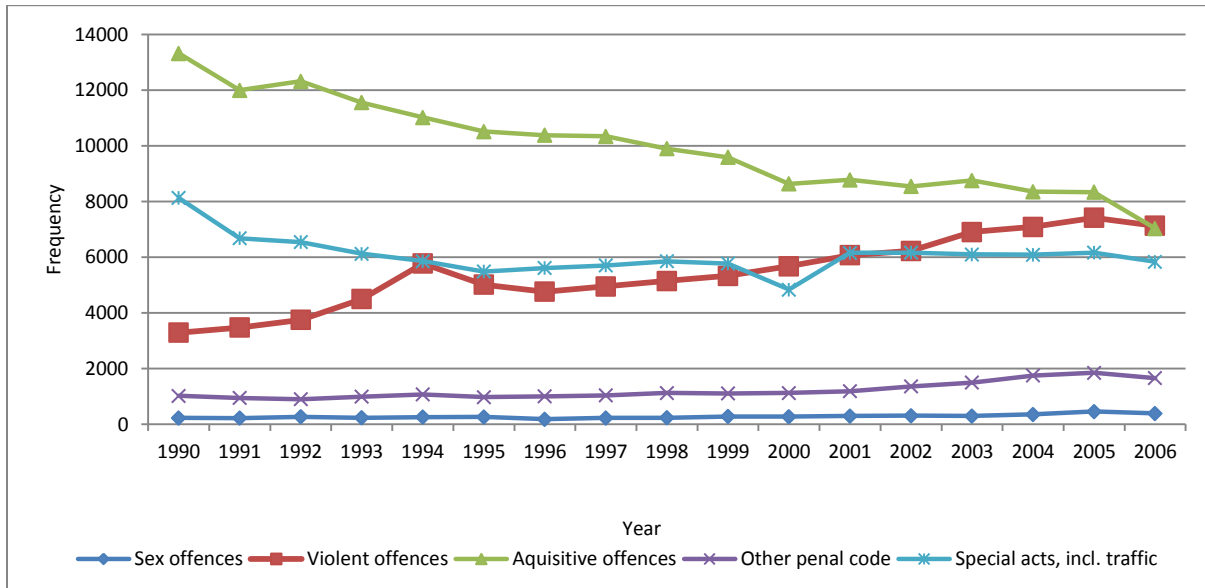
Overall, the combined number of custodial sentences was fairly stable at around 25,000 yearly sentences during the study period whereas there was a marked increase in the number of treatment sentences, growing from 300 in 1990 to 700 in 2006 (cf. figure 1). Looking closer at the type of offences involved, we found that most sentences to treatment concerned violent or acquisitive offences and further, that the growth in numbers were primarily related to violent offending (cf. figure 2).

*Figure 2: Treatment sentences according to offence type, 1990-2006*



The distribution of different types of offences contrasts quite clearly to the pattern seen in the custodial sentences; in this group, apart from violent and acquisitive offending, offences against special legislation comprise a considerable proportion of the overall picture, which of course to a large degree is due to sentences for driving under the influence (cf. figure 3). Likewise, the temporal trends, particularly for acquisitive offending, are different in this group.

*Figure 3: Custodial sentences according to offence type, 1990-2006*



Restricting the comparison to violent offending, we found that a growth similar to that in sentences to treatment was also found for custodial sentences (cf. Paper I, figure 3). While, overall, the treatment sentences went from representing 1.1% to 3% ( $p < 0.0001$ ) of the custodial sentences (almost a threefold increase), the fraction of violent offences grew from 3.5% to 5.9% (less than doubling,  $p = 0.0054$ ). However, the distribution of types of violence was quite different in the two groups of verdict types. The treatment sentences consisted mostly of violence against private persons and violence against public servants, where the latter saw a much larger increase than the former. This difference in growth was also present in the custodial sentences, but here violence against private persons was such a dominant category that other violent offences hardly contributed to the time trends.<sup>4</sup> Disregarding violence against public servants, the proportion of violence committed by those sentenced to treatment grew from 3.2% of the custodial sentences in 1990 to 3.9% in 2006, which was not significantly higher ( $p = 0.2375$ , cf. table 2).

<sup>4</sup> In 1990 violence against a public servant constituted 8% of the custodial and 15% of the treatment sentences, in 2006 this had grown to 14% of the custodial and 43% of the treatment sentences.

*Table 2: Test for difference in trends*

	$\beta_{\text{treatment sentences}}$	$\beta_{\text{custodial sentences}}$	P-value
<b>All offending</b>	<b>0.061</b>	<b>-0.003</b>	<b>&lt;0.0001</b>
<b>Violent offending</b>	0.090	0.044	0.0054
<i>Against public servant</i>	<i>0.179</i>	<i>0.088</i>	<i>0.0047</i>
<i>Against private person</i>	<i>0.061</i>	<i>0.039</i>	<i>0.2375</i>
<b>Acquisitive offending</b>	0.008	-0.033	0.0011
<b>Sexual offending</b>	0.036	0.038	0.9042
<b>Other penal code</b>	0.077	0.043	0.2365
<b>Special acts (incl. traffic)</b>	0.097	-0.009	0.2737

In conclusion, during the study period we found an increase in use of sentences to treatment, predominantly in relation to violent crimes. The rise in sentences for violence against private persons was analogous to that found among those given a suspended or custodial sentence, whereas there was a higher growth in regard to sentences for violence against public servants. There were a declining number of custodial sentences for acquisitive offending during the period, which was not mirrored in the sentences to treatment.

### ***Paper II – Offending prior to first psychiatric contact***

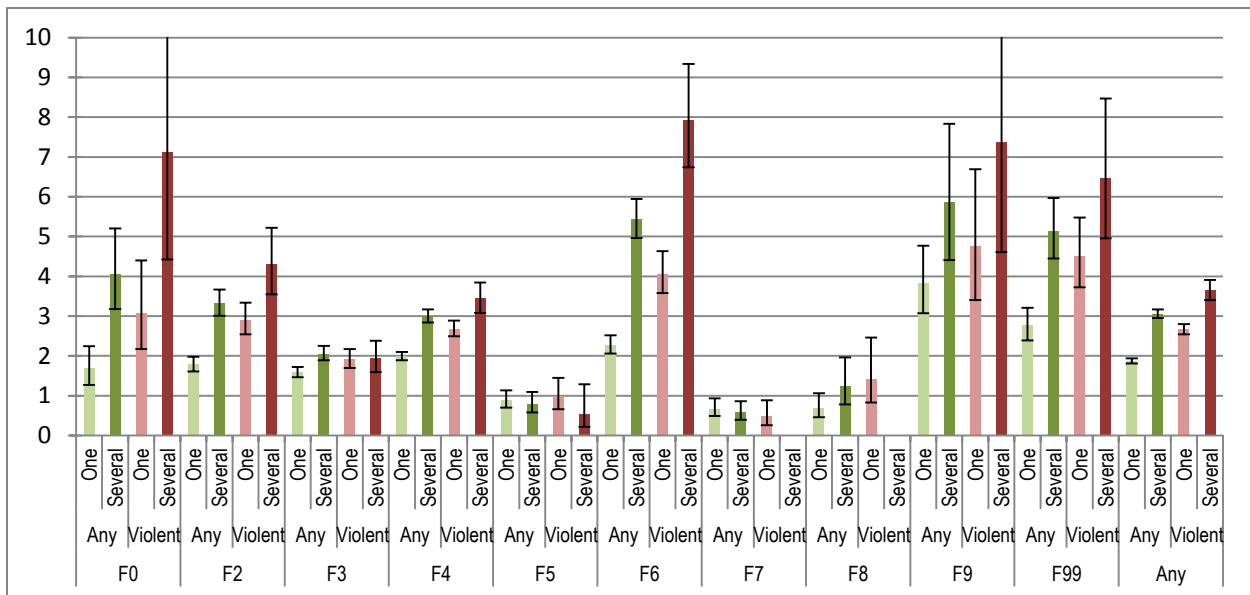
The aim of Paper II was to investigate the association between first psychiatric contact and prior offending across major diagnostic groups. Patterns of offending were examined according to type (violent or any) and frequency (one or several).

In this nested case-control study, we found that a total of 101,890 persons born in Denmark between 1965 and 1991 had their first admission, emergency room visit or outpatient contact with a psychiatric hospital in the years 1995 to 2006. Using incidence density sampling, these were individually matched to 2,236,195 population controls.

Overall, 19% of the psychiatric patients had a guilty verdict prior to their first presentation, whereas this was only true for 8% of the controls. For violent offending 6% of cases and 2% of controls had at least one conviction prior to the first presentation/match date.

When looking at any offending in males, a single conviction yielded an IRR of 2.32 (CI: 2.26-2.40) for psychiatric contact, while two or more convictions resulted in an IRR of 4.97 (CI: 4.83-5.11). For women the results were strikingly similar, since women with one conviction had an IRR of 2.25 (CI: 2.17-2.33) and those with several had an IRR of 4.03 (CI: 3.81-4.26). However, the prevalence of offending was much lower in women, where 8% of cases and 4% of controls had at least one conviction compared to 34% of cases and 14% of controls among males.

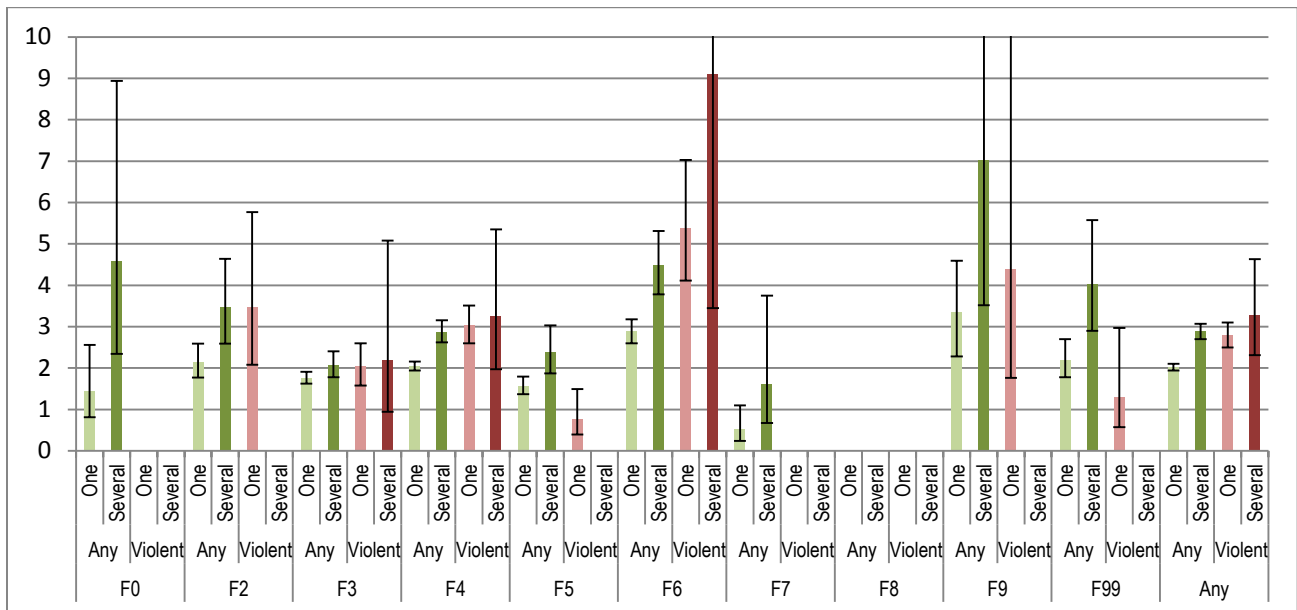
*Figure 4: Adjusted IRR's for males, any and violent offending*



The effect of previous offending was not uniform across diagnostic groups (cf. figures 4 & 5). For both genders, the strongest association by far was found with contacts due to substance related disorders (F1, not depicted). Here incidence rate ratios were 6.05 (CI: 5.61-6.51) for males and 7.28 (CI: 6.29-8.42) for females with one conviction and 21.28 (CI: 19.92-22.73) for males and 35.56 (CI: 29.90-42.28) for females with two or more convictions. Behavioural and emotional disorders with onset in childhood or adolescence (F9) were also strongly correlated

with offending and had IRR's of 4.55 (CI: 3.69-5.61) for males and 3.70 (CI: 2.64-5.17) for females with a single conviction. IRR's above 2 (range: 2.07-3.24) was found for neurotic, stress-related and somatoform disorders (F4), personality disorders (F6) and unspecified mental disorders (F99) in both genders, in males with organic disorders (F0) and females with psychotic disorders (F2). An elevated risk (range: 1.49-1.85) was also found in persons whose first diagnosis was affective disorders (F3), males with psychotic disorders (F2), and females with organic disorders (F0) or behavioural syndromes associated with physiological disturbances and physical factors (F5), while no significant association was found for persons who had a first diagnosis of mental retardation (F7), males with behavioural syndromes associated with physiological disturbances and physical factors (F5) and males with disorders of psychological development (F8).

*Figure 5: Adjusted IRR's for females, any and violent offending*



Comparing single and multiple convictions we found a dose-response relationship in both genders and for most diagnostic groups, such that multiple offences were associated with higher risks than being convicted of a single offence. Exceptions to this pattern regarded males with mental retardation (F7) or behavioural syndromes associated with physiological disturbances and physical factors (F5) where the risk decreased with increasing number of convictions.

Adjusting the results for comorbid substance misuse and parental level of education generally had the effect of attenuating the estimates, but the significant associations between diagnosis at first psychiatric contact and prior convictions persisted in most instances (less F5).

In an attempt to limit the impact on the results from persons who offended after illness onset but before first presentation to services, we fitted models where time between offending and presentation was restricted to at least two years. This sensitivity analysis revealed only a minimal reduction of the association between any offending and any psychiatric contact from 3.06 (CI: 3.01-3.12) to 2.95 (CI: 2.89-3.01), and imposing a five year minimum only had marginal effect as the IRR was here 2.94 (CI: 2.87-3.00). However, it should be noted that part of the reduction is likely due to elimination of those who had acute reactions to the stresses and strains of going through a trial, sentencing etc.

The pattern for male violent offending was similar to that for any offending, although the associations were generally stronger. Rates for female violent offending were very low, whereby estimates were not obtainable for all diagnostic groups due to insufficient number of exposed cases (and sometimes even exposed controls). Where they could be calculated they were similar to their male counterparts.

In conclusion, we found a strong association between violent and any offending and subsequent contact with mental health services across almost all diagnostic groups. Incidence rate ratios were of similar magnitude in both genders, although offending was much more prevalent in men. Patterns of more serious offending – violent versus other offending and multiple versus single convictions – increased the association.

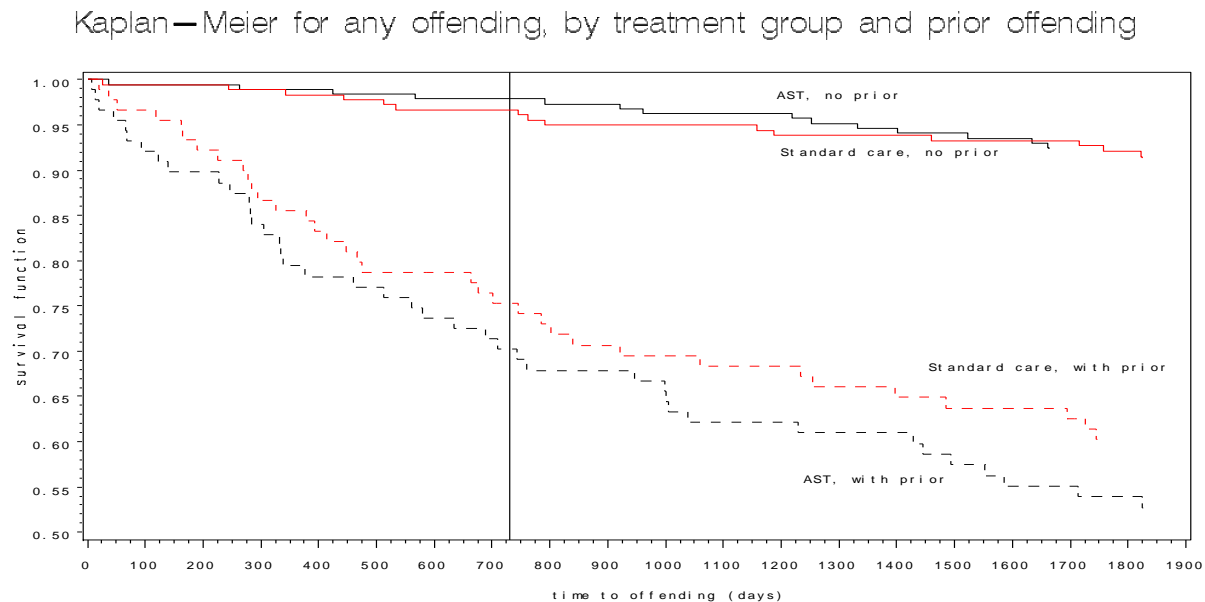
### ***Paper III – Reducing crime in first onset psychosis***

The aim of Paper III was to compare standard care to assertive specialized treatment in respect to reducing violence and other offending in patients with a first episode of psychotic illness. OPUS is a randomized controlled trial with 275 patients in the treatment group and 272 patients in the



control group. Previous studies (Petersen et al. 2005) have shown that patients receiving assertive specialized treatment to have a significantly better clinical outcome after two years of treatment (psychotic and negative symptoms, secondary substance misuse, treatment adherence, and success with lower doses of anti-psychotic medication). Although differences between treatment groups had equalized at the five year follow-up, those in the assertive specialized treatment group fared better on secondary outcomes such as living in supported housing and days spent in hospital (Bertelsen et al. 2008).

*Figure 6: Kaplan-Meier plot for any offending, by treatment group and prior offending*



When looking at any offending within the first five years of inclusion we did not find any differences between those in the assertive specialized treatment group (20%) and those who had received standard care (19%). However, offending prior to inclusion in the trial was prevalent in both groups (about one third), and almost 75% of those who offended after inclusion had also done so before. There were no indications that treatment should have differential effects dependent on prior offending status (tests of equality over strata yielded a p-value of 0.31 for those with prior offending and p-value of 0.73 for those without prior offending. Kaplan-Meier plots are shown in figure 6). In a Cox's regression those in the assertive specialized treatment group had an insignificant HR of 1.08 (CI: 0.74-1.58). Identified risk factors for offending

included male gender, young age, substance misuse at baseline and a history of offending (cf. Paper III, table 1). Those with a long duration of untreated psychosis were not found to be at increased risk for offending after inclusion, but there was a tendency – although statistically not significant ( $p=0.11$ ) – that the risk was elevated among those who were unable or unwilling to give information on duration of untreated psychosis.

Violent offending was less prevalent and only 5% of the assertive specialized group and 6% of the standard care group had such an offence after inclusion in the trial, while 8% in both groups had a record of violent offending at the time of recruitment. The unadjusted HR was 0.91 (CI: 0.45-1.83) and there was not sufficient data to fit an adjusted model.

Our data enabled us to look at the period preceding inclusion in the trial and compare offending before and after onset of the psychotic disorder. Here we found a HR of 1.29 (CI: 0.82-2.02) of committing the first offence after onset of psychosis relative to before. Although this result was not significant, there is some indication that the risk of offending may increase after onset of a psychotic disorder.

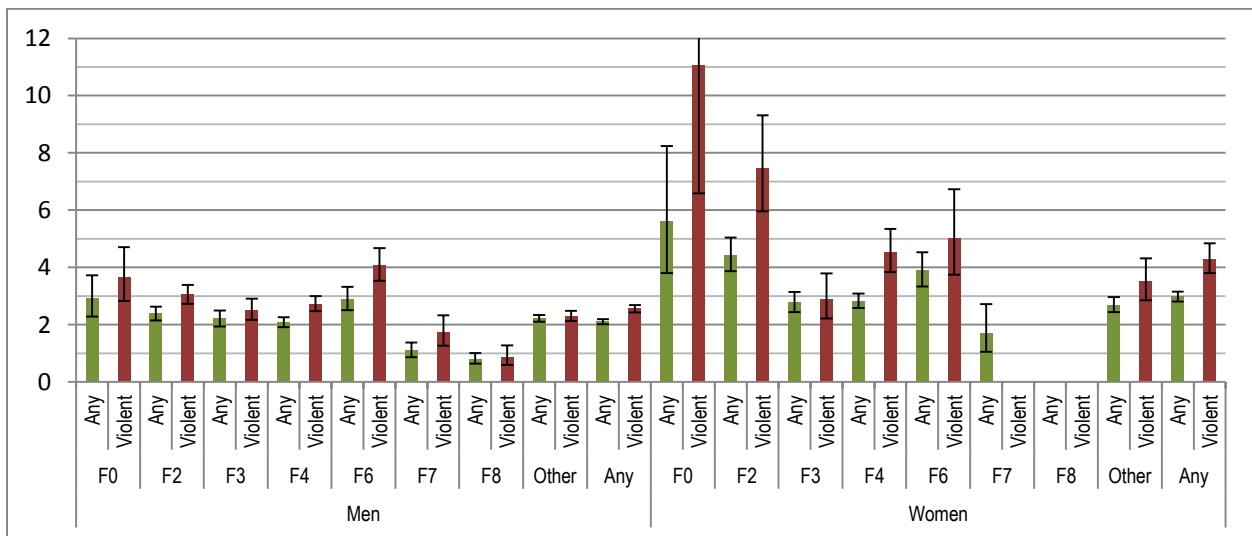
In conclusion, we did not find that assertive specialized treatment reduced offending in first onset psychotic disorders, but the rate of offending, especially that of a violent type, was modest and a majority of those in both groups who offended commenced doing so prior to the start of treatment, suggesting that any successful intervention should happen at an earlier time.

#### ***Paper IV – Risk of offending across the full spectrum of psychiatric disorders***

The aim of Paper IV was to compare the risk of any and violent offending in different diagnostic categories to persons with no known history of mental disorders. Population attributable risk fractions were also calculated. The cohort included 521,340 persons who contributed with 7,455,866 person-years of risk time in the analyses of any offending and 8,019,097 person-years in the analyses of violent offending. During the follow-up from 1980 to 2010, 57,390 persons (44,802 men and 12,588 women) were convicted of at least one offence, and in 17,423 cases (15,684 men and 1,739 women) at least one was of a violent nature.

Males who had ever had a psychiatric contact had an IRR of 2.91 (CI: 2.80-3.02) for any offending, and although effect sizes varied between the diagnostic groups (cf. figure 7), all other categories than developmental disorders were significantly elevated compared to those persons without any mental disorder. The highest elevation of risk was seen in those with personality disorders (IRR 4.18, CI: 3.64-4.81) followed by those with organic disorders (IRR 4.09, CI: 3.20-5.23). While offending rates were much higher in men, the relative impact of mental disorders on risk of offending was stronger in women, where any psychiatric contact yielded an IRR of 4.17 (CI: 3.95-4.40). The highest risk among women was seen in organic disorders (IRR 8.41, CI: 5.72-12.36) and psychotic disorders (IRR 7.08, CI: 6.23-8.05). A dose-response relationship was found between multiple admissions and risk of offending, such that those who had a single psychiatric contact were 2.79 (CI: 2.66-2.91) more likely to offend than those with no admissions, 2-3 contacts carried a risk of 3.13 (CI: 2.97-3.30) while four or more contacts had an IRR of 4.99 (CI: 4.71-5.28).

*Figure 7: Fully adjusted IRR's for males and females, any and violent offending*



In both genders the association between mental disorders and violent offending was greater than that between mental disorders and any offending. As was seen with any offending, relative risks were consistently greater for women than men and, for many disorders, much greater. However,

due to an insufficient number of exposed cases, IRR for mental retardation and developmental disorders in women could not be estimated.

Adjusting the results for parental mental disorders, parental SES and non-Danish place of birth had an attenuating effect on all disorder groups, but only to the point of no association in any offending among males with mental retardation. The attenuation was stronger for violent than for any offending in both genders, however, the association between mental disorders and violent offending remained stronger than for any offending across the board. Further attenuation resulted from additionally adjusting for comorbid substance misuse. However, all rate ratios that were significant in the first adjustment remained so after the inclusion of substance misuse. The impact on results was greater for violent than for any offending and especially pronounced among women. It is of note that in the fully adjusted model for males with any offending, rate ratios were similar in magnitude across diagnostic categories, while larger differences were seen among women and for violent offending.

We also examined the relationship between substance misuse without any diagnosed psychiatric co-morbidity and after adjustment for familial risk factors. We found a significantly higher risk for violent offending in both genders and any offending in males compared to those with any psychiatric disorder without comorbid substance misuse. Those with comorbid mental illness and substance misuse were found to be at particularly high risk, especially with regard to risk of violent offending among women (cf. paper IV, table 4).

In order to ensure that the effects found were not caused by the presence of comorbid personality disorders, we conducted sensitivity analyses in which anyone who was diagnosed with a personality disorder as a main or secondary diagnosis was excluded from the analyses from the day of first diagnosis onwards. As expected, this resulted in further attenuation of the estimates, however, for most diagnostic categories adjusted results were well within the confidence bands found in the main analyses. The exception was any offending in women with schizophrenia spectrum disorders (reduction from 4.42 (CI: 3.87-5.04) to 2.85 (CI: 2.29-3.56)).

Calculating population attributable risk fractions we found that 4.5% of male and 10.4% of female first offending was attributable to mental disorders. The impact on violent offending was greater since it accounted for 10.2% of male and 26.4% of female violent offending. The largest contribution came from other mental disorders in males (2.1% for any offending, 3.5% for violent offending) and neurotic disorders in females (3.4% for any offending and 9.5% for violent offending) (cf. paper IV, table 5).

In conclusion, we found elevated risks for offending, particularly violent offending, across most of the diagnostic groups investigated. IRR's were stronger in women than men and there was evidence of a dose-response relationship between number of psychiatric contacts and risk of offending.

## Discussion

### *Societal ways of dealing with mental disorders and offending; reflections on Paper I*

Previous research has established that those suffering from mental disorders have higher rates of offending than the background population. The question that Paper I seeks to answer is whether the difference in rates has been increasing in recent times. The study showed, first of all, that sentences to treatment constitute a very small part of the overall offending in Denmark, despite a marked increase during the study period. Secondly, it showed that the increase was primarily linked to violent offending, and that the trends were similar to the custodial and suspended sentences in regard to violence against private persons, whereas there was a larger increase in violence against public servants.

While overall crime trends (measured as convictions) may have many causes, including changes in opportunity structure (Tham and Von Hofer 2009), economic and demographic factors (Dhiri et al. 1999), penal reactions (Tonry 2007), and police activity (O'Brien 1996), the crime trends in mentally disordered persons may also be affected by access to treatment. The two main – and not conflicting – ways of regarding this is on the one hand the theory that the individual propensity to offend is higher in un- or inadequately treated patients than in those receiving proper treatment, whereby reductions in treatment opportunities (i.e. in the form of deinstitutionalization) would be seen as a cause of crime. The other theory views the psychiatric and penal institutions as two competing ways of dealing with deviant and unwanted behaviour, and is known as the “criminalization” theory:<sup>5</sup>

If the entry of persons exhibiting mentally disordered behavior into the mental health system of social control is impeded, community pressure will force them into the criminal justice system of social control. Further, if the mental health system is forced to release mentally disordered persons into the community prematurely, there will be an increase in pressure for use of the criminal justice system to reinstitutionalize them (Abramson 1972).

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<sup>5</sup> The term “criminalization of mentally disordered behavior” was originally coined in reaction to changes in Californian rules for involuntary commitment, but the argument applies to other impediments to adequate treatment (such as lack of hospital beds due to deinstitutionalization) (Abramson 1972).

The argument here is not that inadequate treatment leads to offending, but rather that inadequately treated patients display socially unwanted behaviour at a more minor level, such as public drunkenness, disorderly behaviour or possession of illegal substances, where in the latter instance, typically one of the aforementioned behaviours have led to them being searched by the police. The pattern then becomes self-perpetuating since once a person has a criminal record, the likelihood of being processed through the criminal justice system, rather than the mental health system, increases (Aderibigbe 1997).

Much of the criminalization literature is specific to American circumstances, where an influx of persons suffering from severe mental illness into prisons and jails has been demonstrated (Torrey 1995). However, the incarceration rate is much higher in the US than in Denmark, or any other industrialized country in the world for that matter (Christie 2000: 25ff.), so it is questionable whether this hypothesis is relevant in a Danish setting. In Denmark there is a fairly high threshold for incarceration which means that minor crimes would typically not have that outcome, just as they would typically not warrant a psychiatric examination (Rigsadvokaten 2007).<sup>6</sup> Correspondingly, given the higher social security here, the degree to which criminalization driven by homelessness contributes to the picture is significantly reduced, although certainly not completely eliminated (Aderibigbe 1997).

### *The case of deinstitutionalization*

Deinstitutionalization as a cause of increased offending in mentally disordered populations has been argued in Denmark (Kramp 2004) and elsewhere (Taylor and Gunn 1999). Rather than viewing mental health services and criminal justice institutions as competing ways of dealing with socially problematic behaviour, the underlying premise for this line of argument is that of a causal association between mental illness and offending. Hereby adequate treatment is seen as having an individually preventive effect on offending. This idea is not new, but can be dated back to 1939 when Penrose conducted a cross-sectional analysis of 18 European countries in

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<sup>6</sup> It is possible that the criminalization hypothesis is applicable in regard to the frequency by which those suffering from mental disorders are arrested and/or held in detention, which was not a focus of this paper.

which he observed a negative correlation between the number of psychiatric beds in a country and the size of its prison population (Penrose 1939).

In a replication of Penrose's study, using cross-sectional data on 38 high income countries (including those analyzed by Penrose) from 2002-2005, Large and Nielssen (2009) concluded that this association no longer exists in high income countries. Hartvig and Kjelsberg (2009) took a different approach and conducted a longitudinal analysis of Norwegian data covering a total of 75 years, of which the first period (1930-59) had an almost stable amount of psychiatric hospital beds and an incarceration rate that decreased by 30%, while the second period (1960-2004) was characterized by a 74% decline of number of beds and a 52% increase in the prison population. While their findings for the second period are certainly in line with those described by Penrose, Hartvig and Kjelsberg conclude that deinstitutionalization only had a marginal impact on the rising incarceration numbers. This interpretation is substantiated by the observation that the numeric increase in the offender population vastly outnumbers the corresponding reduction in the inpatient psychiatric beds. Regardless of whether a longitudinal or cross-sectional approach is taken, and whether the comparisons are within or between countries, care must be taken when measuring crime rates by the size of the prison population, as this is also importantly influenced by many other factors, including cultural and political factors influencing levels of punitiveness (threshold for incarceration and length of sentences) and the introduction or abandonment of non-custodial forms of punishment (e.g. capital punishment or suspended sentences) (Christie 2000: 38, 46ff.; Green 2009).<sup>7</sup>

The question of the impact of deinstitutionalization on crime rates among the mentally disordered can also be studied by comparing crime rates in this group at different points in time as Mullen et al. (2000) have done. In this Australian study, rates of offending in schizophrenia patients admitted to hospital for the first time in 1975 and 1985 were compared to a random selection of community controls. They found offending rates to be higher in the 1985 than the 1975 patient group; however, this was also true for the controls, such that the relative risks were

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<sup>7</sup> Despite a 10-fold higher incarceration rate, International Crime Victimization Studies show victimization rates to be remarkably similar in USA and Denmark; in 2003-04 the one year prevalence in both countries was around 17% for overall victimization and under 2% for violent victimization (Dijk et al. 2007: 42, 79), although lethal violence is undoubtedly more prevalent in USA, which likely accounts for some of the difference in incarceration rates.



of comparable sizes. Arguing against the conclusion by Mullen et al. that deinstitutionalization is not a cause of increased offending in schizophrenia, Torrey stresses that offending is associated with non-compliance to medication, and that the quality of the outpatient services is highly relevant in regard to the ability to ensure adherence to treatment (Torrey 2000). As such, it is unclear whether the Australian results can be generalized to countries where the reduction of hospital beds has not been complimented by comprehensive community services.

The presupposition of a direct relation between offending and specific symptoms or features of mental disorders, which is evident in the deinstitutionalization argument, can also be found in speculations on the (lack of) association between the overall crime rates in a country and the crime rates among the mentally disordered. It is commonly assumed that the proportions of homicides and non-lethal violence committed by mentally disordered persons is lower in countries with high crime rates (Appelbaum 2006; Buchanan 2008; Mullen 1997), suggesting that those factors that are accountable for increasing the crime rates in the population as a whole, do not apply to the mentally disordered. This assumption has recently been challenged by Large et al. (2009), who in a systematic review and meta-analysis found that the rates of homicides committed by mentally ill offenders varied with the overall homicide rates in the country in question, suggesting that some common etiological factors for lethal violence apply to perpetrators with and without mental disorders.

The findings in our study were along the same lines; there were great commonalities in crime trends in those with and without mental disorders. Most of the increase seen was due to violent offending, a pattern which was also present in the suspended and custodial sentences. A detailed examination of reasons for the increase in convictions for violence is beyond scope of this thesis, however victimization studies suggest that rates of violent victimization were largely similar across the period investigated. Although changes in the severity of violence (increased use of weapons or of incidents with multiple perpetrators) cannot be completely ruled out, there was a clear trend indicating an increased inclination to report violent incidents to the police (Balvig and Kyvsgaard 2009). Violence against public servant was the exception to this pattern, since this increased significantly more among sentences to treatment than among custodial sentences. However, due to the nature of our data, we were unable to determine whether this was

attributable to differences in opportunity structures (i.e. mental patients are commonly more exposed to groups of people that are protected by this section of the penal code than are most other persons), the changing in reporting behavior which was particularly true for violent incidents happening at the workplace in general (Balvig and Kyvsgaard 2009) and more specifically in institutions dealing with the mentally ill (Socialministeriet Indenrigs- og Sundhedsministeriet 2006: 17), or whether quality of care was a relevant factor such that more conflict situations would arise in inpatient settings or supported housing. During the study period the formal rules for using sentences to treatment were not changed, however, ongoing studies of the mental health of remand prisoners (Gosden et al. 2003) may have had the effect of increasing awareness and leading to more psychiatric examinations being conducted, although it does not seem obvious that this last point would have a differential impact on specific types of offending such as violence against public servant.

### ***Causal links or common causes? Reflections on Paper II***

In paper II we examined the total national population of individuals in contact with mental health services and found a strong association between offending and subsequent psychiatric contact in almost all diagnostic groups. Incidence rate ratios for men and women were of similar magnitude, although offending was much more prevalent in men. Also, we found that patterns of more serious offending (violent versus other offending, multiple versus single convictions) increased the association.

Most of the previous research looking at the association between mental disorders and offending has focused on life-time risk of offending (Hodgins 1998; Brennan et al. 2000), or post-onset violence (Fazel et al. 2009a; Fazel et al. 2009b; Fazel et al. 2010) in serious mental disorders, co-occurring mental disorders and violence (Arseneault et al. 2000), or used self-report data with high attrition rates (Corneau and Lanctot 2004). A few studies have looked at pre-onset offending (Munkner et al. 2003) or pre-onset violence (Dean et al. 2007) in schizophrenia, whereas little attention has been paid to pre-onset offending in other mental disorders. Our results compare well with those of Munkner et al. (2003), who found that 37% of male and 7% of female schizophrenia patients had at least one criminal conviction prior to their first contact

with mental health services; close to our finding that 34% of males and 8% of females with any diagnosis had a history of offending prior to their first presentation. In the AESOP study Dean et al. (2007) found substantially higher rates of violence prior to first presentation (14% overall compared to our 12% of men and 1% of women), however, their sample was drawn from socially deprived urban areas with relatively high local crime rates.

### *Understanding the association*

The finding that those in contact with mental health services are more likely to previously have had criminal justice system contact; in other words, that those who have criminal justice system contact are more likely to later have contact with mental health services, has several potential explanations. These include the existence of undiagnosed pre-offending mental disorder, mental disorders arising as a consequence of offending and court contact, and common risk factors for mental disorders and offending.

Symptoms of mental disorders occurring prior to or at the time of the offence, which did not lead to a mental health service contact, would not be picked up in our analyses, since we relied on information from hospital records. Also, the long antecedent periods which are likely in some disorders might be associated with offending. The claim that many offenders suffer from mental disorders is supported by numerous studies showing high prevalence of various disorders at the reception into remand facilities (Andersen et al. 1996; Brooke et al. 1996; Birmingham et al. 2000), however, it is not known to which extent these persons have already been in contact with mental health services. Correspondingly, little is known about the presence of psychiatric morbidity in those offenders that receive non-custodial sentences.

On the other hand, the consequences of offending, court contact and sentencing – especially if custodial – can act as a life stressor which might trigger the onset of mental disorder (Hammen 2005; Slavich et al. 2010) particularly if perceived to have an element of humiliation or social rejection (Kendler et al. 2003). The plausibility of different explanations likely varies between groups of disorders. For instance, it is probable that undiagnosed psychoses or personality disorders may influence propensity to offend, whereas anxiety and depressive disorders may be

more likely to emerge or become exacerbated to the point of treatment contact consequent on offending and/or court contact. This last point is supported by studies that show increased rates of suicide after criminal justice contact, even among those who did not receive custodial sentences (Webb et al. 2011).

Finally, there appears to be a host of common risk factors for offending and mental illness, including low socio-economic status (Murray et al. 2010; Agerbo et al. 2004), living in an urban area (Flango and Sherbenou 1976; Pedersen and Mortensen 2001), migration (Cantor-Graae and Selten 2005; Laub and Sampson 2006), family disruptions/instabilities (Mednick et al. 1990; Niemi et al. 2003), and shared familial vulnerabilities (Frisell et al. 2011; Dean et al. 2010), pointing toward the possibility that both have common causes rather than a causal relationship between them.

#### *Gender differences and similarities*

An interesting and rather surprising result of this study was our finding that offending was a risk factor of similar magnitude in both men and women. Offending is much more prevalent in males than females, which has the potential implication that female offending would lead to a greater degree of stigmatization and social exclusion (Nilsson and Estrada 2011), whereby more adverse mental health outcomes would be expected. Similarly, the gender gap usually found in offending has been shown to narrow considerably when looking exclusively at mentally disordered persons (Robbins et al. 2003; Fazel et al. 2009a), such that mental illness is a much stronger risk factor for female than male criminality. Our results could possibly indicate that offending in females arises to a greater extent from direct effects of mental disorders than common causes or vulnerabilities preceding the disorder.

#### *Substance misuse*

The by far strongest association in this study for both males and females and for both violent and non-violent offending was that for substance misuse disorders. This is a well-known correlate of criminal activity in general as well as when comorbid with other disorders (Grann and Fazel 2004; Fazel et al. 2009b), which is unsurprising given that acquisitive offending is a common

way of financing expensive substances, just like the possession of these may in itself be illegal. Additionally, substance misuse is associated with the antecedents of a range of other mental disorders (Rosen et al. 2006). We were therefore surprised to see that adjusting for comorbid substance misuse in other disorders only had little impact on the estimates. However, this may in part be explained by residual confounding due to the known under-reporting of comorbidity in the psychiatric register (Hansen et al. 2000). In post-onset samples some studies have found that adjusting for co-morbid substance misuse eliminated the association between mental disorders and violence (Elbogen and Johnson 2009) while others have found that the association persisted, although greatly attenuated (Van Dorn et al. 2012; Swartz and Lurigio 2007). The interplay between criminality, substance misuse and other mental disorders is very complex, and as such it is difficult to predict what the effect of adjusting for comorbid misuse would be, if our measurements were more precise. Additionally, there is an issue of timing, since offending may take place many years prior to the first psychiatric presentation by which time the person may no longer be misusing, even if they were at the time of offending.

A surprising finding in this paper was that the association between psychotic disorders and offending were among the weaker associations compared to other groups of disorders. This was true for both violent and non-violent offending. A two-type model of violence in psychosis has been suggested (Mullen 2006) such that one group of patients display persistent patterns of antisocial behaviour, the onset of which predates the onset of the psychotic disorder, while the other group of offending patients have violent outbreaks that are more directly associated with symptoms of the disorder and which do not precede the onset of the disorder (Hodgins et al. 2011). Particularly threat/control override symptoms have been shown to correlate with violent behaviour, even when controlling for the severity of other psychotic symptoms (Link and Stueve 1995). While there is a possibility that our results are vulnerable to differential selection bias (cf. discussion on limitations), compared to the stronger associations that are generally found between psychotic disorders and post-onset violence, our results could lend credence to this two-type model, since only the one group would likely be picked up in our analyses. However, on the other hand, the results certainly also suggest that the association between crime and mental disorders could have a much wider scope than that traditionally investigated, and that studies of post-onset risk of offending in non-psychotic disorders are merited.

### *The fruitfulness or futility of interventions; reflections on Paper III*

The aim of paper III was to assess whether assertive specialized treatment could reduce violent and non-violent offending in first episode psychosis, thereby testing Torrey's (2000) hypothesis that improved community treatment has a beneficial impact on offending. In a randomized controlled trial of 547 patients we found no indication that this should be the case. The modest sample size did reduce our ability to detect small differences, but there were no trends for differences between the treatment groups.

Our findings are in line with those of the UK700 study where Walsh et al. (2001) examined the effect of intensive case management on violence in an inner city sample of persons with chronic psychosis. In comparison to the UK study, our patients were younger, were in an earlier stage of illness and the difference between treatments were larger since our specialized treatment consisted of assertive community treatment, psycho-educational family involvement as well as social skills training (Jørgensen et al. 2000) and not simply a lighter case load. Additionally, the AST patients have been shown to have significantly better clinical outcomes after two years (psychotic and negative symptoms, secondary substance misuse, treatment adherence, and success with lower doses of anti-psychotic medication) (Petersen et al. 2005) and secondary social outcomes after five years (living in supported housing and days spent in hospital) (Bertelsen et al. 2008); these factors would lead one to expect better results. While the lack of difference between treatment groups could lead to the interpretation that the intervention given was still not intensive enough, it is also possible that limited results can be gained by focusing on alleviating symptoms, and that an effective intervention would have to be specifically targeting risk of criminal behaviour. Finally, it is also possible that results could be found in targeting higher risk populations, such as those with dual diagnoses, as offending prevalence in the OPUS study was relatively low, particularly in regard to violent offending.

While numerically most of the pre-inclusion offending took place before illness onset, taking time at risk into account we found a statistically insignificant trend indicating that risk of offending might increase after onset of psychotic symptoms, which makes programs targeting

early detection and early treatment potentially interesting. Related to this, long duration of untreated psychosis is generally associated with poor outcomes (Yung 2012), and we had speculated that this factor might have been associated with later offending also. This was not found in our study, but these findings are consistent with a recent meta-analysis of violence in first episode psychosis, where Large and Nielssen found long DUP to be associated with more but not less severe forms of violence (Large and Nielssen 2011).

A key point in this study – well in line with the results of paper II – is that offending was more prevalent prior to recruitment than after inclusion in the study. Of those who offended after inclusion in the AST program, almost three quarters had commenced doing so prior to recruitment, indicating that interventions may be warranted at an earlier point in time. Relatedly, a study of persons with schizophrenia who pose a high risk to others suggests differences between those who commence offending pre- or post-first psychiatric admission. More of the factors usually associated with offending apply to the pre-admission offenders, suggesting that these are in need of both treatment of illness and interventions directed at criminality, while the post-admission offenders may be driven more by factors related to psychosis (such as delusional beliefs, chaotic and disturbed behaviour, and inhibition) and more standard treatment strategies may be sufficient for this group (Jones et al. 2010).

Prior offending was a strong predictor of future offending (HR above 5), which indicates that enquiring about offending history is a simple way of identifying patients at increased risk of offending. As such, this result also indicates that the effort to reduce offending in clinical populations is to a large degree a question of preventing recidivism. A meta-analysis has shown that the same predictors of general and violent recidivism apply to both mentally disordered and non-disordered offenders, with criminal history, antisocial personality, substance misuse, and family dysfunction being particularly important, while psycho-pathological factors were to a large degree unrelated to the risk of reoffending (Bonta et al. 1998). However, it should be noted that the episodic nature of psychosis places it among those factors that are subject to rapid

change,<sup>8</sup> whereby it may be difficult to obtain valid measures of how much they contribute in the actual offending situation (Agnew 2011).

Finally, it should be noted that some of the stronger risk factors for offending (and reoffending) – criminal justice history, male gender, and young age – are predictors that are not amenable to change. And while these can be helpful in identifying high risk groups, any successful intervention needs to be directed at more dynamic predictors, be they related to comorbid misuse problems, psychopathology, or general life problems.

### ***General or specific effects of disorders? Reflections on Paper IV***

In paper IV we systematically compared the association between violent and non-violent offending and mental disorders across the full spectrum of psychiatric diagnoses, following onset of disorder in a large population-based cohort. The strength of the association was greater for violent than other offending and for women compared to men. We found a dose-response relationship between the number of psychiatric contacts and risk of offending, and a strong combined effect on risk of offending, especially among women, when diagnosed with both mental disorder and substance misuse.

### ***Differences between diagnostic groups and comparisons with other studies***

The risk elevation found for both any and violent offending was apparent across a range of psychiatric diagnoses and was not confined to major mental disorder such as schizophrenia, even after adjustment. In fact, for men, the strength of association, after full adjustment, for any offending was significant across all but two diagnostic groups and effect sizes were very similar across disorders (ranging from 2.92 for organic disorders to 2.08 for neurotic disorders). For violent offending and offending among women the pattern of findings indicated that the strength of association varied to a greater extent between disorders. The fact that risk of offending appears to extend across the full spectrum of mental disorder, particularly in the case of males

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<sup>8</sup> Agnew groups variables that are generally associated with crime into three temporal levels: A stable baseline level (duration is over several weeks), short-term deviations lasting from hours to days, and situational deviations lasting from seconds to minutes (Agnew 2011).



and any offending where even the magnitude of association differed little across the spectrum, implies a role for common rather than disorder-specific underlying mechanisms. Pathways to offending shared across disorders may well involve aspects of social disadvantage, either as a mediating factor or as a common cause of mental disorder and offending. Beyond psychosis, very little is known about illness related risk factors for antisocial behaviour and thus the extent to which the role of such risk factors varies by disorder is unclear. Disorder-specific factors may well play a greater role in explaining risk of offending for women (where the strength of association was greatest for organic and psychotic disorders) and for violent offending for both men and women (for men risk was greatest for those with personality disorder followed by organic and psychotic disorders while for women risk was greatest for these latter two diagnostic groups). Disorder-specific pathways to offending are likely to include the impact of specific symptoms of mental disorder and other direct effects of disorder.

Although the magnitude of the associations differ, the results presented here replicate those of a previous Danish population-based study (Hodgins et al. 1996) which found elevated offending risks in a range of disorders. However, that study was not restricted to offending after the onset of mental disorder. Compared to this previous study, we were able to include a broader range of disorders due to the availability of out-patient contacts, just as the post-morbid nature of offending and duration of exposure was accounted for. However, our findings do contrast to some extent with a number of smaller non-Danish studies. In the Dunedin study (N=1037), an increased risk (unadjusted) of court convictions for violence was found in mania, schizophrenia spectrum disorders, and alcohol and marijuana dependence, but not in depression, anxiety or eating disorders (Arseneault et al. 2000). However, the number of study subjects in each diagnostic category was modest, and hence the statistical power was limited. A study based in Camberwell, London (N=1076), found that criminality among those with schizophrenia was three times higher in women compared to those with other mental disorders, whereas for men such an elevation in risk was only found for violent offending (twice that of other mental disorders) (Wessely et al. 1994). In addition to studies of offending risk, other measures of antisocial behaviour such as self-reported violence have also found evidence for risk extending to diagnoses beyond psychosis (Swanson et al. 1990). In comparison to our study, the temporal relationship between onset of mental disorder and onset of offending was not always established

in these previous studies and the range of disorders included did not necessarily cover the full range of mental disorders. Sample size also limited the ability of some of these studies to detect associations, particularly among women. In our study, mental retardation was not found to increase the risk of any offending in males, in contrast to the findings of the Stockholm Metropolitan study (Hodgins and Janson 2002), where offending in mental retardation was found to be around the same magnitude as major mental disorders (schizophrenia, bipolar disorder, and major depression). Likely, the cases of mental retardation in our study are more severe (and hence for some less able to offend) than in the Stockholm study, where mental retardation was defined according to special needs education and not solely contacts with mental health services.

### *Gender differences*

Finding a higher relative risk of offending among women with mental disorder compared to men replicates previous studies of schizophrenia (Fazel et al. 2009a), major mental disorders (Brennan et al. 2000) and recently discharged psychiatric patients (Robbins et al. 2003). Comparing pre- and post-morbid criminality in psychoses, Kooyman et al. found evidence to support the notion that female offending is related more to illness factors, whereas pre-morbid factors are more predictive of male offending (Kooyman et al. 2012), and paper II showed a risk elevation across most disorders and that the strength of the association between offending and later onset of mental disorder is similar for men and women (Stevens et al. 2012). Given this finding in comparison to the gender differences in relative risk found in the current study, it can be argued that there is now strengthening evidence to indicate 1) that the nature of the relationship between mental disorder and offending risk differs by gender and 2) that in women it is more likely to be explained by the direct impact of disorder rather than as a result of common causes or vulnerabilities. This is also supported by the finding that for women, the strength of association between disorder and offending varied by disorder even when offending in general was examined.

### *The role of substance misuse*

That the misuse of substances is highly correlated with offending in general (Grann and Fazel 2004) and when comorbid with other mental disorders (Fazel et al. 2009b) can hardly be

contested. However, whether mental illness poses an increased risk of offending over and above comorbid misuse has been debated (Van Dorn et al. 2012; Elbogen and Johnson 2009). Reporting on data from the MacArthur Risk Assessment study, Steadman et al. found that recently discharged patients without substance abuse were no more likely than neighbourhood controls to be violent (Steadman et al. 1998), although features of substance misuse were more common among patients than controls. It is arguably likely that the additional presence of substance misuse both confounds and mediates any association between mental disorder and offending and on this basis we considered its adjustment separately. We did find that primary associations between mental disorders and offending persisted however, even after adjustment for substance misuse. It must be acknowledged that relying on secondary care diagnosis of substance misuse comorbidity is likely to have resulted in residual confounding however (Hansen et al. 2000). Apart from any offending in women, risks of offending were significantly elevated for those with substance misuse alone compared to another mental disorder diagnosis alone.

### *Population impact*

In addition to presenting the relationship between mental disorder and offending in the form of relative risks, indicating the strength of associations, the population impact of disorders on offending was examined, taking both the association strength and prevalence of the exposure into account. Assuming causality, the proportion by which the number of offenders would be reduced if no psychiatric contact had occurred in the population was found to be less than 5% for male any offending, approximately 10% for male violent offending and female any offending, and over 25% for female violent offending. The notion that the importance of particular mental disorders in relation to risk of offending extends beyond psychotic and other major mental disorder diagnoses is supported by the population impact findings. However, it should be noted that the documented association does not imply causality and these findings must be interpreted with caution. Also, only first offences are included and potential differences in recidivism rates would impact the proportion of the total volume of offending associated with mental illness.

### *Strengths and limitations*

The use of register-based data is a great strength to these studies. Having population data over a long period of time enables looking at rare outcomes and following a very vulnerable group of people, who are otherwise prone to high degrees of attrition when other methods of study are employed (Steadman et al. 1998). The trade-off is that there is a gap between the conceptual definitions and operational definitions of criminal behaviour and mental disorders. Crimes that are undetected, unreported or do not result in a conviction will not be included, just as mental disorders that are untreated or treated in primary care only are not part of my studies. For both, the selection is differential, such that less severe cases are less likely to be registered and hence enter into the studies (cf. Introduction).

Aside from the implications from choice of data sources, there are also issues regarding the broad view that has been adopted throughout this thesis. Adopting a broad view has served to put known associations into perspective and stimulates new views. However, much detail is lost in grouping both crimes and mental disorders together that are very different with regard to appearance, consequences and likely causes.

### *Measuring crime*

In Paper I sentences to treatment were compared with both suspended and custodial sentences which contrasts with other studies that have limited the comparison group to custodial sentences (Socialministeriet Indenrigs- og Sundhedsministeriet 2006). The Attorney General's guidelines for when to use a psychiatric sentence rather than regular punishment point toward including both sentence types (Rigsadvokaten 2007), but empirical reports have shown that sentences to treatment are more commonly used as an alternative to custodial sentences (Kyvsgaard 1999). When looking at trends over a longer period of time, it is also necessary to consider changes in the law and penal practises. In Denmark, community service was introduced as a new form of sanction in 1992, and since that time the use of this sanction has expanded, and particularly the use of suspended sentences with community service as a condition has increasingly been used instead of a custodial sentence for violent crimes in the latter half of the study period (Clausen

2007). The inclusion of both suspended and custodial sentences gives a more uniform comparison group over the whole study period.

Aside from the question of comparability between the compared types of sanctions in regard to what types of crimes they are used for, there is also the issue of whether there are differential mechanisms in place – e.g. diversions of mentally disordered offenders away from court. As previously described (cf. Introduction), the Danish courts process cases against mentally disordered offenders in the same way as any other offenders, however, there are some exceptions regarding offenders who reoffend while already serving a sentence to treatment, and where the outcome of a new trial does not likely change this (Rigsadvokaten 2007). In these cases a conditional withdrawal of charges can be used instead of a new sentence to treatment;<sup>9</sup> a study has shown this to happen during roughly 20% of the sentences (Socialministeriet Indenrigs- og Sundhedsministeriet 2006). Obviously, this implies our numbers for crime among those with mental disorders are conservative when measured this way. However, in order to change the conclusions of this paper, the use of conditional withdrawals of charges would have to change over the study period. While this must be acknowledged as a potential source of bias, it is unlikely to be of importance for the results.<sup>10</sup>

For papers II and IV the use of the date of conviction rather than the date of the offence implies a degree of imprecision in attempting to establish whether offending took place before or after first contact with psychiatric services. Those persons where the first service contact happened between the (first) offence and conviction will be misclassified. Given the complementary foci of the papers, the effect of this goes in opposite directions; an underestimation in paper II and an overestimation in paper IV. As the sensitivity analyses in paper II showed, the overall effect of this bias is not of great importance, but it should be noted that results regarding psychotic disorders are most vulnerable to this potential bias, as court mandated assessments for establishing eligibility for treatment sentences fall in this category, if the person has not

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<sup>9</sup> A withdrawal of charges can only be given if there is no doubt about guilt (i.e. a full confession or acknowledgement of the facts) and if the new offence isn't more serious than the crime for which the treatment sentence was given.

<sup>10</sup> The aggregate data from DST are not detailed enough to allow analyses of changes in the use of this type of sentence during the study period.

previously received treatment in secondary care. The same argument applies in principle also to those with mental retardation, but given the nature of this disorder, there are fewer in this category who are undiagnosed in adolescence than is the case with psychotic disorders.

Due to the later starting point and hence improved criminal data, this source of potential bias is not a concern for paper III, since the date of the offence was used. But the use of official criminal records undoubtedly underestimates the actual rates of offending and aggression, which becomes quite apparent when comparing the results of Paper III to the meta-analysis of Large and Nielssen (2011), who reported that among first episode patients, 35% had any degree of violence and 17% had more severe violence, involving any degree of injury to the victim, the use of weapon or sexual assault, prior to initial treatment contact. In our study only 8% had a previous conviction for violent offending, and while possible explanations for this difference includes differences in demographic compositions and differences in overall crime rates in the surrounding areas of the various studies, our measurement is no doubt less sensitive than using self-report or case notes. Contrary to papers II and IV other sources of information regarding offending and violence were available in paper III, since questions about criminality and violence were part of the clinical interviews. Apart from ensuring standardised definitions, the reliance on official records also circumvented problems with high (and to some extent differential) attrition which was seen in this study,<sup>11</sup> and protected against information bias in a study where the intervention group had more frequent contact with carers than controls (Petersen et al. 2005), i.e. aggressive or violent behaviour by those in frequent contact with carers is more likely to be detected and hence reflected in the case-notes than similar behaviour by patients with less frequent treatment contact.

### *Measuring mental disorders*

While diagnostic information from secondary mental health services were available for papers II-IV, in paper I the classification of whether a person had a mental disorder was based on the legal relevance of that disorder. As such, a central question for this paper is how well the definitions

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<sup>11</sup> Attrition after two years was 25% in the AST group and 40% in the TAU group. By year five attrition in both groups was close to 45% (M. Bertelsen et al. 2008).

employed capture offending among those with mental disorders, as a broad group. Given the legal requirements for this type of sentence, it is unsurprising that a very large proportion (around 65%) of those who receive a sentence to treatment are diagnosed with a psychotic disorders, and results from Paper IV confirmed that this is a gross misrepresentation compared to other disorders (PAF for psychotic disorders was 0.1%, while it was 4.5% for all mental disorders – males, any offending). Additionally, the type and severity of the crime committed informs the decision whether or not to let a defendant undergo psychiatric examination, consequently this paper does not capture all types of offences equally well. Therefore, Paper I may be better equipped to answer questions relating to trends of violence in psychotic disorders compared to the general population than those relating to trends of any offending in any mental disorder. Conversely, there is a real advantage in using sentencing information, since these are cases where clinicians have assessed whether the offender was suffering from active symptoms at the time of the offence. This question remains unanswered in Papers III and IV, where there is no way of knowing whether offending took place during a period of active symptoms or not.

For papers II and IV, the fact that outpatient contacts were not registered prior to 1995 means that some of the included cases might not be truly incident, since they may have had an unregistered outpatient contact prior to this time. And while this lack of early outpatient information certainly is a limitation, it is, conversely, a great strength to these papers that they have been included at all, since this enables the inclusion of diagnoses that usually have limited contact with inpatient services (e.g. anxiety disorders). In either case, reliance on information from secondary mental health services precludes including those cases that are untreated or treated in primary care only. This is of course of differential importance for different diagnoses, such that less serious disorders are more likely to be unregistered. For paper II it also means that the validity of our results is dependent on referrals from primary to secondary care not being contingent on prior offending. The associations found cannot be generalized to all those in the population who experience psychiatric symptoms, but only to the subgroup who seek treatment in secondary care. Most of the routinely acquired diagnoses are not validated whereby there is a possibility of misclassification. The risk of this should be lessened due to the use of broader diagnostic groups rather than more specific diagnoses; also, those diagnoses in the register which have been validated (schizophrenia, affective disorders, and dementia) have shown reassuring

results (Jakobsen et al. 2005; Kessing 1998; Phung et al. 2007). Conversely, the register-based diagnoses are made at discharge, and hence are based on a longer period of observation, making them potentially more reliable than those based on a single clinical interview (Walsh et al. 2002), and all diagnoses are ascribed by a treating psychiatrist and hence reflect standard clinical practice.

For paper IV there are additional issues regarding translations of diagnoses from ICD-8 to ICD-10. Again, the use of broad diagnostic groups should limit the potential impact of variations between the two systems; however, childhood behavioural disorders (such as ADHD) could not be included as a distinct category in this paper, since these were not classified to a sufficient accuracy prior to the ICD-10 period. Finally, for paper IV, the longitudinal approach has certain implications for those persons who have repeated contact with mental health services and who receive different diagnoses at different points in time. Since we relied on the hierarchical logic of the ICD-10, there is a risk of underestimating the effect of diagnoses at the bottom of the hierarchy. Particularly, one might argue that this approach may not be optimal for diagnoses such as mental retardation, autism spectrum disorders and personality disorders which to a large degree are manifested as consistent traits rather than episodic states, and as such can be assumed relevant even if other diagnoses emerge. Conversely, there may be cases where changes in diagnoses reflect corrections of inaccurate prior diagnoses, thereby underestimating effects of diagnoses at the top of the hierarchy.<sup>12</sup> The diagnostic complexity surrounding comorbidity is a challenge to any study, and although attempts were made to examine the impact of both personality disorders and substance use disorders separately, this issue was not completely resolved.

For paper III the main area of concern is not so much the validity of the diagnoses of those included, but rather of whether the intended and unintended exclusion of some patients had significant impact on the results. The in- and exclusion criteria for this trial were set in order to best represent a normal clinical population. Particularly, this means that substance misuse was only ground for exclusion if this was sufficient to account for the psychotic symptoms (Jeppesen

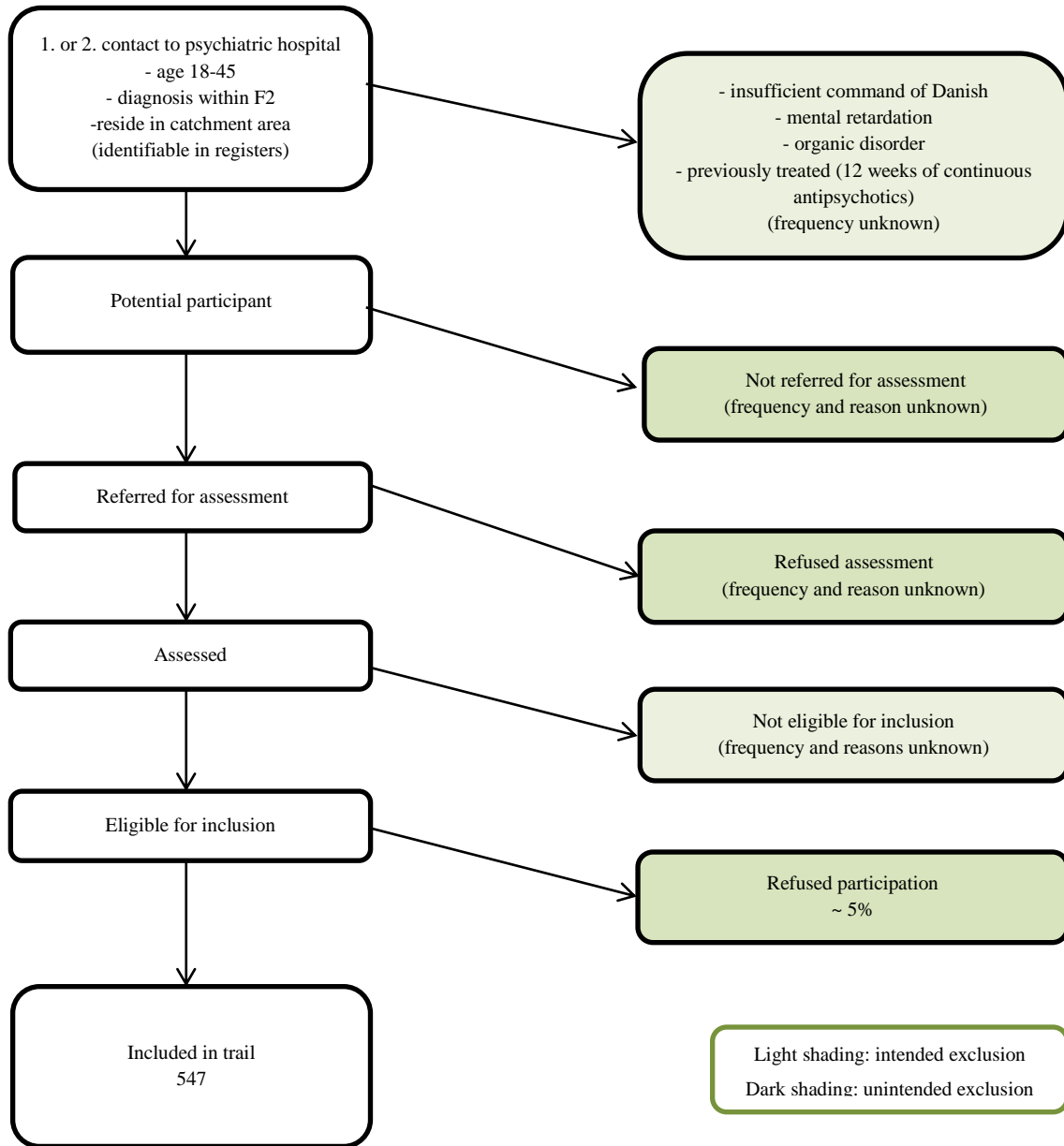
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<sup>12</sup> Studies that examine lifetime psychiatric history and group patients according to the severest diagnosis ever obtained (e.g. Hodgins et al. 1996) produce results that are consistent with this interpretation of diagnostic changes.



2001: 44). Unfortunately, the selection process prior to assessment is not very well documented (cf. figure 8), however, some comparisons with register data have been possible, and these

*Figure 8: Flow chart of selection into OPUS*



suggest that representativity is better in Aarhus than Copenhagen, for those with schizophrenia versus other F2 diagnoses (especially delusions and acute psychosis), and for younger rather than older age groups (Jeppesen 2001: 56).

Present misuse, prior criminality and aggressiveness at presentation to services were not formal grounds for exclusion, but it cannot be ruled out that these factors could influence the decision to refer a patient to assessment or the inclination of a patient to participate. Consequently, this trial – designed for other purposes and largely representative – could miss some groups particularly relevant for the focus of this thesis, but may not be ill equipped to test a hypothesis of the general efficacy of improved outpatient treatment.

### *Age restrictions*

One of the strongest and most consistent criminological findings is the age-crime curve, i.e. that offending rates peak in mid-/late adolescence and decline rapidly from around the early twenties (Greenberg 1977). It is beyond the scope of this thesis to go into possible reasons for this phenomenon, but it does have implications for measuring associations, especially when time is entered explicitly in the models. This is of course of particular relevance to disorders that also have particular distributions across age groups for “normal” onset, but is also a point to consider when choosing measures of socio-economic status (cf. section below). This discussion is mainly relevant for papers II and IV that cover a wide spectrum of diagnoses.<sup>13</sup>

With study populations followed to age 41 (paper II) or age 45 (paper IV), both these papers cover the life-span where criminal activity is most prevalent. However, the generalizability is different for various disorders, due to the age patterns for typical onset. Whether studying offending before or after first treatment contact, the generalizability is likely to be good for those disorders that commonly emerge in late adolescence or early adulthood (e.g. psychotic disorders), whereas findings for disorders of later onset (e.g. organic disorders) will be generalizable only to a select group with earlier onset than is typical. General patterns for disorders with late onset cannot be inferred from the results of this thesis, nor can effects of later onset in other diagnoses. It can be speculated that any examination of post-onset offending in

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<sup>13</sup> Age does not figure in the yearly prevalences in paper I, and the study population in paper III is previously defined – here the caveat is that full criminal records cannot be obtained for all of the study population due to their age and give we only have information from 1980 onward), and that persons under the age of 18 were not included, since recruitment was from adult psychiatric services only.

older study populations could easily generate (deceptively) high relative risk measures, since offending rates in this age group in general is very low. Likewise, in paper II, disorders that emerge in childhood (e.g. developmental or behavioural disorders and mental retardation), almost certainly represent cases of late detection rather than late onset. Incidentally, the latter disorders are also the ones that failed to reach statistical significance.

Another way age restrictions factor in to the results is through the age of legal maturity in Denmark, which by international standards is relatively high (Walgrave and Mehlbye 1998). Without going into the moral or philosophical debate of what age a person can be fully responsible for his or her actions, the lack of registration of delinquent acts prior to age 15 does limit the ability to identify those whose offending starts at a very early age. If the persons in question are more prone to mental disorders (at the time re paper IV or later in life re paper II) this would generally lead to underestimation, and any such effect would be most pronounced in disorders with early onset.

#### *Measuring socio-economic status*

For Papers II and IV there are some common considerations consequent on analysing data that are situated in time, notably that questions of measurement not only address a “what” but also a “when.” For both papers the excellent linkage in the registers enabled the ascertainment of parental information rather than the person’s own. This strategy bypassed the need to decide whether to measure SES at the time of first offence or the time of first psychiatric presentation. More importantly, as pointed out above, the bulk of offending takes place in late adolescence and early adulthood, and both offending and onset of mental disorders can impede the completion of formal education, and the ability to hold a regular job and a steady income. Consequently, any attenuating effect of SES would be difficult to interpret, since some of the effect would likely be attributable to confounding (i.e. low SES influencing the risk of both offending and onset of mental disorder) while parts would rather be a mediating effect (i.e. SES was affected between offending and onset, or between onset and offending). Finally, in a young study population the person’s own SES is to a large extent a proxy for age; teenagers are unlikely to have a steady job or a high income, and have not yet had the opportunity to complete higher levels of education.

As an example, table 3 shows the effects of adjusting the IRR's in paper II for own rather than parental educational level. Clearly, there is an attenuating effect of both measures, and at around the same level, although, not surprisingly, own education has a higher impact on those with two or more prior offences. Although there are no large differences between the two ways of adjusting, the use of parental information is conceptually less ambiguous and a great strength to the study.

*Table 3: Adjustments for any psychiatric contact following any offending (re: paper II)*

	Unadjusted	Parental education	Own education	Own + Parental
<b>Men, none</b>	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
<b>Men, 1</b>	2.32 (2.26-2.40)	1.87 (1.81-1.94)	1.78 (1.72-1.84)	1.77 (1.71-1.83)
<b>Men, 2+</b>	4.97 (4.83-5.11)	3.06 (2.95-3.17)	2.63 (2.54-2.73)	2.64 (2.55-2.74)
<b>Women, none</b>	1 (ref.)	1 (ref.)	1 (ref.)	1 (ref.)
<b>Women, 1</b>	2.25 (2.17-2.33)	2.02 (1.94-2.10)	1.94 (1.87-2.01)	1.89 (1.82-1.96)
<b>Women, 2+</b>	4.03 (3.81-4.26)	2.88 (2.70-3.07)	2.58 (2.14-2.75)	2.48 (2.32-2.65)

Note: All models are adjusted for non-penal code offending. All adjusted models are additionally adjusted for comorbid substance misuse.

Of course, it may be argued that other measures of SES than parental educational level may better capture relevant differences. As SES was entered as confounder control, rather than being the main focus of the studies, a pragmatic decision was made to use parental education rather than any other measures. As pointed out above, in order to ensure that the effect was actual confounding rather than mediating, the measurement would have to be prior to the exposures and outcomes investigated, and as education is a fairly stable measure, parental status when the child was 15 could be used. Ideally, a more detailed model would have included measures of poverty (income level and/or reception of welfare benefits), but as this can fluctuate quite dramatically over time the strategy employed for parental education would not be accurate, and rather combining information from the childhood years and coding poverty levels as none, transient, recurring or persistent would be a better option. Such an approach would enable adding information about broken homes and frequent moves which have been shown to be more

important for offending risk in young people than economic measures (Stevens 2005). In order to this, we would have had to restrict the study population to those born 1980 or later, thereby reducing the follow-up time with 15 years (i.e. to age 26 and 30, respectively). While the adjustments for SES employed in the analyses certainly are crude, they do actually capture important information, and even at this basic level are improvements over many studies in the area.

#### *Using randomized controlled trials for psychosocial interventions*

Despite being one of the larger randomized controlled trials comparing assertive specialized treatment to standard care, in paper III we were unable to show any difference between treatment groups regarding risk of or frequency of future offending. And while this may be evidence that assertive specialized treatment is no better than treatment as usual at preventing offending in a normal outpatient population, decisions regarding design, outcome measures and statistical methods may have restricted our ability to detect differences.

The determination of statistical power depends on sample size, the frequency of the event investigated and the employed method of comparison (Clayton and Hills 1993: 205ff.). In secondary analyses, such as this one, the first factor cannot be modified and problems regarding attrition precluded using a softer outcome measure such as self-reported violence or aggressiveness. A less sophisticated method of analysis would yield better power (akin to Walsh et al. 2001), however, no trends in data suggest that there are differences between the treatment groups that we were statistically unable to detect.

To date not many RCT's have been conducted focusing on psychosocial interventions. This paper therefore addresses an obvious gap in the research base. However, this type of intervention may not lend itself easily to this form of study. First, because the intervention is in many ways situated, relational and context dependent, i.e. a complex form which does not lend itself well to standardized implementation, and in fact, in case of the OPUS trial, the explicit aim was not to standardize:

The ideal was not to treat every patient with one standard package of interventions but rather to tailor an individually adapted treatment, using the specific interventions when needed (Jeppesen 2001: 41).

If a treatment effect had been found, it would not be evident whether this was attributable to the entire set-up or if specific elements of treatment were effective. This contrasts to e.g. a pharmaceutical intervention, which has a standard for administration (dose, intervals) and can be expected to have the same effect across individuals and independently of the administering personnel. Second, interventions that to some degree rely on efforts of individual persons may suffer from differences in administration over time; the initial period may be full of motivation, which can affect results, whereas this effect may diminish over time. Such a pattern has been found in a cognitive skills programme in British prisons, which showed considerable impact after first four years, but where effectiveness seemed to evaporate when rolled out on larger scale (Hough 2010: 14).

Third, intervention studies may sometimes have overly strict inclusion and/or exclusion criteria which can severely hamper external validity although the internal validity may be high. As pointed out above, on the formal level this was not the case in the OPUS trial, although it cannot be ruled out that some selection may have occurred earlier in the inclusion process.

Despite these challenges it is clear that there is a need for more research addressing whether reductions in violent and other offending can be accomplished with treatment programs that are not exclusively pharmacologically based, bearing in mind that evaluative studies in this group are often plagued by considerable confounding, large numbers of non-completers and a patient group that is notoriously difficult to engage.



## Conclusions

Offending is more prevalent among those suffering from mental disorders in general and more specifically for a range of more or less severe disorders (paper IV). However, the temporal trends for violent crime tend to follow that of the general population over time (paper I) and across countries (Large et al. 2009); the association seems to also go in the opposite direction, such that those who offend are more likely to develop mental disorders (paper II). In both cases there seems to be a dose-response pattern such that the risk of offending grows with the number of psychiatric contacts and, conversely, that the risk of psychiatric contact grows with the number of convictions. As for the possibility of reducing offending through treatment aimed at alleviating symptoms in psychotic disorders, the results were inconclusive (paper III).

There appears to be a complex relationship between offending, mental disorders and gender. Prior criminal convictions were a risk factor of comparable magnitude for future psychiatric contact in both genders, whereas psychiatric contacts entailed a larger increase in risk for female than male offending. This suggests that illness related factors could potentially be more predictive of female offending, although such a conclusion would have to be based on more detailed examination of the mechanisms involved than what has been presented here. It should also be noted that female offending, especially violent offending, happens quite infrequently whereby markers of high relative risk are obtained more easily, and that offending is still more prevalent in males with no history of mental disorders than in diagnosed females.

In line with many previous studies, substance misuse was shown to correlate highly with the risk of offending when appearing as the sole diagnosis, and especially when comorbid with other mental disorders. The picture was less clear when examining the opposite association; prior convictions – especially several and/or violent – were strongly associated with the risk of being diagnosed with misuse on the first psychiatric contact, but the risks associated with other mental disorders were not substantially affected by adjusting for comorbid misuse. This could be indicative of real differences regarding the role of misuse, but could also reflect differential misclassification, especially in those with a long time span between offending and subsequent psychiatric contact.



The papers in this thesis have aimed at bridging some of the research gaps initially pointed out regarding the association between offending and mental disorders. Having broadened the picture and drawn attention to the importance of studying non-psychotic disorders and the period prior to illness onset suggests that some common mechanisms may be involved (rather than or) in addition to disorder specific ones. Whether the focus is on offending as a risk factor for mental disorders or on mental disorders as a risk factor for offending, however, it is important to bear in mind that mere statistical associations leave us ill equipped to distinguish between causes and markers or correlates of causes (Farrington 2000).

The use of register-based data with the inherent limitations regarding cases of criminality and mental disorder that go undetected or untreated, and hence unregistered, and regarding imprecisions in relative timings precludes the ability to reach firm conclusions about causality. Similarly, the aetiology of certain disorders dictates a chronological ordering, such that cases where crime precedes diagnosis are of late detection rather than late onset. However, the findings presented here do indicate the relevance of looking beyond psychosis-specific factors in any future attempt to explain the association between crime and mental disorders. On a more immediate level, the findings presented give a picture of what can be known at the point of service contact; i.e. prevalence of prior offending among those presenting to psychiatric services for the first time, or prevalence of prior psychiatric disorders among those appearing in the criminal justice system for the first time.

### ***Perspectives and implications***

Many risk factors for both offending and mental disorders are shared (e.g. unstable families, migration, living in an urban area, low socio-economic status, family history), and additionally, have a tendency to co-occur, rendering it difficult to assess to which degree mental disorders have an independent effect on the risk of offending, and to which degree effects are additive, interactive, or sequential to other risk factors. As such, the question emerges of whether mental disorders could be a marker of high concentrations of other risk factors for offending, or if it is

perhaps the case that those suffering from mental disorders are more susceptible to the adverse effects of other risk factors? The same applies to the effect of offending on mental disorders.

### *Clinical perspectives*

One in five new patients (more than a third of males and almost one tenth of females) presenting at secondary mental health services has a prior history of violent or non-violent offending. We have presented findings that within psychotic disorders these patients are at a vastly increased risk for future offending (paper III), suggesting that the general criminological observation that one of the best predictors of future offending is the presence of prior offending (Bonta et al. 1998) also applies in psychotic illnesses, and likely also in other mental disorders, although re-offending in non-psychotic disorders has not been studied in this thesis.

An important message extending from this thesis is, that the increased risk of offending applies across a broad spectrum of disorders, including some (i.e. depressive disorders) that are commonly thought to be protective of violence and other offending. And as an additional finding, although not a novel one, the thesis highlights the importance of addressing problems of comorbid substance misuse.

In some respects the results give implications for service delivery and policy rather than individual clinicians. Despite the modest size of the clinical trial, the trends reported did not suggest differences that are clinically meaningful. This calls into question the potential efficacy of general improvements on outpatient treatment that are universally applied with respect to preventing (re-)offending, and indicates that more specific interventions or a more narrowly defined high risk group of patients should be considered. Especially since the intervention treatment had been successful in affecting factors associated with offending risk, notably (increasing) treatment adherence and (decreasing) comorbid misuse. This finding is consistent with the observation that during a period of deinstitutionalization (and perhaps, consequently, a generally reduced availability of treatment), rates of violent offending in the most severely mentally ill were not greatly influenced.

### *Criminal justice perspectives*

There is already an increasing awareness in criminal justice settings of screening for pre-existing mental disorders in offender populations in order to comply with European prison rules stating that mentally ill should not be in prison (Munkner 2004). The findings in paper IV highlight that this is certainly a relevant task, especially in regard to female offenders, although the extent to which active symptoms are displayed at the time of offending is not known. The results presented here also suggest that those with offending histories are vulnerable to negative mental health outcomes for a substantial period of time. An important message here is that the risk extends to those having received non-custodial sentences, which are far more common than custodial ones. These results are corroborated by the findings of Webb et al. (Webb et al. 2011) that showed increased risk of suicide following criminal justice system contacts, even for those who received non-custodial sentences or were acquitted.

It can also be noted that while on a societal level the sentences to psychiatric treatment constitute a very minor proportion of overall offending, and continue to do so despite the recent trends, the dramatic increase in the absolute number of sentences does have a noticeable impact on those agencies – forensic and adult psychiatric wards and outpatient clinics, as well as probation services – that process these offenders. Not least because the treatment sentences have on average become longer (Olsen and Ravn 1997) contributing to an even larger increase in the prevalent number of persons serving a sentence to treatment.

### *Further research*

The need for multidisciplinary approaches, especially within areas where health related and social factors intersect, is increasingly recognized. The emerging field of epidemiological criminology (EpiCrim) (Akers and Lanier 2009) is dedicated to explicitly develop theoretical and methodological frameworks in this field. This thesis is a modest empirical contribution to this emerging field and sketches of possible future empirical investigations are outlined in the following.

More detailed investigations of the temporalities of offending and illness onset would be helpful in trying to elaborate on the nature of the association. The prodromal phase in psychosis as well as antecedent periods in other disorders might possibly be associated with increased risk of offending, just as the circumstances around offending or (penal) reactions to offending could trigger acute psychiatric reactions. However, other data sources than those which are register-based may be necessary for this type of analysis, since the possibility of detection bias is high. Related to this, in general terms, offending co-varies greatly with (young) age, and it could be hypothesized that the impact of mental disorder on risk of offending (or the reverse) might be differential for different age groups.

Owing to the lack of diagnostic specificity prior to ICD-10 paper IV did not include ADHD and other childhood behavioural disorders as a distinct category. The relevancy of this disorder for offending and for adult personality disorders has been suggested by other smaller studies and by the large relative risks found for this disorder in paper II, and it would be an obvious next step to investigate this possible association on a larger scale.

While some approaches were taken in paper IV to handle comorbidity, this was only a rudimentary starting point for addressing a very complex phenomenon. A future study dedicated to this area would be better suited to separate cases with sequential disorders from those with concurrent comorbidity. Such an endeavour would require careful consideration of types of disorders and actual courses of illness that are chronic in nature versus those with a more episodic presentation. Inclusions of other data sources, e.g. use of prescription drugs, could be beneficial. The possible differential effects on substance misuse comorbidity across a range of other disorders could be a subtype of such an analysis. Akin to focussing on patients with repeated contacts, focus could be restricted to more chronic offenders, as a large proportion of those convicted only have the one clash with the law.

Finally, the results of this thesis with respect to the broad diagnostic relevance, whether considering offending before or after illness onset points at the need to examine shared factors in more detail, including socio-economic and psychosocial conditions in childhood. The unique possibility for conducting population based studies using the Danish registers means that there is

a large potential for future studies in this area. Also, the combination of clinical and register-based data (as employed in Paper III) is promising and worth further exploration.

## **English Summary**

### ***Introduction***

A consistent association between offending and mental disorders has been found. The association is stronger for violent than other crime, for more rather than less severe violence, and for women than for men. Much of the current research is specific to the association between psychotic disorders and violence, and has not considered the temporal ordering of offending and onset of mental disorder.

### ***Aims***

The aims of this PhD thesis were to address questions of whether levels of offending among the mentally disordered are increasing beyond what would be expected based on the population rates; what the association between crime and mental disorders looks like before and after first presentation to secondary mental health services and across different diagnostic categories; and, whether improved community treatment can reduce levels of offending in psychosis.

### ***Methods***

Data from the national Danish registers were employed in four different quantitative study designs; an ecological study, a nested case-control study, a cohort study, and a randomized controlled trial, where register data were combined with data from a clinical trial.

### ***Results***

The ecological study examined sentencing trends from 1990 to 2006 and showed that rates of violent offending have been increasing in similar ways for disordered and non-disordered perpetrators. In the 17 year study period sentences to psychiatric treatment went from comprising 3.2 to 3.9% ( $p=0.2375$ ) of the custodial and suspended sentences. However, violence against public servant increased more steeply among the mentally disordered offenders ( $p=0.0047$ ).

The case-control study examined criminality as a risk factor for mental disorders and showed that males with one conviction had an IRR of 2.32 (CI: 2.26-2.40) for subsequent psychiatric

contact for any disorder. For violent offending the IRR was 3.97 (CI: 3.81-4.12). In both violent and non-violent offending the association was stronger for several than for single convictions, and was of similar magnitude for females and males.

The cohort study examined mental disorders as a risk factor for criminality and showed that males who had been in contact with a psychiatric hospital had an IRR of 2.91 (CI: 2.80-3.02) for any offending and of 4.18 (CI: 3.99-4.38) for violent offending. Women had an IRR of 4.17 (CI: 3.95-4.40) for any and 8.02 (CI: 7.20-8.94) for violent offending. There was a dose-response effect between number of psychiatric contacts and risk of offending, and a strong combined effect of substance misuse and other mental disorders was found.

The clinical trial proved unsuccessful in reducing violent or non-violent offending by alleviating symptoms of psychosis. However, prevalence of offending, particularly of a violent type, was low and had often commenced prior to inclusion in the trial.

### ***Conclusion***

Offending is more prevalent among those suffering from mental disorders in general, and specifically across a range of more or less severe disorders, however the crime trends tend to follow that of the general population. The association seems to also go in the opposite direction, such that those who offend are more likely to develop mental disorders. In both cases there seems to be a dose-response pattern such that the risk of offending grows with the number of psychiatric contacts, and, conversely, that the risk of psychiatric contact grows with the number of convictions. Results regarding the possibility of reducing offending through treatment aimed at alleviating symptoms in psychotic disorders were inconclusive.

## **Dansk resumé [Danish Summary]**

### ***Indledning***

En konsistent sammenhæng mellem kriminalitet og psykisk sygdom er påvist i tidligere studier. Sammenhængen er stærkere for voldelig end ikke-voldelig kriminalitet, for grovere end for mildere voldskriminalitet, og for kvinder end for mænd. Hovedparten af den eksisterende forskning er koncentreret omkring sammenhængen mellem psykotiske lidelser og voldskriminalitet, og har oftest ikke taget højde for den tidsmæssige rækkefølge af kriminalitet og sygdoms onsets.

### ***Formål***

Formålet med denne afhandling var at belyse hvorvidt kriminalitetsniveauet blandt psykisk syge er stigende i forhold til kriminalitetsniveauet i befolkningen som helhed; hvordan sammenhængen mellem kriminalitet og psykisk sygdom ser ud før og efter første psykiatriske kontakt og for en række forskellige diagnostiske kategorier; og hvorvidt forbedrede ambulante behandlingsmuligheder kan reducere kriminaliteten blandt psykotiske patienter.

### ***Metoder***

Der anvendtes data fra de nationale danske registre til fire studier med forskellige kvantitative undersøgelsesdesigns; et økologisk studie, et nested case-kontrol studie, et kohorte studie og et randomiseret forsøg, hvor registerdata var kombineret med data fra et klinisk forsøg.

### ***Resultater***

Det økologiske studie undersøgte udviklingen i domme fra 1990 til 2006 og viste, at udviklingen i voldskriminalitet blandt psykisk syge i store træk har fulgt den generelle kriminalitetsudvikling. I løbet af den 17 årige undersøgelsesperiode steg andelen af domme til psykiatrisk behandling fra 3.2 til 3.9 % ( $p=0.2375$ ) af de betingede og ubetingede frihedsstraffe. Dog var der blandt behandlingsdommene en større stigning i antallet af domme for vold mod offentlig myndighed ( $p=0.0047$ ).



Case-kontrol studiet undersøgte kriminalitet som en risikofaktor for psykisk sygdom, og viste at mænd med en enkelt dom havde en IRR på 2.32 (CI: 2.26-2.40) for efterfølgende at have en psykiatrisk kontakt. IRR var på 3.97 (CI: 3.81-4.12) for voldskriminalitet. Gældende for både voldelig og ikke-voldelig kriminalitet var, at sammenhængen var stærkere for flere tidligere domme end for en enkelt, og at den var af samme størrelsesorden for kvinder som for mænd.

Kohorte studiet undersøgte psykisk sygdom som en risikofaktor for kriminalitet, og viste at mænd med en psykiatrisk kontakt havde en IRR på 2.91 (CI: 2.80-3.02) for senere at blive dømt for kriminalitet og på 4.18 (CI: 3.99-4.38) for at blive dømt for voldskriminalitet. Kvinder havde en IRR på 4.17 (CI: 3.95-4.40) for kriminalitet i det hele taget og på 8.02 (CI: 7.80-8.94) for voldskriminalitet. Der var en dosis-respons sammenhæng mellem antallet af psykiatriske kontakter og risikoen for kriminalitet, og en stærk kombineret effekt af misbrug sammen med andre psykiatriske lidelser.

Endelig viste det kliniske forsøg, at det ikke var muligt at nedbringe voldelig og ikke-voldelig kriminalitet ved hjælp af en behandlingsindsats, der ganske vist har vist sig i stand til at reducere psykotiske symptomer. Dog var specielt voldelig kriminalitet ikke særligt udbredt i undersøgelsespopulationen, og en høj andel af de der begik kriminalitet efter inklusion i studiet var tidligere straffede.

### ***Konklusion***

Lovovertrædelser forekommer mere hyppigt hos personer med psykisk sygdom generelt, og mere specifikt i en række mere eller mindre alvorlige lidelser, dog lader det til at kriminalitetsudviklingen blandt psykisk syge tilnærmelsesvist følger den generelle kriminalitetsudvikling i befolkningen. Omvendt gælder sammenhængen mellem psykisk sygdom og kriminalitet også den anden vej, således at de der begår kriminalitet også i højere grad bliver psykisk syge. I begge tilfælde fandtes et dosis-respons mønster, således at risikoen for psykiatrisk kontakt stiger med antallet af domme, ligesom risikoen for kriminalitet stiger med antallet af psykiatriske kontakter. Resultaterne vedrørende muligheden for, om behandling rettet mod at reducere symptomer i psykotiske lidelser kan nedbringe kriminaliteten i denne gruppe var usikre.

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# **Paper I**

# Dom til psykiatrisk behandling

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## ORIGINALARTIKEL

Aarhus Universitet, Center for Registerforskning, og Bispebjerg Hospital, Psykiatrisk Center

## RESUME

**INTRODUKTION:** I tidligere studier af stigningen i foranstaltningssdomme har man sammenlignet prævalente populationer af foranstaltningssdomte med incidentte anmeldelsestale. Vi har undersøgt incidentte domme i perioden 1990-2006, hvor der i sammenligningen tages højde for kriminalitetens art og alvorlighed.

**MATERIALE OG METODER:** Med data fra Danmarks Statistiks kriminalstatistik har vi sammenlignet udviklingen i foranstaltningssdomme med udviklingen i frihedsstraffe fordelt på kriminalitetens art.

**RESULTATER:** Vi fandt, at stigningen i foranstaltningssdomme fortrinsvist har fundet sted i forbindelse med voldskriminalitet, hvor især vold mod offentlig myndighed har bidraget.

**KONKLUSION:** Udviklingen i foranstaltningssdomme er parallel med udviklingen i frihedsstraffe for vold mod privatpersoner, hvilket kunne tyde på, at de samme samfundsmæssige forhold, inklusive anmeldelsestilbøjelighed, politimæssig prioritering og retspraksis ligger bag stigningen både generelt og blandt psykiatriske patienter. Derimod er der en kraftigere stigning i vold mod offentlig myndighed blandt psykiatriske patienter. Dette kunne både skyldes forhold, der medfører flere konfrontationer og ændret praksis, f.eks. i forhold til hvor ofte vold mod personale anmeldes. Det er imidlertid sådan, at hvis en almindelig borger udsættes for vold, er sandsynligheden for, at denne vold er begået af en psykisk syg person, lille og stort set uændret siden 1990.

Der har i den senere tid været fokus på stigning i kriminaliteten begået af psykisk syge. Udviklingen er i flere publikationer blevet knyttet til en samtidig deinstitutionalisering på det psykiatriske område [1-3], hvor der over en årrække er blevet nedlagt sengepladser til fordel for distriktpsykiatriske tilbud og særlige bosteder [4]. Denne sammenknytning beror på en forudsætning om, at stigningen i kriminalitet blandt psykisk syge er et isoleret fænomen, der ikke genfindes i kriminalitetsmønsteret blandt resten af befolkningen.

I ovennævnte undersøgelser når man ved at sammenholde prævalensen af personer, der aktuelt er underlagt en dom til psykiatrisk særforanstaltning, med den generelle incidens af anmeldelser frem til, at kriminaliteten i særlig grad er stigende blandt psykisk syge. Antallet af personer, der aktuelt er underlagt en dom til psykiatrisk særforanstaltning påvirkes foruden af antallet, der ikendes en sådan dom, af foranstaltningernes længde og eventuelle ændringer i dette over tid. Ligeledes er der ingen nødvendig sammenhæng mellem anmeldelsestale og antal domme

(den generelle kriminalitet), idet disse blandt andet påvirkes af opklaringsprocenter og sammensætning med hensyn til kriminalitetens art. Det er derfor ikke klart, at de eksisterende studier giver tilstrækkeligt belæg for, at kriminaliteten blandt psykisk syge stiger mere end i den øvrige befolkning. Formålet med denne undersøgelse var at undersøge, hvorvidt der i Danmark er sket en stigning i kriminaliteten blandt psykisk syge, som adskiller sig fra den generelle kriminalitetsudvikling, når der tages højde for overtrædelsernes art og kriminalitetens alvorlighed udtrykt ved den type sanktion, overtrædelserne har ført til. Vi undersøgte perioden fra 1990 til 2006.

## MATERIALE OG METODER

Data er udtrukket fra den alment tilgængelige kriminalstatistik [5] og indeholder for hvert år i perioden fra 1990 til 2006 oplysninger om antal retlige afgørelser fordelt på afgørelsestype og kriminalitetens art. Vi har sammenlignet domme til særforanstaltning med betingede og ubetingede frihedsstraffe.

Foranstaltningssdomme er domme til psykiatrisk behandling, som anvendes over for personer, der på gerningstidspunktet var »utilregnelige på grund af sindssygdom; eller tilstande, der må ligestilles hermed« (straffelovens § 16). I praksis kan disse tages i anvendelse i sager, der ellers ville have ført til en frihedsstraf, men ikke i sager, der kan afgøres med en bøde [6].

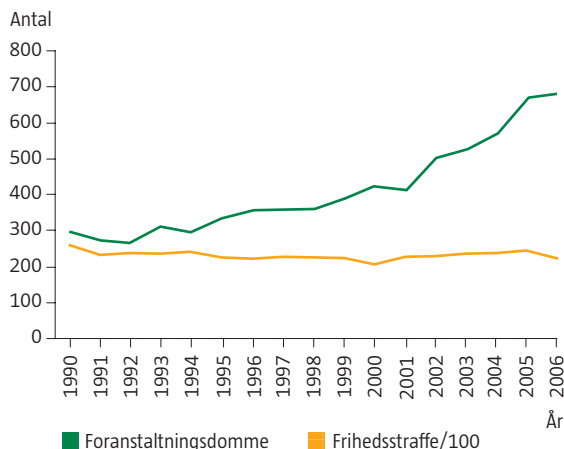
Typen af foranstaltning afhænger af både kriminalitetens og sygdommens alvorlighed, og kan bestå af ambulante behandlinger, indlæggelser eller anbringelser. Alle disse typer af foranstaltningssdomme er inkluderet i undersøgelsen. Forvaringsdomme i henhold til straffelovens § 70 er ikke inkluderet.

Foruden sindssyge (straffelovens § 16, stk. 1) anvendes særforanstaltninger over for mentalt retarderede (§ 16, stk. 1, pkt. 2 og stk. 2) og personer, som på gerningstidspunktet var karakteriserede ved en »mangelfuld udvikling, svækkelse eller forstyrrelse af de psykiske funktioner«, som ikke er omfattet af § 16, og hvor behandling vurderes formålstjenestelig i forhold til at forebygge yderligere kriminalitet (§ 69). I den almindelige kriminalstatistik er det ikke muligt at skelne disse grupper fra hinanden, hvorfor de alle er inkluderet i undersøgelsesmateriale. Hovedparten af dommene vedrører personer med psykotiske lidel-



FIGUR 1

Antal foranstaltningsdomme og frihedsstraffe, alle kriminalitetstyper, 1990-2006.



Kilde: [5].

ser; kun omkring 12% af det årlige antal vedrører mentalt retarderede, mens 23% af dommene vedrører mangelfuld udvikling mv. [7]. I årene fra 2001 til 2006 er der et vist udsving i andelen af § 69-domme, mens andelen af mentalt retarderede er nogenlunde konstant [7-9].

Med frihedsstraffe forstås betingede og ubetingede fængselsstraffe. Kriminalitetens art er opdelt i følgende grupper: Voldsforbrydelser (inklusive røveri), sædelighedsforbrydelser, ejendomsforbrydelser (eksklusive røveri), andre straffelovsovertrædelser, samt særlovsovertrædelser, herunder også færdsel.

Voldskriminaliteten er endvidere underopdelt i manddrab og forsøg herpå, vold mod privatpersoner (§§ 244-246), trusler, røveri, vold mod offentlig myndighed (§ 119) og anden vold.

## RESULTATER

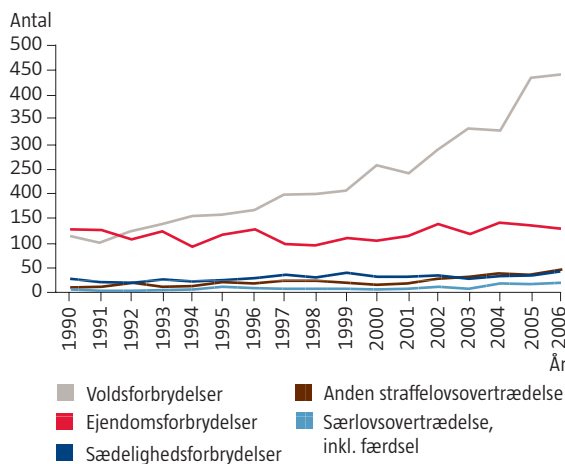
**Figur 1** viser, at antallet af frihedsstraffe i undersøgelsesperioden er tilnærmelsesvist konstant med ca. 25.000 domme årligt. I samme periode stiger antallet af foranstaltningsdomme fra omtrent 300 årlige domme i 1990 til knap 700 domme i 2006 – dvs. godt en fordobling i det årlige antal – hvilket svarer til, at foranstaltningsdommene går fra at udgøre 1,1% af det samlede antal domme til at udgøre 3%.

En analyse af specifikke kriminalitetsformer, jf. **Figur 2**, viser, at de fleste foranstaltningsdomme vedrører enten voldsforbrydelser eller ejendoms kriminalitet, mens sædelighedsforbrydelser, andre straffelovsovertrædelser samt særlovsovertrædelser kun angår en mindre del af sagerne. Den markante stigning i antallet af domme finder imidlertid kun sted



FIGUR 2

Antal foranstaltningsdomme efter kriminalitetens art, 1990-2006.



Kilde: [5].

blandt voldsforbrydelser, mens antallet af ejendomsforbrydelser er forholdsvist stabilt.

Begrænses sammenligningen mellem foranstaltningsdomme og frihedsstraffe til kun at omfatte voldsforbrydelser, jf. **Figur 3**, ses parallelle udviklingstendenser. At udviklingen er parallel betyder, at antallet af foranstaltningsdomme firedobles, mens antallet af frihedsstraffe to-en-halv-dobles, således at antallet af foranstaltningsdomme for vold udgjorde 3,5% i 1990 stigende til 5,9% i 2006 af frihedsstraffene for vold.

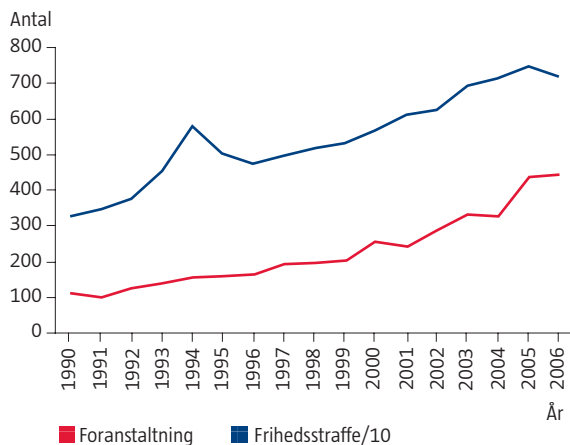
En nærmere analyse viser, at der også inden for voldsområdet er forskelle mellem foranstaltningsdomme og frihedsstraffe med hensyn til sammensætning og tidsmæssig udvikling. Blandt foranstaltningsdommene er det særligt overtrædelser vedrørende vold mod privatpersoner (straffelovens §§ 244-246) samt i særdeleshed vold mod offentlig myndighed (§ 119), der udgør den største stigning (ej vist). De øvrige typer voldsforbrydelser udgør hver især en mindre del af sagerne og stiger moderat i antal. Ved frihedsstraffene udgør vold mod privatpersoner så betydelig en andel, at disse alene tegner udviklingen. Her er der dog også sket en stigning i vold mod offentlig myndighed, omend denne gerningskategori procentuelt udgør en langt mindre andel end foranstaltningsdommene, i 2006 f.eks. 43% henholdsvis 14%. Inden for anden vold er der ligeledes tale om en moderat stigning.

**Figur 4** viser forskelle mellem udviklingen i domme for vold mod offentlig myndighed for foranstaltningsdomme og frihedsstraffe. Fraset vold mod offentlig myndighed udgør foranstaltningsdommene



**FIGUR 3**

Antal foranstaltningsdomme og frihedsstraffe, vold, 1990-2006.



Kilde: [5].

for vold 3,2% stigende til 3,9% af frihedsstraffene i løbet af undersøgelsesperioden.

### DISKUSSION

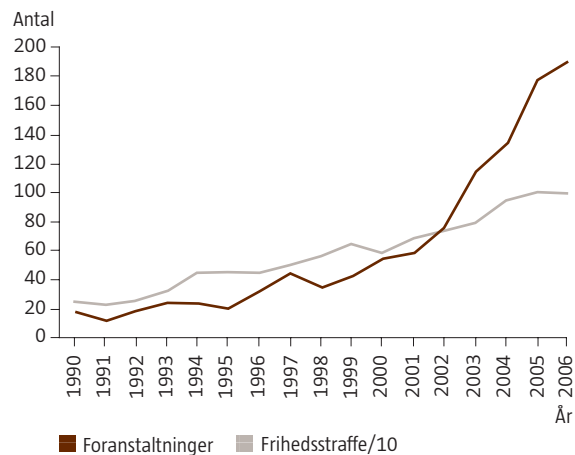
Undersøgelsen viser for det første, at foranstaltningsdomme udgør en meget lille del af det samlede kriminalitetsbillede – også selv om der i løbet af undersøgelsesperioden er sket en stigning. For det andet viser den, at stigningen hovedsageligt finder sted på voldsområdet, hvor den – hvad angår vold mod privatpersoner – svarer til stigningen i frihedsstraffe, mens stigningen er højere, hvad angår vold mod offentlig myndighed.

Undersøgelsens talmateriale stammer fra nationale registre, og validiteten må anses for at være meget høj. Tidligere har der været registreringsproblemer vedrørende foranstaltningsdomme, idet domstolens ændringer og ophævelser af eksisterende domme fejlagtigt har været registreret som nye domme [8]. Dette problem eksisterer dog hovedsageligt i tiden inden undersøgelsesperioden; og i det omfang, fejlagtig registrering stadig måtte forekomme, sker det i så begrænset et omfang, at det hverken har betydning for det årlige antal eller trenden for de tidsmæssige udviklingstendenser.

I denne undersøgelse sammenlignes foranstaltningsdomme med både betingede og ubetingede frihedsstraffe, hvorimod andre opgørelser har sammenlignet med ubetingede straffe alene [10]. Rigsadvokatens retningslinjer for, hvornår en psykiatrisk særforanstaltning kan tages i anvendelse, taler for, at man inkluderer både betingede og ubetingede straffe i sammenligningen [6]. Modsat viser empiriske opgø-

**FIGUR 4**

Antal foranstaltningsdomme og frihedsstraffe, vold mod offentlig myndighed, 1990-2006.



Kilde: [5].

relser, at foranstaltningsdommene i praksis fortrinsvis anvendes i stedet for en ubetinget straf [11]. Ved opgørelser, der dækker en længere tidsmæssig periode, må man også være opmærksom på eventuelle ændringer i retspraksis og lovgivning. Således skete der i løbet af undersøgelsesperioden ændringer i brugen af frihedsstraffe, specielt ved indførelsen af samfundstjeneste. Ordningen blev lovfæstet i 1992, og der er særligt i den sidste halvdel af undersøgelsesperioden sket en stigning i anvendelsen af denne sanktionsform i forbindelse med voldsforbrydelser [12]. Inklusionen af både betingede og ubetingede frihedsstraffe giver således et mere ensartet sammenligningsgrundlag for hele perioden.

Sammenligningen af domme (til særforanstaltninger) med domme (til betinget eller ubetinget frihedsstraf) må anses som værende at foretrække frem for en sammenligning af prævalente populationer af tilsynsklienter med generelle anmeldelsestal (som f.eks. hos [3]), idet tælleenheden er den samme, og man ikke sammenholder personer på den ene side med handlinger på den anden. Det er imidlertid muligt, at den samme person kan idømmes flere frihedsstraffe i det samme år, hvilket ikke sker med foranstaltningsdomme. Der skal dog her ikke drages tvivl om, at der er sket en reel stigning i antallet af personer, der på et givet tidspunkt er under tilsyn af Kriminalforsorgen i Frihed (KiF) i forbindelse med en foranstaltningsdom, hvilket dog også til dels må tilskrives stadig længere tilsynstider [11, 13]. Der sættes således heller ikke spørgsmålstegn ved, at der er sket en reel forøgelse af belastningen af både KiF og de behandlingsansvarlige (rets-)psykiatriske afdelin-

ger. Blot giver denne undersøgelses resultater ikke anledning til at udlede en kausal sammenhæng mellem resurser i psykiatrien i form af sengepladser og stigningen i antallet af pådømte foranstaltninger. Dette understøttes også af, at faldet i sengepladser har været beskedent efter 1993 [14, 15], hvorimod stigningen i domme synes mest markant efter 2000 (jf. Figur 1).

Tanken om, at deinstitutionalisering i form af udvikling af psykiatriske sengepladser kan føre til øget kriminalitet, kan føres tilbage til *Penrose*, der i 1939 observerede en negativ korrelation mellem antallet af psykiatriske sengepladser i et land og fængselsbefolkningens størrelse [16]. Tankegangen er for det første, at adækvat psykiatrisk behandling har en individualpræventiv effekt i tilfælde, hvor der er en direkte sammenhæng mellem den psykiske sygdom og den kriminelle handling, og for det andet, at de psykiatriske institutioner og fængslerne udgør to konkurrerende måder at håndtere afvigende og uønsket adfærd i samfundet på. I en nyere australsk tværsnitsundersøgelse [17] har man reanalyseret *Penroses* data og bekræftet hans konklusioner. Imidlertid fandt man, at på trods af, at antallet af psykiatriske senge er faldet og fangetallet steget siden *Penroses* studier, er sammenhængen i 2004 ikke længere til stede i vestlige udviklede lande [17].

I en norsk undersøgelse er deinstitutionaliseringstesen belyst med longitudinelle data for perioden fra 1930 til 2004 [18]. Den sammenhæng, *Penrose* i starten af sidste århundrede påviste mellem forskellige lande, har *Hartvig* og *Kjelsberg* genfundet over tid i norske data. Over en længere tidsperiode, hvor antallet af psykiatriske sengepladser faldt, var der samtidigt en markant stigning i kriminaliteten i samfundet, særligt hvad den personfarlige kriminalitet angår. Forfatterne påpegede dog samtidigt, at stigningen i kriminalitet er af et sådan omfang, at nedgangen i sengepladser kun i meget begrænset omfang kan have bidraget til udviklingen.

Indeværende undersøgelsesresultater er i overensstemmelse med de norske: Der er i løbet af undersøgelsesperioden sket en stigning i antal foranstaltningsdomme i forbindelse med vold, men denne stigning er parallel med stigningen i betingede og ubetingede fængselsstraffe for vold. At søge at forklare den stigning i voldskriminaliteten, der har fundet sted i Danmark i løbet af de sidste 17 år, ligger uden for denne undersøgelses fokus. Det kan dog nævnes, at stigningen i voldskriminaliteten ikke nødvendigvis udelukkende er udtryk for, at flere udsættes for vold, men også kan afspejle en øget tilbøjelighed til at anmelde volden, når den forekommer. Tilsvarende kan det tænkes, at den vold, der finder sted nu, er grovere,



end den var før i tiden [19]. Offerundersøgelser viser, at den stigende anmeldelsestilbøjelighed særligt gør sig gældende i forbindelse med arbejdsrelaterede voldsepisoder [19], hvilket blandt andet skal ses i lyset af, at de fleste arbejdspladser efterhånden har en formuleret voldspolitik [20]. Denne form for vold er således også særligt udbredt blandt psykisk syge, hvor omkring halvdelen af stigningen i voldsdomme kan tilskrives vold mod offentlig myndighed. Dette kan til dels skyldes en øget anmeldelsestilbøjelighed i de psykiatriske institutioner [10] m.fl., men må også tilskrives en større grad af kontrol og regulering i det offentlige rum i det hele taget [20].

## KONKLUSION

Stigningen i antallet af foranstaltningsdomme i undersøgelsesperioden finder fortrinsvist sted i forbindelse med voldskriminalitet. Hvad angår vold mod privatpersoner, følger stigningen den almindelige kriminalitetsudvikling, hvilket kunne tyde på, at de samme samfundsmæssige forhold, inklusive anmeldelsestilbøjelighed, politimæssig prioritering og retspraksis ligger bag stigningen både generelt og blandt psykiatriske patienter. Derimod er der en kraftigere stigning i vold mod offentlig myndighed blandt psykiatriske patienter. Dette kunne både skyldes ændrede forhold, der medfører flere konfrontationer, og ændret praksis, f.eks. i forhold til hvor ofte vold mod personale anmeldes.

Det er imidlertid sådan, at hvis en almindelig borger udsættes for vold, er sandsynligheden for at denne vold er begået af en psykisk syg person lille og stort set uændret siden 1990.

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**INTERESSEKONFLIKTER:** Ingen

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# Præoperativ funktionel magnetisk resonans-billeddannelse hos patienter med hjernetumor

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## ORIGINALARTIKEL

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## RESUME

**INTRODUKTION:** Funktionel magnetisk resonans-billeddannelse (fMRI) kan noninvasivt kortlægge vigtige funktioner i hjernebarken. Formålet med dette arbejde har været ved hjælp af en standardiseret målemetode at klarlægge, hvorvidt der er en sammenhæng mellem afstanden fra tumor til den kortikale fMRI-aktivitet og patientens postoperative symptomer. Et andet formål har været at undersøge den præoperative fMRI's betydning for den neurokirurgiske beslutningsproces.

**MATERIALE OG METODER:** Undersøgelsen er en retrospektiv undersøgelse af 25 patienter. Inklusionskriterierne var operation eller biopsi efter fMRI, og endvidere skulle patienterne have gennemført postoperativ kontrol efter tre måneder. I alt 14 patienter opfyldte disse krav (seks mænd og otte kvinder, gennemsnitsalderen var 39 år). fMRI-rådata blev indhentet vha. en tretles magnetisk resonans-skanner (Signa HDx R14M5, GE Healthcare). Afstanden fra tumor til fMRI-aktivitet blev målt vha. GE-reformat version 4.2, efter at rådata var blevet forarbejdet i GE BrainwavePA version 1.3.08130. Neurokirurgerne vurdering af fMRI i den præoperative beslutningsproces blev indhentet via et spørgeskema.

**RESULTATER:** Des kortere afstand fra kortikal aktivitet til tumor, des større risiko for blivende postoperativt funktionstab (Fishers eksakte test: afstand < 15mm, p = 0,43; afstand < 10 mm, p =

0,14). fMRI havde stor betydning i den præoperative planlægning for vurderingen af operabilitet og resektionsstørrelse samt for planlægningen af kirurgisk fremgangsmåde i henholdsvis 42, 83 og 50% af tilfældene.

**KONKLUSION:** Standardiseret måling af afstanden mellem tumor og fMRI-aktivitet hos patienter med hjernetumorer kan bidrage til den præoperative risikovurdering.

Funktionel magnetisk resonans-billeddannelse (fMRI) kan noninvasivt kortlægge vigtige funktioner i hjernebarken [1-4], og dette kan bruges i den præoperative evaluering af patienter med hjernetumorer. Teknikken bruges i stadig større grad klinisk og kan også bruges intraoperativt i neuronavigationssystemet ved tumorresektion [5].

I flere studier har man forsøgt at klarlægge eventuelle sammenhænge mellem afstand fra tumor til kortikal aktivitet for derigennem at få et mål, der direkte kan bruges i den præoperative risikovurdering [6, 7]. Ideen bygger på erfaringer fra »guldstandarden«, direkte kortikal stimulering (DKS), hvor man netop under tumorresektionen holder en vis afstand

## **Paper II**

# Offending prior to first psychiatric contact: a population-based register study

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**Background.** There is a well-established association between psychotic disorders and subsequent offending but the extent to which those who develop psychosis might have a prior history of offending is less clear. Little is known about whether the association between illness and offending exists in non-psychotic disorders. The aim of this study was to determine whether the association between mental disorder and offending is present prior to illness onset in psychotic and non-psychotic disorders.

**Method.** In a nested case-control study, cases ( $n=101\,890$ ) with a first psychiatric contact during the period 1995 to 2006 were identified and matched by age and gender to population-based controls ( $n=2\,236\,195$ ). Exposure was defined as prior criminal and violent offending.

**Results.** Males with one offence had an incidence rate ratio (IRR) of 2.32 [95% confidence interval (CI) 2.26–2.40] for psychiatric admission whereas two or more convictions yielded an IRR of 4.97 (95% CI 4.83–5.11). For violent offending the associations were stronger and IRRs of 3.97 (95% CI 3.81–4.12) and 6.18 (95% CI 5.85–6.52) were found for one and several offences respectively. Estimates for females were of a similar magnitude. The pattern was consistent across most diagnostic subgroups, although some variability in effect sizes was seen, and persisted after adjustment for substance misuse and socio-economic status (SES).

**Conclusions.** A prior history of offending is present in almost one in five patients presenting to mental health services, which makes it an important issue for clinicians to consider when assessing current and future risks and vulnerabilities.

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**Key words:** Crime, epidemiology, forensic psychiatry.

## Introduction

The association between severe mental illness and offending has been established primarily by revealing elevated rates of offending, particularly of a violent nature, in persons suffering from schizophrenia and other psychotic disorders (Fazel *et al.* 2009a). Substance misusers, persons suffering from antisocial personality disorder and adolescents with behavioural disorders (e.g. attention deficit/hyperactivity disorder, ADHD) have also been shown to have elevated rates of offending (Grann & Fazel, 2004; Retz & Rösler, 2007; Logan & Johnstone, 2010) whereas there is little knowledge of offending behaviour in other non-psychotic disorders. Studies of prison populations have consistently shown that, in addition to psychotic

and personality disorders, there are elevated rates of less severe disorders such as anxiety disorders and clinical depression in incarcerated offenders (Fazel & Danesh, 2002) and those recently remanded (Andersen *et al.* 1996), suggesting that the association between crime and mental illness is not confined to the most serious disorders, although the nature of this association remains unclear.

Much of the existing research is based on studies that are too small to compare rates for men and women but, as discussed in Robbins *et al.* (2003), studies that do look at female offending have shown mental illness to be a stronger risk factor for offending in women than in men, such that the gender gap in crime rates tends to decrease after onset of psychotic disorders.

Offending behaviour in mentally ill persons has long been considered a consequence of the disorder, but there is now an emerging interest in comparing offending before and after illness onset among those with severe mental disorder. The few studies that do

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exist (Wallace *et al.* 1998; Munkner *et al.* 2003; Jones *et al.* 2010) suggest that for many patients offending commences long before illness onset. The results of these studies still need to be replicated on a larger scale. Pre-onset offending in non-psychotic disorders remains unexamined.

Using a large population-based sample covering the full range of mental disorders, the aim of this study was to investigate the association between first psychiatric contact and prior offending across major diagnostic groups. We examined patterns of general and violent offending respectively, in each case distinguishing between one-time and repeat offending. We also assessed whether the pattern was comparable in males and females. Potential confounding of the results by co-morbid substance misuse and parental socio-economic status (SES) was also considered.

## Method

Data were obtained by linking Danish population-based registers by means of the unique personal identification number. The Danish Civil Registration System (CRS) contains data for each individual on gender and date of birth, continuously updated information on vital status and the CRS numbers of parents, along with many other variables (Pedersen *et al.* 2006). The Danish Psychiatric Central Register (PCR) contains data relating to all admissions to psychiatric hospitals since 1969 and all out-patient contacts since 1995 (Munk-Jorgensen & Mortensen, 1997). Discharge diagnoses ascribed by the treating psychiatrist were recorded according to ICD-8 (WHO, 1967) from April 1969 to December 1993 and according to ICD-10 (WHO, 1992) from January 1994 onwards. The Danish National Crime Register (NCR) became electronic in November 1978 and all court verdicts and police decisions relating to criminal charges have been registered since this date. The NCR contains information on date of verdict (or police decision), type of offence and type of verdict along with length and type of sentence (Kyvsgaard, 1998), and data are made available through Statistics Denmark from 1980 onwards. The age of criminal responsibility in Denmark was 15 years during the study period.

### Study population

Cases were identified as the total sample of Danish inhabitants born between 1 January 1965 and 31 December 1991 who were admitted for the first time to a psychiatric hospital or were registered with an out-patient contact or emergency room visit with an ICD-10 Chapter V (F) diagnosis between 1 January 1995 and 31 December 2006. In this way the study

**Table 1.** Main categories of ICD-10 Chapter V

Code	Description
F0	Organic, including symptomatic, mental disorders
F1	Mental and behavioural disorders due to psycho-active substance use
F2	Schizophrenia, schizotypal and delusional disorders
F3	Mood (affective) disorders
F4	Neurotic, stress-related and somatoform disorders
F5	Behavioural syndromes associated with physiological disturbances and physical factors (e.g. eating disorders, sexual disorders)
F6	Disorders of adult personality and behaviour
F7	Mental retardation
F8	Disorders of psychological development (e.g. autism)
F9	Behavioural and emotional disorders with onset usually occurring in childhood and adolescence
F99	Unspecified mental disorder

period was confined to the years where we have complete information on both in-patient and out-patient visits, and persons who had an ICD-8 diagnosis in the period 1969 to 1993 or an ICD-10 diagnosis in 1994 were therefore not included. Only persons who were at least 15 years of age at the time of their first contact were included because younger persons could not have a prior record of offending.

Each case was matched to a random sample of controls using a nested case-control design (Clayton & Hills, 1993). Controls were of the same gender as the case, were born on the same day, had no record of psychiatric contact up until and including the day the case was confirmed as a case, and were selected randomly from the entire Danish population such that the study population contained all cases and 25% of those at risk.

### Assessment of mental disorders in cases

Information on main discharge diagnosis was obtained from the first admission, out-patient contact or emergency room visit. If the main diagnosis was not in ICD-10 Chapter V (F), secondary diagnoses were considered. The diagnoses were grouped according to the main categories of ICD-10 Chapter V (Table 1). In addition, all secondary diagnoses were searched for a code within F1 to establish the presence of co-morbid substance misuse.

### Assessment of offending

For all cases and controls the NCR was searched for guilty verdicts before the match date. Guilty verdict types included: custodial sentences, suspended

sentences, conditional withdrawal of charges, fines and sentences to psychiatric treatment. Only convictions for crimes listed in the penal code were included in the study; traffic violations and violations of other special acts (e.g. tax laws, environmental laws) were not included. We recorded the total number of convictions in addition to the number of convictions for violent offences for each individual. Given the design of the study, we were able to obtain complete information on criminal convictions from the age of legal responsibility until the end of 2006.

#### *Assessment of parental level of education*

SES is known to correlate with both offending and mental illness (Agerbo *et al.* 2004; Murray *et al.* 2010) and because own SES may be a mediating effect rather than a confounder, we chose to use parental status. We used information on maternal and paternal level of education in the year in which the proband turned 15 years of age. The highest obtained level of education for each parent was coded as: basic education, vocational training, higher education, educational status unknown, and parent unknown. Data were obtained from the Integrated Database for Longitudinal Labour Market Research, which contains annually updated information from 1980 onwards in addition to information from the 1970 population and housing census (Danmarks Statistik, 1991). Using the level of educational attainment has the advantage over other measures of SES in that it is fairly stable over time, whereas income level, labour market attachment and receipt of welfare benefits may vary substantially from year to year.

#### *Statistical analysis*

Data were analysed by conditional logistic regression using the PHREG procedures in SAS version 9.1.3 (SAS Institute Inc., USA), where each case and matched controls formed a separate stratum. Because the controls were selected randomly within the appropriate risk sets, the estimated measures of relative risk are incidence rate ratios (IRRs; King & Zeng, 2002), with 95% Wald confidence intervals (CIs). For each gender we estimated the effect of one or several offences and of one or several violent offences respectively, and for all analyses adjusted models were fitted controlling for co-morbid substance misuse and parental level of education. Sensitivity analyses were performed on all models, eliminating cases or controls that were registered with a sentence to psychiatric treatment. We also fitted models that were restricted to cases where the time between offending and presentation exceeded 2 and 5 years respectively.

## **Results**

### *Descriptive results*

A total of 101 890 persons born in Denmark between 1 January 1965 and 31 December 1991 had their first admission to, or out-patient contact with, a psychiatric hospital in the years 1995 to 2006. Their age at first contact ranged from 15 to 41 years, where the lower limit is defined by the age of criminal responsibility in Denmark and the upper limit is restricted by the cohort definition. The cases were matched by incidence density sampling to a total of 2 236 195 controls.

### *Main findings*

Overall, 19.2% of the psychiatric patients had a guilty verdict relating to the penal code prior to their first psychiatric contact, whereas 8.3% of population controls had at least one verdict corresponding to an IRR of 3.06 (95% CI 3.01–3.12). For violent offending 5.6% of cases and 1.8% of controls had at least one conviction, resulting in an IRR of 4.37 (95% CI 4.24–4.50).

### *Penal code offending and subsequent psychiatric contact*

Males with one conviction had an IRR of 2.32 (95% CI 2.26–2.40) for psychiatric contact and two or more convictions resulted in an IRR of 4.97 (95% CI 4.83–5.11). The corresponding values for women were very similar, with an IRR of 2.25 (95% CI 2.17–2.33) for one conviction and 4.03 (95% CI 3.81–4.26) for several. A total of 34% of males with a psychiatric contact were registered with at least one offence but this applied to only 14.4% of the controls. Offending was less prevalent among females, where 8.4% of the cases and 3.5% of the controls had at least one conviction.

There was some variability in the effect sizes for different diagnostic groups (Tables 2 and 3). For both genders, prior offending had by far the strongest association with contacts due to substance-related disorders (F1). IRRs were 6.05 for males (95% CI 5.61–6.51) and 7.28 for females (95% CI 6.29–8.42) with one conviction and 21.28 for males (95% CI 19.92–22.73) and 35.56 for females (95% CI 29.90–42.28) with two or more convictions. Behavioural and emotional disorders with onset in childhood or adolescence (F9) were also strongly correlated with offending, with IRRs of 4.55 (95% CI 3.69–5.61) for males and 3.70 (95% CI 2.64–5.17) for females with one conviction. Neurotic, stress-related and somatoform disorders (F4), personality disorders (F6) and unspecified mental disorders (F99) were associated with an IRR >2 (range 2.07–3.24) in both genders. An estimate of

**Table 2.** Penal code offending prior to first psychiatric contact by diagnosis, men

	Number of offences	Cases		Controls		IRR (95% CI) <sup>a</sup>	Adjusted IRR (95% CI) <sup>b</sup>
		n	%	n	%		
F0	None	349	61.9	11 047	85.0	1 (ref.)	1 (ref.)
	1	85	15.1	1156	8.9	2.26 (1.75–2.92)	1.69 (1.27–2.24)
	≥2	130	23.0	791	6.1	5.07 (4.04–6.37)	4.06 (3.18–5.20)
F1	None	3015	40.3	147 977	85.0	1 (ref.)	1 (ref.)
	1	1365	18.3	15 422	8.9	6.05 (5.61–6.51)	5.73 (5.32–6.18)
	≥2	3097	41.4	10 635	6.1	21.28 (19.92–22.73)	19.54 (18.26–20.90)
F2	None	2832	69.6	79 748	85.6	1 (ref.)	1 (ref.)
	1	522	12.8	7913	8.5	1.80 (1.63–1.99)	1.79 (1.61–1.98)
	≥2	716	17.6	5499	5.9	3.65 (3.33–4.00)	3.32 (3.01–3.67)
F3	None	4817	74.8	125 662	84.7	1 (ref.)	1 (ref.)
	1	831	12.9	13 381	9.0	1.65 (1.52–1.78)	1.58 (1.46–1.72)
	≥2	791	12.3	9257	6.2	2.32 (2.14–2.52)	2.06 (1.89–2.25)
F4	None	10 524	71.0	289 334	85.3	1 (ref.)	1 (ref.)
	1	2105	14.2	29 839	8.8	2.07 (1.97–2.18)	1.99 (1.89–2.10)
	≥2	2190	14.8	20 073	5.9	3.29 (3.13–3.46)	3.00 (2.84–3.17)
F5	None	814	86.5	18 704	84.6	1 (ref.)	1 (ref.)
	1	81	8.6	2037	9.2	0.81 (0.64–1.03)	0.89 (0.70–1.13)
	≥2	46	4.9	1374	6.2	0.68 (0.50–0.93)	0.79 (0.58–1.09)
F6	None	2497	60.4	81 074	85.5	1 (ref.)	1 (ref.)
	1	602	14.6	8266	8.7	2.44 (2.21–2.68)	2.28 (2.06–2.52)
	≥2	1032	25.0	5444	5.7	6.52 (6.00–7.09)	5.43 (4.96–5.94)
F7	None	469	85.9	10 660	86.5	1 (ref.)	1 (ref.)
	1	47	8.6	1013	8.2	0.82 (0.60–1.12)	0.67 (0.49–0.93)
	≥2	30	5.5	652	5.3	0.81 (0.55–1.18)	0.58 (0.39–0.86)
F8	None	544	91.9	11 177	92.4	1 (ref.)	1 (ref.)
	1	26	4.4	617	5.1	0.78 (0.52–1.18)	0.70 (0.46–1.06)
	≥2	22	3.7	297	2.5	1.38 (0.88–2.18)	1.24 (0.78–1.96)
F9	None	866	79.3	20 778	94.2	1 (ref.)	1 (ref.)
	1	131	12.0	879	4.0	4.55 (3.69–5.61)	3.83 (3.07–4.77)
	≥2	95	8.7	389	1.8	8.69 (6.70–11.28)	5.87 (4.41–7.83)
F99	None	1089	64.7	32 026	86.1	1 (ref.)	1 (ref.)
	1	268	15.9	3085	8.3	2.75 (2.38–3.19)	2.77 (2.39–3.21)
	≥2	326	19.4	2106	5.7	5.12 (4.44–5.90)	5.15 (4.45–5.97)
Any	None	27 816	65.7	828 190	85.5	1 (ref.)	1 (ref.)
	1	6063	14.3	83 608	8.6	2.32 (2.26–2.40)	1.87 (1.81–1.94)
	≥2	8475	20.0	56 517	5.8	4.97 (4.83–5.11)	3.06 (2.95–3.17)

IRR, Incidence rate ratio; CI, confidence interval.

<sup>a</sup> Matched for gender and exact birthday, adjusted for non-penal code offending.

<sup>b</sup> Matched for gender and exact birthday, adjusted for non-penal code offending, parental level of education and, except for F1, co-morbid substance misuse.

this magnitude was also found for males with organic disorders (F0) and females with psychotic disorders (F2). Significantly elevated risks with an IRR <2 (range 1.49–1.85) were found in persons whose first diagnosis was affective disorders (F3), males with psychotic disorders (F2), and females with organic disorders (F0) or behavioural syndromes associated

with physiological disturbances and physical factors (F5). The association with prior offending was not significant for persons who had a psychiatric contact for mental retardation (F7), males with behavioural syndromes associated with physiological disturbances and physical factors (F5) and males admitted with disorders of psychological development (F8).



**Table 3.** Penal code offending prior to first psychiatric contact by diagnosis, women

	Number of offences	Cases		Controls		IRR (95% CI) <sup>a</sup>	Adjusted IRR (95% CI) <sup>b</sup>
		n	%	n	%		
F0	None	269	91.8	6214	96.1	1 (ref.)	1 (ref.)
	1	13	4.4	200	3.1	1.49 (0.84–2.65)	1.44 (0.81–2.56)
	≥2	11	3.8	55	0.9	4.83 (2.48–9.40)	4.57 (2.34–8.94)
F1	None	1369	69.8	41 088	96.2	1 (ref.)	1 (ref.)
	1	273	13.9	1293	3.0	7.28 (6.29–8.42)	6.85 (5.91–7.95)
	≥2	320	16.3	330	0.8	35.56 (29.90–42.28)	31.64 (26.53–37.74)
F2	None	2024	91.3	46 189	96.5	1 (ref.)	1 (ref.)
	1	133	6.0	1323	2.8	2.32 (1.92–2.79)	2.14 (1.77–2.59)
	≥2	60	2.7	370	0.8	3.85 (2.92–5.09)	3.47 (2.59–4.64)
F3	None	11 746	93.0	262 026	96.2	1 (ref.)	1 (ref.)
	1	675	5.3	8253	3.0	1.85 (1.71–2.01)	1.76 (1.62–1.91)
	≥2	204	1.6	2135	0.8	2.26 (1.95–2.61)	2.07 (1.78–2.40)
F4	None	24 390	92.1	546 015	96.4	1 (ref.)	1 (ref.)
	1	1527	5.8	16 175	2.9	2.16 (2.05–2.28)	2.05 (1.94–2.16)
	≥2	556	2.1	4092	0.7	3.27 (2.99–3.58)	2.87 (2.62–3.15)
F5	None	6149	95.0	129 007	96.9	1 (ref.)	1 (ref.)
	1	250	3.9	3463	2.6	1.55 (1.36–1.77)	1.56 (1.37–1.79)
	≥2	76	1.2	729	0.5	2.33 (1.84–2.96)	2.38 (1.87–3.03)
F6	None	5508	88.8	127 531	96.5	1 (ref.)	1 (ref.)
	1	496	8.0	3752	2.8	3.15 (2.85–3.47)	2.88 (2.60–3.18)
	≥2	197	3.2	887	0.7	5.58 (4.76–6.54)	4.48 (3.78–5.31)
F7	None	379	96.7	8114	96.4	1 (ref.)	1 (ref.)
	1	7	1.8	233	2.8	0.61 (0.29–1.31)	0.51 (0.24–1.10)
	≥2	6	1.5	69	0.8	1.83 (0.79–4.24)	1.60 (0.67–3.75)
F8	None	229	97.4	4475	97.3	1 (ref.)	1 (ref.)
	1	4	1.7	111	2.4	–	–
	≥2	2	0.9	12	0.3	–	–
F9	None	765	93.1	15 245	98.2	1 (ref.)	1 (ref.)
	1	43	5.2	245	1.6	3.70 (2.64–5.17)	3.34 (2.28–4.59)
	≥2	14	1.7	29	0.2	10.11 (5.30–19.29)	7.03 (3.52–14.04)
F99	None	1692	91.9	36 951	96.7	1 (ref.)	1 (ref.)
	1	104	5.7	1023	2.7	2.30 (1.86–2.83)	2.19 (1.78–2.70)
	≥2	45	2.4	246	0.6	4.34 (3.14–6.00)	4.02 (2.90–5.57)
Any	None	54 520	91.6	1 222 855	96.5	1 (ref.)	1 (ref.)
	1	3525	5.9	36 071	2.8	2.25 (2.17–2.33)	2.02 (1.94–2.10)
	≥2	1491	2.5	8954	0.7	4.03 (3.81–4.26)	2.88 (2.70–3.07)

IRR, Incidence rate ratio; CI, confidence interval.

<sup>a</sup> Matched for gender and exact birthday, adjusted for non-penal code offending.

<sup>b</sup> Matched for gender and exact birthday, adjusted for non-penal code offending, parental level of education and, except for F1, co-morbid substance misuse.

When looking at single *versus* multiple convictions there was a dose–response relationship in both genders and for most diagnostic groups, such that multiple offences were associated with higher risks than just being convicted of a single offence. The exceptions to this pattern were males with a contact for mental retardation (F7) or behavioural syndromes associated

with physiological disturbances and physical factors (F5), where the risk decreased with increasing number of convictions.

Adjusting the results for co-morbid substance misuse and parental level of education generally had the effect of attenuating the estimates, but the significant associations between diagnosis at first psychiatric

contact and prior convictions persisted. The exception was behavioural syndromes associated with physiological disturbances and physical factors (F5), where adjusting the model led to higher estimates, and for males the significance of lower risk of multiple offences disappeared. Conversely, the risk of psychiatric contacts for mental retardation (F7) associated with males who had a history of offending became statistically significant only after adjustment.

#### *Violent offending and subsequent psychiatric contact*

As was the case for penal code offending, the overall association between violent offending and later psychiatric contact was similar for men and women (Tables 4 and 5). The IRRs for psychiatric admissions were 3.89 (95% CI 3.75–4.04) for males with one violent conviction and 6.16 (95% CI 5.85–6.48) for multiple convictions. Similarly, females had IRRs of 3.59 (95% CI 3.27–3.94) and 6.00 (95% CI 4.60–7.84) for single and multiple violent offending respectively. The rates of offending were much greater in males than females (12% *v.* 0.9% of cases and 3.8% *v.* 0.3% of controls), which means that estimates for the latter are less robust and, for some diagnostic groups, unobtainable because of an insufficient number of exposed cases and indeed exposed controls in some instances.

In males, the pattern of violent offending prior to first psychiatric contact was similar to that found for all offending; however, the associations were generally stronger. IRRs >3 (range 3.18–6.99) were found for organic disorders (F0), psychotic disorders (F2), personality disorders (F6), behavioural and emotional disorders (F9) and unspecified mental disorders (F99), whereas substance-related disorders had an IRR of 14.23 (95% CI 13.10–15.47). Significantly elevated risks with an IRR <3 (range 2.04–2.94) were found for affective disorders (F3) and neurotic, stress-related and somatoform disorders (F4), whereas estimates for behavioural syndromes associated with physiological disturbances and physical factors (F5), mental retardation (F7) and disorders of psychological development (F8) were not statistically significant. Patterns for multiple *versus* single convictions and for adjustment for co-morbid substance misuse and parental level of education were analogous to those found for all offending.

Where estimates for females were obtainable they were of similar magnitude to their male counterparts. The clearest exception was for substance-related disorders (F1), where IRRs were much higher (IRR 23.35, 95% CI 17.50–31.15), and for unspecified mental disorders (F99), which were not significantly associated with violent offending in females.

#### *Sensitivity analysis*

There may be a direct link between offending and contact with mental health services in persons who have been sentenced to psychiatric treatment. To avoid these causing inflated estimates, we performed sensitivity analyses where persons who had ever received such a sentence (164 cases and 118 controls, corresponding to 0.2% and 0.01%) were eliminated from the models. Most persons with such a verdict were excluded by definition because mental assessments used by the courts would be recorded and hence first contact would be before the conviction date. Exceptions related to sentences that predate 1995 when out-patient contacts were not recorded and to mentally retarded persons who may have been assessed by doctors outside of psychiatric hospitals. The sensitivity analyses yielded results that were very similar to those presented above, but there were marginally lower estimates for women with mental retardation and men with organic disorders, personality disorders or mental retardation.

Restricting the time between offending and presentation to services would limit the impact that persons offending after illness onset but before first presentation to services would have on the results. In a model where there were 2 years between offending and presentation, the association between any offending and any psychiatric contact was reduced from 3.06 (95% CI 3.01–3.12) to 2.95 (95% CI 2.89–3.01), and imposing a 5-year minimum reduced it very slightly further to 2.94 (95% CI 2.87–3.00). However, part of this reduction is also probably due to elimination of those who have acute reactions to the strain of going through a trial, sentencing, etc.

#### **Discussion**

##### *Main findings*

In this study of the total national population of individuals in contact with mental health services we found that there was a strong association between offending and subsequent psychiatric contact across almost all diagnostic groups. We found IRRs of similar magnitude for men and women, although offending was much more prevalent in men. We also found that patterns of more serious offending (violent *versus* other offending, multiple *versus* single convictions) increased the association.

Although there has been a long-standing scientific interest in the association between mental disorders and offending, most prior research has focused on the lifetime risk of offending (Hodgins, 1998; Brennan *et al.* 2000), post-onset violence (Fazel *et al.* 2009a,b) in serious mental disorders, co-occurring mental

**Table 4.** Violent offending prior to first psychiatric contact by diagnosis, men

	Number of offences	Cases		Controls		IRR (95% CI) <sup>a</sup>	Adjusted IRR (95% CI) <sup>b</sup>
		n	%	n	%		
F0	None	485	86.0	12 513	96.3	1 (ref.)	1 (ref.)
	1	50	8.9	383	2.9	3.94 (2.85–5.44)	3.09 (2.17–4.40)
	≥2	29	5.1	98	0.8	9.38 (6.06–14.53)	7.13 (4.42–11.50)
F1	None	5733	76.7	167 215	96.1	1 (ref.)	1 (ref.)
	1	1082	14.5	5157	3.0	14.23 (13.10–15.47)	13.02 (11.97–14.16)
	≥2	662	8.9	1662	1.0	27.77 (25.00–30.86)	24.85 (22.33–27.65)
F2	None	3601	88.5	89 605	96.2	1 (ref.)	1 (ref.)
	1	307	7.5	2640	2.8	3.18 (2.80–3.62)	2.91 (2.54–3.34)
	≥2	162	4.0	915	1.0	4.87 (4.09–5.80)	4.31 (3.55–5.22)
F3	None	5979	92.9	142 414	96.0	1 (ref.)	1 (ref.)
	1	336	5.2	4378	3.0	2.04 (1.82–2.30)	1.92 (1.70–2.17)
	≥2	124	1.9	1508	1.0	2.19 (1.81–2.64)	1.94 (1.59–2.38)
F4	None	13 413	90.5	326 080	96.1	1 (ref.)	1 (ref.)
	1	978	6.6	9841	2.9	2.94 (2.74–3.15)	2.68 (2.49–2.89)
	≥2	428	2.9	3325	1.0	3.82 (3.44–4.24)	3.44 (3.08–3.84)
F5	None	908	96.5	21 234	96.0	1 (ref.)	1 (ref.)
	1	27	2.9	639	2.9	0.85 (0.57–1.26)	0.98 (0.66–1.45)
	≥2	6	0.6	242	1.1	0.50 (0.22–1.12)	0.53 (0.22–1.29)
F6	None	3500	84.7	91 245	96.3	1 (ref.)	1 (ref.)
	1	387	9.4	2668	2.8	4.87 (4.33–5.48)	4.07 (3.58–4.63)
	≥2	244	5.9	871	0.9	9.57 (8.22–11.14)	7.93 (6.74–9.34)
F7	None	530	97.1	11 876	96.4	1 (ref.)	1 (ref.)
	1	12	2.2	323	2.6	0.66 (0.37–1.19)	0.48 (0.26–0.88)
	≥2	4	0.7	126	1.0	–	–
F8	None	575	97.1	11 873	98.2	1 (ref.)	1 (ref.)
	1	15	2.5	174	1.4	1.57 (0.92–2.71)	1.42 (0.83–2.46)
	≥2	2	0.3	44	0.4	–	–
F9	None	1015	92.9	21 719	98.5	1 (ref.)	1 (ref.)
	1	58	5.3	268	1.2	6.99 (5.14–9.50)	4.77 (3.40–6.69)
	≥2	19	1.7	59	0.3	11.64 (6.79–19.96)	7.38 (4.61–13.59)
F99	None	1463	86.9	35 815	96.2	1 (ref.)	1 (ref.)
	1	145	8.6	1021	2.7	4.52 (3.74–5.48)	4.52 (3.72–5.48)
	≥2	75	4.5	384	1.0	6.47 (4.98–8.42)	6.48 (4.95–8.47)
Any	None	37 202	87.8	931 589	96.2	1 (ref.)	1 (ref.)
	1	3397	8.0	27 492	2.8	3.97 (3.81–4.12)	2.67 (2.54–2.80)
	≥2	1755	4.1	9234	1.0	6.18 (5.85–6.52)	3.65 (3.40–3.91)

IRR, Incidence rate ratio; CI, confidence interval.

<sup>a</sup> Matched for gender and exact birthday, adjusted for non-penal code offending.

<sup>b</sup> Matched for gender and exact birthday, adjusted for non-penal code offending, parental level of education and, except for F1, co-morbid substance misuse.

disorders and violence (Arseneault *et al.* 2000), or has been based on self-report data where attrition rates are high (Corneau & Lanctot, 2004). Although a few studies of schizophrenia have reported the prevalence of pre-onset offending (Munkner *et al.* 2003) or pre-onset violence (Dean *et al.* 2007), little attention has been paid to pre-onset offending in

other psychiatric disorders. In a Danish study Munkner *et al.* (2003) found that 37% of male and 7% of female schizophrenia patients had at least one criminal conviction before their first psychiatric contact, which is comparable to what we found for a wider group of psychiatric patients, where, regardless of diagnosis, 34% of males and 8.4% of females had

**Table 5.** Violent offending prior to first psychiatric contact by diagnosis, women

	Number of offences	Cases		Controls		IRR (95% CI) <sup>a</sup>	Adjusted IRR (95% CI) <sup>b</sup>
		n	%	n	%		
F0	None	288	98.3	6453	99.8	1 (ref.)	1 (ref.)
	1	4	1.4	13	0.2	–	–
	≥2	1	0.3	3	0.05	–	–
F1	None	1854	94.5	42 576	99.7	1 (ref.)	1 (ref.)
	1	84	4.3	129	0.3	23.35 (17.50–31.15)	20.59 (25.36–27.62)
	≥2	24	1.2	6	0.01	156.26 (62.92–388.06)	138.72 (55.08–349.38)
F2	None	2197	99.1	47 752	99.7	1 (ref.)	1 (ref.)
	1	18	0.8	121	0.3	3.41 (2.06–5.62)	3.47 (2.08–5.77)
	≥2	2	0.1	9	0.02	–	–
F3	None	12 547	99.4	271 580	99.7	1 (ref.)	1 (ref.)
	1	72	0.6	774	0.3	2.15 (1.68–2.74)	2.03 (1.58–2.60)
	≥2	6	0.05	60	0.02	2.30 (0.99–5.35)	2.19 (0.94–5.08)
F4	None	26 243	99.1	564 732	99.7	1 (ref.)	1 (ref.)
	1	211	0.8	1436	0.3	3.40 (2.94–3.94)	3.02 (2.60–3.51)
	≥2	19	0.1	114	0.02	3.77 (2.32–6.15)	3.24 (1.97–5.35)
F5	None	6464	99.8	132 900	99.8	1 (ref.)	1 (ref.)
	1	9	0.1	276	0.2	0.72 (0.37–1.39)	0.77 (0.39–1.49)
	≥2	2	0.03	23	0.02	–	–
F6	None	6114	98.6	131 861	99.8	1 (ref.)	1 (ref.)
	1	80	1.3	295	0.2	6.61 (5.14–8.49)	5.38 (4.11–7.03)
	≥2	7	0.1	14	0.01	12.71 (5.11–31.64)	9.09 (3.45–23.92)
F7	None	390	99.5	8401	99.8	1 (ref.)	1 (ref.)
	1	2	0.5	11	0.1	–	–
	≥2	–	–	4	0.05	–	–
F8	None	234	99.6	4589	99.8	1 (ref.)	1 (ref.)
	1	1	0.4	8	0.2	–	–
	≥2	–	–	1	0.02	–	–
F9	None	813	98.9	15 495	99.8	1 (ref.)	1 (ref.)
	1	7	0.9	24	0.2	6.04 (2.59–14.06)	4.38 (1.76–10.91)
	≥2	2	0.2	–	–	–	–
F99	None	1835	99.7	38 112	99.7	1 (ref.)	1 (ref.)
	1	6	0.3	98	0.3	1.39 (0.61–3.18)	1.30 (0.57–2.97)
	≥2	–	–	10	0.03	–	–
Any	None	58 979	99.1	1 264 451	99.7	1 (ref.)	1 (ref.)
	1	493	0.8	3185	0.3	3.62 (3.29–3.98)	2.78 (2.50–3.10)
	≥2	64	0.1	244	0.02	6.08 (4.61–8.02)	3.27 (2.31–4.63)

IRR, Incidence rate ratio; CI, confidence interval.

<sup>a</sup>Matched for gender and exact birthday, adjusted for non-penal code offending.

<sup>b</sup>Matched for gender and exact birthday, adjusted for non-penal code offending, parental level of education and, except for F1, co-morbid substance misuse.

a history of penal code offending before their first psychiatric contact. Dean *et al.* (2007) found that 14% of first-episode psychoses in the AESOP (Aetiology and Ethnicity of Schizophrenia and Other Psychoses) study had a history of violent offending. Their substantially higher percentage is unsurprising given their population was drawn from socially deprived

urban areas where local crimes rates are relatively high.

What may be surprising is that the IRRs we found for males with psychotic disorders were <2 for a single conviction, thereby placing them among the weaker associations in the study, and although the association with violent offending was stronger, this

association was also among the weaker relative to other groups of disorders. Although part of the explanation is probably differential selection bias (see discussion on limitations), compared to the strong associations generally found between psychotic disorders and post-onset violence this result lends credence to the theory that violence in psychosis can be divided into two groups, those who have long histories of offending and those whose offending is related directly to the psychotic symptoms and that only commenced post-onset (Hodgins *et al.* 2011; Large & Nielssen, 2011).

### *Understanding the association*

There are several potential explanations for the association between offending and subsequent psychiatric contact. These include the occurrence of undetected pre-offending mental disorder, the consequences of offending causing mental disorder and the existence of common risk factors.

Because our analyses were based on hospital records, we were not able to take account of symptoms of mental disorder occurring prior to or at the time of an offence that did not lead to mental health service contact. In addition, some disorders are likely to have a long antecedent period that itself might be associated with offending. Numerous studies have shown that, even upon reception into remand facilities, there is a large over-representation of persons showing symptoms of mental illness (Andersen *et al.* 1996; Brooke *et al.* 1996; Birmingham *et al.* 2000), although the degree to which these persons have already been in touch with mental health services is not known. Furthermore, little is known about the presence of psychiatric morbidity in offenders receiving non-custodial sentences.

Conversely, the consequence of offending, court contact and sentencing, especially if custodial, can act as a life stressor that might itself trigger the onset of mental disorder (Hammen, 2005; Slavich *et al.* 2010), particularly if perceived to have an element of humiliation or social rejection (Kendler *et al.* 2003). Which explanation is most plausible is likely to vary between different groups of disorders. For instance, it is probable that undiagnosed psychoses or personality disorders may influence propensity to offend whereas anxiety and depressive disorders may be more likely to emerge consequent on offending/court contact.

Finally, it seems that risk factors such as low SES (Agerbo *et al.* 2004; Murray *et al.* 2010), living in an urban area (Flango & Sherbenou, 1976; Pedersen & Mortensen, 2001), migration (Cantor-Graae & Selten, 2005; Laub & Sampson, 2006), family disruptions/instabilities (Mednick *et al.* 1990; Niemi *et al.* 2003) and

inherited vulnerabilities (Dean *et al.* 2010; Frisell *et al.* 2011) apply to offending and to psychiatric disorders, pointing to shared risk factors for both rather than a causal relationship between them. The dose-response nature of the association found between offending and subsequent mental disorder adds weight to the notion that the association reflects underlying causal processes.

It is also important to note that, although it is well known that disorders such as schizophrenia are not always diagnosed on the first contact with mental health services, especially in cases with a more insidious onset, the fact that we found strong associations across almost the full range of disorders makes it unlikely that the results are due to misclassification caused by reliance on the first treatment contact diagnosis. This also suggests that the association between crime and mental disorder has a much wider scope than that traditionally investigated.

### *Gender differences and similarities*

In line with existing research, we found large differences in the prevalence of offending in men and women. Surprisingly, however, we also found offending to be a risk factor of similar magnitude for subsequent psychiatric contact in both genders. Numerous studies have found that the gender gap generally found in offending patterns narrows considerably in mentally disordered populations, such that mental illness is a much stronger risk factor for offending in females than in males (Robbins *et al.* 2003; Fazel *et al.* 2009a). Our findings may suggest that female offending arises to a greater extent from direct effects of mental disorders, rather than to common causes or vulnerabilities preceding the disorder.

### *Substance misuse*

The use of illegal substances is highly correlated with criminal activity in general and when it is co-morbid with other mental illnesses (Grann & Fazel, 2004; Fazel *et al.* 2009b) and is potentially a source of common vulnerability for offending and mental disorder, in addition to being associated with the antecedents of a range of mental disorders (Rosen *et al.* 2004). An American study by Elbogen & Johnson (2009) found that adjusting for substance misuse eliminated the association between mental disorders and violence, which contrasts to our surprising finding that adjusting for co-morbid substance misuse had only a limited impact on the estimates for other diagnoses, despite it having by far the strongest association with both violent and non-violent offending when appearing as a primary diagnosis. Although our results may be

affected by residual confounding due to substance-related co-morbidity being under-represented in the register (Hansen *et al.* 2000), other studies have also found that the association persists after controlling for co-morbid substance misuse (Van Dorn *et al.* 2012). There may also be an issue of timing because offending may take place many years before the first psychiatric contact, by which time the person may no longer be misusing substances even if they were at the time of offending.

### **Strengths and limitations**

Using national registers covering the entire Danish population enabled us to follow a large number of people over a long period of time. The advantages include the ability to investigate rare outcomes, such as violent offending in women, and the lack of bias in selecting controls and in the availability of information on cases and controls.

However, there are also some shortcomings to our data. First, out-patient contacts were not registered before 1995 and thus it is possible that some of the included cases had prior unregistered out-patient contacts. Second, mental disorders that were treated in primary care only were not included. Obviously these two factors are of differential importance for different diagnoses, such that less serious disorders are more likely to be unregistered. For disorders commonly treated in primary care, such as depression, the validity of our results is contingent upon referral to secondary care not being dependent on previous offending. Although being considered at risk for harm to others certainly could increase the likelihood of admittance, the inclusion of out-patient contacts would significantly lower the impact of this potential source of selection bias. Regardless, our findings cannot be generalized to all those in the population who experience psychiatric symptoms, but only the subgroup who seek treatment in secondary care. Third, although those diagnoses that have been validated have shown reassuring results (Kessing, 1998; Jakobsen *et al.* 2005; Phung *et al.* 2007), most of these routinely acquired diagnoses are not validated. However, the use of broader diagnostic groups rather than more specific diagnoses should lessen the extent to which misclassification would occur.

The age restrictions of the cohort are not so problematic for the measurement of criminality because most offending occurs in the teens and early twenties, but the generalizability of our results does vary between different disorders. The generalizability is likely to be good for disorders that commonly emerge in late adolescence or early adulthood (e.g. psychotic disorders), whereas findings for disorders of later

onset (e.g. organic disorders, especially various forms of dementia) will be generalizable only to a selected group with earlier onset than is typical. The same applies to disorders that emerge in childhood (e.g. developmental or behavioural disorders and mental retardation), which almost certainly represent cases of late detection rather than late onset. Incidentally, the latter disorders are also the ones that failed to reach statistical significance.

Using the date of conviction rather than the date of the actual offence will tend to bias the results towards underestimation because any court-mandated psychiatric assessment will have taken place before conviction and thus the offence will be regarded as post-onset. This particularly applies to those suffering from psychotic disorders and those having committed (more serious) violent crimes (Rigsadvokatens Meddelelse, 2007).

### **Conclusions**

In a study of a total national population of individuals in contact with mental health services we found that there was a strong association between offending and subsequent psychiatric contact. With almost one in five new patients presenting to mental health services having some history of offending, there is a clear clinical relevance to our findings. Having established that the risk is not confined to severe mental disorders, our results might encourage clinicians to enquire about an offending history more than they currently do. A history of offending could reflect important aetiological information for the individual and also suggests elevated risk for future offending. Our findings also add weight to the notion that antisocial behaviour heralds future risk for a range of mental disorders and so targeting those in contact with the Criminal Justice System may be effective not only for early detection, which is now increasingly being addressed in many countries, but also for preventive strategies.

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**Declaration of Interest**

None.

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## **Paper III**

**Reducing crime in first onset psychosis – randomised controlled trial of assertive specialised treatment versus standard care**

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## **ABSTRACT**

**Objective:** Violence and criminality are adverse outcomes for some persons who develop psychotic illnesses. The extent to which treatment can reduce offending has rarely been studied. The aim of this study was to evaluate whether assertive specialised treatment reduces the risk of crime in patients with a first episode of psychotic illness.

**Method:** During 1998 to 2000 a total of 547 patients with a first episode of schizophrenia spectrum disorder were randomised to assertive specialised or standard treatment. The patients were followed up for any or violent offending during a two year treatment period and the three following years for a total of five years of follow-up.

**Results:** No significant reduction in violent or any offending was found in the assertive specialised treatment group (HR: 1.06, 95% CI: 0.72-1.56) compared with the control group. Prevalence of offending was low and had often commenced prior to inclusion in the trial.

**Conclusion:** While assertive specialised treatment has shown good treatment effects, it had no impact on risk of offending.

**Declaration of interest:** None

**Clinical Trials Registration:** ClinicalTrials.gov ([www.clinicaltrials.gov](http://www.clinicaltrials.gov)), NCT00157313

## Introduction

Those suffering from psychotic illnesses have been consistently shown to display elevated rates of violence and criminality,<sup>1,2</sup> particularly around the time of illness onset.<sup>3</sup> Some have argued that the excess risk in this group can be explained by co-occurring anti-social traits and problems with substance misuse,<sup>4</sup> while others maintain it to be driven by the psychotic symptoms per se, whereby adequate treatment is thought to be preventive of offending.<sup>5</sup> The reduction of such criminality is important both in terms of avoiding the adverse impact on perpetrator and victims, and in terms of potentially reducing the stigma of those with psychosis.<sup>5,6</sup> However, violence and criminality have rarely been considered an outcome of interest for interventions in this group.

Using data from the OPUS trial,<sup>7</sup> which is a randomised controlled trial comparing assertive specialised and standard treatment of first episode psychosis, the aim of this study was to compare rates of offending in the two treatment groups and to assess whether assertive specialised treatment can prevent offending in the treatment period and subsequent years (2 and 5 year follow-up). Since the treatment under consideration was not directed at reducing anti-social behaviour, the question addressed in this study is whether improved clinical management is sufficient to reduce offending.

Outcomes are any and violent offending. Additionally, we utilized the high quality information on duration of untreated psychosis in the OPUS data to assess whether the risk of offending increased after illness onset (but before treatment).

## Method

### *Participants*

During the period from January 1998 to December 2000 a total of 547 patients with a diagnosis in the schizophrenia spectrum (ICD-10 code within F2) were included in the OPUS trial. They were recruited from both inpatient and outpatient mental health services in the two largest Danish cities, Copenhagen and Aarhus, were 18-45 years old and had not received antipsychotic drugs for more than 12 weeks of continuous treatment at the time of inclusion. Exclusion criteria included presence of mental retardation, organic mental disorder, and psychotic condition due to acute intoxication or withdrawal state, although comorbid substance misuse in itself was not grounds for exclusion. Additionally, familiarity with the Danish language was required. Around 5% of the referred patients refused to participate in the trial,<sup>8</sup> however, they did not differ from those who did participate with regard to duration of psychosis, severity of psychopathology or diagnosis.<sup>9</sup> Comparisons with national registers revealed that in Aarhus 90% of those who had a first diagnosis within F2 in the inclusion period participated in the trial. In Copenhagen the corresponding number was 63%.

The experimental treatment consisted of assertive community treatment, family involvement and social skills training and had a duration of two years, where patients saw their primary staff member usually on a weekly basis and often in their own home. The caseload was 1:10. The standard treatment offered contact with a community mental health centre with an average caseload of 1:25, less frequent meetings and no systematic offers of additional treatment elements. In both treatment groups, anti-psychotic medication was administered as indicated and in accordance with Danish guidelines which recommend a low-dose strategy

and SGA drugs as first choice. For a full description of randomisation, treatment content and assessments, see.<sup>7</sup> After a two year treatment period, persons receiving the assertive specialised treatment were found to have significantly better clinical outcomes with regard to psychotic and negative symptoms, secondary substance misuse, treatment adherence, and success with lower doses of anti-psychotic medication.<sup>7</sup> At the five year follow-up these differences had equalized between the treatment groups, however the persons receiving assertive specialised treatment fared better on secondary outcome measures such as living in supported housing and days spent in hospital.<sup>10</sup>

From the OPUS trial we obtained baseline information on gender and age at inclusion, primary diagnosis according to ICD-10,<sup>11</sup> level of psychotic and negative symptoms (Scale for Assessment of Positive Symptoms and Scale for Assessment of Negative Symptoms),<sup>12</sup> duration of untreated psychosis (Instrument for the Assessment of Onset and Early Course of Schizophrenia)<sup>13</sup> and presence of substance misuse (Schedule for Clinical Assessment in Neuropsychiatry)<sup>14</sup> which was combined with information from Danish registers. The Psychiatric Central Register<sup>15</sup> contains information on all admissions since 1969 and all outpatient contacts since 1995. From this register we obtained information for each patient on any periods of admission after inclusion in the trial. The Danish Civil Registration System<sup>16</sup> contains data on gender, date of birth, continuously updated information on vital status and from this register we obtained information on the date of death or emigration where applicable. Data were linked using the unique personal identification number.

### *Main outcome measure*

From the Danish National Crime Register<sup>17</sup> which is virtually 100% complete we obtained information on all offences that led to a guilty verdict. The register became electronic in 1978 and through Statistics Denmark we had access to all criminal charges from 1980 to 2007. Guilty verdicts include: custodial sentences, suspended sentences, conditional withdrawal of charges, fines and sentences to psychiatric treatment. Offences against the penal code, special legislation regarding drugs and weapons or sections of the traffic act dealing with impaired driving were included as “any” offending, while violent offending included all violent and sexual offences. We used the date of the offence as the time point for the survival analyses, and in cases where this was missing (16/904=1.8%) we used the date of the conviction instead. We also calculated the number and type of offences and convictions within the 5 year follow-up period. For this analysis we considered the following types of offending: violent (including sexual), acquisitive, substance related, and other.

#### *Statistical analysis and power calculation*

The participants were followed from inclusion in the trial until (violent or any) offending, death, emigration or the end of follow-up (2 and 5 years respectively), whichever came first. Attrition from the study was around 45% in both treatment groups after five years,<sup>10</sup> but since we used official records to assess offending status, we were able to obtain full follow-up information on all participants in the trial. For generating Kaplan Meier plots<sup>18</sup> we used the LIFETEST procedure in SAS software (version 9.1.3; SAS Institute Inc., Cary, NC). Hazard Ratios (HR), 95% confidence intervals, Wald statistics and associated p-values were based on Cox’s proportional hazards model<sup>18</sup> using the PHREG procedure. Adjusted models considered the potential confounding effect of age at baseline, gender, offending history (prior to recruitment into the study), level of negative and psychotic dimension symptoms, duration

of untreated psychosis, and the presence of substance misuse at baseline. Periods during follow-up spent as inpatient in a psychiatric hospital were included as a time-varying covariate. All analyses were performed as intention to treat.

With 270 patients randomised to each group, we would be able to detect a difference equivalent to a HR of 0.7 in any offending in the assertive specialised treatment group statistically significant at the 5% level with a high probability (power > 80%).<sup>19</sup>

#### *Analysis of offending prior to treatment*

Looking at the period prior to inclusion in the trial, we used information on duration of untreated psychosis to estimate the time of onset of psychosis and analysed whether the first offence occurred before or after this time. This analysis was restricted to those patients who had experienced psychotic symptoms (excluding 93 patients with a diagnosis of schizophrenia simplex or schizotypal disorder) and to those whose complete criminal record was available (excluding a further 75 patients born 1964 or earlier). Using a Cox's regression model we followed persons from their 15<sup>th</sup> birthday until first offence or inclusion in OPUS, whichever came first. Onset of psychosis was entered as a time varying variable and the model was adjusted for gender. Note that this analysis involves conditioning on the future as all participants are later enrolled in the OPUS study.

#### *Ethics*

All participants gave informed consent. The study was approved by the Danish Ethics Committee (KF 01-387/97) prior to its initiation.



## Results

275 (50.3%) and 272 (49.7%) patients were randomised to the assertive specialised treatment group and the standard care group respectively. There were no significant differences between the groups in respect to socio-demographic and clinical factors. Characteristics for the groups have been described in full elsewhere.<sup>20</sup> Offending prior to inclusion in the trial was prevalent in both groups with 88 (32%) of the assertive specialised treatment group and 90 (33%) of the standard care group having engaged in such behaviour. In both treatment groups 23 (8%) had a conviction for violent offending prior to inclusion in the trial.

### *Main outcome: Effect of treatment on crime*

Figure 1 shows a Kaplan-Meier plot of the two treatment groups with respect to their first offence following inclusion in the program. Contrary to what was hypothesized, there did not appear to be any difference between the two treatment groups ( $p=0.69$ ). By the end of the two-year treatment period, 12% in both groups had offended, and five years after inclusion 20% of the assertive specialised treatment group and 19% of the standard treatment group had offended. Of those who offended after inclusion almost 75% had also done so before inclusion (41 of 55 in the assertive specialised treatment group and 35 of 50 in the standard treatment group).

[Figure 1]

Violent offending was less prevalent, but also of similar magnitude in both treatment groups with 3% in both groups having committed a violent crime after 2 years and 5% in the assertive specialised and 6% in the standard treatment group after 5 years. Hypothesizing that treatment could have differential effects depending on the person's prior offending history, we tested for equality over strata in restricted models that contained only those with or those without a history of offending. With p-values for the log-rank test in the range 0.31-0.73 for any offending and 0.65-0.97 for violent offending we found no evidence to support this hypothesis.

In a Cox's regression we found an insignificant HR of 1.08 (CI: 0.74-1.58) for assertive specialised compared to standard treatment. In a fully adjusted model (Table 1), the association remained insignificant, but male gender, young age, substance misuse at baseline and a history of offending were identified as risk factors for offending. Although the result was not significant, there was some indication ( $p=0.11$ ) that those that were unwilling or unable to give information on duration of untreated psychosis were at increased risk for offending, while our data did not indicate that those with a long duration of untreated psychosis should be at increased risk for offending. For violent offending the unadjusted HR was 0.91 (CI: 0.45-1.84). Given the very low prevalence of this outcome we did not have sufficient data to fit an adjusted model.

[Table 1]

*Frequency of offending*

Although we found no evidence that assertive specialised treatment reduces the occurrence of offending relative to standard treatment, we considered the possibility that assertive specialised treatment could reduce the volume of offending, such that those who offend do so less frequently. Table 2 shows the cumulative number of offences for both treatment groups during the first 5 years after inclusion along with frequencies of different types of verdicts and offences and the total number of convictions within the 5 year follow-up. Again, there were no significant differences between the two treatment groups; however the level of criminality was modest. Most of those who offended did so only once and many received only a fine.

[Table 2]

#### *Relative onsets – psychosis versus offending*

Looking to the period preceding inclusion in the trial, we found a HR of 1.29 (CI: 0.82-2.02) of committing the first offence after the onset of psychosis relative to before. Although the result was not significant this does give some indication that the risk of offending may increase after onset of a psychotic disorder.

## Discussion

In a controlled trial of 547 patients with a first episode of psychosis randomised to assertive specialised treatment or standard care we found no significant reductions in violent or any offending, both in terms of the number of people who engaged in such behaviours and with respect to the frequency of offending. While sample size may have limited our ability to detect small differences, no trends for differences between the treatment groups were found.

Our finding of no difference is in line with one previous study of the effect of intensive case management on violent behaviour. Utilising data from the UK700 study, Walsh et al. found no reduction in violence in an inner city sample of persons with chronic psychosis.<sup>21</sup> In comparison to the UK study, our patients were younger, were in an earlier stage of illness and the difference between treatments were larger since our specialised treatment consisted of assertive community treatment, psycho-educational family involvement as well as social skills training and not simply a lighter case load. For these reasons along with the fact that OPUS patients have been shown to have significantly better clinical (psychotic and negative symptoms, secondary substance misuse, treatment adherence, and success with lower doses of anti-psychotic medication) and secondary (living in supported housing and days spent in hospital) outcomes<sup>7,10</sup> one would have expected better results. Explanations for a lack of effect include the possibility that the intervention was still not intensive enough or that it should specifically target risk of criminal behaviour. It is also the case that the prevalence of offending after inclusion in the OPUS study was relatively low and it might be argued that benefits would more likely be found in interventions targeting higher risk patients such as those with dual diagnoses.

Periods spent in psychiatric hospitals can be regarded as more intensive interventions and for the analyses we considered whether these times were best conceptualised as time not at liberty to offend or as time with reduced opportunities to offend. Based on Danish practice where it is not uncommon that violent episodes in inpatient settings are reported to the police and dealt with by the courts<sup>22</sup> and based on the empirical observation that some patients did in fact offend while hospitalised, we entered time in hospital as a time varying variable in the Cox's regression rather than censoring out those periods.<sup>23</sup> As this variable was not significant in multivariate regression, we found no indication that hospitalisation reduced offending. Of course, those who are at increased risk of violence would more likely be admitted, which would confound the results, however, we have no reason to believe that increased risk of non-violent offending, which is by far the most prevalent in our study, should have any association with likelihood of admission.

A key point is that almost three quarters of those who offended after commencing treatment had already started doing so before inclusion in the programme, and it may be that any intervention needs to be implemented at an earlier time point in order to be effective.

Numerically most of the pre-inclusion offending took place before illness onset, but taking time at risk into account we found some indication – although statistically not significant – that the risk of offending increases after onset of psychotic symptoms, which makes programmes targeting early detection and early treatment potentially interesting. Our failure to find any association between offending and duration of untreated psychosis is consistent with the results of a recent meta-analysis and systematic review by Large and Nielssen<sup>3</sup> where

more serious violence was associated with a long duration of untreated psychosis, while less serious violence was not.

### *Strengths and limitations*

Despite being one of the larger randomised controlled trials comparing assertive specialised treatment with standard care, our study still suffers from the possibility of type II error in the Cox's regression, although we did not see any indication of trend in our data. A great strength in the study is the use of national registers for follow-up information, particularly since those with antisocial traits are more likely to be lost to follow-up under usual study conditions. Linking the OPUS dataset to the national registers means that differential attrition is avoided and that we were able to obtain follow-up information on all participants regardless of whether or for how long they participated in the trial. Loss to follow-up only occurred in cases of death or emigration, and in these cases we had access to the exact dates of loss in order to make relevant adjustments to the analyses.

Using official records underestimates the rates of offending and aggression which becomes quite apparent when our results are compared to the meta-analysis of Large and Nielssen, who reported that 35% of first episode patients had any degree of violence, and that 17% had at least one episode of more severe violence (any degree of injury, use of weapon or sexual assault) prior to treatment contact.<sup>3</sup> Only 8% in our study had a previous conviction for violence, and while part of the difference can possibly be related to differences in levels of criminality or demographic compositions in the various studies, our measurement is less sensitive than using self-report or case notes. Apart from avoiding differential attrition, the reliance on official records also protects against information bias in a study where the

intervention group has more frequent contact with carers than controls and ensures standardised definitions.

### *Conclusions*

While assertive specialised treatment has been shown to improve clinical outcomes in first episode psychosis, we found no indication of an effect on offending. Offending prevalence was low in the study group, and the majority of those who offended after inclusion in the trial had commenced doing so prior to that time, indicating that earlier intervention may be warranted.

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### *Author contributions*

Ms. Stevens analysed and interpreted the data and drafted the manuscript

Drs Nordentoft, Agerbo, Dean and Mortensen interpreted the data and critically revised the manuscript

All authors have read and approved the final version for submission



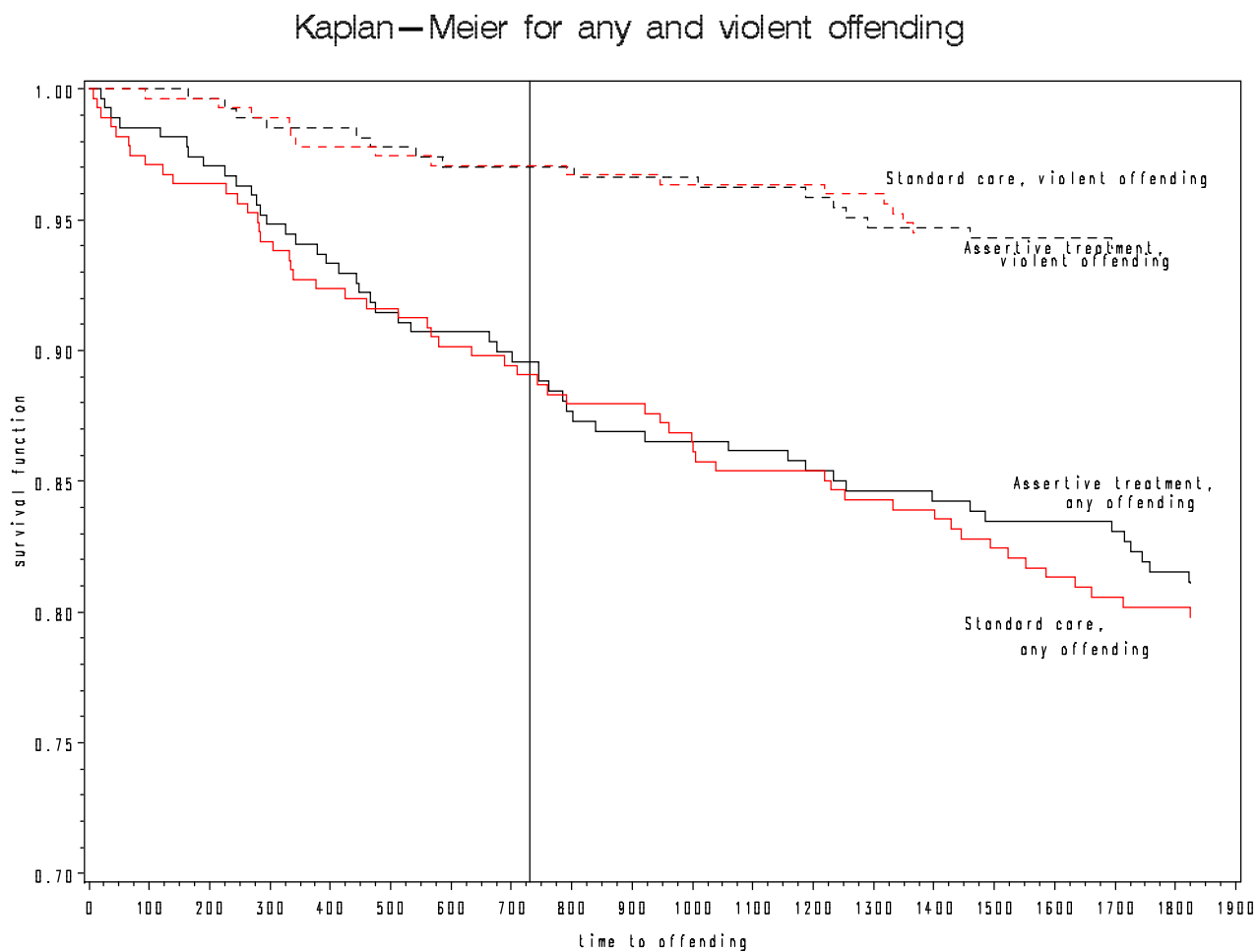
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*Figure 1 Kaplan-Meier of any and violent crime since inclusion*



*Table 1: Cox regression, any offending*

	Cases / person-years	Adj. HR Any offending
<b>Treatment group</b>		
Standard	50 / 1167	1 (ref.)
Assertive Specialised	55 / 1193	1.06 (0.72-1.56)
<b>Hospitalisation<sup>a</sup></b>		
Not hospitalised	94 / 2146	1 (ref.)
Hospitalised	11 / 215	0.70 (0.36-1.35)
<b>Gender</b>		
Male	87 / 1304	1 (ref.)
Female	18 / 1056	0.48 (0.28-0.82)
<b>Substance misuse</b>		
Not present	50 / 1835	1 (ref.)
Present	55 / 525	1.77(1.16-2.68)
<b>Negative dimension</b>		
None or low	25 / 542	1 (ref.)
Medium	61 / 1326	1.08 (0.67-1.73)
High	19 / 492	0.77 (0.42-1.42)
<b>Psychotic dimension</b>		
None or low	18 / 482	1 (ref.)
Medium	43 / 1006	1.29 (0.68-2.46)
High	44 / 872	1.28 (0.64-2.54)
<b>Duration of Untreated Psychosis</b>		
Short	40 / 702	1 (ref.)
Long	45 / 1137	0.68 (0.44-1.05)
Missing	8 / 98	1.98 (0.86-4.55)
Not applicable	12 / 424	0.56 (0.26-1.20)
<b>Prior offending</b>		
No	29 / 1736	1 (ref.)
Yes	76 / 624	5.28 (3.27-8.52)
<b>Age at inclusion<sup>b</sup></b>		
	-- / ----	0.68 (0.49-0.95)

a) time dependent variable

b) pr. increment of (age-27)/10

*Table 2: Type and frequency of offending, by treatment group, number (percent)*

	<b>Assertive specialised treatment</b>	<b>Standard treatment</b>
	(n=275)	(n=272)
<b>Within 5 years of inclusion</b>		
Incarcerated	4 (1)	2 (1)
Suspended	9 (3)	9 (3)
Fined	45 (16)	38 (14)
Conditional withdrawal of charges	10 (4)	11 (4)
Psychiatric order	12 (4)	11 (4)
Violent	15 (5)	16 (6)
Acquisitive	42 (15)	31 (11)
Substance related	14 (5)	20 (7)
Other	16 (6)	11 (4)
<b>First conviction after inclusion</b>		
Incarcerated	1 (0)	0 (0)
Suspended	3 (1)	5 (2)
Fined	39 (14)	34 (13)
Conditional withdrawal of charges	6 (2)	4 (1)
Psychiatric order	6 (2)	6 (2)
Violent	7 (3)	10 (4)
Acquisitive	36 (13)	26 (10)
Substance related	7 (3)	10 (4)
Other	5 (2)	3 (1)
<b>Number of convictions after inclusion</b>		
One	30 (11)	31 (11)
Two	9 (3)	6 (6)
Three to Five	10 (4)	11 (4)
Six or more	6 (2)	1 (0)

## **Paper IV**

# **Risk of offending across the full spectrum of psychiatric disorders: a population-based longitudinal study**

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## ABSTRACT

**Context:** While the link between psychotic disorders and violent offending is well-established, there is a lack of knowledge about the risk of post-morbid offending and violence in other psychiatric disorders.

**Objective:** To compare rates of any and violent offending in different diagnostic groups to population controls.

**Design:** Population-based cohort study.

**Setting:** Danish population

**Participants:** A 25% random sample of Danish inhabitants born 1965-1995 (n=521,340) were followed from age 15. Follow-up ended in 2010.

**Main outcome measures:** Incidence rate ratios and population attributable risk fractions for any and violent offending.

**Results:** Males who had ever been in contact with a psychiatric hospital had an IRR of 2.91 (95% confidence interval (CI): 2.80-3.02) for any offending and of 4.18 (CI: 3.99-4.38) for violent offending. Women had an IRR of 4.17 (CI: 3.95-4.40) for any and 8.02 (CI: 7.20-8.94) for violent offending. The magnitude of risk was largely similar across diagnostic groups for any offending in males, while larger differences were seen in male violent offending and offending in females. The

pattern persisted after adjustment for socio-economic status, parental mental disorder and comorbid substance misuse, although some attenuation was seen, and a strong combined effect of substance misuse and mental disorder was found. We also found a dose-response relationship between number of psychiatric admissions and risk of offending.

**Conclusion:** The results confirm and expand on prior Scandinavian findings that risk of offending is elevated across a range of mental disorders. This study considered a wider range of diagnoses, potential confounding by familial risk factors and co-morbidity, and focussed on post-morbid offending. Great commonalities were found across disorders, particularly for any offending in males, and the clinical importance of addressing problems of comorbid misuse was highlighted.

## Introduction

An association between schizophrenia and other psychotic disorders and an elevated risk of antisocial behaviour, including violence and criminality, has been well established,<sup>1,2</sup> although the extent to which such risk extends to non-violent offending is less clear.<sup>3</sup> It is also noteworthy that, although the association between psychosis and criminality has been extensively investigated, many studies have failed to consider the temporal nature of the relationship between the two factors – either because information was gathered cross-sectionally or because lifetime records of both psychosis and criminality were examined for association. There is, however, an emerging literature to support the notion that different underlying mechanisms and likely outcomes are associated with typologies defined by whether or not criminality precedes or follows onset of severe mental illness.<sup>4,5</sup>

The vast majority of studies of offending risk within this field have focused on severe mental disorders such as schizophrenia while little is known about other disorders. The danger of focusing on one disorder or group of disorders is that unfounded assumptions can emerge about the diagnostic specificity of the relationship and this in turn can have undue influence on the range of underlying mechanisms investigated. Recently, a number of studies have emerged focusing on disorders other than schizophrenia, including bipolar disorder<sup>6</sup> and substance misuse disorders.<sup>7</sup> The small number of population-based studies which have considered a range of mental disorders<sup>8,9</sup> indicate that the association between mental disorder and offending risk may not be confined to those with psychotic disorders. Our previous work examining pre-onset offending<sup>10</sup> supports this notion.

The aim of this study was to estimate the rate ratio of any and violent offending after the first psychiatric contact across the entire spectrum of psychiatric diagnoses compared to the general population. Results were calculated separately for men and women, and potential confounding by parental factors and comorbidity was taken into account.

## **Methods**

### ***Study population***

Our study population consisted of exactly 25% of the Danish population randomly selected from the Danish Civil Registration System (CRS). The sample was then restricted to those born 1965 or later, who were residing in Denmark on the day they turned 15, the age of criminal responsibility in Denmark. The CRS contains information on gender, date and place of birth, continuously updated information on vital status and the CRS numbers of parents along with many other variables. Each person is assigned a unique personal identification number at birth or at point of first immigration to Denmark, through which it is possible to link information between registers.<sup>11</sup>

### ***Assessment of offending***

All members of the cohort were followed from their 15<sup>th</sup> birthday until their first criminal conviction, death, emigration or end of follow-up in 2010, whichever came first. From the Danish National Crime Register (NCR), which is virtually 100% complete, we extracted information on transgressions against the penal code<sup>12</sup> and conducted separate analyses for any and violent offending. Only guilty verdicts (custodial sentences, suspended sentences, conditional withdrawal of charges, fines, and sentences to psychiatric treatment) were included. We had access to complete information on criminal history from the age of criminal responsibility until the end of 2010.

### ***Assessment of mental disorder***

Information on mental disorders was obtained from the Danish Psychiatric Central Research Register (PCRR), which contains data relating to all admissions to psychiatric hospitals since 1969 and additionally all out-patient contacts and emergency room visits since 1995.<sup>13</sup> Diagnoses were

given according to the ICD-8<sup>14</sup> during the period 1969 to 1993 and according to ICD-10<sup>15</sup> from 1994 onward. We grouped discharge diagnoses into eight distinct groups (**table 1**) and retained information on an individual's first diagnosis within each group. Relying on the hierarchical logic in the ICD-10, individuals with more than one psychiatric contact and who belonged to more than one diagnostic category were allowed to move up in the hierarchy, but not down. The presence of co-morbid substance misuse was assessed separately using information from main and secondary diagnoses in both the PCRR and the Danish National Hospital Register, which covers all hospital admissions since 1977 and additionally all outpatient contacts and emergency room visits since 1995.<sup>16</sup> Both psychiatric disorders and substance misuse were coded as time-varying.

#### *Assessment of parental mental disorder and educational status*

As the presence of mental disorders in parents is associated with increased risk of both criminality<sup>17</sup> and mental disorder<sup>18</sup> in the offspring, we considered this a potential confounder of any association found between mental disorders and offending. Using data from the PCRR we recorded the presence of severe (F2 and F3 with ICD-8 equivalents) or other (all other) mental disorders in the mother or the father in a time-varying fashion. Correspondingly, we considered the potential confounding effect of parental SES. Here we used information on maternal and paternal level of education in the year when the proband turned 15. The highest obtained level of education for each parent was coded as: basic education, vocational training, higher education, educational status unknown, and parent unknown. This information was obtained from the Integrated Database for Labour Market Research, which contains information from the 1970 population and housing census along with annually updated information from 1980 onwards.<sup>19</sup>

### *Statistical analysis*

Data were analysed as a cohort study<sup>20</sup> using Poisson regression with the GENMOD procedure in SAS version 9.1.3 (SAS Institute Inc, Cary, NC). We calculated the incidence rate of offending as the number of first convictions per 1000 person-years at risk. The main outcome measures were incidence rate ratios (IRRs), where each psychiatric exposure group was compared to the reference category of no psychiatric contacts. IRRs were calculated by log-likelihood estimation, and Wald's 95% confidence intervals (CIs) were used. Basic models with adjustment for calendar period and age were fitted for each gender in both outcomes (any and violent offending), and adjusted models were fitted for all analyses controlling for co-morbid substance misuse, maternal and paternal mental disorder and educational level, and non-Danish place of birth.

We performed additional analyses where bipolar disorders (F30 and F31 with ICD-8 equivalents) were omitted from the affective disorder category and where the impact of comorbid personality disorders (F6 and ICD-8 equivalents) on other mental disorders was assessed separately. Measures of population attributable risk fractions were calculated by measuring the percentage of first offences (or first violent offences) that would not have occurred if the risk of (any or violent) offending had been the same in exposed and non-exposed.<sup>21</sup>

## Results

### *Descriptive results*

The cohort included 521,340 persons who were born between January 1<sup>st</sup> 1965 and December 31<sup>st</sup> 1995, and who were residing in Denmark on their 15<sup>th</sup> birthday. In total they contributed with 7,455,866 person-years of risk time in the analyses of any offending and 8,019,097 person years in the analyses of violent offending. During the follow-up from 1980 to 2010, 57,390 persons (44,802 men and 12,588 women) were convicted of at least one offence, and in 17,423 cases (15,684 men and 1,739 women) at least one was of a violent nature.

### *Mental disorders and offending*

Males who had ever had a psychiatric contact had an IRR of 2.91 (CI: 2.80-3.02) for any offending, and although effect sizes varied between the diagnostic groups (**table 2**), all other categories than developmental disorders were significantly elevated compared to those persons without any mental disorder. The highest elevation of risk was seen in those with personality disorders (IRR 4.18, CI: 3.64-4.81) followed by those with organic disorders (IRR 4.09, CI: 3.20-5.23). While offending rates were much higher in men, the relative impact of mental disorders on risk of offending was stronger in women, where any psychiatric contact yielded an IRR of 4.17 (CI: 3.95-4.40). The highest risk among women was seen in organic disorders (IRR 8.41, CI: 5.72-12.36) and psychotic disorders (IRR 7.08, CI: 6.23-8.05).

Additionally, we found a dose-response relationship between multiple admissions and risk of offending. Those who had a single psychiatric contact were 2.79 (CI: 2.66-2.91) more likely to



offend than those with no admissions, 2-3 contacts carried a risk of 3.13 (CI: 2.97-3.30) while four or more contacts had an IRR of 4.99 (CI: 4.71-5.28).

### ***Mental disorders and violent offending***

In both genders the association between mental disorders and violent offending was greater than that between mental disorders and any offending (**table 3**). Men with any psychiatric contact had an IRR of 4.18 (CI: 3.99-4.38), while the corresponding estimate for women was 8.02 (CI: 7.20-8.94). Relative risks were consistently greater for women than men and, for many disorders, much greater. However, due to an insufficient number of exposed cases, IRR for mental retardation and developmental disorders in women could not be estimated.

### ***Adjusted models***

The third columns in tables 2 & 3 (first adjustment) show the effect of adjusting the rate ratios for parental mental disorders, parental SES and non-Danish place of birth. For all disorder categories this adjustment resulted in attenuation of rate ratios, but only to the point of no association in any offending among males with mental retardation. The attenuation was stronger for violent than for any offending in both genders, however, the association between mental disorders and violent offending remained stronger than for any offending across the board.

As substance misuse may be regarded as either a confounder or a mediating factor (or both) we chose to present separate estimates for this adjustment, as shown in the final columns of tables 2 & 3 (second adjustment). The effect was that of further attenuation of the results, however, all rate ratios that were significant in the first adjustment remained so after the inclusion of substance misuse. The impact on results was greater for violent than for any offending and especially

pronounced among women. It is of note that in the fully adjusted model for males with any offending, rate ratios were similar in magnitude across diagnostic categories. This pattern was less pronounced among women and for violent offending.

We also examined the relationship between substance misuse without any diagnosed psychiatric comorbidity and after adjustment for familial risk factors. We found a significantly higher risk for violent offending in both genders and any offending in males compared to those with any psychiatric disorder without comorbid substance misuse. Those with comorbid mental illness and substance misuse were found to be at particularly high risk, especially with regard to risk of violent offending among women (**table 4**).

Apart from considering the role of substance misuse, the above analyses have not taken comorbidity into consideration. In order to ensure that the effects found were not caused by the presence of comorbid personality disorders, we conducted sensitivity analyses in which anyone who was diagnosed with a personality disorder as a main or secondary diagnosis was excluded from the analyses from the day of first diagnosis onwards. As expected, this resulted in further attenuation of the estimates, however, for most diagnostic categories adjusted results were well within the confidence bands found in the main analyses. The exception was any offending in women with schizophrenia spectrum disorders (reduction from 4.42 (CI: 3.87-5.04) to 2.85 (CI: 2.29-3.56)).

Additionally, we tested whether the effects in the affective disorders category were driven solely by persons with bipolar disorder. Here we found that although the risk of any or violent offending among those with bipolar disorder more closely resembled the risk among those with schizophrenia spectrum disorders than other affective disorders, they were in fact not significantly different. We

also found that the corresponding drop in risk in the remaining group of affective disorders was modest to negligible.

### *Population impact*

Calculating population attributable risk fractions we found that 4.5% of male and 10.4% of female offending was attributable to mental disorders. The impact on violent offending was greater since it accounted for 10.2% of male and 26.4% of female violent offending. The largest contribution came from other mental disorders in males (2.1% for any offending, 3.5% for violent offending) and neurotic disorders in females (3.4% for any offending and 9.5% for violent offending) (**table 5**).

## Discussion

### *Main findings*

To our knowledge, this is the first study to systematically compare the association between violent and non-violent offending and the full spectrum of psychiatric diagnoses, following onset of disorder in a large population-based cohort. Studying 521,340 Danish inhabitants we found almost all types of mental disorders to be associated with an increased risk of offending. The strength of the association was greater for violent than other offending and for women compared to men. We also found a dose-response relationship between the number of psychiatric contacts and risk of offending, and a strong combined effect on risk of offending, especially among women, when diagnosed with both mental disorder and substance misuse.

### *Differences between diagnostic groups and comparisons with other studies*

The risk elevation found for both any and violent offending was apparent across a range of psychiatric diagnoses and was not confined to major mental disorder such as schizophrenia, even after adjustment. In fact, for men, the strength of association, after full adjustment, for any offending was significant across all but two diagnostic groups and effect sizes were very similar across disorders (ranging from 2.92 for organic disorders to 2.08 for neurotic disorders). For violent offending and offending among women, however, the pattern of findings indicated that the strength of association varied to a greater extent between disorders. The fact that risk of offending appears to extend across the full spectrum of mental disorder, particularly in the case of males and any offending where even the magnitude of association differed little across the spectrum, implies a role for common rather than disorder-specific underlying mechanisms. Pathways to offending shared across disorders may well involve aspects of social disadvantage, either as a mediating factor

or as a common cause of mental disorder and offending. Beyond psychosis, very little is known about risk factors for antisocial behaviour and thus the extent to which the role of such risk factors varies by disorder is unclear. Disorder-specific factors may well play a greater role in explaining risk of offending for women (where the strength of association was greatest for organic and psychotic disorders) and for violent offending for both men and women (for men risk was greatest for those with personality disorder followed by organic and psychotic disorders while for women risk was greatest for these latter two diagnostic groups). Disorder-specific pathways to offending are likely to include the impact of specific symptoms of mental disorder and other direct effects of disorder.

Although the magnitude of the associations differ, our results replicate those of a previous Danish population-based study<sup>9</sup> which found elevated offending risks in a range of disorders. However, that study was not restricted to first-time offending after the onset of mental disorder. Compared to this previous study, we were able to include a broader range of disorders due to the availability of out-patient contacts, just as the post-morbid nature of offending and duration of exposure was accounted for. However, our findings do contrast to some extent with a number of smaller non-Danish studies. In the Dunedin study (N=1037), an increased risk (unadjusted) of court convictions for violence was found in mania, schizophrenia spectrum disorders, and alcohol and marijuana dependence, but not in depression, anxiety or eating disorders.<sup>8</sup> However, the number of study subjects in each diagnostic category was modest, and hence the statistical power was limited. A study based in Camberwell, London (N=1076), found that criminality among those with schizophrenia was three times higher in women compared to those with other mental disorders, whereas for men such an elevation in risk was only found for violent offending (twice that of other mental disorders).<sup>22</sup> In addition to studies of offending risk, other measures of antisocial behaviour

such as self-reported violence have also found evidence for risk extending to diagnoses beyond psychosis.<sup>23</sup> In comparison to our study, the temporal relationship between onset of mental disorder and onset of offending was not always established in these previous studies and the range of disorders included did not necessarily cover the full range of mental disorders. Sample size also limited the ability of some of these studies to detect associations, particularly among women. In our study, mental retardation was not found to increase the risk of any offending in males, in contrast to the findings of the Stockholm Metropolitan study,<sup>24</sup> where offending in mental retardation was found to be around the same magnitude as major mental disorders (schizophrenia, bipolar disorder, and major depression). Likely, the cases of mental retardation in our study are more severe (and hence for some less able to offend) than in the Stockholm study, where mental retardation was defined according to special needs education and not solely contacts with mental health services.

We also found evidence for a dose-response relationship between number of psychiatric contacts and risk of offending, a finding which may reflect a relationship between severity of illness and risk of offending. Alternatively we know that risk of harm to others is more likely to result in psychiatric admission.

### *Gender differences*

Finding a higher relative risk of offending among women with mental disorder compared to men replicates previous studies of schizophrenia,<sup>2</sup> major mental disorders<sup>25</sup> and recently discharged psychiatric patients.<sup>26</sup> Comparing pre- and post-morbid criminality in psychoses, Kooyman et al. found evidence to support the notion that female offending is related more to illness factors, whereas pre-morbid factors are more predictive of male offending.<sup>4</sup> In a study of offending prior to

first psychiatric contact in Denmark, we have previously reported a risk elevation across most disorders and that the strength of the association between offending and later onset of mental disorder is similar for men and women.<sup>10</sup> Given this finding in comparison to the gender differences in relative risk found in the current study, we would argue that there is now strengthening evidence to indicate 1) that the nature of the relationship between mental disorder and offending risk differs by gender and 2) that in women it is more likely to be explained by the direct impact of disorder rather than as a result of common causes or vulnerabilities. This is also supported by our finding that for women, the strength of association between disorder and offending varied by disorder even when offending in general was examined. Risk assessment approaches and preventative strategies, need to take such potential gender differences into account.

#### *The role of substance misuse*

That the misuse of substances is highly correlated with offending in general<sup>7</sup> and when comorbid with other mental disorders<sup>27</sup> can hardly be contested. However, whether mental illness poses an increased risk of offending over and above comorbid misuse has been debated.<sup>28,29</sup> Reporting on data from the MacArthur Risk Assessment study, Steadman et al. found that recently discharged patients without substance abuse were no more likely than neighbourhood controls to be violent,<sup>30</sup> although features of substance misuse were more common among patients than controls. It is arguably likely that the additional presence of substance misuse both confounds and mediates any association between mental disorder and offending and on this basis we considered its adjustment separately. We did find that primary associations between mental disorders and offending persisted however, even after adjustment for substance misuse. We acknowledge that relying on secondary care diagnosis of substance misuse comorbidity is likely to have resulted in residual confounding however.<sup>31</sup> We also found that, apart from any offending in women, risks of offending were

significantly elevated for those with substance misuse alone compared to another mental disorder diagnosis alone.

### *Population impact*

In addition to presenting the relationship between mental disorder and offending in the form of relative risks, indicating the strength of associations, we examined the population impact of disorders on offending, taking both the association strength and prevalence of the exposure into account. Assuming causality, the proportion by which the number of offenders would be reduced if no psychiatric contact had occurred in the population was found to be less than 5% for male any offending, approximately 10% for male violent offending and female any offending, and over 25% for female violent offending. The notion that the importance of particular mental disorders in relation to risk of offending extends beyond psychotic and other major mental disorder diagnoses is supported by the population impact findings. However, it should be noted that the documented association does not imply causality and these findings must be interpreted with caution. Also, only first offences are included and potential differences in recidivism rates would impact the proportion of the total volume of offending associated with mental illness.

### *Strengths and limitations*

The current study benefits from a large sample size, minimal selection, attrition and information biases, and includes consideration of the full spectrum of psychiatric diagnoses with clarity about the post-morbid nature of offending identified. However, it does suffer from a number of potential limitations. Data was obtained during both the ICD-8 and ICD-10 eras and thus required a translation between systems to be undertaken. This may have led to a degree of diagnostic misclassification, although the broad categories of diagnosis employed here did not change



significantly between the two eras, and is unlikely to have a substantial impact on findings.

However, we were unable to assess possible associations between offending and childhood behavioural disorders (such as ADHD) and offending since these were less accurately classified prior to the ICD-10. It is not unlikely that part of the effect found in the “other” category is due to these disorders, and further investigations are certainly merited.

One of the key strengths of the study was the ability to include diagnostic information from outpatient as well as inpatient mental health service contact; reliance on inpatient information only has significantly limited the ability of most previous register-based population studies to examine the full range of psychiatric diagnoses since many disorders are characterised by limited contact with inpatient services (e.g. anxiety disorders). We were, however, only able to include outpatient contacts after 1995 and thus our findings for such disorders are likely to be conservative given that those with prior contacts would be misclassified. Diagnostic validity and reliability is often called into question when routinely collected clinical data is relied upon. Validation studies have been undertaken for a number of diagnoses (e.g. schizophrenia, dementia, and affective disorders) but validation has not been established for all diagnoses considered in the current study.<sup>32–34</sup> It is important to note that only broad diagnostic groups were considered and thus diagnostic misclassification occurring for this reason is likely to have had a limited impact only. Additionally, it should be noted that all diagnoses were ascribed by a psychiatrist and often based on a period of observation rather than a single clinical interview, which likely increases the diagnostic validity.<sup>35</sup>

In examining the associations between individual mental disorder categories and risk of offending in a mutually exclusive manner has particular implications for individuals who have repeated

mental health contact over time and whose diagnosis changes. We utilised the hierarchy inherent in the ICD and for this reason our results are at risk of being underestimated for those with diagnoses at the bottom of the hierarchy. We were able, however, to examine the impact of co-morbidity between mental disorders and both substance misuse and personality disorders, an aspect of diagnostic complexity which is rarely examined in detail in such studies. Although our study covered a long period and included individuals aged up to 45 years, we could not cover the entire period of risk for onset of mental disorder, particularly for disorders with later onset such as those in the organic disorders category.

Relying on official criminal records for data on offending obviously ignores behaviour which does not result in criminal justice contact, either because it is of a lesser severity or is not detected/reported/pursued for a range of other reasons for which we cannot account. In addition, using the conviction date implies a risk of including as pre-offence some cases of mental disorder which occur subsequent to the offence but prior to conviction. Such instances are not likely to be many. Although time-at-risk for offending limits due to incarceration is avoided in the current study by our focus on first-offending, time in spent in hospital has not been taken into account. Risk of offending is likely to be reduced by inpatient containment but is certainly not eliminated and complexities exist in relation to the likelihood that an offence which occurs in hospital is likely to be detected, reported or pursued. For analyses of first violent conviction, time at risk to offending may have been limited by a previous incarceration for non-violent offending but given the approach to sentencing for such offences in Denmark it is unlikely this will have had a significant impact on findings.

### *Conclusions*

In a large population-based study we found increased risk of offending across a range of mental disorders. Within any offending in males even the magnitude of risk was largely similar across diagnostic groups. For violent offending and offending in females differences between groups were larger, indicating that more specific illness related factors could be involved. A particularly high risk was found in those suffering from dual diagnoses highlighting the clinical importance of addressing problems of misuse and indicating the need to further elucidate the complex mechanisms involved.

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Table 1: Diagnostic categories

Name	ICD-10, Chapter V	ICD-8, Chapter V
Organic, including symptomatic, mental disorders	F0x.xx	290.09, 290.10, 290.11, 290.18, 290.19
Schizophrenia, schizotypal and delusional disorders	F2x.xx	295.xx, 297.xx, 298.39, 301.83
Mood [affective] disorders	F3x.xx	296.09, 296.19, 296.29, 296.39, 296.89, 296.99, 298.09, 298.19, 301.19, 300.49
Neurotic, stress-related and somatoform disorders	F4x.xx	305.x9, 300.09, 300.19, 300.29, 300.39, 300.59, 300.69, 300.79, 300.89, 300.99, 305.68, 307.99
Disorders of adult personality and behaviour	F6x.xx	301.xx, 302.19, 302.29, 302.39, 302.49, 302.89, 302.99
Mental retardation	F7x.xx	311.xx, 312.xx, 313.xx, 314.xx, 315.xx
Pervasive developmental disorders	F84.xx	299.00, 299.01, 299.02, 299.03, 299.04, 299.05
Substance use disorders	F1x.xx	291.xx, 294.4x, 303.xx, 304.xx, 570.xx, 571.00, 571.10, 573.00, 573.01, 577.10, 979.xx, 980.xx
Other mental disorders	All other codes	All other codes

Table 2: Risk of any offending in men and women

	No. cases	Basic Model <sup>a</sup>	First adjustment <sup>b</sup>	Second adjustment <sup>c</sup>
<i>Males</i>				
<b>No psychiatric contact</b>	<b>41,745</b>	<b>1 (ref.)</b>	<b>1 (ref.)</b>	<b>1 (ref.)</b>
Organic mental disorders	64	4.09 (3.20-5.23)	3.22 (2.52-4.12)	2.92 (2.28-3.73)
Schizophrenia spectrum disorders	401	3.79 (3.43-4.18)	3.15 (2.85-3.48)	2.38 (2.15-2.63)
Mood [affective] disorders	253	2.88 (2.55-3.27)	2.65 (2.34-3.01)	2.20 (1.94-2.50)
Neurotic disorders	593	2.80 (2.58-3.04)	2.41 (2.22-2.61)	2.08 (1.92-2.26)
Personality disorders	198	4.18 (3.64-4.81)	3.46 (3.01-3.98)	2.89 (2.51-3.32)
Mental retardation	71	1.38 (1.09-1.74)	1.09 (0.86-1.38)	1.09 (0.87-1.38)
Developmental disorders	73	0.87 (0.69-1.10)	0.80 (0.64-1.01)	0.80 (0.64-1.01)
Other mental disorders	1,404	3.12 (2.96-3.29)	2.47 (2.34-2.61)	2.22 (2.10-2.34)
<b>Any psychiatric contact</b>	<b>3,057</b>	<b>2.91 (2.80-3.02)</b>	<b>2.41 (2.32-2.50)</b>	<b>2.10 (2.02-2.19)</b>
<i>Females</i>				
<b>No psychiatric contact</b>	<b>10,874</b>	<b>1 (ref.)</b>	<b>1 (ref.)</b>	<b>1 (ref.)</b>
Organic mental disorders	26	8.41 (5.72-12.36)	7.19 (4.89-10.57)	5.60 (3.80-8.24)
Schizophrenia spectrum disorders	242	7.08 (6.23-8.05)	5.88 (5.17-6.68)	4.42 (3.87-5.04)
Mood [affective] disorders	261	3.64 (3.21-4.12)	3.30 (2.92-3.74)	2.77 (2.44-3.14)
Neurotic disorders	567	3.97 (3.64-4.33)	3.23 (2.96-3.52)	2.83 (2.59-3.09)
Personality disorders	170	5.55 (4.76-6.46)	4.71 (4.04-5.48)	3.89 (3.33-4.53)
Mental retardation	17	2.17 (1.35-3.49)	1.64 (1.02-2.65)	1.69 (1.05-2.72)
Developmental disorders	4	-- <sup>d</sup>	-- <sup>d</sup>	-- <sup>d</sup>
Other mental disorders	427	3.67 (3.33-4.04)	3.01 (2.73-3.32)	2.69 (2.44-2.97)
<b>Any psychiatric contact</b>	<b>1,714</b>	<b>4.17 (3.95-4.40)</b>	<b>3.48 (3.29-3.67)</b>	<b>2.98 (2.81-3.15)</b>

<sup>a</sup> Adjusted for age and calendar period

<sup>b</sup> Adjusted for age, calendar period, parental mental disorder, parental level of education and non-Danish place of birth

<sup>c</sup> Adjusted for age, calendar period, parental mental disorder, parental level of education, non-Danish place of birth, and substance misuse

<sup>d</sup> Insufficient number of exposed cases

Table 3: Risk of violent offending in men and women

	No. cases	Basic Model <sup>a</sup>	First adjustment <sup>b</sup>	Second adjustment <sup>c</sup>
<i>Males</i>				
<b>No psychiatric contact</b>	<b>13,590</b>	<b>1 (ref.)</b>	<b>1 (ref.)</b>	<b>1 (ref.)</b>
Organic mental disorders	60	6.47 (5.02-8.34)	5.01 (3.88-6.46)	3.65 (2.83-4.71)
Schizophrenia spectrum disorders	373	5.99 (5.40-6.64)	4.85 (4.37-5.38)	3.04 (2.73-3.39)
Mood [affective] disorders	189	3.83 (3.32-4.43)	3.48 (3.01-4.02)	2.52 (2.17-2.91)
Neurotic disorders	454	4.16 (3.78-4.57)	3.51 (3.19-3.86)	2.72 (2.47-3.00)
Personality disorders	204	7.07 (6.16-8.13)	5.73 (4.99-6.59)	4.07 (3.53-4.68)
Mental retardation	42	2.29 (1.69-3.10)	1.75 (1.29-2.37)	1.72 (1.27-2.33)
Developmental disorders	27	0.93 (0.64-1.36)	0.88 (0.60-1.28)	0.87 (0.60-1.28)
Other mental disorders	745	3.81 (3.54-4.11)	2.99 (2.78-3.23)	2.30 (2.13-2.49)
<b>Any psychiatric contact</b>	<b>2,094</b>	<b>4.18 (3.99-4.38)</b>	<b>3.43 (3.27-3.60)</b>	<b>2.56 (2.43-2.69)</b>
<i>Females</i>				
<b>No psychiatric contact</b>	<b>1215</b>	<b>1 (ref.)</b>	<b>1 (ref.)</b>	<b>1 (ref.)</b>
Organic mental disorders	15	26.68 (15.99-44.49)	20.70 (12.41-34.56)	11.07 (6.59-18.59)
Schizophrenia spectrum disorders	98	17.73 (14.38-21.85)	13.65 (11.05-16.86)	7.45 (5.96-9.31)
Mood [affective] disorders	62	4.94 (3.81-6.41)	4.26 (3.28-5.52)	2.90 (2.22-3.79)
Neurotic disorders	189	8.13 (6.94-9.52)	6.12 (5.21-7.18)	4.53 (3.84-5.35)
Personality disorders	50	10.18 (7.66-13.54)	7.94 (5.96-10.57)	5.03 (3.75-6.73)
Mental retardation	4	-- <sup>d</sup>	-- <sup>d</sup>	-- <sup>d</sup>
Developmental disorders	1	-- <sup>d</sup>	-- <sup>d</sup>	-- <sup>d</sup>
Other mental disorders	105	6.23 (5.09-7.62)	4.77 (3.89-5.85)	3.51 (2.85-4.32)
<b>Any psychiatric contact</b>	<b>524</b>	<b>8.02 (7.20-8.94)</b>	<b>6.22 (5.57-6.96)</b>	<b>4.29 (3.80-4.84)</b>

<sup>a</sup> Adjusted for age and calendar period

<sup>b</sup> Adjusted for age, calendar period, parental mental disorder, parental level of education and non-Danish place of birth

<sup>c</sup> Adjusted for age, calendar period, parental mental disorder, parental level of education, non-Danish place of birth, and substance misuse

<sup>d</sup> Insufficient number of exposed cases

Table 4: Combined effects of mental disorders and substance misuse

<i>Males</i>	<b>Any offending</b>		<b>Violent offending</b>	
	No. cases	IRR <sup>a</sup>	No. cases	IRR <sup>a</sup>
<b>No mental disorder, no misuse</b>	<b>40,094</b>	<b>1 (ref.)</b>	<b>12,667</b>	<b>1 (ref.)</b>
Mental disorder only	2217	2.03 (1.94-2.12)	1147	2.50 (2.35-2.67)
Substance misuse only	1651	2.66 (2.53-2.80)	923	3.12 (2.92-3.34)
Mental disorder and substance misuse	840	6.43 (6.00-6.90)	947	8.36 (7.80-8.95)
<i>Females</i>				
<b>No mental disorder, no misuse</b>	<b>10,526</b>	<b>1 (ref.)</b>	<b>1,108</b>	<b>1 (ref.)</b>
Mental disorder only	1,210	2.82 (2.65-3.00)	287	4.42 (3.86-5.07)
Substance misuse only	348	2.84 (2.55-3.16)	107	6.45 (5.28-7.89)
Mental disorder and substance misuse	504	11.20 (10.21-12.28)	237	25.12 (21.59-29.22)

<sup>a</sup> Adjusted for age, calendar period, parental mental disorder, parental level of education and non-Danish place of birth

Table 5: Population attributable risk fractions (percent)

	<b>Any offending</b>		<b>Violent offending</b>	
	Males	Females	Males	Females
Organic mental disorders	0.11	0.18	0.32	0.83
Schizophrenia spectrum disorders	0.66	1.65	1.98	5.32
Mood [affective] disorders	0.37	1.50	0.89	2.84
Neurotic disorders	0.85	3.37	2.20	9.53
Personality disorders	0.34	1.11	1.12	2.59
Mental retardation	0.04	0.07	0.15	0.17
Developmental disorders	-0.02	-0.01	-0.01	0.02
Other mental disorders	2.13	2.47	3.50	5.07
<b>Any psychiatric contact</b>	<b>4.48</b>	<b>10.35</b>	<b>10.16</b>	<b>26.38</b>

Note: Male fractions of male offending and female fractions of female offending. Models are adjusted for age and calendar period.

