Risk factors of violent offending in mentally ill prisoners with autism spectrum disorders

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ABSTRACT

Background: Results of research regarding a possible causal relation between autism spectrum disorders (ASDs) and violence are mixed. Several explanations have been proposed.
Aims: To assess prevalence rates of comorbid disorders in a large sample of mentally ill offenders diagnosed with ASD. Offenders with and without comorbid mental disorders were compared on several characteristics. To better understand the relationship between ASD and violent criminal behavior, the predictive value of several proposed risk factors (comorbidity, negative social network/influenceability, and childhood trauma/victimization) on violent offending was investigated.
Method: Data of 394 male offenders with a diagnosis of ASD were included. Prevalence rates of comorbid mental disorders next to ASD were calculated, and characteristics were compared using chi-square or t-tests. The predictive value of the risk factors was assessed using a binary logistic regression (n = 357).
Results: High rates of comorbidity were found (78.9%), specifically for substance use disorders (39.8%), schizophrenia spectrum disorders (31.7%), and neurodevelopmental disorder other than ASD (24.1%). Offenders with and without comorbidity differed significantly in their criminal and mental health care history. Both comorbidity (OR = 1.68; 95% CI 1.27–2.18) and a negative social network/influenceability (OR = 1.49; 95% CI 1.11–1.99) showed to be significant predictors of violent offending within this sample.
Conclusions: The highest rates of comorbid disorders found were disorders that have been previously linked to violent offending, and the risk of violent offending could be unrelated to ASD. However, the role of social functioning indicates a risk specific to the symptoms of ASD.

1. Introduction

Extensive media coverage of conspicuous and very violent incidents in which the perpetrator was diagnosed with an autism spectrum disorder (ASD) have given rise to concerns about a possible link between ASD and violent behavior. According to the DSM-V (Diagnostic and Statistical Manual of Mental Disorders; American Psychiatric Association, 2013), ASDs are neurodevelopmental disorders and are identified by two prominent symptom clusters. Firstly, persons with ASD often display impairments in their social communication and interaction. Secondly, they regularly exhibit repetitive patterns of behaviors, activities, and interests (World Health Organization, 1993; American Psychiatric Association, 2013). Results of research regarding a possible causal relation between ASD and violence are mixed (Mouridsen, 2012;

Im, 2016a, 2016b; Del Pozzo et al., 2018), and several explanations have been proposed. One explanation is the possible effect of comorbid mental disorders (Långström et al., 2009; Mouridsen, 2012; Im, 2016a; Del Pozzo et al., 2018). Research has indicated that high levels of comorbidity are very common in ASD (Del Pozzo et al., 2018), about 75% (Lever and Geurts, 2016), and are possibly more prevalent in violent offenders with ASD. Based on 37 case studies, Newman and Ghaziuddin (2008) reported that 83.7% of violent individuals with ASD showed evidence of a definite or probable comorbid psychiatric disorder. Others seek an explanation for this relation between violence and ASD in certain specific symptoms associated with the disorder, such as sensory sensitivities, preoccupations and impaired social skills (Mouridsen, 2012; Del Pozzo et al., 2018). For example, individuals with ASD may misinterpret social cues resulting in problematic behavior. Furthermore,

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because of a heightened influenceability, individuals with ASD could be more prone to be led by others to commit criminal acts (Långström et al., 2009; Mouridsen, 2012; Im, 2016a; Del Pozzo et al., 2018). Finally, childhood trauma or victimization, such as neglect and physical or sexual abuse, have been proposed as risk factors for violent behavior (Im, 2016b; Del Pozzo et al., 2018), just as these factors increase the risk of violent behavior in the general population (OR = 1.8; Fitton et al., 2020; Del Pozzo et al., 2018). Unfortunately, a common limitation of the studies addressing ASD and violent behavior is the small sample size or the use of case studies (Im, 2016a). Furthermore, no studies have investigated the relative risk of the proposed factors in a single model, thereby correcting for possible confounding effects.

The aim of the current study is to assess prevalence rates of comorbidity and specific comorbid mental disorders in a large sample of mentally ill offenders diagnosed with ASD (n = 394). Subjects with and without comorbid mental disorders will be compared on several demographic variables. To better understand the relationship between ASD and violent criminal behavior, the predictive value of comorbidity, a negative social network/influenceability, and childhood trauma/victimization is investigated using logistic regression. More knowledge about comorbidity and other possible risk factors for violent behavior in ASD could aid the early detection and treatment of individuals at risk.

2. Methods

2.1. Penitentiary psychiatric centers and the National Database PPC

The data used in this study were collected in the penitentiary psychiatric centers (PPCs) in the Netherlands.

PPCs are separate facilities within the penitentiary institutions of the Dutch criminal justice system and are equipped to house detainees unable to function within a regular detention regime due to their mental state and need for specialized psychiatric care. On average, there are 11,139 individuals in detention in the Netherlands on any single day (Dutch Custodial Agency, 2020). In total, the PPCs have a capacity for 676 offenders (Dutch Custodial Institutions Agency, 2020). Individuals are only referred to the PPC when there is severe dysfunctional behavior due to their mental state, for example, suicidal or psychotic behavior.

Since May 1, 2013, the PPC's systematically gather information on all offenders admitted to the PPC, resulting in the National Database PPC. This database contains diagnostic information, demographic characteristics, and criminal records of over 10,000 offenders. Primarily, the data are used for policymaking and clinical purposes. The present study comprises a secondary analysis of these data for scientific research.

2.2. Ethical considerations

Secondary use of anonymized data for this study was authorized by the Dutch Ministry of Justice and Security. Additionally, the Ethics Committee of the Department of Law and Criminology, Vrije Universiteit Amsterdam gave their consent.

2.3. Participants

This study includes data on all offenders detained in the four PPCs in the Netherlands between May 1, 2013, and December 19, 2019, with a diagnosis of ASD.

In the case of multiple admissions, which is not unusual in this population, data gathered during the most recent admission were included in the study. A sample size of 425 unique subjects was identified. Given possible gender differences in ASD (Rivet and Matson, 2011), comorbidity (Diamond et al., 2001), and the limited number of female offenders in our sample (n = 31), only male offenders were included in this study, resulting in a final sample size of 394 offenders. The criminal status of 283 subjects was defined as pre-trial detention at admission to

the PPC. In these cases, only information on convicted offenses committed in the past were included in the current study.

2.4. Measures

2.4.1. DSM-diagnosis

Upon admission to the PPC, both a psychiatrist and psychologist conduct an independent primary diagnostic interview with the offender and are often informed by extensive information from previous clinical admissions in mental health clinics, or forensic reports. Both are trained professionals, usually with extensive experience within the forensic field. The final DSM-diagnosis is the result of a consensus diagnosis, which has to be agreed upon by both professionals. Note that this procedure is the regular clinical practice of every PPC.

Due to the publication of a new edition of the DSM, diagnoses in this study were made based on either DSM-IV or DSM-5 criteria, and represented in the data by their corresponding ICD-9-CM code.[1] When diagnosed using DSM-IV, ICD-9-CM codes 299.00 (autistic disorder) and 299.8 (Asperger's disorder and Pervasive Developmental Disorder NOS) were defined as ASDs. DSM-5 only defines ICD-9-CM code 299.00 as an ASD. Comorbid diagnoses, besides ASD, were also categorized based on their ICD-9-CM codes. Substantial changes were made in the definition of various disorders in the transition to DSM-5. Nevertheless, the diagnostic codes of DSM-IV are still compatible for this study, as we assigned them to more broad categories (for example, psychotic disorders) of DSM-5 diagnoses to report prevalence rates of comorbid disorders. Thus, the diagnoses in this study consist of DSM-5 categories, derived from either a DSM-5 or DSM-IV diagnosis.

2.4.2. Demographics

Several demographic measures were examined, including age at admission, information on criminal history and the history of mental health care.

2.4.3. Risk factors of violent offending

Comorbidity was measured as the number of diagnoses individuals received as a result of the primary diagnostic interview at admission to the PPC. Both a negative social network/influenceability and childhood trauma/victimization were operationalized using the Historisch, Klinisch, Toekomst - Revisie (Historical, Clinical, Future - Revised; HKT- R; Spreen et al., 2014). This risk assessment tool consists of 33 risk factors for (violent) offending and is systematically scored for all offenders detained in the PPC. Scoring is based on all criminal files available to the researchers, often including extensive psychological reports. If insufficient reliable sources of information are available, the item will be scored as missing. This can be the case due to a number of factors, for example when individuals have spent prolonged periods of time abroad or have recently migrated to the Netherlands. All items of the HKT-R are part of the National Database PPC.

The risk factor "Network influences" (H05) of the HKT-R was used to assess the presence of a negative social network and the degree of influenceability by this network. This risk factor describes the extent to which an individual has been influenced by a negative social network in the past. It also takes into consideration the presence of antisocial peers and family members, engaging social groups with a negative connotation, the possible rejection of prosocial network influences, and the presence of social isolation. Scoring is done on a 5-point Likert scale (0–4). The extent to which offenders experienced some form of trauma and/or victimization under the age of 18, was assessed by means of the HKT-R risk factor "Victim of violence in youth" (H07). This risk factor is

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[1] Unlike the US version, the Dutch translation of the DSM-5 did not yet contain ICD-10-CM codes upon publication in May 2013. Therefore, when the National Database PPC switched from DSM-IV to DSM-5, DSM-5 diagnoses were continued to be coded into ICD-9-CM codes.

scored from any statement concerning abuse and/or neglect (emotional, physical, or sexual) towards subjects under the age of 18. Besides apparent cases of abuse, such as a parent that is physically violent towards a child, it includes prolonged and frequent bullying and frequently witnessing violence. Examples of neglect include malnutrition, an unstable environment, or caretakers lacking appropriate parenting skills. Scoring is done on a 5-point Likert scale (0–4).

The psychometric qualities of the first version of the HKT (HKT-30) have been found to be good (Canton et al., 2004), and improved with the revision of the instrument. With regard to violent reoffending, the total instrument and the historical domain both have an acceptable predictive validity (respectively, AUC = .78 and AUC = .75) Furthermore, both showed to have a good interrater reliability (respectively, ICC = .62 and ICC = .80; Bogaerts et al., 2018).

2.4.4. Outcome

The outcome measure was either violent or non-violent offending. Violent offending was operationalized as convicted perpetration of an offense in which the behavior of the perpetrator causes (potential) damage to a human victim. Under the Dutch law, the following categories are defined as such: moderate and severe violent offenses, violent property offenses (for example, armed robbery), hands-on (pedo)sexual offenses, manslaughter, arson, or murder. Non-violent offending was scored as a convicted perpetration of an offense within the following non-violent offense categories: misdemeanors, drug offenses, vandalism, and property offenses (for example, theft). All previous convictions were used to assess the presence of violent offending in the past.

2.5. Statistical analysis

Statistical analyses were conducted using SPSS (SPSS IBM, v24). Comparisons between subjects with and without comorbid disorders were made using either chi-square tests in the case of categorical variables and t-tests in the case of numeric values. A binary logistic regression, using a forced entry method, was executed to examine the relationship between the binary outcome, convicted violent offending, and the number of comorbid disorders, negative social network/influenceability, and childhood trauma/victimization as possible predictor variables for violent offending.

3. Results

3.1. Offending behavior

The offenses committed by this sample were mostly violent. Only 11.7% committed non-violent offenses. Moderate violent offenses, for example cases of assault not resulting in serious injury, were most prevalent (32.0%). A percentage of 11.2% committed a severe violent offense, such as aggravated assault resulting in serious injury. Furthermore, 7.1% committed violent property offenses and 11.9% manslaughter. Rates of arson (8.1%) and murder (8.4%) were similar in this sample. Finally, 4.1% committed a sexual offense, and 5.3% committed a pedosexual offense. Both categories of sexual offending are comprised of hands-on offenses.

3.2. Prevalence rates of comorbidity

Results show that, in total, 78.9% of the subjects were diagnosed with at least one comorbid disorder. Table 1 presents the number of comorbid disorders that have been diagnosed in addition to ASD. Prevalence rates of specific co-occurring diagnoses are displayed in Table 2. Substance-related and addictive disorders had the highest prevalence within this sample (39.8%), followed by schizophrenia spectrum and other psychotic disorders (31.7%). The third most prevalent diagnosis was a neurodevelopmental disorder other than ASD (24.1%) including, amongst others, intellectual disabilities, attention-

Table 1
Number of comorbid mental disorders (in addition to ASD), in a sample of mentally ill offenders with ASD.

Number of comorbid diagnoses	n	%
0	83	21.1
1	122	31.0
2	96	24.4
3	65	16.5
4	20	5.1
5	6	1.5
6	2	0.5

Note: N = 394.

Table 2
Prevalence rates of mental disorders in a sample of mentally ill offenders with ASD, in addition to ASD.

Diagnosis	N	%
Neurodevelopmental disorders	95	24.1
Schizophrenia spectrum and other psychotic disorders	125	31.7
Bipolar and related disorders	8	2.0
Depressive disorders	10	2.5
Anxiety disorders	5	1.3
Obsessive-compulsive and related disorders	3	0.8
Trauma- and stressor-related disorders	18	4.6
Dissociative disorders	1	0.3
Sleep–wake disorders	1	0.3
Disruptive, impulse-control, and conduct disorders	10	2.5
Substance-related and addictive disorders	157	39.8
Neurocognitive disorders	2	0.5
Paraphilic disorders	14	3.6
Other Mental disorders	3	0.8
Cluster A personality disorder	1	0.3
Cluster B personality disorder	39	8.7
Cluster C personality disorder	8	0.8
Other specified/Unspecified personality disorder	40	10.2

Note: N = 394.

deficit/hyperactivity disorder (ADHD), and learning disorders.

3.3. Patient characteristics

Information on demographics for subjects with and without comorbid disorders in combination with ASD are shown in Table 3. The proportion of first offenders was smaller for the subjects with comorbid mental disorders (n = 311) compared to subjects without (n = 83), albeit with a small effect size (X^2 (1) = 4.65, $p < .05$, r = .11). Subsequently, the proportion of frequent offenders (more than 10 convicted offenses in

Table 3
Demographics of patients with and without comorbid mental disorders

	ASD Only	ASD Comorbid	Total
	n = 83	n = 311	n = 394
Mean age (SE)	32.64 (1.17)	31.45 (.54)	31.70 (.49)
Criminal history			
Mean age at first offense (SE)	21.86 (1.19)	19.66 (.47)	20.09 (.44)
Recidivism*			
First offenders (%)	20 (24.1)	44 (14.1)	64 (16.2)
Recidivists (%)	63 (75.9)	265 (85.8)	328 (83.2)
Frequent offenders*	6 (7.2)	55 (17.8)	61(15.5)
History of mental health care			
Youth care* (%)	35 (46.7)	182 (61.7)	217 (58.6)
Outpatient care (%)	48 (64.0)	217 (72.8)	265 (71.0)
Inpatient care (%)	32 (42.7)	154 (51.3)	186 (49.6)
Compulsory admission (%)	22 (29.3)	117 (39.4)	139 (37.4)
Assisted living* (%)	23 (30.7)	129 (43.4)	152 (40.9)

Note: * p <.05, ** p <.01.
Abbreviations: SE = Standard error.

the past five years) was larger for the subjects with comorbid mental disorders compared to subjects without comorbid mental disorders (X^2 (1) = 5.56, $p < .05$, r = .11). With regard to the history of mental health care, subjects with comorbid mental disorders in addition to ASD had received mental health care during their childhood significantly more often (X^2 (1) = 4.76, $p < .05$, r = .11) and had resided in assisted living facilities (X^2 (1) = 4.03, $p < .05$, r = .10) more often than subjects without comorbid mental disorders.

3.4. Risk factors of violent offending in ASD

Due to missing values on one or more predictor variables, 12 non-violent offenders and 25 violent offenders were excluded from the binary logistic regression. The results of the analysis are presented in Table 4. Comorbidity shows to be a significant predictor of violence in this model. With an increase in the number of mental disorders, the risk of violent offending increases by 1.68 (95% CI 1.27–2.18). Negative social network/influenceability also appears to be a significant predictor for violent offending in this sample. An increase in this variable corresponds to a more antisocial network, and a higher susceptibility to influences from this network. An increase of this variable by one point increases the risk of violent offending by 1.49 (95% CI 1.11–1.99). The model had a small effect size, with Nagelkerke's R^2 = .14 (Nagelkerke, 1991).

4. Discussion

This study presents data on prevalence rates of comorbid mental disorders in a relatively large group of mentally ill prisoners with ASD. The results show that high levels of comorbidity are common within this sample. In total, 78.9% had one or more comorbid disorders, a number that is in line with previous research (Newman and Ghaziuddin, 2008; Del Pozzo et al., 2018). High rates of comorbidity were found for substance use disorders (39.8%), psychotic disorders (31.7%), and neurodevelopmental disorders other than ASD (24.1%). Offenders with comorbid mental disorders in addition to ASD were also more likely to have an elaborate history of criminal offenses and mental health care.

To better understand the relationship between ASD and violent criminal behavior, the predictive value of comorbidity, negative social network/influenceability, and childhood trauma/victimization was investigated. The results of the current study indicate that the risk for violent offending by individuals with ASD is bipartisan: both comorbidity and the presence of a negative social network or an increased degree of influenceability by this negative social network seemed to increase the risk of violent offending significantly. High rates of comorbidity were found for disorders that have been previously linked to violent offending. One could argue that violent offending in individuals with ASD is a result of the known risk associated with their comorbid disorders rather than their ASD (Långström et al., 2009), which some researchers have proposed (Newman and Ghaziuddin, 2008).

However, the present study also showed that violent offenders with ASD perhaps have more negative or inadequate social networks, and could have an increased susceptibility to influences from others than their non-violent counterparts. These are known risk factors for violent

offending, regardless of the presence of mental disorders (Bonta et al., 2014). However, in ASD, the indirect effect of the disorder on this risk factor is possibly to be of significance due to its inherent effects and impairments in social functioning (World Health Organization, 1993; >American Psychiatric Association, 2013; Van Hoorn et al., 2017). Individuals with ASD often experience impairments in social communication and interaction, perhaps leaving them more susceptible to engaging in antisocial peer groups or social isolation.

Finally, a history of trauma has been reported to increase the risk of aggression in individuals without ASD (Im, 2016b). Although research regarding this possible increase in individuals with ASD is mostly comprised of case studies, Helverschou et al. (2015) found that, in a group of 48 offenders with ASD, a significant proportion were raised in institutional or foster care, or were otherwise involved with childcare services growing up (Kawakami et al., 2012). This finding is supported by the current study, as 58.6% of the total sample had received childcare services. Furthermore, in individuals with high-functioning ASD, childhood adversities have been found to correlate significantly with an increased risk of criminal behavior (Kawakami et al., 2012). The results of the current study, however, indicate that childhood trauma or abuse does not increase the risk of violent offending in offenders with ASD. It is possible that risk factors associated with offending in individuals with ASD do not necessarily increase the risk for violent offending, but are associated with other non-violent offenses such as theft or drug-related crime.

It has been suggested that there is a need for an ASD specific risk assessment tool (Allely, 2018; Westphal and Allely, 2019), as there is evidence that commonly used tools do not successfully predict the risk of violent offending in individuals with ASD (Girardi et al., 2019). The current study identifies two possible risk factors for violence in individuals with ASD that could improve risk assessments in this population. First, comorbidity seems to be an essential risk factor for violent offending, just as in non-ASD populations (Långström et al., 2009; Mouridsen, 2012; Higgs and Carter, 2015). Furthermore, specific characteristics of the disorder could be of indirect influence when violent offending occurs in individuals with ASD, given the importance of the social domain in violent offending by individuals with ASD found in this study. Finally, it seems possible that risk factors for general offending differ from those associated with violent offending within the ASD population.

4.1. Comorbidity, ASD and violent behavior

This study found that the most prevalent comorbid mental disorders in this sample have been previously related to violent, and aggressive behaviors. The relationship between substance use disorders and violent behavior is well-established and prevalence rates of these disorders are high in offender samples (Fazel and Danesch, 2002; Grann et al., 2008). Although it has long been assumed that substance use disorders are rare in individuals with ASD, Butwicka et al. (2017) found that individuals with ASD are at an increased risk for substance use disorders. In their population-based cohort study, they found a prevalence rate of 3.6% in 26,986 individuals with ASD. Långström et al. (2009) found that 16.1% of 31 individuals with ASD that had been convicted of a violent criminal offense, also suffered from a comorbid substance use disorder. However, this is a much lower rate than found in the current study (39.8%) and is based on a small sample size.

With regard to psychotic disorders combined with ASD, studies have found prevalence rates of 4.4–18% in population studies (Vannucchi et al., 2020) and 7–16% in clinical samples (Underwood et al., 2019; Vannucchi et al., 2020). Psychotic disorders and ASDs seem to share specific features that are strongly correlated, and autistic features in childhood are even predictive of schizophrenia at a later age (Barneveld et al., 2011). The relationship between psychotic disorders and violence has been often documented (Douglas et al., 2009). Consequently, prevalence rates of psychotic disorders in prison samples are high (Fazel

Table 4
Results of binary logistic regression.

	B (SE)	OR	CI for OR
Comorbidity**	.51 (.14)	1.68	1.27–2.18
Social skills/naivety**	.40 (.15)	1.49	1.11–1.99
Childhood trauma/victimization	.14 (.10)	1.15	.94–1.39
Constant*	-.84 (.42)	.43	

Note. n = 357, violent offending n = 286, non-violent offending n = 71Abbreviations: OR = Odds Ratio, CI = Confidence Interval.
*$p < .05$, **$p < .01$.*

and Seewald, 2012). In comparison to the study of Långström et al. (2009), who found a prevalence rate of 25.8% for comorbid psychotic disorders in violent offenders with ASD, the current study again finds a higher rate of 31.7%.

Research has indicated that even though diagnostic criteria do not overlap, ASD, and either attention-deficit/hyperactivity disorder (ADHD) or intellectual disabilities frequently co-occur (Buck et al., 2014; Underwood et al., 2019). Furthermore, individuals with ASD with comorbid intellectual disabilities seem to be at increased risk for the development of psychotic disorders (Buck et al., 2014). High rates of ADHD (Retz and Rösler, 2009) and intellectual disabilities (Fazel et al., 2008) have been found in prison samples, and both are associated with aggression (Fazel et al., 2008; Retz and Rösler, 2009).

A striking result of the current study is the low rates of comorbid depressive (2.5%) and anxiety (1.3%) disorders, while high prevalence rates are found for both disorders in non-forensic samples with ASD, around 50% (Underwood et al., 2019). Helverschou et al. (2015) found similar results in a group of offenders with ASD. It may be hypothesized that comorbidity with these disorders, often described as internally focused (Krueger and Markon, 2006), may lead to a reduced risk of (violent) offending in individuals with ASD, thereby leading to under-representation within this forensic sample. It should be noted that the prevalence rates for anxiety and depression found in the current study are also in contrast to those found in other prison samples without ASD. Both depression and anxiety are more prevalent in forensic samples than in the general population (Fazel and Seewald, 2012; Helverschou et al., 2015). It is reasonable to assume that high rates of depression and anxiety within detention centers are, at least in part, a result of negative emotions induced by incarceration. Perhaps these highly controlled and often restricted settings influence individuals with ASD less negatively than they do other populations.

4.2. Strengths and limitations

An important strength of this study is the large sample size that was available for analyses. Much of the previous research regarding this topic relies on case studies or small sample sizes, making it difficult to interpret results with certainty. Moreover, the large sample size used in this study made it possible to test several proposed risk factors in one model. It thereby controlled for possible confounding effects of comorbid mental disorders. To our knowledge, no study has done so before. Previous research either included study samples in which subjects with disorders comorbid with ASD were excluded or included samples in which ASD was present, without considering possible comorbid mental disorders. The results of the current study indicate that comorbidity has a significant effect on the risk of violent offending and should, therefore, always be considered in research regarding this topic.

Although the results indicate that comorbidity is a risk factor for violent offending in mentally ill offenders with ASD, it should be noted that this study is based on a sample of offenders specifically selected, and no control groups were included in this study for comparison. Therefore, the results of this study are limited to the population of mentally ill offenders with ASD in a specialized care facility, but cannot be generalized to all individuals with ASD. The lack of control groups and the use of biased samples is a common restriction in research regarding this topic. Furthermore, offenders with ASD were subdivided into two groups as being violent or non-violent. The non-violent offenders in this study may have displayed violent behavior in the past without their behavior resulting in criminal charges. Finally, the data used in this study are part of a large and unique cohort of mentally ill prisoners and are an accurate representation of the clinical practice. As a result, data on the diagnoses have not been gathered by means of a structured instrument and no standard tool to diagnose ASD was used. However, as the diagnoses are based on a thorough analysis by a psychiatrist as well as a psychologist, both with ample experience, we do not assume that this limitation affected the diagnoses made.

4.3. Future research

The current study provides an important step in the understanding of risk factors for violence within this population of mentally ill offenders. The results could aid the early detection of individuals at risk and contribute to developing an ASD-specific risk assessment tool. The next step towards early detection and risk assessment should be to investigate whether specific patterns of comorbidity exist that might increase the risk of violent offending. The results suggest that comorbidity with certain disorders influence the risk of (violent) offending. For example, a comorbid substance use disorder might increase the risk of violence, as it does in other populations of offenders. Alternatively, a comorbid depression or anxiety disorder may actually reduce the risk of violent offending in patients with ASD. Future research should investigate this further and include control groups that have not been in contact with the criminal justice system. Furthermore, to prevent recidivism by offenders suffering from ASD, the current study underlines the need for treatment programs that effectively target multiple disorders simultaneously or treat specific comorbidities in offenders with ASD.

Finally, given the suggested relative importance of social skills in violent offending by individuals with ASD, future research should investigate in more detail what aspects of social functioning increase the risk for violent offending (for example, insufficient social skills, social naivety or negative social influences). Furthermore, therapies targeting the improvement of these social skills in offender populations diagnosed with ASD should be developed, and their influence on reoffending should be investigated. These therapies may reduce the risk of reoffending by reducing social naivety and improving offenders' resilience to negative social influences.

5. Data availability

The authors received permission from the Dutch Ministry of Justice and Security to access the data used in this study. However, they are unable to share the data as they are not custodians of the data.

Author statement

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NB contributed to data collection, designed study, processed the raw data, performed the statistical analysis, interpreted the data, wrote the manuscript until the final version.

JM and JH contributed to the study design and interpretation of data, edited and critically reviewed the manuscript, and contributed to the preparation of the manuscript.

CB Critically reviewed the manuscript and contributed to the interpretation of data.

Declaration of competing interest

The authors declare that no conflicts of interest exist.

Acknowledgements

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