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Criminal offending and associated factors in dual diagnosis patients

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ABSTRACT

Dual diagnosis patients perpetrate crime more often than healthy individuals. Crime perpetration has major mental health consequences for the victim. Knowledge of factors related to perpetration is needed for the development of prevention programs. However, in dual diagnosis patients, very little is known about factors explaining criminal behavior. The current study investigated cross-sectional associations between demographic and clinical factors and perpetration of three crime types (violence, threat, and property crime) in 243 treatment-seeking dual diagnosis patients. In our sample, perpetration of violence was independently associated with younger age, severity of alcohol use problems, lifetime trauma exposure, and higher manic symptom scores. Expression of threat was independently associated with severity of alcohol use problems and higher manic symptom scores. Perpetration of property crime was independently associated with severity of alcohol and drug use problems. Remarkably, gender was not associated with any type of perpetration. These findings indicate that criminal offending is a significant problem among dual diagnosis patients and are a first step towards understanding the complex causal networks that lead to criminal perpetration. Future longitudinal research should investigate additional risk factors and establish causality to support the development of treatment programs to prevent criminal offending by dual diagnosis patients.

1. Introduction

Suffering from a mental illness is strongly associated with suffering from a co-occurring drug or alcohol use disorder (Kessler, 2004). Patients diagnosed with both a mental health and substance use disorder are referred to as dual diagnosis patients. Research has consistently shown that suffering from dual diagnosis is related to poor clinical and social outcomes, such as medication non-adherence, relapse, treatment resistance, suicide, homelessness and incarceration (Carra et al., 2015; Wallace et al., 2004; Drake et al., 1991; Hunt et al., 2013). Furthermore, dual diagnosis patients have an elevated risk to perpetrate crime (Swanson et al., 1990). Criminal perpetration has major mental health consequences for the victim, such as depression, posttraumatic stress disorder and increased anxiety (Robinson and Keithley, 2000; Krug et al., 1996; Brown and Harris, 1989; Chon and Wilson, 2016). In addition, dual diagnosis patients who perpetrate crime are at elevated risk to be victimized themselves (de Waal et al., 2018).

Crime is often subdivided in violent crime and property crime in the literature. In this study we additionally consider *threat,* defined by the Oxford English Dictionary as a communicated intent to inflict harm or loss on another person, as a separate type of crime. Criminological research has established several factors that are associated with criminal offending in the general population. Two of the most robust findings are that (1) crime perpetration is more prevalent in men compared to women and (2) crime perpetration decreases with age. Both these relationships have shown to be stable in several historical periods, across geographic locations and among all crime types (Hirschi and Gottfredson, 1983; Gottfredson and Hirschi, 1990). Moreover, drug use (Bennett et al., 2008) and alcohol use have consistently been associated with perpetration of crime in the general population (Bennett et al., 2008; Murdoch et al., 1990). Another factor that has been linked to perpetration of crime is mental illness (Hodgins, 1992, 1996), although several studies have estimated that only 4–12% of all arrests are directly attributable to mental illness (Peterson et al., 2014; Monahan et al., 2001; Junginger et al., 2006). Other risk factors for criminal perpetration are a history of criminal behavior (Andrews and Bonta, 1994), homelessness (Levitt et al., 2009) and trauma exposure in early or later life (Widom and Maxfield, 1996; McCord, 1983).

To the best of our knowledge, little is known about factors that explain criminal perpetration by dual diagnosis patients. Research has however established certain factors that are associated with criminal perpetration in patients with substance use disorders or severe mental illness (SMI). Male gender (Chermack et al., 2001), non-Caucasian race (Chermack et al., 2000) and severity of alcohol (Stith et al., 1991) and drug use problems (Schuckit and Russell, 1984) have been associated with violent crime perpetration by patients with substance use disorders. With regard to criminal perpetration in the SMI population Witt et al. (2013) systematically reviewed 110 studies in patients with psychosis and found that male gender, non-white ethnicity, lower socioeconomic status, homelessness, history of violent victimization, childhood abuse, higher general psychopathology symptom scores, comorbid substance use disorder and recent misuse of alcohol or drugs were associated with perpetration of violence (Witt et al., 2013). Despite strong associations between SMI and criminal perpetration, only a small proportion of crimes can be directly related to psychiatric symptoms. More specifically, symptoms of bipolar disorder have been found to be more strongly related to crime perpetration compared to symptoms of depression or schizophrenia spectrum disorders (Peterson et al., 2014). Evidence is inconsistent about the direct relationship between psychotic symptoms and criminal behavior. Some studies suggest that a small part of criminal events can be directly linked to psychotic symptoms (Monahan et al., 2001), whereas other studies suggest a small protective effect of psychotic symptoms (Prins et al., 2015).

Despite ample research on the prevalence of criminal perpetration among patients with dual diagnosis compared with other populations (Scott et al., 1998; Wright et al., 2002), studies investigating factors that are associated with criminal perpetration in this specific population are lacking. Previous research has been conducted in either patients with SMI or patients with substance use disorders and mainly focuses on violent perpetration, rather than threat and property crime. Research that aims to explain criminal perpetration by dual diagnosis patients is desirable, since it could contribute to future longitudinal research, subsequently enabling the development or refinement of specific prevention and treatment programmes, with potential benefit to victims and perpetrators with dual diagnosis.

This cross-sectional study aimed to identify demographic and clinical factors that are associated with crime perpetration in dual diagnosis patients. We constructed three statistical models, identifying factors that explain perpetration of violent crime, threats and property crime. Based on extensive research in the general population, we hypothesize that younger age and male gender are associated with perpetration of all three types of crime. Furthermore, we hypothesize that perpetration of violent crime is associated with homelessness, symptoms of mania, severity of alcohol and drug use problems and prior victimization. Since in some studies threat is included in the definition of violent crime, we tentatively hypothesize that threat is associated with the same factors as violent crime perpetration. Finally, due to increased prevalence in patients with substance use disorder, we hypothesize that perpetration of property crime is associated with severity of drug use problems and homelessness.

2. Methods

2.1. Study design and participants

This cross-sectional study used baseline data from a randomized controlled trial that investigates the effectiveness of an intervention aimed at reducing victimization in dual diagnosis patients using group therapy (de Waal et al., 2015). The study was approved by the ethics committee of the Amsterdam University Medical Center of the University of Amsterdam, the Netherlands. The target population consisted of individuals 18 years of age or older, suffering from at least one mental disorder on the DSM-IV Axis I or II other than substance use disorder, with comorbid substance dependence or substance abuse according to DSM-IV. Patients were excluded from participation if they had insufficient understanding of the Dutch language or were not eligible for group therapy according to their case manager. Written informed consent was obtained from all participants. Participants were recruited at an inpatient as well as outpatient site from a psychiatric service in Amsterdam, the Netherlands (Arkin Mental Health Care, division Mentrum) where patients are treated for both substance use disorders and mental disorders. Recruitment took place from April 2014 until April 2016. In this period, all participants who fulfilled the criteria were informed about the study and invited to participate. An assessment was performed by one of five researchers (one with a master's degree, four trained master's degree students in clinical psychology) in a face-to-face setting at the treatment facility. Confidentiality was assured at the start of the assessment. Participation was rewarded with €15 cash.

2.2. Measures

In order to assess perpetration of crime within the past twelve months, we used self-designed dichotomous yes/no questions. The questions were developed in accordance with the Dutch 2011 Veiligheidsmonitor (Safety Monitor), which is the Dutch equivalent of the International Crime Victims Survey (van Dijk et al., 1990) and has been developed by the Dutch Ministry of Security and Justice. There are no psychometric properties available. Perpetration was measured by assessing various crimes, subdivided in three categories: (1) violent crimes, consisting of physical abuse and sexual assault; (2) threat; and (3) property crimes, consisting of burglary, car theft, theft from car, other motor vehicle theft, bicycle theft, robbery, and theft of other property. Physical abuse was defined as physically attacking or being physically abusive. Sexual assault was defined as touching or grabbing in an offensive way with sexual intentions. Threat was defined as threatening somebody with hitting, kicking, a pistol, a knife, or something similar, without being physically attacking or abusive. For each crime, participants were asked whether they had ever been a perpetrator of that particular crime (e.g. "have you ever attacked, hit, kicked, or physically abused someone?"), and if yes, whether this had also happened in the past 12 months. Moreover, the assessment contained an extra reminder of confidentiality and anonymous data management. Researchers who conducted the assessments explained to participants that they were working for a separate research department, were not involved in patient care, would not report in electronic patient files and that patients answers would not influence their treatment in any way.

Demographic characteristics were obtained from all participants. Based on prior research we included measures of age, gender and homelessness in our bivariate analyses. Homelessness was defined as the absence of permanent residence at the time of assessment. Temporary stays in (psychiatric) care facilities and homeless shelters were not considered permanent residence.

Severity of alcohol use problems in the twelve months prior to assessment was examined with the Alcohol Use Disorders Identification Test (AUDIT) (Saunders et al., 1993). This tool was developed by the World Health Organization and consists of 10 items, scored on a 5-point scale. Sum scores range from zero to 40. Higher sum scores suggest more serious alcohol use problems. The AUDIT has good reliability and validity in individuals with SMI (Dawe et al., 2000). In the current study AUDIT showed an excellent internal consistency, examined by Cronbach's α ($\alpha = 0.93$). Severity of drug use problems in the twelve months prior to assessment was examined with the Drug Use Disorders Identification Test (DUDIT) (Berman et al., 2005), which is a parallel instrument to the AUDIT. The DUDIT is an 11 item self-report questionnaire, scored on a 5-point scale. Sum scores range from zero to 44. Higher sum scores suggest more serious drug use problems. The DUDIT has good reliability and validity in individuals suffering from psychosis (Nesvag et al., 2010) and substance use disorder (Berman et al., 2005).

In the current sample DUDIT showed an excellent internal consistency ($\alpha = 0.92$). Both the AUDIT and the DUDIT were performed through a face-to-face interview.

Psychiatric symptoms in the past month were measured with the Brief Psychiatric Rating Scale – Expanded (BPRS-E) (Lukoff et al., 1986), which consists of 24 symptoms. Items were grouped in four subscales: manic excitement/disorganization, depression / anxiety, positive symptoms, and negative symptoms, as proposed by Ruggeri et al. (2005). The clinician-administered instrument is valid and reliable in patients with dual diagnosis (Lykke et al., 2008). In the current sample the BPRS-E subscales showed an internal consistency, examined by Cronbachs α, of .47 (manic excitement / disorganization), .62 (positive symptoms), .51 (negative symptoms), and .73 (depression / anxiety).

Lifetime trauma exposure was investigated with the Jellinek Posttraumatic Stress Disorder Screening (PTSD) Questionnaire (van Dam et al., 2013). The dichotomous variable lifetime trauma exposure (yes/no) was scored positively when a participant self-reported having ever experienced or witnessed a traumatic event, such as physical violence, sexual assault, threats, a severe accident, disaster or war.

2.3. Statistical analysis

Continuous variables were tested for normality. Normally distributed variables were reported with mean and standard deviation (SD), whether non-normally distributed variables were presented using the median and inter quartile range (IQR). We used bivariate logistic regression in order to determine associations between recent perpetration of violent crime, threat and property crime and independent variables. We subsequently performed three multivariable logistic regression analyses, creating the best models to understand perpetration of violent crime, threat and property crime. All variables with a p-value < 0.1 in bivariate regression were forced into the multivariable models using the forced entry method. We checked for multicollinearity in all three models. Independent relations were considered significant when $p < 0.05$ in the multivariable models. Explained variance was reported utilizing R^2 (Nagelkerke) and model fit was evaluated using the Hosmer-Lemeshow goodness of fit test. Statistical analyses were performed using R studio version 0.99.892.

3. Results

3.1. Sample characteristics

As shown in Fig. 1, 616 patients with dual diagnosis were available for participation in the participating care facilities. However, 129 individuals were not eligible for study participation, mostly due to severe psychotic or cognitive problems, insufficient understanding of the Dutch language or severe antisocial behaviour. Of the remaining 487 eligible patients, 244 patients refused to participate or did not show up or withdrew from the first assessment. Consequently, 243 participants were included in the study. The sample was comparable to the general patient population of the participating care facilities with respect to age and number of psychiatric diagnoses.

The sample consisted mainly of male participants ($n = 171$, 70.4%) who were predominantly born in the Netherlands ($n = 178$, 73.3%) and predominantly had a permanent residence ($n = 187$, 77.0%). The majority of participants were receiving inpatient care at the time of the assessment, but only 6.6% of the participants had been receiving inpatient care for longer than the last three months. The mean age of participants was 42 years (mean = 42.3, SD = 10.9, range = 18–70). 82% of the participants reported lifetime trauma exposure ($n = 200$, 82.3%). The predominant substance use disorder was alcohol use disorder ($n = 154$, 63.4%) and the predominant psychiatric disorders were psychotic disorder ($n = 93$, 38.3%) and personality disorder ($n = 90$, 37.0%). The majority of the sample reported offense of one or more
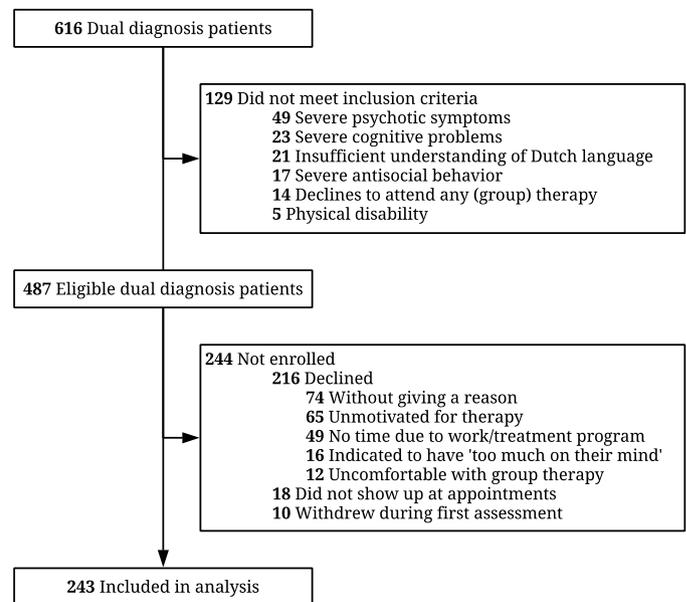

Fig. 1. Flow of participant enrollment.

crimes within the twelve months prior to the assessment ($n = 126$, 51.9%). Table 1 displays all sample characteristics.

The number of violent offenses perpetrated by one individual ranged from 1 to 10 within the twelve months prior to assessment among those who reported to have perpetrated violent crime. Among those who reported to have expressed threats in the twelve months prior to assessment, the number of threats expressed by one individual ranged from 1 to 365. The number of property crimes perpetrated by one individual ranged from 1 to 365 among those who reported property crime perpetration. There were no data missing for any of the characteristics.

As displayed in Table 1, participants can suffer from multiple mental and substance use disorders. Likewise, some participants have reported criminal offenses of multiple crime categories. Fig. 2 shows the number of participants that self-reported violent crime, threat or property crime perpetration and the overlap between the three crime types.

3.2. Factors associated with perpetration of violent crime

Table 2 displays bivariate associations for perpetration of violent crime, expression of threat and perpetration of property crime. Factors found to be associated with violent crime perpetration in the previous year included younger age (OR 0.960, p-value 0.005), severity of alcohol use problems (OR 1.029, p-value 0.017), severity of drug use problems (OR 1.027, p-value 0.025), lifetime traumatic events (OR 4.932, p-value 0.005), and BPRS-E manic excitement/disorganization (OR 1.114, p-value 0.021).

Table 3 displays the results from the multivariable logistic regression of perpetration of violent crime. There was no multicollinearity between any of the variables in the model. Younger age (OR 0.964, p-value 0.026), severity of alcohol use problems (OR 1.032, p-value 0.014), BPRS-E manic excitement/disorganization (OR 1.130, p-value 0.017) and lifetime trauma exposure (OR 5.458, p-value 0.009) were independently associated with perpetration of violent crime. The explained variance was 18.8% (Nagelkerke R^2). The Hosmer–Lemeshow goodness of fit test indicated appropriate model fit (p-value 0.991).

3.3. Factors associated with expression of threat

Factors found to be associated with the expression of threat in bivariate analysis were severity of alcohol use problems (OR 1.032I, p-

Table 1
Sample characteristics.

	n (243)	(%)
Gender		
Male	171	(70.4)
Female	72	(29.6)
Age[a]	42.3	(10.9)
Country of birth		
The Netherlands	178	(73.3)
Europe, other than NL	15	(6.2)
Suriname	15	(6.2)
Morocco	11	(4.5)
Netherlands Antilles	6	(2.5)
Other	18	(7.4)
Permanent residence	187	(77.0)
Type of care at assessment[b]		
Inpatient	163	(68.1)
Outpatient	80	(32.9)
Paid job	17	(7.0)
DSM-IV Substance use disorder (SUD)[b]		
Alcohol	154	(63.4)
Cannabis	112	(46.1)
Cocaine	107	(44.0)
Opioids	56	(23.0)
Sedatives	49	(20.2)
Other	33	(15.6)
DSM-IV Axis I disorder, other than SUD[b]		
None	40	(16.5)
Psychotic disorder	93	(38.3)
Mood disorder	54	(22.2)
Anxiety disorder	52	(21.4)
ADHD	20	(8.2)
Other disorder	28	(11.5)
DSM-IV personality disorder		
None or deferred	153	(63.0)
Personality disorder	90	(37.0)
DSM-IV intellectual disability		
None or deferred	212	(87.2)
Intellectual disability	31	(12.8)
Lifetime trauma exposure (J-PTSD)	200	(82.3)
Criminal offending[b,c]		
Violent crime	57	(23.5)
Threat	67	(27.6)
Property crime	68	(28.0)

	Median	(IQR)
Alcohol use problems (AUDIT)	13	(3–27)
Drug use problems (DUDIT)	19	(4.5–29)
Psychopathology (BPRS-E)	37	(32–43)
Number of diagnoses	4	(3–4)

Abbreviations: AUDIT = Alcohol Use Disorder Identification Test; BPRS-E = Brief Psychiatric Rating Scale Extended; DUDIT = Drug Use Disorder Identification Test; J-PTSD = Jellinek PTSD screening tool.

[a] Age is presented in mean and standard deviation
[b] Substance use disorder, DSM-IV Axis I disorder, other than SUD, DSM-IV personality disorder, DSM-IV intellectual disability and criminal offending include multiple counts.
[c] Number and percentage of participants that self-reported perpetration of a crime type in the twelve months prior to assessment.

value 0.005) and BPRS-E manic excitement / disorganization (OR 1.169, *p*-value < 0.001), as displayed in Table 2. Table 4 displays the results from the multivariable logistic regression model of the expression of threat. There was no multicollinearity between any of the variables in the model. Severity of alcohol use problems (OR 1.035, *p*-value 0.005) and BPRS-E manic excitement / disorganization (OR 1.160, *p*-value 0.02) were independently associated with the expression of threat. The explained variance was 14.8% (Nagelkerke R^2). The Hosmer-Lemeshow goodness of fit test indicated adequate fit to the data (*p*-value 0.148).
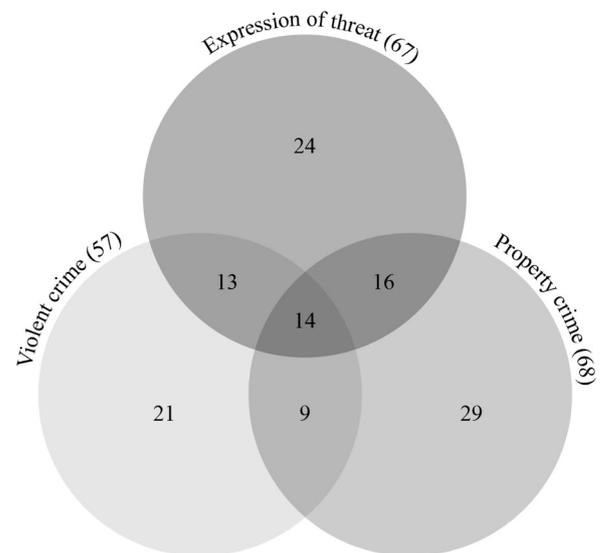

Fig. 2. Overlap between violent crime, expression of threat and property crime perpetration in dual diagnosis patients (*N* = 243).

3.4. Factors associated with perpetration of property crime

Factors found to be associated with perpetration of property crime were younger age (OR 0.956, *p*-value 0.001), severity of alcohol use problems (OR 1.022, *p*-value 0.048), severity of drug use problems (OR 1.050, *p*-value < 0.001), and homelessness (OR 1.983, *p*-value 0.041), as displayed in Table 2. Table 5 displays the results from the multivariable logistic regression model of perpetration of property crime. There was no multicollinearity between any of the variables in the model. Severity of alcohol use problems (OR 1.035, *p*-value 0.005) and severity of drug use problems (OR 1.051, *p*-value < 0.001) were independently associated with perpetration of property crime. The explained variance was 18.5% (Nagelkerke R^2). The Hosmer-Lemeshow goodness of fit test indicated appropriate model fit (*p*-value 0.338).

4. Discussion

4.1. Main findings and context of prior research

This cross-sectional study aimed to find factors that are associated with criminal perpetration by dual diagnosis patients. From a sample of 243 dual diagnosis patients, in which the prevalence of self-reported criminal perpetration in the past twelve months was 51.9%, a number of key findings emerged.

Firstly, gender was not independently associated with any type of criminal offending in the current study. This is in contrast with studies in patients with psychosis (Witt et al., 2013) and in the general population (Gottfredson and Hirschi, 1990) which show that male gender is associated with criminal offending. A possible explanation for the absence of a gender effect in our study is that mental illness and substance use disorder are more strongly related with criminal behavior in women than in men. This theory is supported by a review that suggests that mental illness and drug use disorder are more prevalent in imprisoned women than in men (Fazel and Baillargeon, 2011). Another study shows that offenders among dual diagnosis patients are more often women than among offenders with a SMI alone (Hartwell, 2004). A second possible explanation for the absence of a gender effect is the relatively high rate of female patients with a personality disorder in our sample (61.1% of women vs. 26.9% in men) (de Waal et al., 2017). Personality disorder is conceived to be associated with criminal behavior, since the majority (60–70%) of the prison population meets criteria for at least one personality disorder (Singleton et al., 1998).

Table 2
Bivariate associations with perpetration of violent crime, threat and property crime in dual diagnosis patients ($N = 243$).

	Violent crime		Threat		Property crime	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Gender						
Female	0.719	(0.336–1.469)	1.119	(0.608–2.060)	1.196	(0.653–2.190)
Age	0.960	(0.932–0.987)**	0.977	(0.951–1.003)•	0.956	(0.929–0.982)**
Homelessness Yes	1.798	(0.927–3.487)	1.487	(0.782–2.930)	1.983	(1.055–3.728)*
Alcohol use problems (AUDIT)	1.029	(1.005–1.053)*	1.032	(1.010–1.056)**	1.022	(1.000–1.045)*
Drug use problems (DUDIT)	1.027	(1.004–1.051)*	1.020	(0.999–1.043)•	1.050	(1.027–1.076)***
Lifetime traumatic event (J-PTSD) Yes	4.932	(1.465–16.605)**	1.543	(0.696–3.419)	1.005	(0.482–2.094)
BPRS-E positive symptoms	1.034	(0.947–1.121)	1.043	(0.961–1.128)	1.008	(0.924–1.091)
BPRS-E negative symptoms	0.978	(0.844–1.108)	0.922	(0.790–1.050)	1.004	(0.883–1.128)
BPRS-E manic excitement / disorganization	1.114	(1.016–1.222)*	1.169	(1.069–1.282)***	1.071	(0.980–1.170)
BPRS-E depression / anxiety	1.043	(0.961–1.128)	1.056	(1.000–1.116)•	1.009	(0.955–1.066)

• = p-value < 0.1, * = p-value < 0.05, ** = p-value < 0.01, *** = p-value < 0.001. Abbreviations: AUDIT = Alcohol Use Disorder Identification Test; BPRS-E = Brief Psychiatric Rating Scale Extended; DUDIT = Drug Use Disorder Identification Test; J-PTSD = Jellinek PTSD screening tool.

Table 3
Logistic regression model of factors associated with violent crime perpetration.

	OR	(95% CI)
Age	0.964	(0.933–0.995)*
Alcohol use problems (AUDIT)	1.032	(1.006–1.058)*
Drug use problems (DUDIT)	1.023	(0.997–1.050)
BPRS-E manic excitement / disorganization	1.130	(1.021–1.251)*
Lifetime trauma exposure (J-PTSD)	5.458	(1.769–24.303)**

Model Chi-square = 32.471, Df = 5, p-value < 0.001, R^2 = 0.188 (Nagelkerke R^2). * = p-value < 0.05, ** = p-value < 0.01, *** = p-value < 0.001. Abbreviations: AUDIT = Alcohol Use Disorder Identification Test; BPRS-E = Brief Psychiatric Rating Scale Extended; DUDIT = Drug Use Disorder Identification Test; J-PTSD = Jellinek PTSD screening tool.

Table 4
Logistic regression model of factors associated with expression of threat.

	OR	(95% CI)
Age	0.984	(0.955–1.013)
Alcohol use problems (AUDIT)	1.035	(1.011–1.061)**
Drug use problems (DUDIT)	1.023	(0.998–1.049)
BPRS-E manic excitement / disorganization	1.160	(1.056–1.279)**
BPRS-E depressive	1.018	(0.959–1.081)

Model Chi-square = 26.250, Df = 5, p-value < 0.001, R^2 = 0.148 (Nagelkerke R^2). * = p-value < 0.05, ** = p-value < 0.01, *** = p-value < 0.001. Abbreviations: AUDIT = Alcohol Use Disorder Identification Test; BPRS-E = Brief Psychiatric Rating Scale Extended; DUDIT = Drug Use Disorder Identification Test.

Table 5
Logistic regression model of factors associated with perpetration of property crime.

Characteristic	OR	(95% CI)
Age	0.978	(0.948–1.008)
Homelessness	1.682	(0.835–3.351)
Alcohol use problems (AUDIT)	1.035	(1.011–1.061)**
Drug use problems (DUDIT)	1.051	(1.025–1.079)***

Model Chi-square = 33.419, Df = 4, –-value < 0.001 ***, R^2 = 0.185 (Nagelkerke R^2). * = p-value < 0.05, ** = p-value < 0.01, *** = p-value < 0.001. Abbreviations: AUDIT = Alcohol Use Disorder Identification Test; DUDIT = Drug Use Disorder Identification Test.

Second, in contrast with our hypothesis, no independent association was found between homelessness and any type of criminal perpetration. This is in contrast with a review of studies conducted in individuals with psychosis, reporting an association between recent homelessness and risk of violence with a pooled odds ratio of 2.3 (Witt et al., 2013). Most studies included in this review have been conducted in the United States. Possibly, being homeless contributes less to risk of offending in the Netherlands due to the extensive social security system for homeless people compared to other countries such as the United States, with general assistance for all legal residents and larger availability of mental health services, community programs, and shelters (Sleegers, 2000). At the bivariate level, homelessness was significantly associated with perpetration of property crime. However, this association disappeared when other variables (younger age; substance use problems) were added to the model. Possibly, homelessness correlated with younger age and/or severity of substance use problems and therefore did not independently contribute to the explanation of violent victimization in patients with dual diagnosis.

Thirdly, perpetration of violent crime was independently associated with younger age, higher scores on the BPRS-E subscale for manic excitement / disorganization, lifetime trauma exposure and more severe alcohol use problems. Although younger age is one of the most robust correlates of criminal offending (Hirschi and Gottfredson, 1983), explanations for this association are varied. Hirschi and Gottfredson (1983) state that age has a direct effect on crime, inexplicable by sociological and psychological variables. More recent research however suggests that part of the association could be explained by co-occurring developmental changes, such as social learning (Sweeten et al., 2013). In consistence with our hypothesis, higher BPRS-E manic excitement/disorganization scores are associated with violent perpetration. This is in line with a review indicating that hostility, impulsivity and higher excitement scores are related to violence in individuals with SMI (Witt et al., 2013) and a study by Peterson et al. (2014) reporting that symptoms of bipolar disorder are more strongly related to crime perpetration compared to symptoms of depression or schizophrenia spectrum disorders. The association between violent perpetration and lifetime trauma exposure in our sample is in accordance with our hypothesis and has been observed in a broad range of study samples including the general population (Widom and Maxfield, 1996; McCord, 1983), patients with SMI (Witt et al., 2013) and individuals with substance use disorders (Torok et al., 2016; Liu et al., 2018). The current study is unable to differentiate between trauma during childhood and adulthood or to detect causality. The risk of offending may be increased directly as a result of trauma exposure, or vice versa. Additionally, other factors could have contributed to the risk of both trauma exposure and recent offending. At the bivariate level, violent offending was associated with both severity of alcohol use problems and severity of drug use problems. However, in the multiple regression model, only severity of alcohol use problems was independently associated with violent offending. This finding is in line

with a study conducted in the United Kingdom showing that the use of alcohol increases the chance of injuries to others (e.g. violence, traffic accidents) to a larger extent compared to other substances such as cocaine, heroin and cannabis (Nutt et al., 2010). The relationship between alcohol and violence has long been established. The risk of violent offending during intoxication can be increased due to pharmacological properties of alcohol, such as its disinhibiting effects (Goldstein, 1985; Hoaken and Stewart, 2003). In patients with mental illness specifically, alcohol use can interact with existing psychiatric symptoms, increasing the risk of violence (Pickard and Fazel, 2013; Hiday, 1997). A large epidemiologic study in the United States showed that alcohol and cocaine use disorders are more strongly related to intimate partner violence perpetration compared to cannabis and opioid use disorders (Smith et al., 2012). Future studies in dual diagnosis populations with a larger sample size than the current study should differentiate between different types of drug use problems.

Fourth, expression of threat is independently associated with more severe alcohol use problems and higher score on the BPRS-E subscale for manic excitement/disorganization. It is likely that the association with alcohol use problems is similar for threat and for violent crime. Besides, it is conceivable that, as for violent perpetration, the relation between higher BPRS-E manic excitement/disorganization scores and threat can be explained by higher scores of hostility, impulsivity and excitement. Furthermore, it is striking that, unlike violent crime perpetration, threat expression is not associated with younger age, since literature suggests that the relationship between younger age and criminal behavior is stable among different crime types (Gottfredson and Hirschi, 1990). However, these studies did not research the relationship between age and expression of threat specifically.

Lastly, perpetration of property crime is independently associated with more severe alcohol and drug use problems. This finding is in accordance with evidence in healthy individuals (Bennett et al., 2008) and pre-trial forensic psychiatric reports (Vinkers et al., 2011). Furthermore, research in female offenders has found that those suffering from alcohol use disorder were more often convicted of violent crime, whilst those with drug use disorder were more often convicted of property crime (Kopak and Smith-Ruiz, 2014). To our best knowledge, no research exists on the association between severity of substance use problems and property crime in patients with a mental illness, and evidence in patients with substance use disorder is limited. Although the direction of the relationship between substance use and property crime perpetration cannot be derived from the current study, it is plausible to be bi-directional. Substance use can lead to property crime in several ways, for example when property crime is committed in order to fund substance use (Goldstein, 1985). In addition, crime could cause substance use through an abnormal environment that provides a culture where substance use is common (White and Gorman, 2000). Furthermore, it is remarkable that in the current study perpetration of property crime is not associated with younger age. This finding is in contrast with extensive research in the general population (Gottfredson and Hirschi, 1990) and with a study among offenders who regularly inject drugs (Sutherland et al., 2015). It could be that our sample of patients with dual diagnosis is less susceptible to social learning, explaining stable criminal rates among all ages (Sweeten et al., 2013).

4.2. Study strengths

This study has several strengths. It is the first study to assess factors that are associated with perpetration of crime within dual diagnosis patients. Unlike most studies in patients with SMI, the current study distinguishes three types of crime. We used a very comprehensive dataset that did not contain any missing data. The sample consists of participants within a wide range of ages and includes both male and female patients.

4.3. Study limitations

Our findings should be interpreted with caution, since the current study is limited in several ways. First of all we cannot establish a causal relationship between criminal perpetration and most independent variables, since data were gathered through a cross-sectional survey.

Second, we were unable to adjust for certain important variables in the multiple regression models. Our database does not include data on socioeconomic status, marital status, a history of criminal behavior, type of care in the past 12 months and medication adherence, although evidence suggests associations with criminal perpetration. Additionally, the database lacks a widely used measure for childhood abuse. Instead we collected data on lifetime trauma exposure, lacking statistics on severity and timing of the event. Moreover, we may not have been able to detect certain more subtle associations due to a lack of power.

Third, the study used a heterogeneous sample in terms of clinical characteristics. We were not able to adjust for particular mental health diagnoses and substance use disorders, since the sample is too small to include the vast number of diagnoses and possible combinations in the multiple regression models. Moreover, since a considerable number of participants have a delayed psychiatric diagnosis due to severe substance use, we did not find the use of separate diagnoses in our analyses appropriate. By using BPRS-E subscale scores, positive and negative symptoms as well as symptomatology of manic and depressive nature in the past month were included in the analyses. In this way, we have attempted to provide insight in the relation between disease specific symptomatology and criminal behavior. Since psychopathology varies over time, a limitation of this approach is that we lack data of BPRS-E subscale scores at the time of a criminal offence. BPRS-E subscale scores report about symptomatology in the past month, whereas self-reported criminal perpetration concerns the past twelve months. Because a relationship between psychopathology and criminal behavior is most likely in close temporal proximity, this might have led to a type II error. Moreover, the internal consistency of the BPRS-E subscales is questionable.

A fourth limitation is the fact that the outcome variables were measured using self-designed yes/no-questions that are not validated in our population. Although reliability and validity of self-reported delinquency are usually acceptable (Thornberry and Krohn, 2000), it is probable that true numbers of criminal perpetration are underestimated in our data, especially when the interviewed individuals have a divergent frame of reference than general population. A combination of self-reported data with criminal justice records would have been a more desirable approach. However, criminal justice records were not available, and so far, no assessments on perpetration have been validated in dual diagnosis patients.

Fifth, only individuals suitable for and willing to participate in group therapy were eligible, since the study used baseline data from a randomized trial with a therapeutic intervention. Also, despite broad inclusion criteria, only individuals currently in treatment could participate. Both aspects may limit the generalizability of our findings.

Lastly, the explained variance in our models indicate a role of other factors in explaining perpetration of violent crime, threat and property crime by patients with dual diagnosis.

4.4. Future directions and conclusion

These limitations notwithstanding, the findings of the present study indicate that risk of criminal offending among dual diagnosis patients is a significant problem. There might be particular subgroups within the dual diagnosis population that are at increased risk of criminal behavior, for example patients who suffer from severe alcohol use disorder. This study is a first step in unraveling the complex causal model leading to criminal perpetration in dual diagnosis patients. Further (longitudinal) research is required to identify additional risk factors, such as individual substances of abuse, and establish a causal model leading to

criminal perpetration. More insight in the causal pathways leading to criminal perpetration is desirable, since it could support the development of specific prevention programs on reducing involvement in crime by dual diagnosis patients.

Conflict of interest

Funding

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.psychres.2019.01.057.

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