

PERSONALITY, SCHIZOPHRENIA, AND VIOLENCE: A LONGITUDINAL STUDY

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The aims of this study were (a) to investigate the presence of clinically significant personality traits and personality disorders (PD) in patients living in residential facilities, with or without a history of violence (69 and 46, respectively); and (b) to investigate any associations between clinically significant personality traits and PDs, aggression, impulsivity, hostility, and violent behavior during a 1-year follow-up. The most frequent primary diagnoses were schizophrenia (58.3%) and PD (20.9%). Those with a history of violence demonstrated more antisocial and alcohol dependence features and lower depressive PD symptoms than the control group. Hostility levels, antisocial symptoms, and drug dependence, as well as a Structured Clinical Interview for *DSM-IV* Axis II diagnosis of PD, predicted aggressive and violent behavior during follow-up. The study confirms the relevance of assessing PDs both to evaluate the risk of violent behavior and to plan appropriate preventive and treatment intervention.

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Numerous studies have investigated the relationship between psychopathology and violence to identify psychopathological variables associated with any particular offender's profile. The identification of psychopathological dimensions correlated with violence may help predict future risk of violent behavior. A personality profile, including clinically significant personality traits and personality disorders (PD), seems to play an important role in identifying the risk of violent behavior. Indeed, inflexible and maladaptive personality traits can lead to dysfunctional management of interpersonal dynamics, including aggressive behavior (Blackburn, 1998).

A diagnosis of antisocial or borderline PD is commonly associated with the risk of violent behavior (Howard, Huband, Duggan, & Mannion, 2008; Newhill, Eack, & Mulvey, 2009), often in comorbidity with substance abuse (Fountoulakis, Leucht, & Kaprinis, 2008). Other severe mental disorders, particularly schizophrenia (Fazel, Gulati, Linsell, Geddes, & Grann, 2009; Hodgins, Piatosa, & Schiffer, 2014; Iozzino, Ferrari, Large, Nielsens, & de Girolamo, 2015; Nestor, 2002) and bipolar disorder (Volavka, 2013), are also linked to increased risk of violent behavior. This risk appears to be strongly augmented by comorbidity with substance and/or alcohol abuse (Fazel et al., 2009; Iozzino et al., 2015).

Research has also shown that the risk of violent behavior is increased by comorbidity with schizophrenia and PD (Moore, Green, & Carr, 2012; Newton-Howes, Tyrer, North, & Yang, 2008; Volavka, 2014). For instance, in a sample of 97 subjects with schizophrenia recruited in both forensic and nonforensic settings, 51.5% also met criteria for antisocial PD, 23.7% for narcissistic PD, 18.6% for borderline and paranoid PDs, and 16.5% for avoidant PD. However, only antisocial and borderline PDs were positively associated with aggression (Bo, Abu-Akel, Kongerslev, Haahr, & Simonsen, 2013a).

Corral and Calvete (2014), in their study on perpetrators of intimate partner violence, found that 27.7% of their sample had possible PD (Millon Clinical Multiaxial Inventory–III [MCMI-III] > 84) and that 57.1% met the criteria for clinically significant personality traits (MCMI-III > 74). Another recent study also indicated that *DSM 5* pathological personality traits are associated with intimate partner violence (Dowgwillo, Ménard, Krueger, & Pincus, 2016).

It has also been suggested that one of the most important factors associated with personality traits and violent behavior might well be the expression of anger (Coid et al., 2013). Anger can lead to violent acts, especially when associated with impulse dyscontrol and emotional dysregulation. These characteristics can be observed in various psychopathological conditions, including substance and alcohol abuse, mood disorders, posttraumatic stress disorder (PTSD), intermittent explosive disorder, and PD.

Several studies have demonstrated a relationship between anger, hostility, impulsivity, and aggressive behavior (Birkley & Eckhardt, 2015; Norlander & Eckhardt, 2005; Ramírez & Andreu, 2006; Rubio-Garay, Carrasco, & Amor, 2016). Recently, Garofalo, Holden, Zeigler-Hill, and Velotti (2016) found that a group of offenders reported higher levels of hostility, as well as lower levels of self-esteem and emotional nonacceptance, compared to never-

offenders. This may also suggest that the tendency to perceive the world as hostile is a feature of offenders' psychological functioning and therefore may be a strong predictor of violent behavior.

This study aims to investigate the relationship between clinically significant personality traits, PDs, schizophrenia, and the risk of violent behavior in a sample of patients living in residential facilities (RFs). We hypothesize that (a) patients with a history of violence are more likely to exhibit dysfunctional personality traits and meet criteria for PD, in particular antisocial, borderline, and narcissistic PD, than patients with no history of violence; (b) patients with comorbid schizophrenia and PD show more aggressive and violent behavior than patients with schizophrenia or PD only; (c) patients with a history of violence are more frequently aggressive or violent during a 1-year follow-up, and score higher in specific personality scales; and finally, (d) high scores on personality scales could predict aggressive and violent behavior. We also suggest that patients with a history of substance and alcohol abuse, as well as expressions of anger, impulsivity, and hostility, measured with the State-Trait Anger Expression Inventory-2, the Barratt Impulsiveness Scale-11, the Buss-Durkee Hostility Inventory, and other instruments, might be more aggressive during 1-year follow-up.

MATERIALS AND METHODS

STUDY DESIGN

This study is part of the Violence Risk and Mental Disorders (VIORMED) project (for further details, see de Girolamo et al., 2016), a project with a prospective design involving patients living in RFs in four cities in northern Italy. These RFs have 24-hour coverage and generally host up to 20–25 patients. Practicing clinicians selected all patients with a history of severe interpersonal violence (“violent patients”), as indicated by one or more of the following criteria: (a) admitted at least once to a forensic mental hospital for any violent act against other individuals, (b) arrested at least once for any violent acts against other individuals, and (c) having a documented lifetime history of violent acts against other individuals (as reported in the official clinical records).

A group of patients with no history of violence, similar for age, gender, and primary diagnosis (including comorbidity with substance or alcohol abuse), was identified as a control group. Our sample is representative of patients requiring residential care who have a history of violence and in certain cases of very severe violence. The majority of violent patients (80%) had committed a physical assault of medium gravity, a minority (20%) was responsible for a very severe act of violence, including murder or attempted murder. More than a half of our sample had been referred to RFs by a forensic mental hospital or by a prison. In one third of cases, the victim was a family member, which again highlights the high burden of care and the risk of violence for family members.

Exclusion criteria were being older than 65 and having a primary diagnosis of organic mental disorder. The study was approved by the Ethics

Committee of the coordinating center (IRCCS Saint John of God, Fatebenefratelli) and by ethics committees of all the other recruiting centers. All participants provided written informed consent before entering the study.

BASELINE ASSESSMENT

A patient schedule was used to collect information on sociodemographic characteristics, including social relationships, leisure activities, socioeconomic status, and clinical and treatment-related features. The Structured Clinical Interview for *DSM-IV* Axis I (SCID-I; First, Gibbon, Spitzer, Williams, & Benjamin, 1997), the semistructured interviews based on *DSM-IV*, were administered to establish standardized clinical diagnoses. The Brief Psychiatric Rating Scale (BPRS), consisting of 24 clinical areas evaluated on a Likert 7-point scale (a higher score indicates higher level of symptoms), was used to assess psychopathology (Ventura, Green, Shaner, & Liberman, 1993). The Personal and Social Performance (PSP) scale, a modified version of the *DSM-IV* Social and Occupational Functioning Assessment Scale, was also used to assess social functioning. This scale contains only one score ranging from 0 to 100 (a higher score indicates better functioning) (Morosini, Magliano, Brambilla, Ugolini, & Pioli, 2000).

Aggression and impulsivity were evaluated with the following four measures: (a) the Brown-Goodwin Lifetime History of Aggression, an 11-item questionnaire assessing lifetime aggressive behavior across 2 stages of life (adolescence and adulthood) by directly asking how many times the aggressive behavior had occurred for each item (a higher score indicates more aggressiveness) (Brown, Goodwin, Ballenger, Goyer, & Major, 1979); (b) the Buss-Durkee Hostility Inventory (BDHI), a 75-item questionnaire developed to assess eight subscales related to hostility and their negative effects (a higher score indicates more hostility) (Buss & Durkee, 1957); (c) the Barratt Impulsiveness Scale (BIS-11), a 30-item, 4-point Likert scale questionnaire on personality and behavioral impulsiveness, with scores ranging from 30 to 120 (a higher score indicates more impulsiveness) (Barratt, 1965); and (d) the State-Trait Anger Expression Inventory 2 (STAXI-2), which includes six scales plus an Anger Expression Index, as an overall measure of total anger expression (a higher score indicates more anger) (Spielberger et al., 1985).

All instruments were administered by clinical psychologists who received specific training for each instrument and were given direct supervision throughout all stages of the project. The evaluation sessions were agreed upon with patients, and each session lasted approximately 90 minutes. The baseline assessment included 5–6 sessions, for a total of 8 hours of assessment for each patient. From the first session, baseline assessment for each patient was completed within 1 month.

PERSONALITY ASSESSMENT

The Structured Clinical Interview for *DSM-IV* Axis II (SCID-II; First, Spitzer, Gibbon, & Williams, 2002), the semistructured interviews based on *DSM-IV*, were administered to establish standardized clinical diagnoses of PDs.

The MCMI-III was used to assess the patients' personality profile. It is composed of 175 true-false questions, including 14 personality scales, 10 clinical syndrome scales, and four correction scales (Millon, Davis, & Millon, 1997). We focused on 14 personality scales: Schizoid, Avoidant, Depressive, Dependent, Histrionic, Narcissistic, Antisocial, Sadistic, Compulsive, Negativistic, Masochistic, Schizotypal, Borderline, and Paranoid. These scales assess clinical areas corresponding to *DSM-IV* diagnostic criteria for PD; higher scores indicate higher levels of psychopathology.

The MCMI-III uses a base rate (BR) transformation score for a raw score conversion. This distribution takes into account the prevalence rate to maximize diagnostic efficacy (Gibertini, Brandenburg, & Retzlaff, 1986; Meehl & Rosen, 1955). A BR > 84 indicates that the patient endorses all symptoms at a diagnostic level, so it is possible to speak of a full-blown PD; BR scores between 75 and 84 suggest the presence of clinically significant traits and subthreshold symptoms (not at diagnostic level). Finally, BR scores < 75 are generally considered not clinically relevant (Millon et al., 1997).

For the aims of this study, all patients reporting scores ≥ 75 BR were considered as endorsing clinically significant personality traits. All self-administered instruments were filled out with the attendance of a trained researcher available to explain each item and assist the patients if necessary.

LONGITUDINAL MONITORING OF AGGRESSIVE AND VIOLENT BEHAVIOR

During 1-year follow-up, every 2 weeks (24 evaluations), the treating clinician filled in the Modified Overt Aggression Scale (MOAS; Margari et al., 2005) for each patient involved in the study. The MOAS included the following four subscales of aggression: verbal, physical, against objects, and self-harm behavior. A score from 0 to 4 was assigned to each act, where 0 indicates no aggression and higher scores show increasing severity. In each subscale, the score is multiplied by a factor specific for the category, that is, 1 for verbal aggression, 2 for aggression against objects, 3 for aggression against self, and 4 for aggression against other people. Therefore, the total weighted score ranges from 0 (no aggression) to 40 (maximum grade of aggression). We will subsequently refer to the weighted MOAS score simply as the MOAS total score.

STATISTICAL ANALYSES

Categorical data were analyzed in intergroup comparisons with χ^2 , or Fisher's exact test, when appropriate ($n < 5$ in any cell in binary comparison). Student *t* tests were used to compare both quantitative clinical and personality profile variables.

Given the positively skewed distribution of MOAS, associations between the MOAS total score and personality scales and instruments related to anger and hostility were evaluated by using a Spearman rank correlation (ρ : *r*). Furthermore, total scores obtained on the MOAS by three subgroups of participants (patients with schizophrenia not meeting SCID-II criteria for

TABLE 1. Sociodemographic and Clinical Characteristics of Violent Patients and Controls

	Violent patients (<i>n</i> = 69) <i>n</i> (%)	Controls (<i>n</i> = 46) <i>n</i> (%)	<i>t</i> -Student/ χ^2	<i>p</i> value
Gender			$\chi^2 = .77$.42
Male	61 (88.4)	38 (82.6)		
Female	8 (11.6)	8 (17.4)		
Marital status			$\chi^2 = .41$.52
Married or cohabiting	5 (7.2)	2 (4.3)		
Single	64 (92.8)	44 (95.7)		
Education			$\chi^2 = 1.00$.80
Primary school	8 (11.6)	4 (8.7)		
Middle level	46 (66.7)	33 (71.7)		
High school level	14 (20.3)	9 (19.6)		
University degree	1 (1.4)	0 (0)		
Illness duration (years), mean (<i>SD</i>)	19.8 (\pm 9.8)	22.8 (\pm 10.4)	<i>t</i> = 2.20	.14
Primary Diagnosis			$\chi^2 = 7.61$.18
Schizophrenia	41 (59.4)	26 (56.5)		
Personality disorder	14 (20.3)	10 (21.7)		
Other	14 (20.3)	10 (21.7)		
Meet SCID-II criteria for PD			$\chi^2 = 4.39$.04
Yes	65 (79.3)	36 (63.2)		
No	17 (20.7)	21 (36.8)		
Lifetime use of alcohol			$\chi^2 = 0.61$.56
Yes	29 (42.0)	16 (34.8)		
No	40 (58.0)	30 (65.2)		
BPRS	Mean (<i>SD</i>)	Mean (<i>SD</i>)	<i>t</i> statistic	
Total score	45.4 (20.8)	54.8 (18.4)	-2.48	.01
Somatic concern	2.4 (1.5)	3.2 (1.8)	-2.50	.01
Depression	2.0 (1.2)	2.6 (1.6)	-2.46	.02
Guilt	1.5 (0.9)	2.0 (1.1)	-2.63	.01
Self-neglect	2.0 (1.4)	2.8 (1.7)	-2.45	.02
Blunted affect	2.1 (1.5)	3.0 (1.8)	-2.80	.01
Emotional withdrawal	1.9 (1.3)	2.5 (1.5)	-2.37	.02
Motor retardation	1.4 (1.0)	2.3 (1.6)	-3.41	.001
Tension	1.6 (1.2)	2.4 (1.6)	-2.73	.008
PSP	46.2 (17.0)	38.2 (15.2)	2.57	.01

PD, patients with PD as a primary diagnosis, patients with schizophrenia and comorbid PD) were compared using the nonparametric Kruskal-Wallis test. Subsequently, an analysis of predictors of aggressive and violent behavior was carried out through generalized linear models (GLMs, with tweedie distribution and log-link function), with the MOAS mean total score as a dependent variable and continuous and categorical measures as independent variables. The goodness of fit of the GLMs was assessed with the Akaike information index (AIC).

All tests were two-tailed, with statistically significant level set at $p = .05$. Data were analyzed using the Statistical Package for Social Science, version 21 (IBM, 2012).

RESULTS

Of the 139 inpatients recruited, 82 had a lifetime history of severe aggression against people and 57 were controls. Twenty-four patients (17.3%) were excluded because their MCMI-III questionnaires were incomplete or inap-

TABLE 2. Personality Profile of Patients as Assessed With the MCMI-III

MCMI-III subscale	Violent patients, Mean (SD)	Controls, Mean (SD)	<i>t</i> -Student	<i>p</i> value
Schizoid	59.4 (18.7)	59.3 (22.5)	.001	.98
Avoidant	52.7 (25.9)	59.8 (25.2)	2.13	.15
Depressive	48.4 (27.3)	59.8 (26.5)	4.95	.03*
Dependent	52.7 (26.1)	61.8 (26.6)	3.30	.07
Histrionic	58.4 (22.0)	52.7 (18.9)	2.07	.15
Narcissistic	67.9 (21.0)	60.8 (22.7)	2.96	.09
Antisocial	63.9 (16.1)	55.7 (18.5)	6.41	.01*
Sadistic	50.9 (19.1)	46.5 (21.1)	1.30	.26
Compulsive	73.1 (26.1)	67.3 (23.8)	1.43	.23
Negativistic (Passive-Aggressive)	52.6 (25.2)	56.9 (25.0)	.82	.37
Masochistic (Self-Defeating)	41.3 (23.8)	47.2 (24.0)	1.66	.20
Schizotypal	51.2 (25.8)	55.0 (23.6)	.62	.43
Borderline	49.7 (27.3)	52.5 (25.0)	.30	.58
Paranoid	64.4 (20.0)	61.8 (24.2)	.39	.53
Alcohol Dependence	65.0 (19.5)	56.3 (22.3)	4.78	.03*
Drug Dependence	64.8 (19.1)	60.0 (26.6)	1.30	.26

* $p < .05$

appropriately completed (scores ≥ 2 on the V-Validity scale). The final sample included 115 patients (69 violent and 46 controls patients). In both groups, the majority of patients were male (up to 80%) and did not have a partner (up to 90%); more than half (almost 70%) had finished junior high/middle school. The mean age of the violent group was 44.6 years ($SD = 11.6$) compared to 46.3 years ($SD = 9.8$) for controls. There were no differences concerning sociodemographic characteristics (Table 1).

SAMPLE CHARACTERISTICS

The most frequent primary diagnoses, according to administration of the SCID-I and the SCID-II, were schizophrenia (58.3%) and PD (20.9%). The mean of illness duration was 19.8 years ($SD = 9.8$) for violent patients and 22.8 years ($SD = 10.4$) for controls ($p = .14$).

In terms of psychopathological profiles, as measured by the BPRS, there was a statistically significant difference in the mean total score, with controls exhibiting more severe psychopathological symptoms (mean score 54.8, $SD = 18.4$) compared to violent patients (mean score 45.4, $SD = 20.8$) ($t = -2.48$, $p = .01$) (see Table 1). In particular, statistically significant differences were found in the following areas: somatic concerns, depression, guilt, self-neglect, blunted affects, emotional withdrawal, motor retardation, and tension, all belonging to dimensions of anxiety, depression, inhibition, and isolation. Violent patients were also characterized by better psychosocial functioning (PSP mean score = 46.2, $SD = 17.0$), compared to controls (PSP mean score = 38.2, $SD = 15.2$, $p = .01$).

TABLE 3. Spearman's Rho Correlation Between Personality Scales and Instruments Assessing Anger and Hostility With Total MOAS Scores

	MCMI-III Sadistic	MCMI-III Drug Dependence	BDHI	BIS-11	STAXI-2	MOAS
MCMI-III Antisocial	.63***	.69***	.39***	.34***	.36***	.33***
MCMI-III Sadistic		.45***	.36***	.19*	.37***	.19*
MCMI-III Drug Dependence			.23*	.23*	.18*	.30**
BDHI				.29**	.62***	.38***
BIS-11					.44***	.19*
STAXI-2						.30**

* $p < .05$. ** $.05 < p < .01$. *** $p < .001$.

PERSONALITY TRAITS AND HISTORY OF VIOLENCE

Among violent patients compared to controls, a higher number met SCID-II diagnostic criteria for PD (79.3% vs. 63.2%, $p = .04$). As shown in Table 2, we also found a statistically significant difference between groups for two of the MCMI-III personality scales: depressive and antisocial. In particular, the control group reported a higher mean score on the depressive scale (59.8, $SD = 26.5$ vs. 48.4, $SD = 27.3$; $p = .03$), while violent patients displayed a higher mean score on the antisocial scale (63.9, $SD = 16.1$ vs. 55.7, $SD = 18.5$; $p = .01$).

Violent patients also had higher scores on the histrionic, narcissistic, sadistic, compulsive, and paranoid scales, although this difference was not statistically significant. On the contrary, controls reported higher mean scores on the remaining six scales (avoidant, dependent, negativistic, masochistic, schizotypal, and paranoid).

There was also a statistically significant difference on the alcohol scale, with the violent group reporting a higher score compared to controls (65.0, $SD = 19.5$ vs. 56.3, $SD = 22.3$; $p = .03$). The violent group also had a higher score on the drug dependence scale, but this difference was not statistically significant (64.8, $SD = 19.1$ vs. 60.0, $SD = 26.6$; $p = .26$).

We analyzed how many patients achieved the MCMI-III cutoff values for clinically significant personality traits (≥ 75). The cutoff for clinically significant antisocial personality traits was met by 13 violent patients (18.8%) and six controls (13.0%) ($\chi^2 = .673$, $p = .45$); for narcissistic personality traits by 22 violent patients (32%) and 11 controls (24%) ($\chi^2 = .857$, $p = .40$); for both borderline and paranoid personality traits by 13 violent patients (18.8%) and 12 controls (26.1%) ($\chi^2 = .852$, $p = .37$); and for passive-aggressive personality traits by 19 violent patients (27.5%) and 13 controls (28.3%) ($\chi^2 = .007$, $p = 1.000$).

We assessed the association between MCMI-III scores and SCID-II diagnoses of PD. Although there was no statistically significant association between the two instruments ($\chi^2 = .2399$, $p = .19$), 80 patients (69.6%) received a PD diagnosis through the SCID-II and also displayed clinically significant personality traits (score ≥ 75 on MCMI-III scales). On the contrary, for 30.4% of patients there was no concordance between the two instruments: Seven patients received a SCID-II diagnosis of PD (but did not reach

the cutoff score with the MCMI-III) whereas 28 had a score higher than >75 on the MCMI-III ($k = -.108$), but did not meet SCID-II diagnostic criteria for PD.

ASSOCIATION BETWEEN PERSONALITY TRAITS AND OCCURRENCE OF AGGRESSIVE AND VIOLENT BEHAVIOR

Table 3 shows the Spearman correlations between the MCMI-III personality scales, BDHI, BIS-11, and STAXI-2 scores and the MOAS total scores at 1-year follow-up. In the total sample, the MCMI-III antisocial and sadistic personality scales were positively associated with the mean MOAS total score ($\rho = .33, p \leq .001$; $\rho = .193, p = .039$, respectively). We also found a significant correlation between the MCMI-III drug dependence scale and the MOAS total scores ($\rho = .304, p = .001$), but none for the MCMI-III alcohol dependence scale.

Positive correlations also emerged between the BDHI score, the BIS-11 score, and the STAXI-2 score. These scores also displayed significant correlations with some of the MCMI-III scales: The antisocial personality scale significantly correlated with the BDHI score ($\rho = .39, p < .001$), the BIS-11 score ($\rho = .34, p < .001$), and the STAXI-2 score ($\rho = .36, p < .001$). The sadistic personality scale also showed a positive association with the BDHI score ($\rho = .36, p < .001$), the BIS-11 score ($\rho = .19, p = .045$), and the STAXI-2 score ($\rho = .37, p < .001$). Finally, the drug dependence scale was associated with the BDHI score ($\rho = .23, p = .013$) and the BIS-11 score ($\rho = .23, p = .014$), but not with the STAXI-2 score, although there was a trend in this direction ($\rho = .18, p = .059$).

We then analyzed the correlation between SCID-II diagnoses of PD and mean (across the 24 evaluations) total MOAS scores. In order to investigate whether there was a difference in the occurrence of aggressive and violent behavior, as assessed through the MOAS, we divided the overall sample into three subgroups: (1) patients with schizophrenia not meeting criteria for PD ($n = 23$), (2) patients with PD ($n = 43$), and (3) patients with schizophrenia and comorbid PD ($n = 44$). Five patients were excluded because they did not have any of these diagnoses. The most frequent PDs were Cluster A PDs for patients with comorbidity (in particular paranoid) and Cluster B for patients with PDs only (in particular borderline cases). Patients with both schizophrenia and PD diagnoses (Subgroup 3) reported a lower MOAS total score (mean = 4.2, $SD = 8.9$, median = 0), compared to Subgroup 1, with a diagnosis of schizophrenia (mean = 4.8, $SD = 7.1$, median = 2; $p = 0.24$) and to Subgroup 2, with a PD diagnosis (mean = 17.9, $SD = 24.5$, median = 7; $p < .001$).

LONGITUDINAL ANALYSIS OF PERSONALITY TRAITS AND VIOLENT BEHAVIOR DURING THE FOLLOW-UP

With regard to monitoring total MOAS scores during 1-year follow-up, there was a tendency toward a difference between the mean across time for two groups, that is, patients with a SCID-II diagnosis of PD (SCID-II positive, n

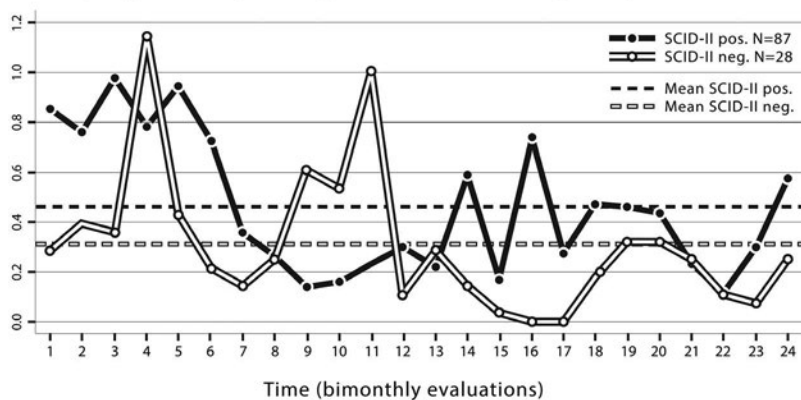


FIGURE 1. Total weighted MOAS scores during the 1-year follow-up. This figure represents the trend of aggressive behavior observed by MOAS in two groups: SCID-II positive ($N = 87$) and SCID-II negative ($N = 28$) patients.

= 87) compared to those who did not meet PD diagnostic criteria (SCID-II negative) (mean = 0.46, $SD = 0.27$ for SCID-II positive group, and mean = 0.31, $SD = 0.28$ for SCID-II negative group; $p = .06$) (Figure 1). The former group exhibited more aggressive and violent behavior during all follow-up times, with only four MOAS evaluations out of 24 (at Times 4, 9, 10, and 11) in which patients with no PD reported a higher mean score.

We also compared all patients meeting both a SCID-II diagnosis of PD and a score higher than 75 on the MCMI-III personality scales (SCID-II and MCMI positive, $n = 80$) with those who either received a SCID-II diagnosis of PD or who displayed a score higher than 75 on MCMI-III scales (SCID-II or MCMI positive, $n = 35$). The former group displayed more aggressive and violent behavior over time (mean = 0.50, $SD = 0.30$ for SCID-II and MCMI positive group, and mean = 0.25, $SD = 0.23$ for SCID-II or MCMI positive group; $p = .002$) (Figure 2).

PREDICTORS OF AGGRESSIVE AND VIOLENT BEHAVIOR DURING THE 1-YEAR FOLLOW-UP

In order to identify potential predictors of aggressive and violent behavior, we performed GLMs with tweedie distribution using the variables that had been shown to be associated with the MOAS total score in the previous analysis. The results obtained with univariate models (Table 4) showed that the factors predicting aggressive and violent behavior (total MOAS score) during the 1-year follow-up were the BDHI score ($p = .001$), the MCMI-III antisocial ($p < .001$) and drug dependence ($p < 0.001$) scales, and a SCID-II diagnosis of PD ($p < .001$).

To investigate the predictive value of PD further, we created a dichotomous variable comparing the group of patients with a SCID-II diagnosis of PD versus patients with any other diagnoses. We then performed multiple models, including significant predictors obtained with univariate models. The findings of these analyses revealed that higher MCMI-III antisocial and

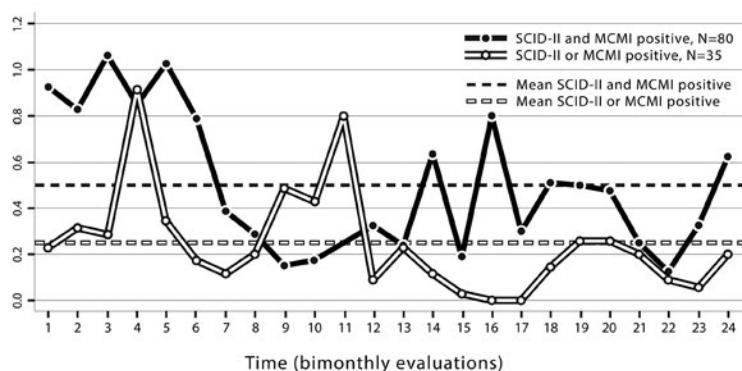


FIGURE 2. Total weighted MOAS scores during the 1-year follow-up. This figure represents the trend of aggressive behavior observed by MOAS in two groups: patients who were both SCID-II positive and reported >75 on the MCMCI-III ($N = 80$) and patients who were either SCID-II positive or reported >75 on the MCMCI-III ($N = 35$).

drug dependence scores, higher BDHI scores, and a SCID-II diagnosis of PD were significantly related to an increased (positive beta coefficients) MOAS total score. In the multiple model analysis (model 8; see Table 4), there was an overlap between MCMCI-III antisocial and MCMCI-III drug dependence, due to their strong correlation ($\rho = 0.69$). We therefore considered the tri-variate model as the best model (in terms of goodness of fit index AIC), and this included the MCMCI-III drug dependence scale, BDHI, and a SCID-II diagnosis of PD (AIC = 1044.6). Among bivariate models, the best fit (AIC = 1064.9) was for BDHI and a SCID-II diagnosis of PD, which suggests a better predictive power of BDHI scores compared to MCMCI-III drug dependence.

DISCUSSION

Violent behavior in psychiatric patients is a worldwide public health problem requiring substantial staff time and effort to manage, and it contributes significantly to increase the stigma of mental illness (Torrey, 2002). For all these reasons, the aims of the VIORMED project in predicting factors for violent behavior is important to be able to plan appropriate prevention and treatment strategies.

PERSONALITY PROFILES, CLINICAL SYMPTOMS, AND HISTORY OF VIOLENCE

Past research shows that patients with a history of violence have more anti-social personality traits than controls (Huber, Hochstrasser, Meister, Schimmelmann, & Lambert, 2016; Volavka, 2014; Yu, Geddes, & Fazel, 2012). Our patients also reported higher scores on the MCMCI-III drug dependence scale, confirming results showing that substance abuse significantly increases the risk of violence, independent of the co-occurrence of mental disorders.

TABLE 4. Predictors of Aggressive and Violent Behavior

Dependent variable: MOAS Total	Independent variables	Transformed Exp(B) coefficient	<i>p</i>
Univariate models	Mod1) MCMI-III Antisocial	1.03	< .001
	Mod2) MCMI- III Sadistic	1.01	.44
	Mod3) MCMI- III Drug Dependence	1.03	< .001
	Mod4) BDHI	1.05	.001
	Mod5) BIS-11	1.01	.37
	Mod6) STAXI-2	1.02	.14
	Mod7) Diagnosis (PD vs. others)	4.08	< .001
Multiple models	Mod8): [AIC = 1046.5]		
	MCMI-III Antisocial	1.00	.74
	MCMI-III Drug Dependence	1.02	.001
	BDHI	1.03	< .001
	Diagnosis (PD vs. others)	3.29	< .001
	Mod8bis): [AIC = 1044.6]		
	MCMI-III Drug Dependence	1.02	< .001
	BDHI	1.03	< .001
	Diagnosis (PD vs. others)	3.27	< .001
	Mod9): [AIC = 1189.5]		
	MCMI-III Drug Dependence	1.02	< .001
	BDHI	1.04	< .001
	Mod10): [AIC = 1064.9]		
	BDHI	1.03	< .001
Diagnosis (PD vs. others)	3.88	< .001	
Mod11): [AIC = 1105.6]			
MCMI-III Drug Dependence	1.02	< .001	
Diagnosis (PD vs. others)	3.22	< .001	

Note. Lower AIC indexes indicate preferred model.

Indeed, an important meta-analysis involving 20 individual studies and 18,423 individuals suffering from schizophrenia and other psychoses confirmed this finding. The study showed that the effect of comorbid substance abuse was marked, with random-effect odds ratios (ORs) of 2.1 (95% CI [1.7, 2.7]) without comorbidity, and an OR as high as 8.9 (95% CI [5.4, 14.7]) with comorbidity ($p < .001$ on meta-regression) (Fazel et al., 2009). On the other hand, according to the MCMI-III depressive scale and BPRS scores, our controls exhibited more severe psychopathology, in particular depressive symptoms, compared to the violent group. This finding is congruent with the clinical observation that depressed patients tend to be more inhibited.

Violent patients also showed better psychosocial functioning compared to controls, although the difference in the PSP mean scores was probably not clinically significant. These results regarding depressive symptoms and psychosocial functioning agree with our previous studies (Bulgari et al., 2017; Candini et al., 2015).

Among patients with a history of violence, we found significant correlations between three MCMI-III scales (i.e., sadistic, antisocial, and drug dependence), the BDHI score, the BIS-11 score, and the STAXI-2 score, with these three instruments all covering aspects of hostility, impulsivity, and anger. Our BDHI questionnaire findings agreed with previous studies, showing that the hostility dimension is strictly related to violent behavior (Birkley & Eckhardt, 2015; Norlander & Eckhardt, 2005; Ramírez et al., 2006).

CAN PERSONALITY TRAITS PREDICT AGGRESSIVE AND VIOLENT BEHAVIOR?

Predictors of aggressive and violent behavior, monitored with MOAS during the 1-year follow-up, included MCMI-III drug dependence and antisocial scales and a SCID-II diagnosis of any PD and BDHI scores. This is consistent with several studies showing that drug dependence and antisocial PD increase the risk of violence (Coid et al., 2006). A recent study showed that antisocial PD also increases recidivism of violence for people with mental disorders (Shepherd, Campbell, & Ogloff, 2016). Furthermore, a SCID-II diagnosis of PD as well as copresence of PD or clinically significant personality traits (as assessed with the MCMI-III) were related to a higher occurrence of aggressive and violent behavior during 1-year follow-up. This finding might suggest that the combined use of these two instruments in a clinical setting could predict a patient's risk of aggressive behavior.

Interestingly, we found a limited relationship between SCID-II and MCMI-III scores. This is not surprising, given that past research outlined the scarce association between these two instruments, even in previous versions (e.g., Kennedy et al., 1995; Messina, Wish, Hoffman, & Nemes, 2001). Moreover, these instruments give two distinct types of information. The SCID-II is a semistructured interview with the clinician required to infer the presence/absence of criteria based on the interview, whereas the MCMI-III is purely self-reported, relying on subjective interpretations of the questionnaire by the patient: This might explain their poor correlation.

PDs are very common for different offending populations, including prisoners. For instance, a large meta-analysis, including 62 surveys and 22,790 prisoners, found that almost half (47%) met criteria for antisocial PD (Fazel & Danesh, 2002). In another recent meta-analysis, Yu et al. (2012) reported that offenders with any PD had up to three times the odds of being repeat offenders compared to mentally ill patients with no PD or non-mentally disordered offenders.

These data highlight the importance of appropriate treatment for PD subjects to prevent aggressive and violent behavior. Unfortunately, for antisocial PD, there is no strong evidence of the efficacy of specific psychosocial or pharmacological treatment (Glenn, Johnson, & Raine, 2013). On the other hand, there is robust evidence of efficacy for other types of PD approaches, such as dialectical behavioral therapy or other psychosocial therapies (Bloom, Woodward, Susmaras, & Pantalone, 2012; O'Connell & Dowling, 2014; Stoffers et al., 2012).

Substance abuse, often comorbid with PD or schizophrenia, can also be vigorously treated either pharmacologically or with psychosocial treatment (Brunette, Mueser, & Drake, 2004; National Institute for Health and Clinical Excellence, 2011). Fazel et al. (2016) underlined that treatment of substance and alcohol abuse is the principal strategy to prevent violence. Finally, the BDHI questionnaire appears to be able to predict and evaluate the risk of aggressive and violent behavior in patients with mental disorders, at least for those who are in a residential setting.

PDS AND SCHIZOPHRENIA

In our sample, 38.3% of patients with a primary diagnosis of schizophrenia also met SCID-II criteria for at least one PD. A meta-analysis on this topic underlined the great variability of comorbid schizophrenia and PD, with rates ranging from a low of 4.5% up to a high of 100%. The heterogeneity of assessment tools and study settings, together with other variables, explains this wide variability (Newton-Howes et al., 2008). Consequently, as highlighted by Schroeder et al. (2012), it is often very difficult to disentangle the correlation between personality traits and schizophrenia spectrum disorder because several symptoms overlap.

In the well-known UK700 study (Moran & Hodgins, 2004), there was a strong association between comorbid PD and violence in community-dwelling patients with psychosis over a 2-year follow-up ($N = 670$). In this study however, the assessment required only 10 min to administer. On the contrary, our evaluation was very detailed and involved two widely used measurements: the clinician-rated SCID-II assessment, and the self-administered MCMI-III.

Generally, even in patients with a standardized diagnosis of schizophrenia, a PD diagnosis is associated with increased risk of aggressive and violent behavior. Consequently, in agreement with Bo et al. (2013b), it is both necessary and crucial to carry out a thorough assessment of clinically significant personality traits in patients with schizophrenia to better manage and prevent the risk of violence.

STUDY LIMITATIONS

The assessment of personality and PD among patients with severe and long-term Axis I disorders is a clinical challenge. Even the modality of diagnostic assessment can be an obstacle. Self-administration of MCMI-III could be difficult for chronic patients to understand, and indeed we had to discard 17% of the MCMI-III questionnaires because of inappropriate self-administration.

Considering the study's limitations, our patients' profiles correspond to a high level of long-term clinical and psychopathological impairment. The results can therefore be generalized only within similar contexts (i.e., residential settings). Moreover, a longer observation period could lead to higher recidivism and highlight risk factors not observable after only 1-year follow-up. Furthermore, we did not directly monitor alcohol and substance abuse during the follow-up period. However, in these 24-hour staffed RFs, the regular or frequent use of alcohol or substances is virtually impossible.

Finally, regarding the SCID-II diagnosis of PD, we considered only presence or absence and did not evaluate any specific diagnostic subgroups due to the sample's small size. Several studies have reported cumulative data on PD because most patients meet criteria for more than one PD, and so it may be very hard to find "pure" PD.

CONCLUSIONS

Our study confirms the importance of PD assessment as an important tool to evaluate the risk of aggressive and violent behavior and to plan appropriate prevention and treatment. It also highlights the importance of more in-depth studies about the co-occurrence of psychotic disorders and PD. This study may also help explain why violence occurs only in a limited fraction of all patients with psychosis and can help elucidate the psychopathological dimensions of this specific comorbidity. Better prediction also means better prevention by developing more appropriate treatments tailored to the psychopathological dimensions associated with violence (e.g., impulsivity, emotion dysregulation, hostility).

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