The relationship between Mood Disorder, Personality Disorder and Suicidality in Adolescence: Does personality disorder play a significant role in predicting suicidal behavior?

Riccardo Williams (riccardo.williams@uniroma1.it)  
Sapienza University of Rome

Marco Chiesa  
University College London

Marta Moselli  
Sapienza University of Rome

Camilla Frattini  
Sapienza University of Rome

Maria Pia Casini  
Sapienza University of Rome

Peter Fonagy  
University College London

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Abstract

Introduction:

Current research points to the importance of diagnosing personality pathology emerging patterns in adolescence for understanding suicidal risk. Studies have mainly focused on the role of BPD and only marginally investigated the interaction of personality disorder (PD) as overall diagnosis and individual PDs and major depression (MDD). In this paper, the independent and cumulative effects of MDD and DSM-IV PDs on suicidal risk are investigated in a longitudinal study.

Methods:

A sample of 118 adolescents (mean age = 15.48 ± 1.14) referred for assessment and treatment on account of suicidal ideation or behavior were administered the CSSRS, SCID II, Kiddie-SADS; after six months the CSSRS was applied again to all patients. In order to test the significance of the associations and predictions between categorical and dimensional PD, BPD, NPD, Major Depression, suicide attempts, number of suicide attempts and potential lethality of suicide attempt, non-parametric bivariate correlations, logistic regression models and mixed-effects Poisson regression were performed PD.

Results:

BPD was confirmed to be a significant risk factor for suicide. Personality disorders assessed at a categorical and dimensional level and Unipolar depression exert an influence on suicidal behaviors and their lethality both as independent and cumulative risk factors.

Limitations: While we incorporated dimensional thinking into our approach to assessing psychopathology, our study still relied on traditional defined. Future studies should include AMPD-defined personality pathology in adolescence to truly represent dimensional thinking.

Conclusion:

These results point to the importance of early identification of emerging patterns of personality disorders in adolescence.

Background

Suicide is a serious public health problem worldwide and its reduction has been declared a primary objective by the World Health Organization (1; 2; 3). Suicide is the second most common cause of death after road accidents in young people between 12 and 29 years (4; 5), and the incidence of suicidal behavior and suicidal ideation is even higher in adolescence. Research both in adulthood and adolescence has identified the convergence of several risk factors that are implicated in determining the shift from suicidal ideation to actual suicidal behavior. However, specific factors that may reliably differentiate the degree of suicidal risk have not yet been conclusively identified.

The significant association between affective disorder and suicide is well documented. The diagnosis of Major Depressive Disorder and the occurrence of a depressive episode in Bipolar Disorder have been documented to play a major role for suicidal risk (6; 7). The literature has also found a high prevalence of emerging personality disorders in adolescent samples with suicidal ideation and behaviors. A systematic review of studies of suicidal behaviors in adolescence has revealed that a diagnosis of personality disorder (PD) was associated with 19–23 % of suicide attempts, and 30–42% of successful suicide (8). A number of contributions have suggested that a synergic interplay between external stressors and the presence of PDs, which may work as an activating factor, increases the risk for suicidal behavior (9; 10; 11; 12; 13; 14). PD may also play a facilitating role in turning suicidal ideation into suicidal behavior, by interfering with the effective processing of negative emotions and psychache, the state of mind supposed to trigger the suicidal process (15; 16). In particular, several studies have found that the incidence of Borderline Personality Disorder (BPD) is high, ranging between 56% and 91%, in samples of suicidal adolescents and adults(17; 18; 19) and between 49% and 62% in attempted suicide (20; 21). Moreover, emerging personality disorder can increase the risk of suicidality in adolescents suffering from mood disorder. In particular, it has been shown that BPD diagnosis mediates the impact of mood disorders on suicidal ideation and suicide attempts (22; 23). The impact of each specific risk factors must be included within a model that conceives of suicide as the outcome of process in which the level of intentionality and the intensity of the ideation needs to be considered (24).
There is also evidence suggesting that all Cluster B personality disorders are at higher risk for suicidal ideation and behavior (25). For example, recent studies have shown that Narcissistic personality disorder (NPD) plays a significant role in increasing the risk of recurrence of suicidal ideation and the lethality of suicidal attempts in adolescence (26) and adulthood (27; 28; 29).

Notwithstanding the necessary caution in diagnosing personality disorders in adolescence, current orientations point to the importance of an early diagnosis, because of its relevance for the understanding of suicidal behaviors in this phase of life (23; 8). The sources of criticism concerning the reliability, validity and clinical usefulness of such diagnoses have been gradually overcome in the face of emerging research evidence (30; 31; 32; 33; 34; 35). Although the validity of PD diagnoses in adolescence has been questioned, recent empirical studies indicate that the prevalence of PD diagnoses is similar between adolescence and adulthood (35).

In recent years there has been a fierce debate on the way in which PD should be diagnosed, either as a categorical or a dimensional disorder. Although several studies have shown that a categorical approach is still valid in diagnosing personality pathology (34), a number of authors have argued that this model is undermined by excessive comorbidity, a degree of within-diagnosis heterogeneity, marked temporal instability, no clear boundary between normal and pathological personality pathology, and poor convergent and discriminant validity (36; 37; 38). PD is therefore increasingly seen as a dimensional disorder, with emphasis on personality functioning and pathological personality traits (39; 36). The number of criteria for personality diagnoses has been found to be a reliable predictor of maladjustment in adolescence and the stability of the diagnosis through to adulthood (35; 40). Furthermore, the diagnoses of personality emerging prototypes or disorders in adolescence have overlapping clinical features with the personality disorders in adulthood (41; 38). Finally, various studies have shown significant concurrent validity and predictive validity of PD diagnoses in adolescence with the clinical features of impulsivity, sexual promiscuous behaviors, substance abuse, aggressive conduct, disturbance of identity and relationships (34; 42; 43). Notwithstanding these limitations, the categorical diagnoses of personality disorders or prototypes in adolescence do represent a useful psychopathological marker for the prediction of the degree of severity of personality pathology and its impact on impulsive behaviors and affective dysregulation (35; 34). Current research indeed point to the necessity to evaluate personality pathology in adolescence also at a dimensional level. The continuity of personality pathology is attributed to core dimensions that are stable during development (44; 45). The continuity of these core dimensions is due to both genetic and early environmental influences (44; 46). These pathological personality traits can be accurately assessed in adolescence as outlined in the Alternative Model for Personality Disorders (AMPD) of the Section III of the DSM-5 (47; 48), and these traits hold for the homotypic continuity of personality diagnoses in the lifespan (33). Furthermore, the clinical validity and reliability of the assessment of personality pathology in adolescence is increased if a dimensional evaluation of the degree of severity is obtained through the count of symptoms for each personality disorder.

Another key aspect in understanding the contribution of PDs to suicidality in adolescence concerns their interaction with mood disorders, and in particular with Major Depression. As already mentioned, the relevance of major depression and depressive symptoms as predictors of suicidality in adolescence is well established. Depression severity is a strong predictor for suicide (49; 50; 51). However, there is a dearth of studies that tested the relative significance of PD and mood disorder separately and in combination in predicting the presence, severity and intensity of suicidal ideation and suicidal behavior. Some studies have indicated that specific BPD features can incrementally increase suicidality in subjects with depression, substance abuse and other psychopathologies (52; 19; 22). For example, Sharp et al. (23) found that the presence of BPD compared to major depression (MDD) resulted in an increased suicidal ideation in a psychiatric sample of adolescents. Yalch et al. (53) considered the association between suicide risk and specific BPD features controlling for the effect of depressive symptoms, and found an independent incremental effect of identity disturbance and impulsivity on the observed variance in suicide risk scores (53). Furthermore, empirical evidence highlights how aggression and impulsiveness are positively correlated with suicidal behavior only among BPD adolescents, whereas hopelessness and depression are positively correlated with suicidal behavior in both BPD and MDD diagnostic groups (54). Other studies found that hopelessness and impulsive aggression independently increase the risk of suicidal behavior both in patients with BPD and with major depressive episode (55). A possible relationship between depression and narcissistic pathology has been recently evidenced in adolescence (56).

Other contributions focused on the combination of MDD and BPD. While Soloff et al. (55) could not find any significant differences in the characteristics of suicide attempts between patients with BPD and those with MDD, patients with both disorders had significantly higher number of suicide attempts and degree of objective planning. In a group of borderline adolescents Mirkovic et
al. (57) found a direct effect of MDD on lifetime suicidal attempts, and an indirect effect mediated by increasing emotional
dysregulation, which may be an important risk factor for suicidal attempts in these patients. In another study, BPD patients with a
history of MDD with melancholic features were more likely to have a history of suicide attempts compared to BPD with no MDD
(58). Subjects with comorbid BPD and MDD had a higher number of lifetime suicide attempts and made their first attempt at a
younger age compared to subjects with BPD alone (59).

The present literature mainly focuses on combination of BPD with MDD in increasing the suicidal risk while little is known as to the
association between MDD the presence of any PD or other specific PDs in predicting suicide in adolescence.

In this study, we evaluate the importance of both categorical and dimensional PD diagnoses on aspects of suicidality in
adolescence and we report results of a prospective study of 118 adolescents followed up 6 months following assessment for day
hospital and inpatient treatment. We aim to evaluate the relative significance of emerging PD as a categorical and a dimensional
construct meant to describe the degree of severity of personality pathology through the count of symptoms and Major Depression,
hereafter called unipolar depression (UND), in predicting presence and intensity of suicidal ideation and suicidal behavior in terms
of presence of suicidal attempt, number of suicidal attempts and suicide episode lethality.

**Methods**

**Study design and sample selection**

128 adolescents aged between 12 and 18 years with either active suicidal ideation and/or a recent history of suicide attempt
consecutively referred for admission to the day hospital and to the inpatient unit at a metropolitan Italian Pediatric Hospital
between 2017–2019, were considered for study inclusion. Subjects with intellectual disabilities (IQ < 70) (N = 2), with severe
impairment of adaptive and school functioning (N = 3) and a diagnosis of Autistic Spectrum Disorder according to the DSM-5 (N =
5) were excluded from the study. The remaining 118 subjects were assessed using a battery anamnestic and diagnostic self-report
measures and semi-structured interviews. Subjects were confirmed as having active suicidal ideation if the Columbia Suicide
Severity Rating Scale (C-SSRS) score was ≥ 2. XXX subjects out of the total of 118 had been admitted to the inpatient unit and YYY
had been referred to the outpatient unit for the onset of a mood symptoms or behavioral problems.

A team of research psychologists and psychiatrists independent from the clinical teams were trained to reliability criteria on all
measures through the use of original training videotapes. Each rater had regular supervision meeting with a senior psychiatrist,
experienced in the delivery of the instruments used in the study. Coding and data entry were regularly monitored and adherence to
protocol was checked using audi-tapes and physical records. Each rater was in charge of the administration and scoring of only
one of the measures administered in the sample and was blind to the evaluations from the other measures.

**Measures**

General cognitive functioning was assessed through scaled tests based on age and language, including the *Raven Progressive
Matrices Test* (Raven, 1981) and the *Wechsler Intelligence Scale for Children-Revised* (WISC-IV; Orsini, Pezzuti & Picone, 2012). The
subjects’ intellectual abilities were classified according to the *Diagnostic and Statistical Manual of Mental Disorders*, 2000 (DSM-IV-TR).

*The Columbia Suicide Severity Rating Scale; Columbia University (C-SSRS; (60)) is a scale that evaluate suicidal ideation in subjects
aged twelve and over. The scale assesses the severity of suicidality in the domains of suicidal ideation and suicidal behavior. The
C-SSRS rates four constructs: (a) The severity of the suicidal ideation, measured on a 5 points Likert scale (1 = desire to be dead; 2
= non-specific active suicidal thoughts; 3 = suicidal thoughts with a method; 4 = suicidal intent; 5 = suicide intent with a plan); (b)
The intensity of the suicidal is reckoned ideation by investigating frequency, duration, degree of control, deterrents and reasons for
the ideation; (c) Suicidal behavior rated for actual attempts, aborted attempts, preparatory acts and non-suicidal self-injury (NSSI);
don The lethality of the gesture. The C-SSRS psychometric properties, validity and satisfactory internal consistency (Cronbach’s
alpha = 0.937) have been published [61]. The scores were obtained after the administration of the specific semi-structured clinical
interview.
Schedule for Affective Disorders and Schizophrenia for School Age Children, Present and Lifetime (K-SADS-PL, (61)) is a semi-structured interview that was used to assess current and past psychopathological features and psychiatric disorders in children and adolescents according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), criteria. All patients and at least one of their parents or legal tutors were interviewed. This interview was used to identify the presence of MDD.

Structured Clinical Interview for DSM-5 Personality Disorders (62) is a semi-structured interview that assesses the presence/absence of the 10 Personality Disorder according to DSM-IV-TR criteria. The average number of PDs per patient and the total number of individual positive traits were then calculated based on the number of criteria met at SCID-IV TR-PD. The Italian version of SCID-II) has good psychometric features: intra-class correlation coefficient (ICC) values ranged from .88 (Dependent PD and Histrionic PD) to .94 (Avoidant PD) for dimensional SCID-II interview dimensional ratings (median ICC value = .94). Cohen k values were also adequate for SCID-II interview categorical PD diagnoses (median k value = .89, SD = .11) (63). The presence of a PD diagnosis was scored when the subject passed the diagnostic threshold for one of the 10 PDs; in the present study the variable PD categorical overall presence was scored when the subject received at least one categorical diagnosis for any of the 10 PDs. The dimensional scores for each PD were obtained by summing the number of criteria met by each subject for any of the 10 PDs. The variable PD dimensional overall was obtained by summing all the PDs criteria met by each subject.

Statistical Analysis

Non-parametric bivariate correlations were used to test the significance of the associations between the suicidality variables (suicidal ideation, suicidal behavior, number and lethality of suicide attempts) and MDD, PD dimensional, BPD dimensional, NPD dimensional, demographic variables and other risk factors variables.

To test the significance of MDD and PD categorical or dimensional as predictors of suicidal behavior and potential lethality, four separate logistic regressions with suicidal behavior or potential lethality as dependent variable, and MDD and PD categorical or dimensional independent variables, and age and gender as covariates, were carried out. Logistic regression analyses were also employed to test the significance of BPD categorical or dimensional as independent variables with suicidal behavior or potential lethality as dependent variable.

In order to evaluate the effect of MDD and PD categorical and dimensional and BPD categorical and dimensional on number of suicide attempts, four separate mixed-effects Poisson regression analyses were carried out to predict the frequency of suicide attempts and potential lethality of attempt as dependent variables and MDD, PD or BPD dimensional as independent variables. Correlational and logistic regression analyses were performed using SPSS for Windows version 26, while STATA version 17 was used to carry out mixed-effects Poisson regressions.

Results

The age of the sample ranged between 12 and 18 years (mean = 15.48 ± 1.14) and 76.3% (n = 90) identified as female. With regard to psychiatric diagnoses 59 (50.0%) subjects fulfilled criteria for MDD, 46 (39.0%) anxiety disorder, 29 (24.6%) substance misuse disorder and 10 (8.5%) eating disorder. PD criteria were met by 29 (24.6%) subjects. BPD (n = 21, 17.8%), Avoidant Personality Disorder (n = 6, 5.1%), NPD (n = 2, 1.7%), Histronic Personality Disorder (n = 1, 0.8%), Paranoid Personality Disorder (n = 1, 0.8%) and Dependent Personality Disorder (n = 1, 0.8%) were the personality diagnoses subjects met DSM-5 criteria for (Table 1).
Table 1
Demographic, diagnostic and risk profile features of the study sample (N = 118)

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>90</td>
<td>76.3</td>
</tr>
<tr>
<td>Neglect</td>
<td>5</td>
<td>4.5</td>
</tr>
<tr>
<td>Any sexual abuse</td>
<td>8</td>
<td>7.1</td>
</tr>
<tr>
<td>Physical abuse</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Mood Disorder</td>
<td>78</td>
<td>66.1</td>
</tr>
<tr>
<td>Anxiety Disorder</td>
<td>46</td>
<td>39.3</td>
</tr>
<tr>
<td>Eating Disorder</td>
<td>10</td>
<td>8.5</td>
</tr>
<tr>
<td>Substance Misuse</td>
<td>29</td>
<td>24.8</td>
</tr>
<tr>
<td>Borderline PD</td>
<td>21</td>
<td>17.8</td>
</tr>
<tr>
<td>Paranoid PD</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>Avoidant PD</td>
<td>6</td>
<td>5.1</td>
</tr>
<tr>
<td>Schizotypal PD</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Narcissistic PD</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>Obsessive-Compulsive PD</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dependent PD</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>Histrionic PD</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td>Schizoid PD</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Attempters</td>
<td>66</td>
<td>55.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>15.9</td>
<td>1.11</td>
</tr>
<tr>
<td>PD dimensional a</td>
<td>6.39</td>
<td>4.44</td>
</tr>
</tbody>
</table>

a Number of positive PD criteria met.

Correlational analysis

Bivariate correlational analysis (Table 2) revealed significant association between a) number of suicide attempts and MDD ($r_{(118)} = .28, p = .001$), PD binary ($r_{(118)} = .25, p = .001$), PD dimensional ($r_{(118)} = .30, p = .001$), BPD binary ($r_{(118)} = .26, p = .001$), BPD dimensional ($r_{(118)} = .29, p = .001$); b) potential lethality of worst episode of suicide and MDD ($r_{(118)} = .20, p = .005$), PD dimensional ($r_{(118)} = .24, p = .008$), BPD binary ($r_{(118)} = .19, p = .035$), BPD dimensional ($r_{(118)} = .22, p = .016$), NPD dimensional ($r_{(118)} = .32, p = .000$); suicidal behavior and MDD ($r_{(118)} = .25, p = .006$), PD binary ($r_{(118)} = .19, p = .042$), PD dimensional ($r_{(118)} = .20, p = .03$), BPD binary ($r_{(118)} = .22, p = .016$), BPD dimensional ($r_{(118)} = .24, p = .01$).
Table 2
Correlations between suicidality variables, demographic, risk factors and diagnostic variables (N = 118)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Suicidal behavior</th>
<th>Suicidal ideation severity</th>
<th>Suicidal ideation intensity</th>
<th>Number suicide attempts</th>
<th>Suicide attempt lethality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>.11</td>
<td>.05</td>
<td>.08</td>
<td>.07</td>
<td>.14</td>
</tr>
<tr>
<td></td>
<td>.20</td>
<td>.55</td>
<td>.86</td>
<td>.39</td>
<td>.12</td>
</tr>
<tr>
<td>Gender</td>
<td>−.13</td>
<td>.02</td>
<td>.01</td>
<td>−.05</td>
<td>−.13</td>
</tr>
<tr>
<td></td>
<td>.15</td>
<td>.76</td>
<td>.86</td>
<td>.56</td>
<td>.14</td>
</tr>
<tr>
<td>Major Depressive Disorder</td>
<td>.25**</td>
<td>.24**</td>
<td>.31**</td>
<td>.27**</td>
<td>.19*</td>
</tr>
<tr>
<td></td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.03</td>
</tr>
<tr>
<td>PD categorical</td>
<td>.18*</td>
<td>.06</td>
<td>.03</td>
<td>.25**</td>
<td>.15</td>
</tr>
<tr>
<td></td>
<td>.04</td>
<td>.45</td>
<td>.74</td>
<td>.00</td>
<td>.08</td>
</tr>
<tr>
<td>PD dimensional</td>
<td>.19*</td>
<td>.01</td>
<td>.04</td>
<td>.30**</td>
<td>.24**</td>
</tr>
<tr>
<td></td>
<td>.03</td>
<td>.85</td>
<td>.66</td>
<td>.00</td>
<td>.00</td>
</tr>
<tr>
<td>Borderline PD</td>
<td>.22*</td>
<td>.05</td>
<td>.00</td>
<td>.25**</td>
<td>.19*</td>
</tr>
<tr>
<td></td>
<td>.01</td>
<td>.59</td>
<td>.95</td>
<td>.00</td>
<td>.03</td>
</tr>
<tr>
<td>Borderline dimensional</td>
<td>.23**</td>
<td>.05</td>
<td>−.00</td>
<td>.29**</td>
<td>.22*</td>
</tr>
<tr>
<td></td>
<td>.01</td>
<td>.57</td>
<td>.95</td>
<td>.00</td>
<td>.01</td>
</tr>
<tr>
<td>Narcissistic dimensional</td>
<td>.11</td>
<td>−.14</td>
<td>−.10</td>
<td>.12</td>
<td>.32**</td>
</tr>
<tr>
<td></td>
<td>.22</td>
<td>.11</td>
<td>.27</td>
<td>.17</td>
<td>.00</td>
</tr>
</tbody>
</table>

**Predictor analyses**

The first logistic regression model revealed that MDD was a significant predictor of suicidal behavior after controlling for age and gender ($\beta_{(1)} = 1.32, SE = .44, p = .002$) and it accounted for 15% of the total variance (Negalkerke $R^2 = .145$). Adding diagnosis of PD to the equation made a significant contribution to the model ($\chi^2_{(1)} = 4.11, p = .045$) and increased the model fit to the data (Negalkerke $R^2 = .186$). The diagnosis of PD made a further significant contribution to the prediction of suicidal behavior ($\beta_{(1)} = .97, SE = .49, p = .049$). The odds ratio for suicidal behavior in MDD were 3.71 (95% CI 1.56, 8.87). Presence of PD increased the odds of suicidal behavior to 2.60 (95% CI 1.01, 6.89).

The second logistic regression showed that MDD was not a significant predictor of the lethality of suicide attempt ($\beta_{(1)} = .69, SE = .51, p = .178$; Negalkerke $R^2 = .111$). Adding PD to the equation improved the significance of the model ($\chi^2_{(1)} = 3.68, p = .055$) and the percentage of the variance accounted for (Negalkerke $R^2 = .153$). PD was a marginally significant predictor of lethality of suicide attempt ($\beta_{(1)} = .97, SE = .50, p = .054$). However, presence of PD increases the odds of greater lethality of suicidal behavior (OR = 2.63, 95% CI .98, 7.08) compared to MDD (OR = 2.09, 95% CI .78, 5.61).

The mixed-effects Poisson regression revealed that both UND and PD were significant predictors of number of suicide attempts ($\beta_{(118)} = .80, SE = .28, z = 2.92, p = .003$, and $\beta_{(118)} = .65, SE = .22, z = 2.95, p = .003$, respectively). Presence of either MDD or PD predicts double the number of suicide attempts compared to subjects with no MDD and PD diagnoses. When both MDD and PD are included in the model the number of suicide attempts is nearly predicted to be five times higher compared to no diagnoses of MDD and PD.

We repeated all the analyses with MDD and diagnosis of BPD as predictor variables. We found that adding BPD diagnosis substantially improved the model for predicting suicidal behavior ($\chi^2_{(1)} = 7.57, p = .006$). BPD was found a significant predictor of...
suicidal behavior ($\beta_{(1)} = 1.58, SE = .62, p = .011$). The odds of occurrence of suicidal behavior associated with BPD diagnosis were 4.84 (95% CI 1.44, 16.23).

While MDD did not significantly impact on the significance of the model for predicting lethality of suicide attempt ($\chi^2_{(1)} = 2.28, p = .131$), BPD diagnosis significantly improved the model when added to the equation ($\chi^2_{(1)} = 4.65, p = .030$). BPD diagnosis was found to be a significant predictor of lethality ($\beta_{(1)} = 1.21, SE = .56, p = .030$) while MDD was not a significant predictor ($\beta_{(1)} = .80, SE = .51, p = .119$). Having a BPD diagnosis increased the odds of a lethal suicidal attempt to 3.36 (95% CI 1.16, 10.04).

The mixed-effects Poisson regression revealed that both MDD and BPD binary were highly significant predictors of number of suicide attempts ($\beta_{(118)} = .88, SE = .27, z = 3.23, p = .001$, and $\beta_{(118)} = .78, SE = .24, z = 3.29, p = .001$, respectively). The estimated marginal means show that the number of attempted suicides nearly trebles when either UND and BPD are present, and it becomes six time higher when both diagnoses are present compared to subjects with no UND and BPD.

Subsequently, we repeated the analyses with PD and BPD as dimensional constructs to test whether these increased the significance of the prediction. The stepwise logistic regression with suicidal behavior as dependent variable, MDD and PD dimensional score (defined as number of criteria met) as independent variables, showed that adding PD dimensional at the final step substantially increased the significance of the model ($\chi^2_{(1)} = 4.97, p = .026$) and the model fit to the data (Negalerke R$^2 = .194$). PD dimensional was found to be a significant predictor of suicidal behavior ($\beta_{(1)} = .11, SE = .05, p = .031$).

The second stepwise logistic regression with potential lethality as dependent variable, showed that adding PD dimensional score at the final step also further increased the significance of the model ($\chi^2_{(1)} = 5.76, p = .016$) and accounted for a greater share of the variance (Negalerke R$^2 = .176$). PD dimensional was a significant predictor of lethality of attempted suicide ($\beta_{(1)} = .12, SE = .05, p = .020$).

The mixed-effects Poisson regression revealed that PD dimensional was a highly significant predictor of number of suicide attempts ($\beta_{(118)} = .10, SE = .02, z = 4.26, p = .001$).

Adding BPD dimensional score at the final step to the model construction with suicidal behavior as dependent variable substantially increases its significance ($\chi^2_{(1)} = 9.94, p = .001$) and the variance accounted for (Negalerke R$^2 = .241$). BPD dimensional was score revealed to be a significant predictor of suicidal behavior ($\beta_{(1)} = .32, SE = .11, p = .003$).

BPD dimensional score also improves the prediction when added to the model of potential lethality ($\chi^2_{(1)} = 4.30, p = .038$). BPD dimensional score was found to be a significant predictor of potential lethality of attempted suicide ($\beta_{(1)} = .22, SE = .11, p = .042$).

Finally, BPD dimensional was revealed a highly significant predictor of number of suicide attempts in the mixed-effects Poisson regression analysis ($\beta_{(116)} = .18, SE = .05, z = 3.80, p = .001$).

We also tested the impact of the number of narcissistic traits on the three suicide dependent variables. Although no significance was found for suicidal behavior and number of suicide attempts, NPD dimensional score was found to improve the significance of the model when added to the equation ($\chi^2_{(1)} = 7.30, p = .007$) and to be a significant predictor of potential lethality ($\beta_{(1)} = .52, SE = .20, p = .010$).

**Discussion**

In this paper we evaluated the relative predictive strength of MDD and PD, independently and in combination, for suicidal risk in adolescence. Both the role of specific personality disorders (BPD and NPD), and personality disorder diagnosis overall, either as categorical or as dimensional constructs, were considered in the analyses.

Firstly, the results of this study confirm that MDD is a significant independent predictor of suicide attempts (7), but not for the suicide attempt potential lethality. Secondly, our results reveal that meeting criteria for any PD diagnosis is a significant predictor of suicide attempt and of its potential lethality. Furthermore, the number of personality disorder criteria met is a significant predictor of the risk of suicide attempt and of its potential lethality, significantly adding to the variance explained by MDD.
To our knowledge, this is the first study to show the relevance of personality pathology overall for the prospective suicidal risk in adolescence (8). With regard to the reliability of personality diagnoses in adolescence, current research indicates that PD diagnoses in adulthood show the same level of temporal instability as also found in adolescent diagnoses (44; 45; 64). Even though categorical diagnoses of PDs in adulthood can be as unstable as the diagnoses obtained in adolescence, it was found that the more severe the personality pathology, the more stable the diagnosis is (65). As said, the continuity of personality pathology is attributed to core dimensions that are stable during development (44; 45). The continuity of these core dimensions is due to both genetic and early environmental influences (44; 64). These pathological personality traits can be accurately assessed in adolescence as outlined in the Alternative Model for Personality Disorders (AMPD) of the Section III of the DSM-5 (47; 48)[47, 48] and these traits hold for the homotypic continuity of personality diagnoses in the lifespan (33). On the other hand, the observed instability of the PD diagnoses is currently interpreted as the product of the more transient nature of the psychopathological symptoms (internalizing and externalizing dimensions) included as criteria of PDs in the diagnostic manuals (45; 66; 67). Thus, the relative instability of personality diagnoses in adolescence over time has been attributed to the variations of such behavioral manifestations due to the peculiarities of adolescence brain maturation as well as to the onset of externalizing and internalizing psychopathology (68). When considering the aspect of prevention and early interventions in the developmental age, the importance of diagnosing personality disorders in adolescence cannot be underestimated. These diagnoses are reported to have a considerable impact on adolescent mental health services and professionals, given the association of PDs with several maladaptive behaviors and their impact on health in general (69; 70). Overall, it has been suggested that the extension of personality pathology can account and be considered a measure of a latent factor expressing a wider vulnerability to the development of psychopathology (47).

Our results confirm recent studies that have highlighted the importance of disturbance of personality, which is a general indicator of psychopathological vulnerability and maladaptive functioning in adolescence (35; 50). When considering specific PD diagnoses, this study confirms that BPD is the most powerful predictor of attempted suicide risk and of the number of attempts at suicide. In particular, both categorical and dimensional approaches to diagnoses show BPD to be as significant independent predictor of suicidality as MDD. This is consistent with previous epidemiological observations where depression, personality pathology and suicidality were concurrently studied (22; 23). Notably, the diagnosis of BPD and the number of borderline disorder symptoms exert a powerful cumulative effect in the presence of MDD. This result seems to further support the need to evaluate the interaction between personality pathology, in particular BPD, and affective disorders in the suicidal process in adolescence as well as other maladaptive outcomes (71). Importantly, we found no evidence of moderation effects in any of the models investigated: BPD diagnosis or BPD criteria met did not interact with MDD to amplify the impact of depression on suicidality. Rather, the risk factors are somewhat overlapping and additive, suggesting that the processes through which they increase the risk of suicidality in adolescents may be different: a possibility to be explored is that MDD creates vulnerability through a background of negative mood and hopelessness, while PD operates via impulsivity and affect dysregulation.

These results are consistent with the observations reported in the ‘National Epidemiologic Survey Mental disorders and risk of suicide attempt: on Alcohol and Related Conditions (NESARC)’ by Hoertel and colleagues (72). These authors generated a bifactor model which parses disorder variance into general variance (i.e., variance of the general psychopathology factor), variance of dimensions of psychopathology (e.g. variance of the externalizing dimension) and unique variance (variance of each mental disorder per se) (73). In this model the general psychopathology factor accounted for the prediction during a 3-year follow-up period of suicide attempts in a large general population sample (n = 35,000). Depression was an independent predictor only for females. Recent analysis of this and other datasets have shown that the general psychopathology factor and a latent BPD dimension correlate at r > 0.8 and could be considered a unitary construct rather than two separate entities (74). Other independent investigations have also linked BPD criteria to a general psychopathology factor rather than an independent personality diagnosis (64; 75). While obtained in a much smaller sample, the associations observed in our study may add to the notion that the risk of suicide is part of a general vulnerability to mental disorder (76; 47).

A specific role of narcissistic pathology has also been found in our study. The number of narcissistic pathological traits in the sample was found to be a highly significant predictor of potential lethality of the suicidal gesture. This result seems to provide a degree of empirical support to the clinical observations and descriptions regarding the association between narcissistic functioning and suicide risk (29; 77).
Limitations

Although the study has areas of strength (prospective design, interview-based assessment), a number of limitations need to be borne in mind when considering the results. Firstly, the sample is relatively small and not balanced for gender, although it is known that successful suicides are more common in males than female (5). Further, the sample may not be representative as the adolescents participating were referred for a treatment setting offering relatively long-term day-hospital or inpatient interventions, so the findings may not be generalizable to milder presentations where such a treatment would not be indicated. Finally, while we incorporated more recent dimensional thinking into our approach to assessing psychopathology, our study still relied on traditional defined categories represented in Section II of the DSM. Future studies of prospective relations with suicide outcomes should include AMPD-defined personality pathology in adolescence to truly represent dimensional thinking.

Overall, the results of this study show that the effects of categorical and dimensional diagnoses of personality disorders on suicidal behaviors in adolescence are highly significant and have a strong additive effect when a diagnosis of MDD is present. As discussed in the introduction, our results give an empirical basis as to the importance of making a diagnosis of PD in adolescence, as it guides and improves the management of concurrent maladaptive behaviors, and, in particular, suicidality. It should also be noted that, in keeping with what already published in the clinical and empirical literature, the number of criteria the personality diagnoses considered in this study enhances the likelihood of suicidal risk in more significant way than the categorical diagnoses alone, pointing to the advantage of evaluating the severity of personality pathology for the management of suicidal risk in adolescence.

Conclusions

The presence of emerging patterns of PD overall is a highly significant risk factor for suicidal behavior. This finding further strengthens the importance of assessing personality pathology in adolescence for the purpose of improving suicide risk management. In particular, emerging BPD as a dimensional construct was found a significant predictor of suicidality six months after intake assessment, confirming the important role BPD plays in suicidal behavior both in adulthood and adolescence (23; 64; 33).

The finding that NPD is a significant predictor of lethality of suicidal gesture, provides empirical support for an association that until now was only being discussed at a clinical level in adulthood and in adolescence (26; 78; 29; 77). The significance of the number of personality traits as moderator between MDD and number of suicides attempts further highlights the interplay between mood disorders and personality pathology in increasing suicide risk in adolescence.

These results point to the importance of early identification of emerging patterns of PD and that the accurate assessment of the degree of severity of personality pathological functioning is important in shaping the clinical management and the treatment planning of services to lower suicidal risk in adolescence.

Declarations

- **Ethical Approval and Consent to participate:** The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of the Department of Dynamic, Clinical Psychology and Health Studies, Faculty of Medicine and Psychology, University of Rome “La Sapienza” (protocol n. 181, 12th December 2020). Informed consent was obtained from all subjects involved in the study.

- **Consent for publication:** Not applicable.

- **Availability of data and materials:** The datasets generated and analyzed during the current study are not publicly available due the sensitivity of the matter under investigation, but are available from the corresponding author on reasonable request.

- **Competing interests:** The authors declares that they have no competing interests

- **Funding:** This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

- **Authors’ contributions:** RW designed the study. MPC wrote the protocol. MM and CF managed the literature searches and dataset. MC and PF undertook the statistical analysis. MM and RW wrote the first draft of the manuscript. PF reviewed the manuscript before submission. All authors have approved the submitted version of the manuscript.
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