Dark Traits, Maladaptive Personality, and Depression: Comparative Network Analysis in Psychotherapy Patients vs. Non-clinical Samples

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Abstract

Background/Objectives: The present research used a network approach to investigate the relationships between antagonistic traits, maladaptive personality, and depressive symptoms in in psychotherapy patients ($N_I = 254$) vs. non-clinical samples ($N_I = 261$). **Methods:** The study used network analysis to provide insight on the differential organisation of these traits and symptoms between the two groups. **Results:** In individuals from the general population, a positive relationship between Machiavellianism and hopelessness and a negative one between the former and negative affect. Psychopathy was positively associated with antagonism and hopelessness in psychotherapy patients but not in individuals from the general population. Psychopathy was also positively associated with disinhibition in individuals from the general population but not in psychotherapy patients. Narcissism and depression were negatively associated, both in psychotherapy patients and controls. Dark traits were not associated with depression, neither in psychotherapy patients nor in individuals from the general population. **Discussion:** The network estimated in the former group suggests patterns of antisocial, callous, and reactive-aggressive forms of behaviour that were not found in those from the general population, outlining important implications for theory, future research, and intervention in clinical and health psychology.

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Keywords: Personality, dark traits, maladaptive domains, depression, hopelessness, network analysis.

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Introduction

The Dark Tetrad refers to a personality model of four interrelated "Dark Traits" (DT), i.e., subclinical and socially aversive personality dispositions, namely Machiavellianism, narcissism, psychopathy, and sadism (Paulhus, 2014; Paulhus et al., 2021), characterised by a tendency to callousness and interpersonal manipulation (Dinić et al., 2020; Jones & Figueredo, 2013). Machiavellianism is identified by strategic manipulativeness and cynicism (Jones & Paulhus, 2009). Narcissism encompasses grandiosity, self-importance, and a sense of entitlement (Krizan & Herlache, 2018). Psychopathy is denoted by impulsivity, recklessness, and a lack of remorse (Hare et al., 1990). Finally, sadism, in its vicarious form, refers to an enjoyment of cruelty and the suffering of others (Paulhus & Dutton, 2016). There is somewhat inconsistent evidence as to the relationships between DT and psychopathology, especially maladaptive personality and depression. It has been proposed that DT may act as both risk factors and protective factors for psychological distress (Bonfá-Araujo et al., 2023) but few studies have investigated the associations between dark personality and psychopathology in clinical populations, and little is it known about their interplay in clinical vs. from non-clinical groups. In light of this, the current study seeks to examine the relationships between the Dark Tetrad, maladaptive personality, and depression, by using a network approach, and to compare networks between psychotherapy patients vs. non-clinical samples.

Dark traits and pathological personality trait domains

The Personality Inventory for the DSM-5 (PID-5; Krueger et al., 2012) is a maladaptive trait model that comprises pathological personality characteristics grouped under five broad domains: negative affect, detachment, antagonism, disinhibition, and psychoticism. These higher-order domains represent maladaptive counterparts of the Five-Factor Model (Costa & McCrae, 1992) and provide a framework for understanding personality dysfunction. Within the PID-5 model, negative affect is characterised by a tendency to experience intense negative emotions, such as anxiety and anger (corresponding to high neuroticism). Detachment refers to restricted emotionality and social withdrawal (low extraversion). Antagonism encompasses callous, aggressive, and antisocial traits as well as self-importance and a willingness to exploit others for personal gain (low agreeableness). Disinhibition involves impulsive behaviours and a tendency towards recklessness (low conscientiousness). Finally, psychoticism comprises odd or unusual behaviours and cognitions, and perceptual dysregulation (high openness).

There are known links between DT and the PID-5 trait domains. For example, it has been suggested that antagonism represents a core characteristic common to all four DT (Dinić et al., 2023). Indeed, Wissing and Reinhard (2017) found that, of the PID-5 trait domains, antagonism showed by far the strongest relationships with DT. Additionally, there is conceptual and empirical overlap between psychopathy and the PID-5 domain of disinhibition, consisting of sharing facets of impulsivity and recklessness (Jones & Paulhus, 2011). Maheux-Caron et al. (2024) conducted a latent class analysis of the Dark Tetrad and PID-5 trait domains, reporting that participants whose personality profile was characterised by high levels across the Dark Tetrad traits scored significantly higher on each of the PID-5 trait domains than participants with a profile of low or moderate levels of Dark Tetrad traits. Grigoras and Wille (2017) found that narcissism correlated significantly only with antagonism, while Machiavellianism showed positive associations with negative affect and psychoticism, and psychopathy was positively related to all five PID-5 trait domains. In the case of sadism, Plouffe et al. (2019) found positive correlations with four of the five PID-5 trait domains, however no significant association was found for negative affect. This contrasts with Benemann et al.'s (2023) finding that sadism strongly correlated with the PID-5 trait domains, including negative affect, in an all-male sample. Given the highly interconnected nature of personality domains (Cramer et al., 2012), network analysis can provide a clearer picture of the complex interplay between DT and pathological personality, uncovering their common network structure and providing insight on the edges(i.e., links between variables expressed as regularised partial correlations) between *nodes* (i.e., psychological traits and variables) as well as the latent *communities* formed by them (i.e., global and local communities of nodes identified by high density of correlations within a given network or specific parts of it) (Isvoranu et al., 2022).

Much of the research on DT and PID-5 trait domains has focused on samples from the general population and on students. However, there is evidence that the associations between DT and pathological personality trait domains may differ in clinical populations vs. individuals from the general population. For example, in a series of case studies, Pincus et al. (2016) reported that high levels of antagonism, disinhibition, and detachment accompanied narcissistic traits in individuals who had sought psychotherapeutic treatment, which contrasts with findings in non-clinical samples (Grigoras & Wille, 2017). When measured as a normative trait, narcissism has shown strong associations with the PID-5 antagonism domain, while measures that incorporate clinical aspects of narcissism have also shown moderate positive relationships to negative affect, disinhibition, and psychoticism (Wright et al., 2013). Given these differences, the present study seeks to explore these patterns of relationships in a clinical sample and to compare the results with those obtained in non-clinical samples.

Dark traits, pathological personality trait domains, and depression

Depression is one of the most prevalent mental health concerns globally, affecting an estimated five percent of adults at any one time (World Health Organization, 2023). There is consistent evidence that personality plays a role in the development and maintenance of depression, as well as impacting responsiveness to treatment (Klein et al., 2011; Qulity et al., 2008). As such, there is a need to better understand how and to what extent 'dark' and maladaptive personalities interact with depressive symptoms. There is evidence that DT are associated with externalising problems characterised by aggression, hostility, and impulsivity, which tend to cause distress to others (Jain et al., 2023; Kjærvik & Bushman, 2021; Muris et al., 2022), however their relationship with internalising disorders such as depression is less well understood.

Research investigating the relationship between DT and depression obtained mixed results. Psychopathy has been found to positively predict both depressive symptoms and suicidal ideation and to negatively predict wellbeing (Love & Holder, 2014; Lucas & Chang, 2022). However, in clinical populations, there is evidence that some features of psychopathy may play a protective role for depression (Dalkner et al., 2018; Schönthaler et al., 2023). In the case of Machiavellianism, studies have reported negative associations with measures of wellbeing and positive associations with depressive symptoms (Al Aïn et al., 2013; Bianchi and Mirkovic, 2020; Blasco-Belled et al., 2023; Gómez-Leal et al., 2019). However, Shih et al. (2021) found that that Machiavellianism was related only to interpressonal symptoms of depression. There is also evidence that, for individuals who have high emotional intelligence and thus an increased ability, among others, to use emotions for their own benefit, Machiavellianism may protect against depression (Bianchi et al., 2020). Few studies have investigated the link between sadism and depression. Dinić et al. (2021) reported that sadism was positively associated with psychological distress, while showing no association with wellbeing. In a recent cross-cultural study, Plouffe and colleagues (2023) found weak to moderate relationships between sadism and depressive symptoms in Greek and Russian samples from the general population, but in the same study, this relationship was not significant in a UK sample.

There is more consistent evidence of the relationship between narcissism and depression, with general consensus on the protective role of narcissism for the development of depression (Lyons et al., 2019; Papageorgiou et al., 2019). Of the DT, narcissism has been found to show the strongest relationship to depressive symptoms as well as to various forms of personal adjustment, being negatively associated with the former and positively with the latter (Joshanloo et al., 2021; Paulhus et al., 2020; Shih et al., 2021). Narcissism has also shown moderate to strong negative associations with depression in clinical samples (Svindseth et al., 2008; Watson et al., 2002). Birkás and colleagues (2016) proposed that the negative link between narcissism and

depression may be explained by the tendency of individuals high in narcissistic traits to employ task-oriented and emotionally controlled coping strategies and to seek social support when faced with stressors.

The Dark Tetrad was found to be associated with higher levels of suicidal ideation and behaviour in adolescents (Chabrol et al., 2015). In a recent longitudinal study, Wang and colleagues (2023) found that this relationship was mediated by social alienation, suggesting that the aversive nature of DT could result in individuals feeling socially disconnected, leading to increased suicidality. When investigated individually, the DT show differential relationships to suicidality. Chabrol et al. (2011) found that sadistic traits were associated with higher levels of suicidal ideation in adolescents. Psychopathy has shown a positive relationship to previous suicide attempts in adults. In particular, tendencies to antisocial behaviour, which characterise psychopathy, have been associated with suicide attempts in psychiatric patients (Coid et al., 2009; Swogger et al., 2009). Li et al. (2024) investigated the relationship between DT and specific depressive symptoms, finding that both psychopathy and Machiavellianism were positively related to thoughts of death. In addition, these two DT have shown positive correlations with hopelessness (Jonason et al., 2018). However, there is also evidence that the affective components of psychopathy may serve a protective function in relation to suicidality (Heirigs et al. 2018; Javdani et al., 2011). In contrast to the other DT, a negative relationship has been reported between narcissism and the number of previous suicide attempts and the severity of suicidal behaviour in psychiatric inpatients (Brioschi et al., 2020; Freudenstein et al., 2012), and in a community sample, narcissism was associated with higher levels of optimism and lower levels of hopelessness (Jonason et al., 2018).

Regarding the relationship between maladaptive personality and depression, individuals diagnosed with depression have been found to score higher on all five PID-5 trait domains vs. individuals without a diagnosis (Vittengl et al, 2023). Few et al. (2013) investigated the relationship between PID-5 trait domains and depressive symptoms in a clinical sample and found that, when controlling for shared variance with the other trait domains, only negative affect and detachment showed positive relationships with depressive symptoms. Negative affect and detachment have also been found to be the strongest predictors of depressive symptoms in student and community samples (Gonçalves et al., 2022; Sleep et al., 2017; Zimmerman et al., 2014). This is unsurprising, given that they are characterised by emotional lability and anhedonia respectively (Krueger et al., 2012). The PID-5 trait domains are also associated with suicidal ideation in clinical samples (De Salve et al., 2023). Somma and colleagues (2016) reported that negative affect and detachment were most strongly associated with past suicide attempts in a group of adolescent psychiatric inpatients, and longitudinal studies found that negative affect prospectively predicted suicide attempts in adults who had sought psychiatric treatment (Yen et al., 2009). Higher levels of disinhibition have also been linked to suicidality in a clinical sample of adolescents with a history of sexual abuse, whereas higher scores on the irresponsibility facet of disinhibition have been observed in a sample of individuals diagnosed with depressive disorders when compared with non-clinical samples (Gonçalves et al., 2022; Stewart et al., 2015).

Beck's (1967, 1976) cognitive theory of depression holds that negative biases in thinking play a central role in the development and maintenance of depressive symptoms. An individual's cognitive schemas influence the way information is processed and give rise to selective appraisals and attentional and memory biases, which in turn, serve to reinforce the schemas. In the face of stressors and in presence of predisposing maladaptive personalities, dysfunctional schemas are likely to manifest, leading an individual to develop negative beliefs about the self, the world, and the future, often referred to as the 'cognitive triad' of depression (Beck, 1976). Cognitive theory has been influential in the understanding, assessment, and treatment of depression. Cognitive behavioural therapy, which aims to modify dysfunction cognitions thereby leading to improvements in mood and behavioural change, is commonly recommended across public health systems as gold standard treatment for depression (American Psychological Association, 2019; National Institute for Health and Care Excellence, 2022). However, individuals with depressive symptoms and dysfunctional personality profiles have been found to be less responsive to cognitive therapy (Fournier et al., 2008; Richter et al., 2023). Interestingly, a recent study by Gonçalves et al (2022) found that negative affect and detachment were the best PID-5 predictors of depression, especially the depressivity and anhedonia facets. The authors argued that the link between depressivity and anhedonia and between both and symptoms of depression may indicate a single latent dimension, supporting the idea of a continuum between maladaptive personality, depressive symptomatology, and clinical depressive disorder, in line with the hypothesis that maladaptive personality represent a constellation of vulnerabilities or a diathesis rather than a set of stable traits.

Research aims

The present research used a network approach to investigate the relationships between antagonistic personality and psychopathological domains in clinical vs. non-clinical populations. In particular, the study focused on two main domains, namely, pathological personality and depression. We used two samples, respectively, of psychotherapy patients and controls from the general population, to estimate and compare the relevant networks and provide insight on the differential organisation of these traits and symptoms between the two groups.

Methods

Participants and procedure

Participants were 515 residents in the metropolitan area of Rome, Italy, who were recruited and completed the procedure between January and November 2022. They were 254 psychotherapy patients (henceforth: 'patients'; $M_{age} = 30.7, SD_{age} = 11.3$; 156 women, i.e., 52.17%) and 261 individuals from the general population (henceforth: 'controls'; $M_{age} = 32.7, SD_{age} = 12.0$; 143 women, i.e., 47.83%).

Patients were recruited by administrative staff at two local private psychotherapy centres (respectively, [MASKED FOR REVIEW]), controls were recruited by two trained research assistants via word of mouth and snowball sampling. Participants from both groups were told that this was a study on personality and psychopathology and were invited to participate on a voluntary basis, with no incentives being offered. Inclusion criteria for both groups included being aged 18 years or older and self-reportedly fluent in Italian as to read, understand, and complete the procedure. Although patients were asked to indicate their main diagnosis as part of the procedure, the information was not used as inclusion or exclusion criterion, since differentiating between sub-clinical groups, although of potential interest for future research, was beyond the scope of the present study.

The procedure lasted approximately 15 minutes. All participants were provided with a detailed information sheet and asked to read and sign an informed consent form, in the first place, were they interested and willing to proceed. Those who signed the consent form were later invited to fill a set of self-report inventories. Finally, all participants were thanked and debriefed. Patients completed the procedure in paper-and-pencil format, within a dedicated room made available by each clinical centre, ahead of pre-booked psychotherapy sessions. Their responses were finally transferred into an electronic spreadsheet file by administrative staff from the centres. Controls completed the procedure online, via a dedicated Google form. The procedure was reviewed by and obtained favourable ethical opinion from [MASKED FOR REVIEW].

Measures

The Short Dark Tetrad (SD4; Paulhus et al., 2021; Italian version: Fino et al., 2023) was used to measure antagonistic or dark personality traits, namely: Machiavellianism, narcissism, psychopathy, and sadism. This is a widely utilized measure developed to assess the revised four-factor model of antagonistic personality and to overcome the limitations of single-trait inventories, especially the non-orthogonal nature of traits, whilst ensuring brevity and reliability of measurement (alpha values ranging 0.75-0.83). Each trait is assessed through seven items, for a total of 28 items. Participants rate their level of agreement with each item (e.g., "It's not wise to let people know your secrets.") using a 5-point Likert response format, with anchors 1 (not at all) and 5 (very much).

The Personality Inventory for DSM-5 – Short Form (PID-5-SF; Krueger et al., 2012; Maples-Keller et al., 2015; Italian version: Fossati et al., 2017) was used to measure pathological personality trait domains, namely: negative affect, detachment, antagonism, disinhibition, and psychoticism. The inventory is composed of 25 items (e.g., "My thoughts often don't make sense to others."), each trait domain measured through

a sub-set of five items. Participants rated each item on a scale from 0 (*Very False or Often False*) to 5 (*Very True or Often True*"). This short form of the inventory previously showed adequate reliability and validity, comparatively to its longer version, with correlational profiles being nearly identical (rICC=0.995; Maples-Keller et al., 2015).

Beck Depression Inventory-II (BDI-II; Beck et al., 1996; Italian version: Ghisi et al., 2006) was used to assess participants' severity of depressive symptoms. This is a 21-item (e.g., "I am not particularly discouraged about the future.") measure of Beck's (1967) cognitive triad of depression, overall defining a unidimensional assessment of negative beliefs about oneself, one's future, and the world, respectively. This requires participants to indicate, for each item, to what extent it accurately describes how they have felt, over the last two weeks, from 0 to 3.

Beck Hopelessness Scale (BHS; Beck & Steer, 1988; Italian version: Pompili et al., 2009; Iliceto & Fino, 2015) was used to measure hopelessness as a proxy of suicidal ideation. This is as a key correlate of depression, encompassing feelings about one's future, motivation, and expectations, that characterize depressive symptoms, as per Beck's (1976) cognitive perspective. The BHS includes 20 items (e.g., "I have great faith in the future.") that use a 5-point format, with anchors 0 (*very strongly disagree*) and 5 (*very strongly agree*).

Data Analysis

We used network analysis to investigate the relationships between antagonistic personality and psychopathological domains in the clinical sample and to compare results with the equivalent network obtained in the general population sample. We estimated undirected edges between the nine observed variables or nodes, aiming to establish the direction and magnitude of partialized statistical relationships between variables and measures of centrality and clustering of nodes within each network. For this purpose, we used partial correlations with adaptive *Least Absolute Shrinkage And Selection Operator regularization* (LASSO; Epskamp & Fried, 2018; Tibshirani, 1996). This method allows for the estimation of a sparse network, i.e., a network estimated by minimizing spurious links between variables, aiming to an accurate evaluation of the structural and topological organization of nodes within the network (Costantini et al., 2015; Dinić et al., 2020; Epskamp & Fried, 2018). In some cases, this method can originate dense networks (i.e., networks including a high number of edges) and prompt false positives. For this reason, we employed a thresholding rule that required edges to be larger than those estimated in the final model, by means of an Extended Bayesian Information Criterion (EBIC) that prioritised specificity vs. sensitivity and provided estimates that are more likely to be true (Epskamp, 2018).

We explored the structural organization of nodes, both in terms of local clustering of nodes and network's overall organization. Local clustering refers to the interconnectivity of a node's neighbours, for which we used the coefficient ($C_{i,Z}$) discussed in Zhang and Horvath (2005; see also Costantini & Perugini, 2014), indicating the degree of cohesiveness of a given node within a relevant interconnected neighbourhood. Communities represent clusters of nodes showing dense within-cluster connectivity and sparse between-cluster connectivity (Fortunato, 2010; Golino & Epskamp, 2017). We used the Louvain algorithm for community detection (Blondel et al., 2008), which optimises the definition of communities hierarchically and iteratively by exchanging nodes between communities until maximum modularity is achieved. Modularity is a measure of within-cluster connectivity over between-cluster connectivity, with values between 0.3 and 0.7 indicative of a strong network structure (Girvan & Newman, 2002). At that point, communities are converted into higher-order latent nodes, with edge weights being estimated between communities and between communities and observed nodes. Recent research has shown that the Louvain algorithm outperforms alternatives by consistently limiting bias in estimation (Christensen et al., 2020). We repeated the algorithm 5,000 times with different initializations, assessing the stability of estimates across them.

We assessed node centrality by considering two measures, namely, Expected Influence (EI) and Bridge EI (BEI). EI accounts for both the strength and the orientation of a node's cumulative influence in a given network (Robinaugh et al., 2016). EI is especially useful in networks where nodes indicate symptoms or otherwise problematic psychological variables, because a negative edge is treated as a potentially mitigating

effect of a symptom on another one, whereas positive edges are interpreted in terms of reinforcing relationships. BEI represents the degree to which a given node acts as a mediator between clusters of nodes, i.e., to what extent it defines indirect pathways between them, as well as indicating the level of cohesiveness of communities within a network (Jones et al., 2019). We used non-parametric bootstrapping (5,000 repetitions) and case-drop stability (i.e., dropping a portion of the sample from 5% to 95% in steps of 5%, and using 1,000 bootstrapped samples at each stage) to assess the robustness and stability of both measures, considering coefficients with values equal to or higher than 0.7 as indicative of a high correlation between estimates obtained on the original network vs. those obtained on networks built on progressively fewer cases (values in the 0.25-0.50 range considered as minimally acceptable; Epskamp et al., 2018).

Lastly, we ran a network comparison test between psychotherapy patients and controls, i.e., a permutation tests that examines multiple group differences at the level of network structure and global strength (van Borkulo et al., 2021). All the analyses were performed in R version 4.3.1 (R Core Team, 2023), platform: x86_64-pc-linux-gnu (64-bit), with code being available at [ANONYMISED FOR REVIEW]. The following packages were used: *bootnet* (Epskamp et al., 2017), *igraph*(Csárdi & Nepusz, 2006), *NetworkComparisonTest* (van Borkulo et al., 2021), *qgraph* (Epskamp et al., 2012).

Results

Table 1 presents descriptive statistics by group, including the results of unequal-variance pairwise t-test comparisons between groups.

[Table 1: About Here]

No significant differences were found between patients and controls with regards to the means scores obtained at DT and psychopathological measures (p = 0.270).

Zero-order correlations

Mardia's (1970) tests of skewness and kurtosis showed violation of the assumption of multivariate normality (Skew = 1520.08, p < .001, Kurtosis = 6.96, p < .001), and for this reason, we used Spearman's method in estimating zero-order correlations. In patients, zero-order correlations between SD4 traits and other nodes were highest for psychopathy and, respectively, antagonism ($r_s = .65, p < .001$), detachment ($r_s = .53, p < .001$) .001), and disinhibition ($r_s = .51$, p < .001). Controls showed similar results, although of lower magnitude (respectively, $r_s = .36, .41, .42; p < .001$). Patients also showed high correlations between antagonism and detachment ($r_s = .70, p < .001$) and between antagonism and disinhibition ($r_s = .62, p < .001$) and between detachment and disinhibition ($r_s = .58, p < .001$). Antagonism and detachment were highly correlated in controls, too ($r_s = .52$, p < .001), but a lower correlation was found between antagonism and disinhibition $(r_s = .36, p < .001)$ and detachment and disinhibition $(r_s = .28, p < .001)$, in this group. In patients, Beck's depression and hopelessness respectively correlated .16 (p = .009) and .26 (p < .001) with Machiavellianism, .25 and .40 (p < .001) with psychopathy, and .15 and .18 (respectively, p = .016 and p = .004) with sadism; the correlation between depression and narcissism was negative ($r_s = -.14$, p = 029), whereas no correlations were found between narcissism and hopelessness. In controls, depression did not correlate with Machiavellianism, but hopelessness did ($r_s = .30, p < .001$). A negative correlation was found between narcissism and depression $(r_s = -.35, p < .001)$ and between the former and hopelessness $(r_s = -.15, p = -.15)$.013). Psychopathy did not correlate with depression but with hopelessness ($r_s = .29$, p < .001), whereas sadism correlated with both (respectively, 21 and 25; p < .001) (Table 3).

[Table 2: About Here]

Partial-correlation networks

The network structure estimated in each group showed acceptable although relatively low (0.3) modularity, indicating that although communities identified through the analysis are meaningful and can be used to interpret the global structure of the networks, caution is required, due to sparsity (Figure 1).

[Figure 1: About Here]

The network comparison test (5,000 iterations) showed significant differences in general network structure (M = 0.28, p=.003) and global strength (S = 2,88, p < .001). In both groups, three communities were identified. Each community presented a series of uniqueness between groups, although sharing some core elements. The first community was characterised by a depressive core in both groups. However, in patients, depression was positively related to hopelessness, which in turn, was positively associated with psychoticism. highlighting patterns of feelings of despair in association with eccentricity and perceptual dysregulation. In controls, though, this community saw depression being positively associated with detachment and negatively with antagonism, i.e., highlighting the relative independence of depression from forms of self-centredness and hostility, thus suggesting alternative paths with regards to the relationship between depression and maladaptive personality. Interestingly, in neither group was any of the DT involved. The second community identified a core of callousness, aggressivity, and anti-social tendencies in both groups, through the sharing psychopathy, sadism, and disinhibition. However, if the one hand, these traits showed associations with antagonism and detachment, on the other, they were associated with psychoticism. Finally, the third community saw a core of positively associated grandiosity and manipulativeness through Machiavellianism and narcissism, and a positive association between Machiavellianism and negative affect. However, negative affect was negatively associated with narcissism only in controls, indicating a protective role for narcissism against negative emotionality in individuals from the general population but not in those with a history of psychopathology. Lastly, controls also saw the presence of hopelessness in the third community, which was positively associated with Machiavellianism and negatively with negative affect. Table 3 presents edges, i.e., partial correlations with LASSO regularisation.

[Table 3: About Here]

Regarding centrality, the bootstrapped case-drop method showed acceptable stability of EI in both patients and controls (0.45 and 0.25) but lower values of BEI (0.05 and 0.15). In fact, the inspection of the nonparametrically bootstrapped solution showed tighter confidence intervals for EIthan for BEI, both for patients and controls (Figure 2). Consistently, we interpreted centrality primarily based on findings about EI, whilst using greater caution in the interpretation of BEI (Figure 2).

[Figure 2: About Here]

In the first community, for patients, hopelessness ($EI = 0.67, BEI = 0.25, C_{i,Z} = -1.05$) and depression ($EI = 0.65, BEI = 0.19, C_{i,Z} = -0.40$) had greatest centrality, whereas depression had highest cohesiveness. In controls, detachment was the most central and cohesive node ($EI = 0.89, BEI = 0.18, C_{i,Z} = -0.21$), although BEI was highest for depression ($EI = 0.31, BEI = 0.27, C_{i,Z} = -0.60$). Regarding the second community, highest centrality values were found for antagonism ($EI = 1.07; BEI = 0.14; C_{i,Z} = 1.54$) and psychopathy ($EI = 1.07; BEI = 0.16; C_{i,Z} = 0.48$), although the former presented highest neighbourhood connectivity; in controls, psychoticism ($EI = 1.27, BEI = 0.82, C_{i,Z} = -0.58$) appeared the most central node and sadism the most cohesive one ($EI = 0.26, BEI = -0.35, C_{i,Z} = -0.35$). As for the third community, in patients, Machiavellianism was the most central node ($EI = 0.67, BEI = 0.24, C_{i,Z} = -1.05$) and narcissism the most cohesive one ($EI = 0.21, BEI = -0.05, C_{i,Z} = 0.28$), whereas in controls, although Machiavellianism was the most central node ($EI = 0.04, C_{i,Z} = 1.57$), negative affect had highest level of neighbourhood connectivity ($EI = 0.05, BEI = 0.04, C_{i,Z} = 1.57$). Table 4 includes a detailed report of centrality indices.

[Table 4: About Here]

Discussion

The aim of the present study was to investigate the relationships between dark personalities, psychopathological personality trait domains, and depression, by estimating and comparing regularized partial correlation networks in two groups, respectively, of psychotherapy patients and individuals from the general population. The results showed significant differences between the two groups. In fact, although both networks revealed three communities, there were substantial differences in their structure and organization.

Regarding psychotherapy patients, Machiavellianism had a central role within a relatively sparse commu-

nity including narcissism and negative affect. Psychopathy and sadism, on the other hand, were associated with detachment, antagonism, and disinhibition. Interestingly, whereas psychopathy was positively related to detachment and sadism, the association between sadism and detachment was negative. Finally, no DT were part of another community characterised by an overall tendency to perceptual and emotional dysregulation, including psychoticism, hopelessness, and depression. With respect to controls, the same narcissism-Machiavellianism-negative affect triplet that was previously found in patients was observed, but with some important additions: This time, in fact, the cluster also included a positive edge linking Machiavellianism with hopelessness and a negative edge was observed between narcissism with negative affect. In patients, psychopathy was associated with antagonism and detachment, and as expected, with sadism, which in turn, was positively associated with disinhibition and negatively with detachment; in controls, psychopathy was positively associated with disinhibition and detachment, whereas there was no negative link between sadism and detachment, as observed in patients, whereas a positive and moderate association between sadism and psychoticism was observed in controls.

These findings contribute to outline important relationships between DT and psychopathological domains. They identify two distinct profiles of aggressivity/hostility and self-centeredness and manipulativeness in individuals with a history of psychopathology. Interestingly, they show that depression is not related to DT at all, although a positive relationship was found between psychopathy and hopelessness in patients. The findings also confirm, to a certain extent, what recently found by Li and colleagues (2024), specifically, the association between Machiavellianism and an overall tendency to negative affect and between psychopathy and thoughts of death (i.e., hopelessness). However, participants from the study by Li and colleagues (2024) were all from a student population. This could explain differences between their results and the results observed here in terms of associations between depression and DT, whilst corroborating findings from the present study about individuals from the general population, i.e., the association between Machiavellianism and thoughts of death/hopelessness. This means that Machiavellianism may be generally linked to negative affect, whilst only under specific circumstances to hopelessness. Thus, self-blame and death thoughts/hopelessness, previously indicated a functional mechanism that enables individuals high in Machiavellianism to cope with stress (Giammarco & Vernon, 2015; Li et al., 2024), might act as a sort of behavioural inhibition mechanism that negatively moderates the relationship between Machiavellian manipulative tendencies and aggressive behaviour, ultimately decreasing their risk for paranoid and antisocial pathological outcomes, often associated with the trait (McHoskey, 2001).

The results from our study also suggest that psychopathy was consistently associated with detachment in both cases and controls, reflecting individuals' dispositions to eccentric and impulsive behaviour and an overall emotional insensitivity, which may explain disadvantageous decision-making tendencies (see Dean et al., 2013; Mitchell et al., 2002). However, for those with a history of psychopathology, this might translate into a greater disposition to callous, hostile, and sadistic behaviour. This reflects, to some extent, Levenson's (1995) differentiation between primary (callous affect) and secondary (eccentric and impulsive) forms of psychopathy, suggesting that different forms of psychopathy engage with aggression and hostility at different levels, with primary psychopaths favouring instrumental aggression vs. secondary psychopaths favouring reactive aggression, thus emphasizing that anger/hostility are facets that characterize primary psychopathy, in the first place (Ross et al., 2008). On the other hand, disinhibition, located within the same community of psychopathy in controls, bridged psychopathic eccentric and impulsive tendencies with hopelessness, indicating the importance of this maladaptive trait domain in relating DT with depression and suicidal ideation. The tendency to irresponsible, distractible, and risk-taking disposition, typical of individuals high in disinhibition, might therefore expose to a lack of trust towards oneself and a general lack of expectations towards one's future.

It is worth noting that the findings from the present study also confirmed the well-known negative relationships between narcissism and depression (Fang et al., 2021; Lyons et al., 2019; Papageorgiou et al., 2020), both in cases and controls. However, the path between disinhibition and narcissism was direct and positive in cases but null in controls. Previous research had already extensively evidenced the negatively correlation of disinhibition with Big Five agreeableness (Dindo et al., 2013; Mullins-Sweatt, 2019), potentially explaining these results. In this regard, disinhibition has even been defined as the "unifying construct in understanding how personality dispositions undergird psychopathology" (Mullins-Sweatt, 2019, p. 55), in that it maps on personality dysfunction, a range health behaviours, and psychopathological outcomes. Therefore, excess in disinhibition might foster a greater disposition to act without considering potential long-term consequences of one's own actions, neither for the individual her/himself, nor for others (Watson & Clark, 1993), possibly diminishing the protective effect of a grandiose and overly positive sense of self by turning it into disorganized and careless action towards oneself and others (Vaidya et al., 2010).

From a clinical perspective, these results have substantial value, in that they might explain different pathways to psychopathology in relation to dt. As previously argued, although disinhibition holds a distinctive centrality among different groups, concomitant manifestation of this trait domain with facets of psychopathy, antagonistic and sadistic tendencies should alert practitioners about the potential for these to lead to foster risk for psychopathology. Similarly, a correct appraisal of Machiavellianism and narcissism in relation to negative affect, hopelessness, and disinhibition may also differentiate between those for whom these paths represent overall protective patterns vs. risk factors for psychopathology. Lastly, a comprehensive assessment of the links between psychopathy, sadism, detachment and antagonism is warranted, considering the different network structures and communities involving them, as highlighted by the findings of the present study.

Furthermore, our findings evidence a network of relationship between depression and detachment, in continuity with the results from Gonçalves et al (2022), and additionally, with psychoticism but not with negative affect. Interestingly, they also suggest differential patterns of correlation with antagonism, which was only related to depression in individuals from the non-clinical sample, and with specific DT such as Machiavellianism in psychotherapy patients and (negatively) with narcissism in both groups. These relationships may contribute to further research and intervention that draw upon the idea of personality and depressive symptoms as a diathesis determined by a set of specific maladaptive vulnerabilities, and potentially, protective strengths, like a positive self-representation and high self-esteem derived from narcissism. However, to gain greater specificity, future research would benefit from replication and integration of network investigations that examine these relations at the facet's level.

Limitations

This study is not without limitations. First, the cross-sectional nature of the data and the correlational study design, and second, the convenience sampling strategy that was used, do not allow for speculation over causal links between the variables. Third, the lack of a differentiation between clinical sub-group represents a major shortcoming, whereas uniformly investigating structure and characteristics of personality networks within these groups, although informative, might have obscured the complex interplay of these with specific pathological conditions, symptoms, and outcomes. This is why we recommend future research to consider replicating these results (i) through longitudinal designs that (ii) map DT and psychopathology on specific outcomes along a temporal perspective.

Conclusions

Differences in pathological personal personality trait domains, depression, and hopelessness exist between individuals from clinical groups vs. individuals from the general population. The network estimated in the former group suggests patterns of antisocial, callous, and reactive-aggressive forms of behaviour that were not found in those from the general population, outlining important implications for theory, future research, and intervention.

Data Availability Statement

The data that support the findings of this study are openly available in Open Science Framework, at: https://osf.io/pgme2/?view_only=5df7058e578849c3aa600a72b25f7674.

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Conflict of Interest Disclosure

The authors declare no conflicts of interest.

Ethics Approval Statement

The study was reviewed and received ethical favourable opinion by the ethics committee of [MASKED FOR REVIEW].

Patient Consent Statement

All the participants provided their consent to participate in the study.

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