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Research paper

Prosocial behaviors across bipolar and major depressive mood disorders: A preliminary investigation☆

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ABSTRACT

Bipolar and major depressive disorders are both serious and costly psychiatric disorders. Yet extant research largely focuses on social functioning impairments in mood disorders despite some work suggesting areas of adaptive social functioning. The present study presents a preliminary investigation aiming to further examine distinct facets of prosocial behavior using previously validated survey and behavioral measures among a clinically diagnosed sample of adults with bipolar I disorder (BD; $n = 19$), major depressive disorder (MDD; $n = 28$) and non-psychiatric controls (CTL; $n = 29$). A subset of individuals with BD and MDD were prospectively followed at a 6-month and 12-month follow-up time point. Findings suggest that BD and MDD individuals did not differ in prosocial behavior across eight distinct measures compared to the CTL group. Follow-up findings suggest that prosocial behavior may be associated with better prospective social support outcomes in the MDD and BDD groups. Although these results are preliminary due to the modest sample size, they suggest that some aspects of prosocial behaviors may be preserved among individuals with bipolar and unipolar mood disorders.

1. Introduction

Bipolar disorder (BD) and major depressive disorder (MDD) encompass severe and chronic mood disorders associated with serious social functioning difficulties (Godard et al., 2011; MacQueen et al., 2001). Individuals with BD report lower social support, worse social adjustment, and impaired interpersonal connection compared to non-psychiatric controls (Beyer et al., 2003; Johnson et al., 1999; Romans and McPhearson, 1992). In turn, these social difficulties are associated with more severe depressive symptoms and higher frequency of lifetime suicide attempts in BD (Kahr Nilsson, 2016; Weinstock and Miller, 2010). Similarly, individuals with MDD also experience marked social difficulties. Indeed, social impairment is a typical diagnostic feature of MDD and family members of individuals with MDD typically observe significant social withdrawal (American Psychiatric Association, 2022). Further, individuals diagnosed with MDD tend to exhibit poorer social problem-solving skills compared to matched non-psychiatric controls. On the other hand, some work suggests areas of intact social functioning in individuals with BD and MDD. Indeed, some studies indicate in similar prosocial behavior of individuals with and without mood disorders (e.g., Destoop et al., 2012; Saunders et al., 2015) or even areas of unique social strengths (Ong et al., 2017; Sorgi and van 't Wout, 2016). Given that prosocial behaviors like sharing, cooperation, helping, and trust are foundational to building strong supportive social connections, we argue that it is critical to better understand the role of prosocial behavior on mood pathology. Yet, few studies to date have systematically assessed multiple domains of adaptive, or prosocial, behavior in individuals diagnosed with mood disorders.

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1.1. Prosocial behavior in mood disorders: difficulties and strengths

There are incongruent findings on the nature of prosocial behaviors in the context of mood disorder profiles. Some work indicates that individuals with BD I and MDD diagnoses exhibit poorer social functioning abilities and report less satisfaction with social relationships compared to individuals without mood disorders (e.g., Gillissie et al., 2022; Martini et al., 2013). Conversely, other work indicates that individuals with a history of BD I and MDD report unique "*social silver linings*" (i.e., Gruber et al., 2025) like greater affective empathy, stronger perceived connection with others, and greater self-reported quantity of social networks (Ibonie et al., 2025; Lobban et al., 2012). Despite these incongruent findings there is strong agreement in the literature on the importance of strong supportive social networks for both BD I and MDD prognosis including reductions in mood episode frequency and symptom severity (Anderson et al., 2021; Johnson et al., 1999; Layous et al., 2012; Son and Padilla-Walker, 2020).

1.1.1. Social difficulties in mood disorders

Several studies highlight the social difficulties experienced in the context of mood disorders. First, one meta-analysis of 29 studies of individuals with BD reported impaired social-cognition abilities. Specifically, emotion recognition, perspective taking, and social decision making were lower among individuals with BD during both periods of symptom remission and euthymia (i.e., not currently manic or depressed; Gillissie et al., 2022). Second, another study using a well-validated clinician-rated instrument (i.e., the Functional Assessment Short Test) found that interpersonal relationship impairment was significantly higher among euthymic individuals with BD compared to matched non-psychiatric controls (Aparicio et al., 2017). Third, currently euthymic adults with BD reported fewer close friends and acquaintances on social networking sites (i.e., Facebook) (Martini et al., 2013). Taken together, these findings suggest that individuals with BD experience significant difficulties in diverse domains of social functioning.

Studies of individuals with unipolar MDD diagnoses point to similar social difficulties. First, one study found that women currently experiencing a major depressive episode engaged in fewer social activities, reported fewer close relationships, and lower overall quality of relationships than both a group of symptomatic psychiatric patients without affective or psychotic disorders and a group of non-psychiatric controls (Gotlib and Lee, 1989). Second, a review article of 31 studies on social cognition in MDD highlighted themes of patients interpreting others' affect as overly negative and difficulties with mentalizing (i.e., perspective taking) compared to non-psychiatric controls (Weightman et al., 2014). Third, another study found that both currently depressed and remitted individuals with MDD diagnoses reported greater difficulties in both behavioral (i.e., frequency of social interactions, social support) and affective (i.e., loneliness) social functioning compared to individuals with anxiety-related disorders and non-psychiatric controls (Saris et al., 2017). Taken together, this work underscores the significant social costs of mood disorder pathology across BD and MDD.

1.1.2. Social strengths in mood disorders

At the same time, there is growing evidence that people with BD and MDD also display unique social strengths. First, in one study using a validated behavioral economics game (i.e., the Trust Game) to assess interpersonal cooperation, mood-remitted individuals diagnosed with BD I and MDD exhibited significantly more cooperative behaviors compared to a non-psychiatric control group (Ong et al., 2017). Second, another study using a similar behavioral task assessing trust and social risk-taking reported that currently depressed adolescent inpatients scored higher on trusting behavior compared to matched non-psychiatric controls (Mellick et al., 2019). Third, Sorgi and van 't Wout (2016) similarly found that higher depressive mood symptoms were associated with more cooperative decision making in community samples, using another behavioral task (i.e., Prisoner's Dilemma). Fourth, one related study suggests that currently depressed individuals with MDD had greater functional activation than controls in the left inferior frontal gyrus, a brain region that has been linked to affective empathy (Fujino et al., 2014). Taken together, these findings highlight the relative social strengths in mood disorder profiles.

Finally, another line of evidence suggests that people with BD and MDD may have comparable prosocial abilities to controls. One study found that prosocial decision making and fairness did not differ between individuals with MDD and non-psychiatric controls using a modified Ultimatum Game (Destoop et al., 2012), while another study using a similar task to assess cooperation found no differences among individuals diagnosed with MDD compared to non-psychiatric controls (Mukherjee et al., 2020). While research in BD populations is limited, Saunders et al. (2015) found that currently mood-remitted patients with a BD diagnosis performed equally to non-psychiatric controls on a task of reciprocal cooperation using the Prisoner's Dilemma. Taken together, these studies paint a complex picture of the nature of social behavior in mood disorders and highlight a need for further research utilizing multiple measures of prosocial behaviors concurrently in individuals with BD and MDD diagnoses, compared to non-psychiatric samples.

1.2. The present investigation

Given the known importance of prosocial behavior and social support for mood disorder prognosis and trajectory (i.e., Johnson et al., 1999), additional work is needed that adopts a between-within subjects approach assessing multiple domains of positive social (or prosocial) behavior across mood disorder profiles. The present investigation seeks to begin to address these empirical gaps by examining differences in six domains of prosocial behavior (i.e., cooperation, reciprocity, altruism, trust, perspective taking, and helping) using previously validated surveys and behavioral measures drawn from behavioral economics and psychological science between BD I and MDD groups and non-psychiatric controls. Furthermore, a subset of BD and MDD participants were recontacted approximately six and twelve months later to assess self-reported mood symptom severity, mood episode frequency, health functioning and perceived social support to examine potential prospective clinical links between prosocial behaviors and clinical and functioning outcomes. This study design enabled us to examine the following main aims:

1.2.1. Aim 1: cross-sectional baseline group differences in prosocial behaviors

The first aim examined baseline group differences in prosocial behavior among inter-episode adults with BD I, MDD and a non-psychiatric control (CTL) group. We examined two non-mutually exclusive perspectives regarding group differences in six distinct domains of prosocial behavior functioning. The first "*increased prosociality*" perspective posits that the BD and MDD groups would exhibit more prosocial behavior than the CTL group (**Aim 1a**), given past literature on heightened socially adaptive behavior in populations with mood disorders (e.g., Ong et al., 2017; Sorgi and van 't Wout, 2016). The second "*diminished prosociality*" perspective posits that the BD and MDD groups would exhibit less prosocial behaviors than the CTL group (**Aim 1b**), given past literature on social functioning difficulties among individuals with mood disorders (e.g., Goldstein and Naglieri, 2014; Hellvin et al., 2013).

1.2.2. Aim 2: prospective associations with prosocial behaviors and mood severity dimensions: a pilot investigation

The second aim examined a smaller pilot sample of BD and MDD participants who completed prospective clinical and functioning measures at a 6- and 12-month follow-up assessment. We assessed whether baseline levels of prosocial behaviors were prospectively associated with mood symptom severity (**Aim 2a**), self-reported mood episode

frequency (**Aim 2b**), and health and social functioning (i.e., perceived social support) (**Aim 2c**). These aims were examined both across the BD and MDD groups (i.e., combining both groups into one mood-disordered group) and separately within each BD and MDD group to examine whether there are unique or disorder-specific associations.

2. Methods

2.1. Participants

Eligible participants included $N = 76$ adults between the ages of 18–55 recruited into one of three groups: BD type I ($n = 19$[1]),MDD ($n = 28$), and a non-psychiatric control (CTL) group (CTL; $n = 29$). Participants were recruited from the community using recruitment methods including posting printed IRB approved flyers, calling nearby researchers, treatment facilities, and clinicians to distribute flyers and informational postings, emailing online list-servs, posting IRB approved advertisements on Craigslist and social media, and making press releases to local media. Study recruitment materials included a link to a prescreen survey, which was used to collect basic information on mental health status to inform scheduling of baseline clinical interview visit. Specifically, 1795 individuals completed the prescreening survey in full. Of those, 152 were subsequently scheduled for the baseline interview. Following baseline study procedures, 89 were ultimately eligible for the larger study protocol and 76 completed all required study measures for the present investigation. Primary reasons for ineligibility included not meeting eligibility criteria (described next) or MRI contraindications. Participants in the BD and MDD groups met for inter-episode status (i.e., no manic, depressive, or mixed mood episode in the past month) and scored below current (i.e., past week) clinician-rated symptom cutoffs (QIDS-C < 11; CARS-M < 8) to examine more trait-like or enduring differences in prosocial behavior dimensions independent of mood symptom phase or severity. Participants in the non-psychiatric control (CTL) group included individuals with no current or lifetime DSM-5 disorder and no self-reported first degree relative with a bipolar disorder or a psychotic disorder. Participants in all three groups were further screened for substance use in the past six months. Additional diagnostic and symptom evaluation details are described in the Measures section.

A subset of BD and MDD participants completed an additional 6-month follow-up survey (Overall $N = 34$ [BD: $n = 16$; MDD: $n = 18$]) and a smaller subset completed a 12-month follow-up survey (Overall $N = 27$; BD: $n = 9$; MDD: $n = 18$).

2.2. Measures

See Table 2 for descriptive statistics for all clinical and prosocial behavior measures[2] and Supplementary Materials for full item text and scoring anchors of all measures.

2.3. Clinical measures

2.3.1. DSM-5 clinical diagnosis

Diagnostic mood status (i.e., BD I, MDD, or CTL) was confirmed using the SCID-5 (First et al., 2015). A trained clinical psychology graduate student or licensed faculty member administered the SCID-5 and all interviews were supervised by a licensed clinical psychologist. For the BD and MDD groups, we administered the modules for current and lifetime mood and psychotic and associated symptoms and for the CTL we administered modules for current and lifetime mood episodes, psychotic and associated symptoms, substance use disorders, anxiety disorders, obsessive-compulsive and related disorders, trauma and stressor-related disorders, somatic symptom and related disorders, eating disorders, externalizing/disruptive and impulse-control disorders, sleep-wake disorders, and other optional conditions (e.g., premenstrual dysphoric disorder). Consistent with meta-analyses highlighting the high rate of psychiatric comorbidity in BD and MDD, participants were not excluded based on comorbidities (e.g., Léda-Rêgo et al., 2024) with the exception of current alcohol and substance use disorders based given their impact on cognitive and socioemotional functioning (e.g., Miguel et al., 2023). Participants in the CTL group were excluded on the basis of any current or lifetime psychological disorders assessed on the SCID-5.

Participants in all groups scored below cutoffs for both alcohol (AUDIT $\geq$10; Saunders et al., 1993) and drug (DUDIT $\geq$6 or $\geq$ 10 if endorsed cannabis use only; Berman et al., 2003) use in the past six months.

2.3.2. Mania mood symptoms

Both clinician-rated and self-reported mania/hypomania symptoms were collected. Clinician-rated mania symptoms were used to determine inter-episode status using the 15-item Clinician-Administered Rating Scale for Mania (CARS-M; Altman et al., 1994), assessing mania/hypomania symptom severity over the past week, with total scores ranging from 0 to 29. Higher scores reflect greater mania severity (with cutoff scores for inter-episode status $\geq$9). Self-reported mania symptoms were collected at baseline using the Altman Self Rating Mania Scale (ASRM; Altman et al., 1997), a 5-item scale assessing current mania symptoms over the past week, with total scores ranging from 0 to 20, with higher scores indicating greater mania symptom severity. Internal consistency for ASRM at baseline and 6-month follow-up was acceptable ($\alpha = 0.79$ and 0.87 respectively) and slightly lower at the 12-month follow-up ($\alpha = 0.66$) which may be due to limited sample size on a scale with fewer items.

2.3.3. Depression mood symptoms

Both clinician-rated and self-reported depression symptoms were collected. Clinician-rated depression symptoms were used to determine inter-episode status using the 16-item Quick Inventory of Depressive Symptomatology (QIDS-C; Rush et al., 2003), assessing depression symptom severity over the past week, with total scores ranging from 0 to 29. Higher scores reflect greater clinician-rated depressive severity (with cutoff scores $\geq$11). Self-reported depression symptoms were collected at baseline and the 6 and 12-month follow-ups using the Beck Depression Inventory Short Form (BDI-SF; Beck and Beck, 1972), which is a 13-item continuous measure of current depressive mood symptoms over the past two weeks. Higher summed scores indicate greater depressive symptom severity. Internal consistency for BDI-SF was acceptable at baseline ($\alpha = 0.90$), the 6-month follow-up ($\alpha = 0.90$) and the12-month follow-up ($\alpha = 0.91$) time points.

2.3.4. Mood episode frequency

Mood episode frequency at the 6- and 12-month follow-up was assessed including self-reported mania and depression episodes using the Mood Disorder Questionnaire for mania (MDQ; Hirschfeld, 2002) and the Inventory for Diagnosing Depression-Lifetime for depression (IDD-L; Zimmerman and Coryell, 1988). The MDQ includes 13 items assessing symptoms of mania in the past 6 months with additional items added to assess the severity and duration of these symptoms. The IDD-L includes 22 questions about symptoms of depression lasting at least two weeks in the past 6 months. Both the MDQ and IDD-L were assessed at both the 6-and 12-month follow-up points to cover up to an entire 12-month longitudinal monitoring period. Specifically, scores $\geq$7 on the MDQ meet criteria for a manic episode; and scores $\geq$10 on the 9 IDD-L meet criteria for a depressive episode (e.g., Gilbert et al., 2013). Both the

[1] Data collection for the present study was conducted between 2017 and 2022 and was severely impacted by the COVID-19 pandemic, resulting in fewer BD I participants completing all required study components compared to the other two groups.

[2] Note that additional measures were included as part of the broader study protocol.

MDQ and IDD-L were assessed at both the 6-and 12-month follow-up points to cover up to an entire 12-month longitudinal monitoring period.

2.3.5. Social support

Self-reported social support was measured using the Multidimensional Scale of Perceived Social Support (MSPSS), which contains 12 questions assessing perceived support from family, friends, and significant others (Zimet et al., 1988). Items are assessed on a 7-point Likert scale with higher summed scores reflecting greater perceived social support. Internal consistency for MSPSS was acceptable at 6- and 12-month follow-up time points ($\alpha = 0.86$ at both).

2.3.6. Health functioning

Health functioning was measured using the World Health Organization Disability Assessment Scale 2.0 (WHO-DAS 2.0), which includes 12 self-report items assessing health-related functioning impairment over the past 30 days on a 5-point scale. The WHO-DAS 2.0 was scored by summing items to create a total score representing greater health functioning impairment across domains (Ustun et al., 2010).

2.4. Prosocial behavior measures

Six distinct domains of prosocial behavior dimensions were measured including cooperation, reciprocity, altruism, trust, perspective taking, and helping. Each is described below.

2.4.1. Cooperation

Two well-validated social dilemma games were used to measure cooperative behavior, including the Public Goods Game (PGG) and Dictator Game (DG) (e.g., Engel, 2011). In the PGG task participants make strategic decisions involving a hypothetical endowment of $10. Higher monetary endowments measured more cooperative behavior. In the DG task (Forsythe et al., 1994), participants are told to imagine making strategic decisions involving a hypothetical endowment of $10, with responses ranging between $1 and $10. Higher monetary endowments reflect more cooperative behavior. See Supplementary materials for full text of PGG and DG.

2.4.2. Prosocial behavior preferences

The Global Preferences Survey (GPS; Falk et al., 2018) is a self-report instrument assessing prosocial behavioral preferences, including self-reported reciprocity, altruism, and trust. *Reciprocity* items included one positive reciprocity item (scored 0 to 10) and three negative reciprocity items (two items scored −3 to +3 and one item scored 0–10). *Altruism* (scored 0 to 10) and *Trust* (scored −3 to +3) were each one-item. Following previously scoring guidelines (Falk et al., 2018; Petrakis et al., 2021), individual items on the GPS were standardized (i.e., Z-scored) to create four subscales: Negative Reciprocity, Positive Reciprocity, Altruism, and Trust.

2.4.3. Perspective taking

Participants were asked to complete the "E-Card" behavioral task shown to reflect self- or other- orientation or perspective taking (Hass, 1984). Specifically, participants are asked to write the letter E on an index card placed on their forehead with the experimenter. Responses are scored categorically as either non-prosocial/self-facing or prosocial/outward-facing depending on the orientation of the letter E. Participants completed this either in person ($n = 62$) or via Zoom ($n = 12$) due to subsequently enforced COVID-19 social distancing guidelines.

2.4.4. Helping

Daily helping behaviors were measured using the Daily Experience Survey (DES; Rameson et al., 2012; modified by Morelli et al., 2014) in which participants were asked to self-report on the frequency of 10 different daily helping behaviors provided over the past week. Total scores represent the total number of helping behaviors endorsed over the past week, including both total helping behavior (Help-All), as well as subscales differentiating helping behaviors towards friends (Help-Friend) and acquaintances (Help-Acq).

2.4.5. Prosocial behavior composite

A composite score for prosocial behavior was created by standardizing [Z-scoring] and averaging across each of the six separate prosocial variables collected, with higher scores reflecting greater overall prosocial behavior.

2.5. Procedure

Data was collected between approximately 2017–2022 as part of a larger study (NIMH 5 R01 MH112560-03) with institutional approval for the present investigation at the University of Colorado Boulder (IRB #17-0358). The study procedure consisted of three main components. First, interested potential participants completed a brief remote eligibility survey. Second, potentially eligible participants were invited for a baseline session that included surveys, clinical interviews, and prosocial behavioral tasks (eligible participants also had the option to complete a separate MRI experimental session and measures unrelated to the present investigation). All tasks were administered via survey through Qualtrics™. We note that only a subset of participants completed the prosocial behavior measures due to experimenter and participant constraints during the COVID-19 pandemic. Third, eligible BD and MDD participants were recontacted at approximately 6-month and 12-month follow-up time points and completed a remote-based Qualtrics survey assessing self-reported mood symptoms, mood episode frequency, perceived social support, and health functioning, in addition to other measures not part of the present investigation.

3. Results

All analyses were pre-registered following data collection but prior to the present investigation's analyses (e.g., Aim 1: https://osf.io/q9z3x; Aim 2: https://osf.io/8nx7v). We note that we deviated from the pre-registration by running one-way ANCOVAs (i.e., rather than ANOVAs) to account for the effect of age which ranged from 18 to 52-year-olds in the final sample.

3.1. Preliminary analyses

For our preliminary analyses, we first examined skewness and kurtosis indices for our main study variables and no variables significantly departed from normality following previous guidelines (i.e., skewness indices of ±2 and kurtosis indices of ±7; Hair et al., 2022). Second, following recommended guidelines (e.g., Blaine, 2018; Osborne, 2008), we examined our primary study variables for potential outliers ±3 standard deviations from the mean and noted that <4% of the total participant sample was Winsorized for main analyses (i.e., Dictator Game $n = 3$). Third, we ran descriptive statistics for all primary measures (see Tables 1 and 2).

3.2. Aim 1: cross-sectional group differences in prosocial behaviors

To examine group differences in overall prosocial behavior we ran a one-way ANCOVA with Group (BD, MDD, CTL) as the between-subjects factor and Prosocial Behavior Composite as the dependent variable with age as a covariate. Results did not suggest significant between-group differences in the prosocial behavior composite, $F(2,70) = 0.213$, $p = 0.808$, $\eta_p^2 < 0.001$.

While not part of the original registration, considering our interest in examining distinct types of prosocial behavior domains we examined group differences individually for each of our prosocial behavior variables. Specifically, we ran seven separate one-way ANCOVAs (i.e., with age as a covariate) for each prosocial behavior measures (i.e., PGG, DG,

Table 1
Demographic and clinical participant characteristics.

	BD (n = 19)	MDD (n = 28)	CTL (n = 29)
Demographic			
Age (yrs)	29.42 (10.25)	27.85 (8.75)	24.89 (5.18)
Female (%)	63.2%	82.1%	72.4%
Caucasian (%)	84.2%	85.7%	79.3%
Education (yrs)	15.83 (1.82)	16.19 (2.45)	15.73 (1.98)
Employed (%)	52.6%	78.6%	58.6%
Partnered (%)	52.6%	64.3%	44.8%
Clinical symptoms			
Baseline survey			
CARS-M	1.33 (1.28)	1.21 (1.07)	0.48 (0.74)
ASRM	2.42 (2.63)	2.21 (3.24)	3.17 (2.85)
QIDS-C	5.00(5.80)	5.29 (5.32)	1.79 (2.16)
BDI-SF	3.63 (4.91)	5.29 (5.54)	2.03 (3.62)
6-month follow-up survey			
ASRM	3.25 (4.25)	3.44 (3.57)	–
BDI-SF	6.19 (6.29)	2.94 (2.51)	–
12-month follow-up survey			
ASRM	2.44 (3.13)	3.06 (3.23)	–
BDI-SF	9.22 (6.85)	4.72 (3.86)	–

Note: BD = Bipolar disorder group; CTL = Non-psychiatric control group; Employed = Employed full-time or part-time; Partnered = Married or in a relationship; ASRM = Altman Self-Report Mania Scale; BDI-SF = Beck Depression Inventory, Short Form; mean values are displayed with standard deviations in parentheses where applicable.

GPS-NegRec, GPS-PosRec, GPS-Trust, GPS-Altruism, Help-All) with Group (BD, MDD, CTL) as the between-subjects variable and a Chi-Square test to examine our E-Card measure given the binary output of that variable. Given the large number of separate analyses, we applied a Bonferroni adjustment. As seen in Table 2, results from these exploratory analyses yielded no significant group differences for any of the individual outcomes. Detailed explanation of results may be referenced in Supplementary materials. Since no significant results were obtained, follow-up analyses examining whether significant group effects held when controlling for mood symptoms were not conducted.

3.3. Aim 2: prospective associations with prosocial behaviors and mood severity dimensions

Preliminary analyses examined the skewness and kurtosis indices for all variables at the 6- and 12-month time points, and no variables were outside of normal limits. We also examined summary statistics for all variables at the 6-month and 12-month time points (Table 3). We note that mood episode frequency rates were low in the present study due to modest follow-up sample sizes at 6- (i.e., $n = 34$) and 12-month (i.e., $n = 27$) follow-ups. Inferential statistics are summarized in detail in Tables 4a–4c.

We examined differences between those who did and did not complete each follow-up survey to understand whether attrition was non-random. Specifically, we examined both participant characteristics (i.e., Age and Binary Gender) and baseline clinical symptoms (i.e., self-report and clinician-rated current manic mood (ASRM, CARS-M) and current depressed mood (BDI-SF and QIDS-C)), as well as clinician-rated lifetime number of mood episodes. At the six-month follow up, there were no significant group differences in Age (Completers $M = 28.94$; Non-Completers; $M = 27.50$) or Gender ($\chi2 = 0.261$, $p = 0.610$) between Completers and Non-Completers. Likewise, at the six-month follow up there were also no differences between Completers and Non-Completers on self-reported current mania (ASRM: Completers $M = 2.13$; Non-Completers $M = 2.67$) or current depression (BDI-SF: Completers $M = 17.84$; Non-Completers $M = 17.13$) or clinician-rated current mania (CARS-M Completers $M = 1.193$; Non-Completers $M = 1.40$) or current depression (QIDS-C Completers $M = 5.23$; Non-Completers $M = 5.07$). Finally, at six-months there were no differences on number of self-reported lifetime episodes of mania (Completers $M = 2.29$; Non-Completers $M = 2.40$) or depression (Completers $M = 5.57$; Non-Completers $M = 7.00$). At the twelve-month follow up, there were no significant group differences in Age (Completers $M = 28.34$; Non-Completers; $M = 28.70$). There was a significant difference in Gender ($\chi2 = 3.89$, $p = 0.049$) between Completers and Non-Completers,

Table 3
6- and 12-month follow up descriptive statistics.

	6-month follow-up N = 34	12-month follow-up N = 27
Mood symptom severity measures		
ASRM	3.35 (3.84)	2.85 (3.15)
BDI-SF	4.47 (4.89)	6.22 (5.37)
Social and health functioning measures		
WHO-DAS 2.0	17.00 (6.05)	17.63 (7.55)
MSPSS	5.44 (0.98)	5.46 (0.90)
Mood episode frequency		
Mania episode	$n = 8$	$n = 2$
Depression episode	$n = 7$	$n = 8$

Note: ASRM = Altman Self-Rating Mania Scale; BDI-SF = Beck Depression Inventory, Short-Form; WHO-DAS 2.0 = World Health Organization Disability Assessment Scale 2.0; MSPSS = Multidimensional Scale of Perceived Social Support. Mood Episode Frequency = number of participants who reported a clinically-significant mania or depression episode during the follow-up period.

Table 2
Means, standard deviations, and one-way analyses of variance of prosocial behavior by group.

Measure	Group M (*SD*)			Inferential statistics		
	BD $n = 19$	MDD n = 28	CTL n = 29	F	np^2	DF
Prosocial composite	−0.06 (0.53)	−0.01 (0.57)	0.01 (0.45)	0.213	<0.001***	2,70
DG	4.31 (2.16)	4.82 (1.68)	5.10 (0.98)	2.578	0.07	2,70
PGG	7.84 (3.04)	7.89 (2.79)	8.44 (2.43)	0.371	0.01	2,70
NegRec	0.14 (0.84)	0.08 (0.78)	−0.18 (0.76)	1.444	0.04	2,70
PosRec	9.52 (1.87)	10.36 (0.99)	9.52 (1.53)	2.489	0.07	2,70
Trust	4.42 (1.35)	3.82 (1.61)	4.52 (1.40)	1.762	0.05	2,70
Altruism	8.79 (2.52)	8.86 (1.84)	8.00 (2.12)	0.968	0.03	2,70
Helping	30.10 (3.53)	29.32 (3.38)	28.93 (3.22)	0.503	0.01	2,70

Note: DG: Dictator Game; PGG: Public Goods Game; NegRec: Negative Reciprocity, Z-scored to combine scores on different scales; PosRec: Positive Reciprocity; Trust: Self-reported trust; Altruism: Self-reported altruism; Helping: Daily Helping Behavior to Friends and Acquaintances. Summary statistics reflect unstandardized and unadjusted scores unless otherwise noted. Output represents ANCOVAs with Age as a covariate in each model. DG mean and standard deviation include non-Winsorized values.
*** $p < 0.001$.

Table 4a
Aim 2a: Prosocial behavior and prospective mood symptom severity.

Outcome var.	Predictor	Aim 2a: 6 month follow-up				Aim 2a: 12 month follow-up			
		R^2	β	CI low	CI high	R^2	β	CI low	CI high
BD and MDD groups collapsed together									
Block 1		0.055				0.022			
	Baseline ASRM		0.235	−0.227	1.158		0.149	−0.500	0.938
Block 2		0.080				0.042			
Prospective ASRM	Baseline ASRM		0.289	−0.154	1.067		0.204	1.089	1.089
	Prosocial behavior		−0.047	−2.643	2.072		0.007	−3.199	3.287
Block 1		0.118				0.010			
	Baseline BDI-SF		0.343*	0.004	0.574		0.098	−0.341	0.509
Block 2		0.196				0.153			
Prospective BDI-SF	Baseline BDI-SF		0.443*	0.062	0.619		0.264	−0.231	0.698
	Prosocial behavior		−0.193	−5.002	1.529		−0.403	−10.249	1.358
BD group only									
Block 1		0.058				0.001			
	Baseline ASRM		0.241	−0.722	1.824		−0.037	−1.079	1.012
Block 2		0.174				0.166			
Prospective ASRM	Baseline ASRM		0.458	−0.387	1.493		−0.169	−2.034	1.710
	Prosocial Behavior		−0.113	−3.703	2.763		0.466	−4.255	6.928
Block 1		0.436				0.447			
	Baseline BDI-SF		0.660*	0.269	1.273		0.669	−0.161	1.317
Block 2		0.764				0.583			
Prospective BDI-SF	Baseline BDI-SF		0.876**	0.567	1.408		0.823	−0.429	1.922
	Prosocial Behavior		−0.302	−7.752	0.815		−0.453	−14.973	7.220
MDD group only									
Block 1		0.003				0.081			
	Baseline BDI-SF		−0.051	−0.231	0.190		−0.284	−0.498	0.191
Block 2		0.058				0.096			
Prospective BDI-SF	Baseline BDI-SF		−0.114	−0.265	0.174		−0.353	−0.607	0.224
	Prosocial Behavior		0.243	−1.704	4.371		0.143	−6.277	9.144

Outcome var. = outcome variable of interest by model.
* $p < 0.05$.
** $p < 0.001$.

Table 4b
Aim 2b: Prosocial behavior and prospective mood episode frequency.

Outcome var.	Aim 2b: 6 month follow-up				Aim 2b: 12 month follow-up			
	β	Odds ratio	CI low	CI high	β	Odds ratio	CI low	CI high
BD and MDD groups collapsed together								
Any mood episode frequency	−0.414*	0.446	0.069	2.223	−0.750	0.249	0.014	1.712
Depressive mood episode frequency[a]	−0.360**	0.492	0.074	2.890	−0.750	0.249	0.014	1.712
BD group only								
Any mood episode frequency	−0.130	0.799	0.061	7.863				
Mania/hypomania mood episode frequency	−0.580	0.360	0.012	3.507				
Depressive mood episode frequency	−0.150	0.768	0.065	9.603				
MDD group only								
Depressive mood episode frequency	−0.350	0.461	0.011	13.456				

Outcome var. = outcome variable of interest by model.
[a] Note: Results for depressive mood episode frequency at 12-month were the same as results for any mood episode frequency at 12 months; since there were n = 8 participants that experienced both depressive mood episodes and any type of mood episode (i.e., the two people who experienced manic/hypomanic mood episodes also experienced depressive mood episodes).
* $p < 0.05$.
** $p < 0.001$.

specifically with fewer Male Completers ($n = 2$) than Female Completers ($n = 23$). However, given the constrained sample of Male Completers these Chi-Square results should be interpreted cautiously. At the twelve-month follow up there were also no differences between Completers and Non-Completers on self-reported current mania (ASRM: Completers $M = 1.81$; Non-Completers $M = 2.95$) or current depression (BDI-SF: Completers $M = 18.81$; Non-Completers $M = 16.00$) or clinician-rated current mania (CARS-M Completers $M = 1.26$; Non-Completers $M = 1.26$) or current depression (QIDS-C Completers $M = 5.77$; Non-Completers $M = 4.32$). Finally, at six-months there were no differences on number of self-reported lifetime episodes of mania (Completers $M = 2.55$; Non-Completers $M = 2.10$) or depression (Completers $M = 6.40$; Non-Completers $M = 5.53$).To examine associations between prosocial behavior and prospective changes in mania and depression mood severity, we ran two separate hierarchical linear regressions examining if overall Prosocial Behavior Composite was associated with

Table 4c
Aim 2c: Prosocial behavior and prospective health and social functioning.

Outcome var.	Predictor	Aim 2c: 6 month follow-up				Aim 2c: 12 month follow-up			
		R^2	β	CI low	CI high	R^2	β	CI low	CI high
BD and MDD groups collapsed together									
Block 1		0.570**				0.269			
	Baseline WHO-DAS 2.0		0.755**	0.447	0.914		0.565*	0.072	1.058
Block 2		0.596**				0.423*			
Prospective WHO-DAS 2.0	Baseline WHO-DAS 2.0		0.757**	0.451	0.913		0.525	−11.732	0.371
	Prosocial behavior		−0.163	−4.68	1.045		−0.392	0.116	1.026
Block 1		0.169*				0.063			
MSPSS	Prosocial behavior		0.412*	1.365	18.096		−0.251	−15.737	5.160
BD group only									
Block 1		0.758**				0.490			
	Baseline WHO-DAS 2.0		0.871**	0.504	1.251		0.700	−0.420	1.382
Block 2		0.784*				0.566			
Prospective WHO-DAS 2.0	Baseline WHO-DAS 2.0		0.831*	0.444	1.231		0.652	−0.951	1.846
	Prosocial behavior		−0.165	−7.373	2.982		−0.279	−19.309	14.654
Block 1		0.580*				0.06315			
MSPSS	Prosocial behavior		0.762*	6.87	27.396		−0.251	−23.296	15.955
MDD group only									
Block 1		0.357*				0.165			
	Baseline WHO-DAS 2.0		0.598*	0.119	0.707		0.406	−0.073	0.369
Block 2		0.373*				0.264			
Prospective WHO-DAS 2.0	Baseline WHO-DAS 2.0		0.552*	0.061	0.702		0.199	−0.191	0.336
	Prosocial behavior		0.135	−2.789	5.07		0.377	−2.027	6.424
Block 1		0.007				0.169			
MSPSS	Prosocial behavior		0.085	−11.602	16.052		−0.412	−32.794	6.227

Outcome Var. = outcome variable of interest by model.
* $p < 0.05$.
** $p < 0.001$.

mania (i.e., ASRM) and depression (i.e., BDI-SF) symptom measures at 6- and 12-month follow-up assessments, while controlling for the same respective mood symptom measure collected at baseline. First, we ran two regressions (mania and depression symptoms) in both mood groups collapsed together; second, we ran these two regressions in the BD group only; and finally we ran one regression (depression symptoms only) in the MDD group. Self-reported mania symptoms in the BD group at the 6- ($p = 0.424$) and 12- ($p = 0.762$) month follow-ups were not significantly associated with prosocial behavior at baseline. Self-reported depression symptoms were not significantly associated with prosocial behavior at baseline across BD and MDD groups collapsed together at 6- ($p = 0.053$) or 12- ($p = 0.266$) months. Results did not change when examining the MDD group individually at 6- ($p = 0.641$) or 12- ($p = 0.603$) months. When examining depressive symptoms in the BD group only, prospective BDI-SF was not uniquely associated with prosocial behaviors at 6- ($p = 0.100$) or 12- ($p = 0.269$) months.

To examine associations between prosocial behavior and mood episode frequency at the 6- and 12-month time points, we ran a separate logistic regression between the overall Prosocial Behavior Composite and *any* mood episode occurrence (i.e., coded as 1 if at least one mood episode was endorsed in the follow-up time period; 0 if no mood episodes were endorsed). We also conducted these analyses separately for the BD group (examining mania and depressive episodes) and the MDD group (examining only depressive episodes). Results of our binomial logistic regression did not indicate a significant association between prosocial behavior at baseline and any mood episode frequency across BD and MDD groups collapsed together at 6- ($p = 0.329$) or 12- ($p = 0.217$) months. This remained true when examining the BD (6-month $p = 0.835$) and MDD groups (6-month $p = 0.653$) individually. Frequency of mania ($n = 2$) and depression ($n = 8$) mood episode frequency at 12 months was too low to analyze associations with composite prosocial behavior. See Table 4b for detailed results.

We additionally ran parallel analyses separately for hypomania/mania (in the BD group) and depressive (in both BD and MDD groups) mood episode frequency to examine whether prosocial behavior uniquely predicts distinct mood episode types. In the BD group, there was no significant association between baseline prosocial behavior and *manic/hypomanic mood episode frequency* at 6 months ($p = 0.399$). It was not possible to run these analyses at the 12-month follow-up given low manic mood episode frequency (i.e., $n = 2$). In both the BD and MDD groups collapsed together, there was no significant association between prosocial behavior at baseline and *depressive mood episode frequency* at 6 months ($p = 0.415$) or 12 months ($p = 0.217$). Likewise, results were insignificant when examining the MDD ($p = 0.653$) and BD ($p = 0.811$) groups individually at the 6-month time point. We were unable to examine MDD and BD groups individually due to the low frequency of depressive mood episode frequency at 12 months (i.e., $n = 4$ for MDD; $n = 4$ for BD).

To examine associations between prosocial behavior and health functioning at the 6-month and 12-month time points, we ran a hierarchical linear regression between the overall Prosocial Behavior Composite and 6- and 12-month health functioning, controlling for baseline health functioning. As above, regressions were run initially across both BD and MDD groups collapsed together and separately for the BD and MDD groups. In the combined BD and MDD groups baseline prosocial behavior was not associated with health functioning at either 6 ($p = 0.203$) or 12 months ($p = 0.064$). Results were also non-significant when examining health functioning in the BD group only at 6 ($p = 0.357$) and 12 months ($p = 0.615$). Likewise, there was no association between baseline prosocial behavior and prospective health functioning in the MDD only group at 6 ($p = 0.546$) or 12 months ($p = 0.273$). See Table 4c.

Additional analyses examined whether baseline composite prosocial behavior prospectively predicted social support (MSPSS) in the BD and MDD groups at the 6- and 12-month follow-up. Towards this end, we ran one linear regression between the overall Prosocial Behavior Composite and the 6- and 12-month follow-up social support. Since social support was not collected at baseline, we were unable to control for baseline social support to examine change over time. There was a significant

association between baseline prosocial behavior and prospective perceived social support in the BD and MDD groups collapsed together at 6 months ($p < 0.05$), but not at 12 months ($p = 0.301$). This association remained significant when examining the BD group individually at 6 months ($p < 0.05$) but not at 12 months ($p = 0.631$). Interestingly, these results did not hold when examining the MDD group individually at 6- ($p = 0.737$) or 12 months ($p = 0.162$).

4. Discussion

The present study aimed to elucidate associations between mood disorder diagnosis and prosocial behavior outcomes. We did so by utilizing well-validated behavioral economics tasks and self-report surveys to measure distinct dimensions of prosocial behavior including cooperation, reciprocity, altruism, trust, perspective taking, and helping. We examined prosocial behavior differences between individuals clinically diagnosed with BD I or MDD compared to non-psychiatric controls. This investigation also included a pilot longitudinal component with a smaller subsample of the mood disorder groups to examine clinically relevant outcomes at 6 and 12 months.

We did not find support for either of the non-mutually exclusive increased or diminished prosociality perspectives. Contrary to our predictions, there were no significant group differences in overall prosocial behavior composite or individual prosocial variables between our mood and control groups. While this finding is contrary to literature indicating social dysfunction in mood disorders (i.e., Porcelli et al., 2020), it is consistent with previous studies reporting no significant prosocial behavior differences between individuals with and without mood disorder history (e.g., Destoop et al., 2012; Mukherjee et al., 2020). One potential interpretation is that individuals with MDD and BD are just as prosocial as non-psychiatric controls in all measured domains of prosocial behavior including cooperation, reciprocity, altruism, trust, and helping. This indicates perhaps a "*preserved prosociality*" perspective, suggesting that prosocial behavior is not significantly impacted by mood disorder diagnosis. This is congruent with emergent strengths-based perspectives, highlighting that individuals with severe psychopathology like BD have unique areas of strength like heightened quantity of relationships and greater perceived social support (e.g., Gruber et al., 2025; Ibonie et al., 2025). Though interpretations must be considered in the context of limitations, results contribute to a greater literature working to destigmatize mood illness and highlight areas of adaptive functioning.

Our second aim examined prospective associations between baseline prosocial behavior dimensions and longitudinal mood symptom severity, episode frequency, health, and social support in a pilot subsample of BD and MDD participants who participated in a 6-month and/or 12-month follow-up survey. Baseline overall prosocial behavior was associated with social support at the 6-month follow-up time point. Of note, this association only held within the BD group and was not observed in the MDD group. Although such results are preliminary and within the confines of a small subsample, they point to a tentative association between prosocial behavior and social support that warrants future investigation. Such findings are relevant to existing affective science literature linking prosocial behavior like cooperation and trust to increased social support (e.g., Wang and Hu, 2021). Further, these results may be congruent with literature in community samples, indicating that mania risk and current manic mood symptoms are associated with heightened perceived social support (e.g., Ibonie et al., 2025). Given previous findings suggesting social support is a known buffer against mood disorder severity (e.g., Johnson et al., 1999; Weinstock and Miller, 2010), future work is needed to explore the potential associations between prosocial behavior in the laboratory and everyday perceptions of positive social support from others.

4.1. Limitations and future directions

The present study is subject to several limitations. First, although sample sizes for this project are consistent with previous experimental psychopathology studies recruiting BD and MDD clinical populations, they are modest and are hence limited in their ability to detect small or moderate effect sizes. As such, it is possible that this constrained our ability to detect group differences and consider potential moderators (e.g., age or gender) in baseline measures of prosocial behavior. Likewise, null results must be interpreted with caution in light of the modest sample size; future studies should collect this data in larger and more diverse sample sizes that are adequately powered to detect potentially more subtle effects with confidence.

Second, although we collected a diverse sampling of behavioral task-based and self-report survey measures of prosocial behavior, we may have been constrained in capturing real-world and naturally occurring prosocial behavior occurrences. For example, the E-card task had limited variability as all participants responded with the prosocial 'other-facing' orientation so interpretations of these analyses are invalid. Future studies should employ more dynamic experience-sampling procedures to capture prosocial behavior occurring naturally.

Third, our preliminary longitudinal component was constrained by a notably small subsample at the 6- and 12-month follow-up time points, which raises concerns for adequate power and limits our ability to make generalizations from these results. Future studies will benefit from conducting longitudinal analyses with more robust clinically diagnosed sample sizes. We also note that follow-up measures were obtained using validated self-report symptom and mood episode measures and future research should replicate these findings using parallel clinician-rated mood instruments.

Taken together, initial results indicate that there may be intact areas of prosocial behavior functioning including cooperation, reciprocity, altruism, trust, and helping in individuals with BD I and MDD compared to non-psychiatric controls. Likewise, baseline prosocial behavior may predict follow-up perceived social support in individuals with BD. Future studies should examine group differences across mood disorder diagnoses compared to non-psychiatric individuals in a larger and more well-powered sample. Despite these limitations, these initial findings highlight important considerations to assess prosocial behavior among individuals with mood disorders.

CRediT authorship contribution statement

Stevi G. Ibonie: Writing – original draft, Project administration, Investigation, Formal analysis, Conceptualization. **Cynthia M. Villanueva:** Writing – review & editing, Project administration, Investigation. **Marianne C. Reddan:** Writing – review & editing, Project administration. **Luiza Rosa:** Writing – review & editing, Project administration, Investigation. **Rachael Hargrove:** Writing – review & editing, Project administration, Investigation. **Lauren M. Weinstock:** Writing – review & editing, Supervision. **McKell Carter:** Writing – review & editing, Resources, Methodology, Funding acquisition, Conceptualization. **Tor D. Wager:** Writing – review & editing, Resources, Methodology, Funding acquisition, Conceptualization. **Jamil Zaki:** Writing – review & editing, Supervision, Resources, Funding acquisition, Conceptualization. **June Gruber:** Writing – review & editing, Supervision, Resources, Project administration, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Jamil Zaki reports financial support was provided by National Institute of Mental Health. If there are other authors, they declare that they have no known competing financial interests or personal relationships that

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Appendix A. Supplementary data

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