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Original Article

Differential effects of depression and mania symptoms on social adjustment: prospective study in bipolar disorder

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Objectives: Previous studies of social adjustment in bipolar disorder have been cross-sectional and small in sample size, have examined a limited number of roles, or were not controlled for baseline mood and other clinical, social, or treatment confounders. We aimed to prospectively explore the strength and stability of correlations between depression and mania-type symptoms and impairment in a broad range of social adjustment roles and domains.

Methods: Multilevel modeling analysis of correlation coefficients between depression and mania-type symptoms with roles and domains of the modified social adjustment scale (overall, work, social/leisure, extended family, marital, parental social adjustment roles, performance, interpersonal behavior, friction, dependency, overactivity domains) was used. Interview assessments were made at eight-week intervals beginning at eight weeks and continuing through 72 weeks after baseline in 253 patients in a multicenter randomized controlled trial.

Results: After controlling for baseline mood episodes, and other clinical, social, and treatment variables, depression symptoms showed strong and stable correlations over time with performance, overall social adjustment, and the work role; and a moderate but stable relationship with interpersonal behavior. The relationships of depression symptoms with the other roles were weak, non-significant, or not stable. For mania-type symptoms, only the correlation with interpersonal friction was moderately strong and reasonably stable over time. Mood episodes, substance use disorder, and borderline/antisocial personality disorder increased role impairment, while employment and marriage mildly decreased it.

Conclusions: Depression and mania-type symptoms have specific effects on social adjustment in bipolar I disorder. Depression symptoms are correlated strongly with performance and moderately with interpersonal behavior, while mania-type symptoms are correlated moderately with interpersonal friction.

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Social adjustment is the inter-relationship between the individual and their environment, often examined from the perspective of the multiple different social roles that an individual has (e.g., as a worker, marital partner, parent, member of extended family, friend, and participant in social and leisure activities) (1, 2). Social adjustment can also be examined dimensionally in domains of similar patterns of behavior across roles (e.g., performance, interpersonal behavior, friction, dependency) (1). Individuals are said to show impairment in a social adjustment role if behaviorally they do not

fulfill society's expectations of that role and/or they do not derive personal satisfaction from that role (2). Defined in this way, bipolar depression and mania-type episodes (mania, hypomania, mixed affective) impair behavior in many social functional roles (3, 4). A limited number of large, prospective studies in bipolar disorder have suggested that depression symptoms are more impairing than mania-type symptoms in overall and occupational social adjustment, aside from episodes of mania and major depression (4–6). However, there has been little prospective research exploring how depression and mania-type symptoms impact on a broader range of social adjustment roles and domains. Furthermore, previous studies have rarely explored the stability of such relationships in bipolar disorder, which is by nature changeable over time (7, 8).

In a previous analysis of baseline data from the current study, we have shown that mood episode and a number of other non-mood-related clinical, treatment, and social factors contribute to impaired social adjustment (9). The aim of the current study was to investigate the strength and stability over time of the relationship between the severity of depression and mania-type symptoms with impairment in a broad range of social adjustment roles and domains once baseline mood episode and other clinical, social, and treatment variables have been controlled for.

Methods

Study design and participants

Prospective assessments of mood and social adjustment were made by trained interviewers every eight weeks from eight to 72 weeks' follow-up after baseline. The total sample of 253 participants was recruited for a multicenter pragmatic randomized controlled trial of the effectiveness of cognitive therapy in bipolar disorder (10). Random allocation resulted in 126 patients receiving treatment as usual and 127 patients receiving 22 sessions of individual cognitive therapy based on Beck's model as previously outlined (10). Five sites across the UK (Cambridge, Glasgow, Liverpool, Manchester, and Preston) were utilized, permitting recruitment from both inner-city and more rural sites. Eligible patients with bipolar disorder were recruited systematically by seeking referrals to the study from each consultant psychiatrist and team of mental health professionals working in publicly funded general adult psychiatry services serving a defined geographical catchment area in each center. Inclusion criteria were: (i) age 18 years or older; (ii) history of bipolar affective disorder meeting DSM-IV criteria (1); (iii) history of two or more episodes of illness meeting DSM-IV criteria for mania, hypomania, major depressive disorder, or mixed affective disorder, one of which must have been within 12 months prior to recruitment; (iv) currently, or in the previous six months, in contact with mental health services.

Exclusion criteria were: (i) bipolar disorder secondary to an organic cause; (ii) continuous illicit substance misuse such that the primary diagnosis of bipolar disorder was uncertain; (iii) currently meeting DSM-IV criteria for mania (although these participants could be included when symptoms had subsided and participants could be in hypomania); (iv) rapid cycling bipolar disorder (defined as more than four episodes of mania and major depressive episodes alternating with less than one month in between in the previous year); (v) borderline personality disorder accompanied by suicidal attempts or intent in the previous three months; (vi) current exposure to systematic psychological treatment specifically aimed at helping the patient to manage bipolar disorder; (vii) inability to read and write English; (viii) inability or unwillingness to give written informed consent.

Each individual approached was provided with verbal and written information about the study and those who participated gave written informed consent. Ethical approval for the study was granted by the North East Multi-Centre Research Ethics Committee in the UK.

Procedures and measures

All of the five sets of measures outlined below that informed the analysis in the present paper were collected by one of six research assistants (RAs) (two based at Cambridge, one each at the remaining four sites).

1. Social Adjustment Scale (SAS) (1). The SAS was collected every eight weeks from week eight to week 72 after baseline. It was originally developed for use in unipolar depression but was modified by one of its original authors (EP) to capture impairment in social roles as a result of behavior during mania (e.g., increased social and sexual contacts). All SAS scales refer to the average performance in the eight-week period immediately preceding the index interview, thereby covering the period from weeks one to 72 after baseline. The five social adjustment roles are: work (including at least half-time or more work in paid or voluntary jobs, student, or house-person roles); social and leisure activities; marital role (including

living companion who was not otherwise related); parental role; and relationships with extended family. Scores on each item range from one, indicating no problems, to five, indicating the most severe problems. Since depression and mania can impair a person's subjective judgment concerning performance in the social adjustment role, the subject's report of good or poor performance is not accepted at face value, but requires evidence of behavior consistent with the report, to enable an objective rating (9). If a person is not eligible to fulfill a role (e.g., not a parent), then this role is omitted from the mean scores.

An overall score of social adjustment is determined by the mean score of all role scores. In addition, social adjustment can be examined across four domains (performance, interpersonal behavior, interpersonal friction, and dependency) (9). Performance is derived from items on time lost from work, impairment at work, number of friends, diminished dating (if unmarried), impaired leisure activities, diminished leisure activities with spouse, diminished sexual intercourse (if married), involvement with children's activities, and communication with children. Interpersonal behavior is derived from items on reticence with friends, reticence with partner, dependency on extended family, dependency on partner, dominance of partner, submissiveness with partner, and contact with family. Friction refers to overt behavior such as arguing, annoyance observable to others, and withdrawal due to tension precipitated by interpersonal contact. It is derived from friction items in the domains of work, friends, extended family, marital, and children. Dependency refers to the overt seeking of help or advice on practical matters or friendship from other people with little evidence of independent action or tolerance of spending long periods of time on their own. It is derived from the dependency items in the domains of extended family, and marital or living companions. Overactivity refers to behavior indicating increased activity that can be quantified such as increased numbers of social interactions and increased spending rather than subjectively increased energy, restlessness, or increased interest. These are increased social interaction, increased dating (if unmarried), increased sexual intercourse (if married), and excessive spending.

In the three-month period immediately before the start of the study, all RAs were trained by an interviewer who had extensive experience in the use of SAS from previous research (11). The training included making ratings on bipolar disorder patients and discussion of the ratings among all the RAs. Once recruitment started, supervision was provided by one member of the team if the RAs were uncertain how to rate an item, and discussion of the ratings was made at three-monthly meetings held with all of the RAs.

2. The diagnoses of current and past episodes of bipolar disorder, comorbid current and past Axis I mental disorder, and borderline or antisocial personality were made using the Structured Clinical Interview for DSM-IV (SCID) (12, 13) and DSM-IV (3) at baseline. DSM-IV criteria were used for remission in determining the presence or absence of a past episode. The RAs were trained in the use of SCID by a psychiatrist (RM) for three months before the start of the project, using official training materials and live patients. Inter-rater reliability was good for the DSM-IV episode diagnosis [κ = 0.92, 95% confidence interval (CI): 0.81–1.00]. Assessments of Axis II disorders other than antisocial personality disorder and borderline personality disorder proved both time consuming and unreliable in pilot work so they were not collected.
3. Detailed background data were collected at baseline, including age, gender, marital status, living circumstances, work status, socio-economic status (whether the most recent job of the patient with bipolar disorder or spouse was in professional, managerial, or technical posts versus manual, partly, or unskilled posts), age at onset of symptoms, history of violence and offending, and history of suicide attempts.
4. Longitudinal severity ratings of symptom levels were made by interview every eight weeks from weeks 8 to 72 after baseline using the Longitudinal Interval Follow-up Evaluation (LIFE-II) (8, 14). Two LIFE scores were rated, one for mania and one for depression, and each used a six-point scale where: 1 = no symptoms; 2 = minor symptoms; 3 = partial remission; 4 = marked symptoms short of definite relapse; 5 = definite relapse meeting DSM-IV symptom criteria for major depression, mania, mixed affective episode, or hypomania; and 6 = definite severe relapse (8). Rating scores could be assigned simultaneously for mania and depression if mixed symptoms were present. Each interview assesses mental state for each week in the preceding eight weeks so that there is an assessment of the severity of

depression and mania-type symptoms for every week from weeks 1 to 72 after baseline. Inter-rater reliability on the LIFE and other measures was assessed (15) on 110 joint ratings from audio tapes. For the depression rating only 3.6% (four out of 110), and for the mania rating 2.7% (three out of 110), of rating-pair differences from their joint means were outside two standard deviations (SDs) of the distributions of these differences. The mean differences were −0.01 (SD = 0.62) for depression and +0.26 (SD = 0.62) for mania.

5. Prescribed medication for each week of follow-up was recorded every eight weeks in terms of total dose of each class of medication for antidepressants (in average imipramine-equivalent milligrams per day), neuroleptic drugs, and benzodiazepines, and separately for lithium, valproate, carbamazepine, and lamotrigine. Adherence to medication was recorded in four categories over an eight-week period: (1 = more than prescribed dose, 2 = 76 –100% prescribed dose, 3 = 26 –75% prescribed dose, 4 = 25% or less prescribed dose).

Statistical analysis

The analysis was conducted in three steps. First, overall correlations between the severity of depression and mania symptoms and all of the roles and domains of the SAS were described for each eight-week assessment point using Pearson's correlation coefficient. This analysis presented a raw pattern of the relationships over time and guided further modeling. Second, the relationship described in step 1 was established in model 1, in which correlations were calculated based on model estimates. Agreement between the raw and model-based correlations confirmed the adequacy of the model. Finally, a further analysis examined if the relationships were attenuated by mood episodes at baseline or other clinical, treatment, or social factors by adding those variables in model 1 to form model 2. Moderate or strong relationships that persisted over time between the severity of depression or mania symptoms and roles or domains of the SAS in model 1 that were not attenuated in model 2 were regarded as clinically important.

Given the nature of repeated measures data and our research hypothesis on the association between mood symptoms measured by LIFE scores and social adjustments measured by SAS scales, multivariate multilevel models (16) were used. In this approach, data were structured as follow-up times nested within the patient, and the SAS scale and LIFE score nested within a time point. In model 1, we examined overall change patterns of SAS scale and LIFE score over time. This was done by fitting each measure as a function of follow-up time simultaneously in the fixed part of the model. The total variance of each measure and its covariance were disentangled into two sources: between patients and within the patient. An overall correlation coefficient between the two measures can be calculated based on their variance–covariance structure at the patient level. For the change pattern of their correlation over time, model 1 was further extended to allow for random effects of time at the patient level for each measure. In this model, the variance–covariance estimates of each measure were a function of time or time bond, which enabled us to estimate the correlation coefficient between the two measures at any given time point during the follow-up period. By plotting the model of estimated correlation coefficient against time, we could observe evidence on how the two measures are co-varying over time. The time-differentiated correlation coefficients estimated by model 1 were not adjusted for baseline variables.

To investigate the impacts of baseline variables on the association between social adjustment and mood symptoms, we entered baseline variables in model 1 to form model 2 using those clinical and sociodemographic factors that were associated with impairment in at least one role or domain of social adjustment in a previous cross-sectional analysis of this data set (9). Only the results of model 2 are shown graphically. The following variables that were not liable to change or would only infrequently change were entered as baseline variables only in model 2: age, gender, living alone or not, in work or not, educational level, allocation to cognitive behavior therapy or treatment as usual, diagnosis of antisocial or borderline personality disorder, current comorbid Axis I psychiatric disorder, lifetime/current substance abuse/dependence, history of charge or caution for violence, history of self-harm, number of previous bipolar episodes, living with partners for 35 or more hours per week, having unmarried children under the age of 21 years at home, and differences among the five centers from which recruitment took place. Medication use was considered as a changing variable throughout the follow-up period in model 2. The mean average dose of antipsychotic agent, mood stabilizer, hypnotic, or antidepressant, or the prescription of any drugs for physical illness, and overall medication adherence (*good adherence* was considered as taking 76–100% prescribed medication, versus *poor adherence*, which was considered as taking greater than 100% prescribed medication

or 75% of prescribed medication or less) were included in model 2. Correlation coefficients between each SAS scale and LIFE score as a function of time were estimated based on model 2 with adjustment for significant baseline variables and medication use over time. Based on the minimum sample size in the analysis and total number of parameters in the model, a conservative criterion of correlation for the significant level of 0.05 (two-sided) is 0.27. Correlation coefficients which were consistently below 0.27 were regarded as non-significant. The Wald test was used for significance tests on regression coefficients for the effects of the baseline variables. Given the number of tests performed, statistical significance was set at the 1% level. Collinearity analysis among baseline variables was conducted to ensure an adequate fit of model 2.

As the proportions of missing data were low at eight weeks but higher later in follow-up for different SAS function scales, sensitivity analysis was carried out to examine patterns of dropout. Multilevel models take care of missing data in the estimation procedure for residuals or latent means within the cluster (17) if missing data are at random so there is no need to impute missing values to perform the analysis. However, if missingness is informative or not at random, the results from the analysis might be biased. To assess possible bias of multilevel models analysis due to the dropout of patients, selection bias modeling (18), which fits a logistic model for dropout and its association and a normal model for each of the SAS function scales simultaneously, was performed. SPSS v17 (IBM, Chicago, IL, USA) for Windows was used for simple and descriptive analyses. MLwiN v2.10 (University of Bristol, Bristol, UK) (19) was used for modeling analysis.

Results

Sample

The characteristics of the sample are shown in Table 1 and more details have been previously reported (10). In summary, 253 patients were recruited in roughly equal numbers from the five centers. The mean age was 41.0 (SD = 10.8) years (range 20–75 years). The sample overwhelmingly comprised patients with bipolar I disorder taking mood-stabilizer medication.

Table 1. Characteristics of sample (N = 253)

Characteristic	n (%)
Gender, female	164 (65)
Employed	156 (62)
Married or living with partner	114 (45)
Ever married or cohabited	156 (62)
Unmarried children living at home	82 (32)
Bipolar I disorder	238 (94)
Bipolar II disorder	15 (6)
Not in episode at baseline	171 (68)
Major depressive episode at baseline	60 (48)
Hypomanic episode at baseline	14 (6)
Mixed affective or manic episode at baseline	8 (3)
No. of previous bipolar episodes, median (range)	11 (1–30+)
Current anxiety or eating disorder	58 (23)
Current substance use disorder	26 (11)
Borderline or antisocial personality disorder	9 (7)
History of psychotic symptoms in episode	208 (82)
Medications at baseline	
Mood stabilizer	213 (84)
Antidepressants	109 (43)
Antipsychotic drugs	127 (50)
Benzodiazepines	46 (18)

Missing data

On the overall, performance, interpersonal, friction, dependency, social and leisure, and extended family SAS scales, missing data, mostly due to dropout, ranged from 20 (8%) patients at eight weeks to 65 (26%) at 72 weeks. Similar proportions of missing data were also lost on the marital scale [n = 151: six (4%) at eight weeks to 31 (21%) at 72 weeks], work scale [n = 156: six (4%) at eight weeks to 22 (14%) at 72 weeks], and parental scale [n = 82: three (4%) at three weeks to 23 (28%) at 72 weeks]. Rates of dropout increased over time in general and disproportionately if patients had a borderline or antisocial personality disorder: (i) from 5.6% to 55.6% among patients with borderline or antisocial personality disorder and (ii) from 8.1% to 23.0% among patients without those personality disorders [odds ratio (OR) = 4.49, 95% CI: 1.23–16.3]; or lifetime/current substance use disorder: (i) from 7.6% to 30.5% among those with substance use disorders and (ii) from 8.1% to 20.7% among those without substance use disorders (OR = 2.41, 95% CI: 1.17–4.95). However, selection bias model analysis did not show significant effects of patient dropout on the time trend of any scale (i.e., the correlation between scales based on time trend will be the same in spite of some informative missing data). Hence, further analyses did not employ imputation for missing data.

Effects of cognitive therapy

In line with our original report (10), there was no effect of cognitive therapy on overall social

adjustment, role, or domain compared to treatment as usual (data not shown).

Simple correlation

The simple correlation coefficients in Table 2 suggested stronger associations between all the SAS scales, except friction and overactivity, and the severity of depression symptoms compared to their association with the severity of mania symptoms. The severity of mania items was independent from the severity of depression symptoms, as expected.

Overall social adjustment and mood symptoms

The severity of depressive symptoms was strongly correlated over time with overall social adjustment (unadjusted analysis correlation coefficients 0.6–0.7), and the relationship was only mildly attenuated in the adjusted analysis (Fig. 1A). After adjustment, correlations between severity of mania-type symptoms and overall impairment in social adjustment were non-significant at all time points (Fig. 1A).

Work adjustment and mood symptoms

In the unadjusted analysis there was a strong and stable association between the severity of depressive symptoms and impaired work adjustment (correlation coefficients 0.6–0.7) that was mildly attenuated in the adjusted analysis (Fig. 1B). By contrast, the severity of mania symptoms was weakly and inconsistently associated with impairment in work adjustment (Fig. 1B).

Social/leisure adjustment and mood symptoms

The social and leisure role was consistently but weakly associated with the severity of depression symptoms over time [five (56%) data points with a correlation above 0.27], and not significantly related to the severity of mania-type symptoms at all time points (Fig. 1C).

Extended family adjustment and mood symptoms

The extended family role was not significantly associated with the severity of depressive symptoms at most time points or with the severity of

Table 2. Pearson's correlation coefficients between means of LIFE score and SAS for depression and mania at eight-week follow-up intervals

	Follow-up intervals (weeks)								
	8	16	24	32	40	48	56	64	72
Depression (SAS)									
Friction	0.21[a]	0.13[b]	0.09	0.20[c]	0.29[a]	0.26[a]	0.20[c]	0.21[c]	0.28[a]
Dependency	0.22[a]	0.34[a]	0.29[a]	0.24[a]	0.25[a]	0.28[a]	0.28[a]	0.21[c]	0.23[a]
Interpersonal	0.36[a]	0.42[a]	0.37[a]	0.31[a]	0.44[a]	0.28[a]	0.36[a]	0.41[a]	0.51[a]
Performance	0.41[a]	0.48[a]	0.43[a]	0.47[a]	0.51[a]	0.50[a]	0.52[a]	0.55[a]	0.58[a]
Work	0.49[a]	0.59[a]	0.58[a]	0.54[a]	0.47[a]	0.48[a]	0.57[a]	0.59[a]	0.57[a]
Social/leisure	0.34[a]	0.37[a]	0.28[a]	0.37[a]	0.44[a]	0.31[a]	0.37[a]	0.41[a]	0.42[a]
Extended family	0.27[a]	0.29[a]	0.24[a]	0.26[c]	0.28[a]	0.26[a]	0.26[a]	0.31[a]	0.31[a]
Marital living companions	0.32[a]	0.31[a]	0.19[b]	0.26[c]	0.36[a]	0.28[c]	0.44[a]	0.30[a]	0.43[a]
Parental	0.24[b]	0.38[c]	0.13	0.21	0.18	0.50[a]	0.32[c]	0.39[c]	0.41[a]
Overactivity	−0.02	0.07	0.10	0.03	−0.14[b]	−0.01	−0.06	−0.05	−0.06
SAS overall	0.47[a]	0.51[a]	0.47[a]	0.49[a]	0.54[a]	0.50[a]	0.53[a]	0.59[a]	0.62[a]
Mania (SAS)									
Friction	0.28[a]	0.29[a]	0.35[a]	0.23[a]	0.33[a]	0.34[a]	0.32[a]	0.26[a]	0.40[a]
Dependency	−0.06	0.14[b]	0.16[b]	0.10	0.20[c]	0.17[b]	−0.004	0.10	0.11[b]
Interpersonal	0.08	0.11	0.18[b]	0.22[c]	0.25[a]	0.22[c]	0.06	0.13	0.06
Performance	−0.01	0.11	0.11	0.29[a]	0.32[a]	0.17[b]	0.04	0.04	0.06
Work	0.14	0.25[c]	0.24[c]	0.24[c]	0.27[a]	0.35[a]	0.34[a]	0.18[b]	0.21[b]
Social/leisure	0.02	0.04	0.07	0.18[b]	0.23[a]	0.05	−0.04	0.02	0.03
Extended family	0.05	0.15[b]	0.21[c]	0.25[a]	0.24	0.21[c]	0.16[b]	0.12	0.16[b]
Marital living companions	0.02	0.06	0.18[b]	0.10	0.42[a]	0.35[a]	0.21[b]	0.11	0.11
Parental	0.29[b]	0.21[b]	0.18	0.14	0.23	0.19	0.03	−0.03	0.22
Overactivity	0.20[c]	0.21[c]	0.30[a]	0.17[b]	0.04	0.16[b]	0.05	0.10	0.24[a]
SAS overall	0.11	0.17[b]	0.24[a]	0.31[a]	0.39[a]	0.27[a]	0.13	0.12	0.17[b]

LIFE = Longitudinal Interval Follow-up Evaluation; SAS = Social Adjustment Scale.
[a]$p \leq 0.001$.
[b]$p \leq 0.05$.
[c]$p \leq 0.01$.

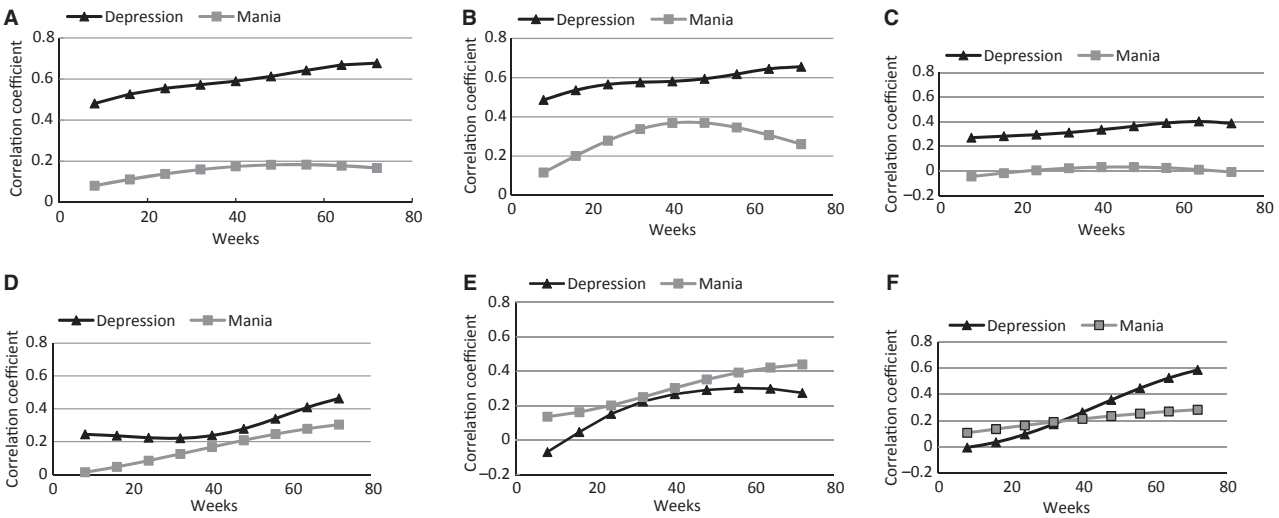

Fig. 1. Adjusted correlations between depression and mania-type symptoms and social adjustment roles in bipolar disorder. (**A**) Social Adjustment Scale (SAS) overall score and Longitudinal Interval Follow-up Evaluation (LIFE) scales, (**B**) SAS work score and LIFE scales, (**C**) Social/leisure and LIFE scores, (**D**) Extended family and LIFE scores, (**E**) Marital and LIFE scores, (**F**) Parental role and LIFE scales.

mania-type symptoms at all time points in the adjusted analysis (Fig. 1D).

Marital adjustment and mood symptoms

There was a non-significant relationship between impairment in the marital role and depressive symptoms at all time points in the adjusted analysis (Fig. 1E). In the unadjusted analysis, there was a moderate correlation between mania-type symptoms and impairment in marital adjustment (correlation coefficient 0.4–0.5) but in the adjusted analysis the relationship was significant in only the latter part of the follow-up period [five (56%) data points with correlation above 0.27] (Fig. 1E).

Parental role adjustment and mood symptoms

The relationship between depression symptoms and impairment in the parental role was strong in the unadjusted analysis (correlation coefficient 0.4–0.6) but completely attenuated at first in the adjusted analysis (Fig. 1F). The association between mania symptoms and parental impairment was non-significant at all time points in the adjusted analysis (Fig. 1F).

Performance domain and mood symptoms

In the unadjusted analysis, there was a strong and stable correlation over time between impaired performance and strength of depression symptoms (correlation coefficient 0.6–0.8) that was only mildly attenuated in the adjusted analysis (Fig. 2A). In both models there was no significant correlation between impairment in performance and mania-type symptoms.

Interpersonal behavior and mood symptoms

Impairment in interpersonal behavior showed a moderately strong and stable correlation over time

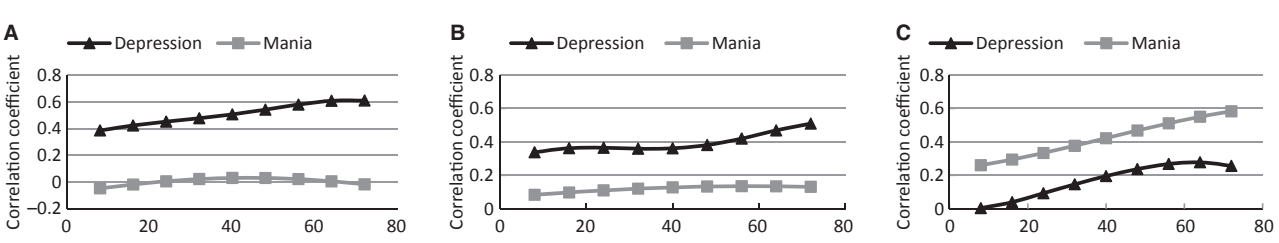

Fig. 2. Adjusted correlations between depression and mania-type symptoms and social adjustment domains in bipolar disorder. (**A**) Performance and Longitudinal Interval Follow-up Evaluation (LIFE) scores, (**B**) Interpersonal and LIFE scores, (**C**) Friction and LIFE scores.

with strength of depression symptoms (unadjusted analysis correlation coefficient 0.5–0.6) but this was mildly attenuated in the adjusted analysis (Fig. 2B). In both models there was no significant correlation between impairment in interpersonal behavior and mania-type symptoms.

Friction and mood symptoms

Greater interpersonal friction showed a non-significant relationship with depression symptoms at all time points in the adjusted analysis (Fig. 2C). By contrast, mania-type symptoms showed a moderately strong correlation with greater interpersonal friction (unadjusted analysis correlation coefficient 0.4–0.7), which was attenuated at first in the adjusted analysis [seven (78%) data points with correlations above 0.27] (Fig. 2C).

Dependency and overactivity with mood symptoms

In the adjusted analysis, neither greater dependency nor overactivity was significantly associated with the strength of either depression or mania-type symptoms at the majority of time points (data not shown).

Baseline predictors and social adjustment

Major depressive episodes were associated with impairment in all social roles, while hypomania, mania, and mixed affective episodes were associated with all roles except the marital and parental roles (Tables 3 and 4). Baseline mood episodes and mood symptoms were the only variables correlated with social adjustment in relation to work, social/leisure, and interpersonal roles and domains. Non-mood-related variables had a relatively small cumulative effect on social adjustment in the overall, extended family, marital, parental, performance, and friction roles and domains. For instance, in relation to friction and mania symptoms, borderline/personality disorder and substance use disorder attenuated the relationship by less than one-third of the overall effect of mania symptoms at baseline, and the size of this attenuating effect diminished over time so that it was negligible by the end of the follow-up period. Borderline/antisocial personality disorder worsened impairment in the overall, extended family, and parental roles and the friction domain. Substance use disorders had a relatively small impairing effect on the friction domain and the marital role in relation to depression symptoms. Employment, marriage, and male gender tended to have small beneficial effects on the overall, extended family, and parental roles and performance domains, particularly attenuating the adverse effects of depression symptoms on social adjustment. Hypnotic drugs were associated with a small adverse effect on overall social adjustment and performance, while antipsychotic drugs were associated with a beneficial effect on friction.

Table 3. Independent effects of baseline variables on the association between different roles and domains of social adjustment and severity of depression symptoms

Baseline predictor	Partial regression coefficient (SE)	p-value
Overall social adjustment		
Gender, male	−0.13 (0.048)	0.005
Professional occupation	−0.24 (0.080)	0.002
Technical occupation	−0.17 (0.052)	0.001
Married/living as a couple	−0.18 (0.050)	<0.001
Employed	−0.15 (0.051)	0.005
Borderline/antisocial personality disorder	0.30 (0.097)	0.002
Taking hypnotic drugs	0.16 (0.056)	0.004
Work/life		
Manic–mixed episode	0.84 (0.246)	<0.001
Taking antipsychotic drugs	−0.20 (0.089)	0.009
Social/leisure		
Manic–mixed episode	0.51 (0.188)	0.006
Extended family		
Married/living as a couple	−0.12 (0.047)	0.010
Borderline/antisocial personality disorder	0.47 (0.098)	<0.0001
Marital/living companion		
Substance use disorder	0.15 (0.057)	0.008
Hypomanic episode	0.48 (0.127)	<0.001
Manic–mixed episode	0.86 (0.157)	<0.0001
Parental		
Gender, male	−0.38 (0.108)	<0.001
Employed	−0.37 (0.114)	0.001
Borderline/antisocial personality disorder	0.78 (0.176)	<0.0001
Performance		
Male gender	−0.23 (0.067)	<0.001
Married/living as a couple	−0.24 (0.066)	<0.001
Employed	−0.20 (0.071)	0.006
Manic–mixed episode	0.59 (0.180)	0.001
Taking hypnotic drugs	0.25 (0.083)	0.002
Interpersonal		
Hypomanic episode	0.31 (0.123)	0.012
Friction		
Substance use disorder	0.18 (0.047)	<0.001
Borderline/antisocial personality disorder	0.34 (0.102)	<0.001
Taking antipsychotic drugs	−0.13 (0.047)	0.007

Major depressive episode was associated with impairment in all roles and domains. SE = standard error.

Discussion

In this prospective study, we have shown that depression and mania-type symptoms in bipolar disorder have differential effects on social adjustment. The strong relationship between depression

Table 4. Independent effects of baseline predictors on the association between different roles and domains of social adjustment and severity of mania-type symptoms

Baseline predictor	Partial regression coefficient (SE)	p-value
Overall social adjustment		
Major depressive episode	0.18 (0.049)	<0.001
Hypomanic episode	0.24 (0.089)	0.006
Manic–mixed episode	0.43 (0.110)	<0.001
Borderline/antisocial personality disorder	0.25 (0.089)	0.004
Taking hypnotic drugs	0.16 (0.051)	0.002
Work/life		
Hypomanic episode	0.42 (0.132)	0.0017
Manic–mixed episode	0.52 (0.166)	0.0015
Social/leisure		
Hypomanic episode	0.35 (0.104)	<0.001
Manic–mixed episode	0.53 (0.132)	<0.0001
Extended family		
Married/living as a couple	−0.11 (0.043)	0.008
Hypomanic episode	0.26 (0.091)	0.005
Manic–mixed episode	0.30 (0.115)	0.010
Borderline/antisocial personality disorder	0.35 (0.090)	<0.001
Marital/living companion		
Married/living as a couple	0.23 (0.076)	0.002
Employed	−0.25 (0.078)	0.0016
Major depressive episode	0.43 (0.091)	<0.0001
Parental		
Borderline/antisocial personality disorder	0.67 (0.114)	<0.0001
Performance		
Major depressive episode	0.18 (0.058)	0.002
Hypomanic episode	0.27 (0.105)	0.010
Manic–mixed episode	0.67 (0.131)	<0.001
Interpersonal		
Major depressive episode	0.15 (0.053)	0.004
Hypomanic episode	0.42 (0.097)	<0.001
Manic–mixed episode	0.42 (0.120)	<0.001
Friction		
Substance use disorder	0.13 (0.042)	0.002
Borderline/antisocial personality disorder	0.33 (0.090)	0.0002
Hypomanic episode	0.25 (0.092)	0.007
Manic–mixed episode	0.32 (0.119)	0.006
Taking antipsychotic drugs	−0.11 (0.043)	0.010

SE = standard error.

symptoms, but not mania symptoms, and impairment in performance, and the moderate relationship between depression symptoms, but not mania-type symptoms, and interpersonal behavior, confirm previous prospective studies (4–6). These findings have been extended by showing that these relationships are stable over time. We have also demonstrated a specific and moderately strong correlation between mania-type symptoms and interpersonal friction. There was no such relationship between depression symptoms and interpersonal friction, even though irritability is a common symptom of depression (20).

However, the relationships between depression or mania-type symptoms and impairment in the extended family, marital, and parental roles or the dependency and overactivity domains were weak, not stable over time, or non-significant once baseline mood episode and some key non-mood-related clinical, social, and treatment factors were taken into consideration. Previously, there has been little prospective research into the role of depression or mania-type symptoms, and impairment in these social adjustment roles or domains, in bipolar disorder. The relationship between dependency and depressive symptoms has been related to personality structures rather than mood itself (21). Previous cross-sectional studies have indicated that mania-type symptoms may have more of an impact on romantic or marital relationships in comparison to other aspects of family function (22, 23) – not only because of interpersonal friction, but also overspending, lack of sleep, sexual activity, and recklessness (22). Our study suggests that mania-type symptoms do have an adverse impact on marital adjustment but the effects are relatively weak and may not be stable over time.

Cognitive therapy had no discernible treatment effect on the overall social adjustment score, or on any of its roles and domains at any time point. The lack of effectiveness of cognitive therapy in the present study is consistent with previously reported time-to-episode and symptom outcomes (10), possibly because of the severity of illness in this bipolar I disorder population or the cognitive behavioral therapy intervention, which did not specifically address the social adjustment of the individual.

As expected, baseline major depressive episodes were associated with impairment in overall social adjustment and in all the roles and domains (4, 9). Hypomania and mixed or manic episodes were also associated with impairment in overall social adjustment (4, 24) and in all roles and domains except marital and parental roles. The smaller sample size and lower frequency of hypomania and mixed affective or mania episodes may have compromised the power of the study to find such an association in the parental role (9). Taking the evidence together, episodes of major depression, mania, hypomania, and mixed affective episodes of sufficient severity may be associated with impairment in any social adjustment role or domain, but less severe depression and mania-type symptoms have differential effects on social adjustment.

Non-mood-related variables did have small influences on increasing or decreasing the effects of mood symptoms on social adjustment, but only in relation to some of the roles and domains. These

and other variables may independently and directly affect social adjustment over and above their indirect effects on mood. Our study confirms that borderline or antisocial personality disorder is an important determinant of social adjustment in bipolar disorder (25), even though its prevalence in the sample was only 10%. Hypnotic drugs were associated with impairment in overall social adjustment and performance, possibly because of their sedative properties, while lifetime/current substance use disorders were associated with increased interpersonal friction, confirming our previous analysis of baseline data (9). Antipsychotic drugs reduced friction in bipolar disorder, a finding compatible with routine clinical practice. Employment and living as a couple reduced impairment in the overall, extended family, and performance roles and domains, possibly by buffering distress from depression symptoms. However, since this was an observational analysis, non-mood-related variables may not contribute directly to the relationship between mood and social adjustment but merely reflect better or worse social adjustment over the follow-up period. There were no consistent differences between centers.

The strength of the study was that it included a large representative sample of patients with bipolar I disorder in treatment with secondary care mental health services in the UK who were prospectively assessed over a substantial period of time. Detailed information was collected over time using standardized instruments that recorded mood symptoms and social adjustment. The latter was considered on the basis of reported behavior, not just self-report of good or poor performance, which may be colored by pessimism and self-doubt during depression or an overinflated view of performance during mania. The current study considered a variety of social adjustment roles and domains, unlike most previous studies in bipolar disorder, which considered only overall social adjustment, often derived as a mean of the different roles that a person has. Such an approach assumes that each person rates each of their roles as equally important, whereas it is likely that many people weight some areas of their social adjustment more highly than others (2). Furthermore, we have explored domains of similar behavior as part of social adjustment; on the whole, there were more clearly differentiated relationships between impairments in domains of social adjustment than in the many different social adjustment roles. Unlike most previous studies with infrequent assessment, the stability over time of the relationship between mood and social adjustment was considered. Using mixed models of analysis of all data from all individuals at all time points allowed consideration of both within- and between-individual variance.

A further strength of the study was that in each eight-week period, there was a relationship between the average score of LIFE symptoms of mania and depression and social adjustment over the same eight-week period. This means that more prolonged episodes of mania and depression would have a greater effect than brief episodes on function in the analysis; in addition, the lagged effect of worsening symptoms on function is also considered, as well as the immediate association at any given time.

There were some important conceptual and methodological limitations to the study. Social adjustment measures make assumptions about behavior in social roles that is consistent with the interviewer's interpretation of societal norms. While training and supervision with a manual of scoring rules helped to improve the consistency between rates of scoring behavior associated with society norms, rating may be inaccurate if the context of an individual's social role is somewhat different from usual roles in British society (2). Such differences from usual roles may be due to choice, unusual social circumstances, cultural, ethnic, religious, or sexuality reasons, or extremes of age. Furthermore, there are some social roles that have not been considered in the SAS but are important to some individuals (e.g., a spiritual role) (26). These limitations may have led to an underestimation of the impact of mood symptoms on social adjustment roles.

There were also problems with the generalizability and interpretation of the findings. The sample consisted mostly of white British patients aged between 20 and 60 years with bipolar I disorder. The results should not be applied to patients with bipolar II disorder, in which subsyndromal mania symptoms can improve some aspects of social performance (4). Cycling mood may have adverse effects on social adjustment (4, 24) but patients currently in rapid cycling states were excluded from the study. Moreover, the participants were all recruited from a large randomized controlled trial of psychological treatment; it is possible but unlikely that such patients may identify with a different set of social norms than non-participants in such a trial, given the similarity of findings to the few previous prospective observational studies of bipolar disorder and social adjustment (4–6). The relationships between mood symptoms and impairments in social adjustment are not necessarily causal or even directly associated. Indeed, exposure to interpersonal friction in families has been shown to lead to more bipolar depressive symptoms (27),

and poor social adjustment is a predictor of later poor symptomatic outcome (28). Ideally, the assessment of social adjustment in an individual would be made blindly to the assessment of mood symptoms and personality because the rating of social adjustment might be biased by diagnostic assessment. There was also no examination of neuropsychological impairment, which can compromise social performance (29, 30), or stigma, which has been associated with reduced social and leisure activities outside the family (31).

Further potential confounds that were considered in the analysis to some extent included the course of illness, as measured by number of previous bipolar episodes in model 2, which was also strongly correlated with duration of illness. The number of bipolar episodes did not significantly attenuate the relationship between social adjustment and depression or manic-type symptoms, possibly because this was mostly a sample of patients with many previous bipolar episodes and a history of psychotic symptoms in some of these bipolar episodes. Some of the instability between social adjustment and depression or manic-type symptoms might have been due to abrupt medication changes or the side-effects of medication, such as akathisia, although only less than 5% of the sample was taking no medication or was on an antidepressant alone. The effects of borderline personality disorder may have been underestimated because a few patients who made suicide attempts in the three months before study entry were excluded. Although the sample was relatively large, it did not have the power to look at the effects of duration of marriage, number of marriages, number of children, and ages of children on social adjustment.

These results confirm that the active treatment of persistent residual bipolar depression or mania-type symptoms may be desirable if there are impairments in performance and interpersonal behavior or interpersonal friction, respectively, provided that such treatment does not involve excessive sedation. Such functional impairment can remain a problem, even 15 years later (32). Further research is required to understand how mood symptoms can lead to impairments in social adjustment domains such as performance, interpersonal behavior, and friction, and their interplay with other biological, psychological, social, and treatment factors.

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Author contributions

All authors approved the final draft of the paper. RM conceptualized and designed the analysis and wrote the first draft of the paper. MY helped to design the analysis and led the analysis of the paper. AC interpreted the data and redrafted the paper. RM, JS, RB, and EP were all grant holders for the study. EP devised the SAS and adapted it for the study. JS, EP, and RB all contributed to the design of the study.

Disclosures

The authors of this paper report no conflicts of interest in connection with this manuscript.

References

1. Weissman MM, Paykel ES. The Depressed Woman. A Study of Social Relationships. Chicago: University of Chicago Press, 1974.
2. Clare AW, Corney RH, Cairns VE. Social adjustment: the design and use of an instrument for social work and social work research. Br J Soc Work 1984; 14: 323–336.
3. American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders, 4th edn. Washington, DC: American Psychiatric Association, 1994.
4. Judd LL, Akiskal HS, Schettler PJ et al. The long-term natural history of the weekly symptomatic status of bipolar I disorder. Arch Gen Psychiatry 2005; 62: 1322–1330.
5. Altshuler LL, Post RM, Black DO et al. Subsyndromal depressive symptoms are associated with functional impairment in patients with bipolar disorder: results of a large, multisite study. J Clin Psychiatry 2006; 67: 1551–1560.
6. Simon G, Bauer MS, Ludman EJ, Operskalski BH, Unutzer J. Mood symptoms, functional impairment, and disability in people with bipolar disorder: specific effects of mania and depression. J Clin Psychiatry 2007; 68: 1237–1245.
7. Judd LL, Akiskal HS, Schettler PJ et al. The long-term natural history of the weekly symptomatic status of bipolar I disorder. Arch Gen Psychiatry 2002; 59: 530–537.
8. Paykel ES, Abbott R, Morriss R, Hayhurst H, Scott J. Sub-syndromal and syndromal symptoms in the longitudinal course of bipolar disorder. Br J Psychiatry 2006; 189: 118–123.
9. Morriss R, Scott J, Paykel E, Bentall R, Hayhurst H, Johnson T. Social adjustment based on reported behaviour in bipolar affective disorder. Bipolar Disord 2007; 9: 53–62.
10. Scott J, Paykel E, Morriss R et al. Cognitive behaviour therapy plus treatment as usual compared to treatment as usual alone for severe and recurrent bipolar disorders: a randomized controlled treatment trial. Br J Psychiatry 2006; 188: 313–320.
11. Scott J, Teasdale JD, Paykel ES et al. Effects of cognitive therapy on psychological symptoms and social functioning in residual depression. Br J Psychiatry 2000; 177: 440–446.
12. First MB, Spitzer RL, Gibbon M, Endicott J. Structured Clinical Interview for DSM-IV Axis 1 Disorders. Washington, DC: American Psychiatric Press, 1997.

13. First MB, Spitzer RL, Gibbon M, Endicott J. Structured Clinical Interview for DSM-IV Axis 2 Disorders. Washington, DC: American Psychiatric Press, 1997.
14. Keller MB, Lavori PW, Friedman B et al. The Longitudinal Interval Follow-up Evaluation: a comprehensive method for assessing outcome in prospective longitudinal studies. Arch Gen Psychiatry 1987; 44: 540–548.
15. Bland JM, Altman DG. Statistical methods for assessing agreement between two methods of clinical measurement. Lancet 1986; i: 307–310.
16. Yang M, Goldstein H, Browne W, Woodhouse G. Multivariate multilevel analyses of examination results. J R Stat Soc 2002; 165: 137–153.
17. Goldstein H. Multilevel Statistical Models, 3rd edn. London: Arnold, 2003.
18. Diggle P, Heagerty P, Liang KY, Zeger SL. Analysis of Longitudinal Data. Oxford: Oxford University Press, 2009.
19. Rasbash J, Browne W, Goldstein H et al. A User's Guide to MLwiN, version 2.1d. Bristol: Centre for Multilevel Modelling, Institute of Education, University of Bristol, 2000.
20. Schaffer A, Cairney J, Veldhuizen S, Kurdyak P, Cheung A, Levitt A. A population-based analysis of distinguishers of bipolar disorder from major depressive disorder. J Affect Disord 2010; 125: 103–110.
21. Skodol AE, Gallaher PE, Oldham JM. Excessive dependency and depression: is the relationship specific? J Nerv Ment Dis 1996; 184: 165–171.
22. Lam D, Donaldson C, Brown Y, Malliaris Y. Burden and marital and sexual satisfaction in the partners of bipolar patients. Bipolar Disord 2005; 7: 431–440.
23. Sheets ES, Miller IW. Predictors of relationship functioning for patients with bipolar disorder and their partners. J Fam Psychol 2010; 24: 371–379.
24. Reed C, Goetz I, Vieta E, Bassi M, Haro JM, EMBLEM Advisory Board. Work impairment in bipolar disorder patients—results from a two-year observational study (EMBLEM). Eur Psychiatry 2010; 25: 338–344.
25. Fan AH, Hassell J. Bipolar disorder and comorbid personality psychopathology: a review of the literature. J Clin Psychiatry 2008; 69: 1794–1803.
26. Michalak EE, Yatham LN, Kolesar S, Lam RW. Bipolar disorder and quality of life: a patient-centered perspective. Qual Life Res 2006; 15: 25–37.
27. Miklowitz DJ, Wisniewski SR, Miyahara S, Otto MW, Sachs GS. Perceived criticism from family members as a predictor of the one-year course of bipolar disorder. Psychiatry Res 2005; 136: 101–111.
28. Nolen WA, Luckenbaugh DA, Altshuler LL et al. Correlates of 1-year prospective outcome in bipolar disorder: results from the Stanley Foundation Bipolar Network. Am J Psychiatry 2004; 161: 1447–1454.
29. Bonin CM, Martinez-Aran A, Torrant C et al. Clinical and neurocognitive predictors of functional outcome in bipolar euthymic patients: a long-term, follow-up study. J Affect Disord 2010; 121: 156–160.
30. Burdick KE, Goldberg JF, Harrow M. Neurocognitive dysfunction and psychosocial outcome in patients with bipolar 1 disorder at 15 year follow-up. Acta Psychiatr Scand 2010; 122: 497–506.
31. Perlick DA, Rosenheck RA, Clarkin JF et al. Impact of family burden and affective response on clinical outcome among patients with bipolar disorder. Psychiatr Serv 2004; 55: 1029–1035.
32. Goldberg JF, Harrow M. A 15-year prospective follow-up of bipolar affective disorders: comparisons with unipolar nonpsychotic depression. Bipolar Disord 2011; 13: 155–163.