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Rydahl, Klara F. K.; Brund, René B. K.; Medici, Clara R.; Straarup, Krista M. N.; Straszek, Sune P. V.; Østergaard, Søren D.

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MS. KLARA F.K. RYDAHL (Orcid ID : 0000-0002-4705-2866)

DR. SØREN D. ØSTERGAARD (Orcid ID : 0000-0002-8032-6208)

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## **Bipolar disorder and regretted behavior in relation to use of social media and online dating**

Klara F. K. Rydahl<sup>1,2</sup>, René B. K. Brund<sup>1,2</sup>, Clara R. Medici<sup>1,2</sup>,  
Krista M. N. Straarup<sup>1</sup>, Sune P. V. Straszek<sup>3,4</sup>, Søren D. Østergaard<sup>1,2</sup>

<sup>1</sup>Department of Affective Disorders, Aarhus University Hospital - Psychiatry, Aarhus, Denmark

<sup>2</sup>Department of Clinical Medicine, Aarhus University, Aarhus, Denmark

<sup>3</sup>Psychiatry, Aalborg University Hospital, Aalborg, Denmark

<sup>4</sup>Department of Clinical Medicine, Aalborg University, Aalborg, Denmark

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**Corresponding author:**

Klara F. K. Rydahl

Department of Affective Disorders

Aarhus University Hospital – Psychiatry

Palle Juul-Jensens Boulevard 175

8200 Aarhus N

Phone: +45 78410000

Email: klaryd@rm.dk

**Abstract**

**Objectives:** Individuals with bipolar disorder are prone to risk-taking behavior that is subsequently regretted. Here, we investigated whether this also occurs in relation to use of social media and online dating.

**Methods:** A questionnaire-based survey focusing on the use of social media and online dating was conducted among individuals attending an outpatient clinic for bipolar disorder, and among individuals attending two general practices in the same region (controls). The association between bipolar disorder and self-reported regretted behavior on social media/online dating sites was investigated using logistic regression with adjustment for age and sex.

**Results:** A total of 124 individuals with bipolar disorder and 196 individuals without affective disorder from the general practices (controls) formed the study sample. Among the individuals

with bipolar disorder who used social media, 66% reported regretted behavior as a consequence of this use, whereas only 31% of the controls reported such behavior. The corresponding numbers for individuals who used online dating were 65% for those with bipolar disorder and 31% for the controls. Following adjustment for age and sex, bipolar disorder was associated with elevated risk of regretted behavior in relation to use of both social media (adjusted odds ratio: 3.6, 95%CI: 2.2;5.9) and online dating (adjusted odds ratio: 4.1, 95%CI: 2.1;8.0).

**Conclusions:** These findings suggest that risk-taking behavior and subsequent regret among individuals with bipolar disorder extends to social media and online dating. Cautious use of these platforms may be particularly relevant for individuals with bipolar disorder.

Keywords

Bipolar Disorder; Social Media; Risk-Taking; Affective Symptoms, Sexual Behavior

## Introduction

Individuals with bipolar disorder are at elevated risk of displaying excessively risk-taking and socially inappropriate behavior (1-4) such as e.g. substance abuse (5-7) buying sprees (1) and risky sexual behavior (5, 6, 8, 9), which is often regretted (10). In addition to feelings of regret, such behavior may have severe negative consequences for interpersonal relations, e.g. marriage, family, friendships and work-relations, and has been suggested to contribute to the significantly lowered quality of life reported by individuals with bipolar disorder (11, 12).

With the rapid development of social media over the past decade, new and very accessible platforms for risk-taking behavior have emerged. Furthermore, the very wide “audience” that can be reached via social media – Facebook currently reports to have approximately 3 billion users



(13) – is problematic in this regard. As a further challenge, online behavior can be virtually impossible to erase (14). For these reasons, sharing of text, images or videos on online platforms may have extremely severe consequences – probably even suicide (15-17).

In a qualitative study from 2017, “oversharing” on social media was mentioned as a potential problem for individuals with bipolar disorder (18), but to our knowledge, there have been no studies with a systematic assessment of regretted behavior on social media among individuals with bipolar disorder. Therefore, we conducted a survey to provide more knowledge on this topic. Due to the hypersexuality occasionally experienced by individuals with bipolar disorder (9, 19), social media of the “online dating” type may be particularly problematic in this context (20, 21).

Therefore, the survey was designed to cover both experiences with social media in general – and online dating specifically. The study had five sequential aims:

- I) To investigate whether bipolar disorder is associated with displaying behavior in relation to use of social media and online dating sites that is subsequently regretted or that others have considered to be transgressive.
- II) To determine whether the type of regretted behavior in relation to use of social media and online dating sites differs between individuals with bipolar disorder and individuals without affective disorder (controls).
- III) To assess whether having bipolar disorder is associated with experiencing negative interpersonal consequences in relation to use of social media and online dating sites.
- IV) To investigate whether subsequently regretted behavior on social media and online dating occurring during hypomanic/manic episodes may have a negative effect on mood, increase the risk of a depressive episode, or lead to negative thoughts during depressive episodes.
- V) To assess how restricted access to online platforms during hospital admission for hypomanic/manic episodes is experienced by individuals with bipolar disorder.

## **Materials and methods**

### **Data source**

The data used in this study stem from a questionnaire-based survey on the use of social media and online dating sites among individuals with affective disorders, which is described in detail elsewhere (22). In brief, we conducted a questionnaire-based survey to obtain data on: I) sociodemographic and psychiatric history, II) use of social media and regret/transgression associated with this use, and III) use of online dating and regret/transgression associated with this use. An English version of the questionnaire is available in Supplementary Material 1. As the questionnaire was filled in using pen and paper, some responses were ambiguous (check between two boxes etc.). In the present analyses, we handled these responses as reported by Rydahl et al. (22). The same was the case for the merging of response categories. Please see a full description in Supplementary Material 2.

The questionnaire was handed out at four study sites: 1) The outpatient unit for bipolar disorder at Aarhus University Hospital – Psychiatry, 2) The outpatient unit for unipolar depression at Aarhus University Hospital – Psychiatry, 3) an urban general practice in the Central Denmark Region and 4) a rural general practice in the Central Denmark Region. The two general practices were chosen to reflect the urban/rural distribution in the catchment area of the outpatient units. For the present study, we focused exclusively on the data collected at the outpatient unit for bipolar disorder and the two general practices (control population of individuals without affective disorder).

### **Population**

A total of 134 patients from the outpatient unit for bipolar disorder and 305 patients from the two general practices (189 from the urban general practice and 116 from the rural general practice) responded to the survey. Respondents were excluded from the analysis if they reported no current/prior use of social media or online dating – as this was an inclusion criterion ( $n=7$ ), or if they had not provided information on age and/or sex, which were crucial variables (potential confounders) for adjustment of the analyses ( $n=33$ ). The definition of bipolar disorder or control status was identical to that employed by Rydahl et al. (22). Specifically, respondents from the outpatient unit for bipolar disorder were considered to have bipolar disorder unless their response

to the questionnaire clearly suggested otherwise – i.e. if they reported never to have experienced a hypomanic/manic/mixed episode and if their response to the questions pertaining to use of social media (questions 26-36) or online dating (questions 49-57) during hypomanic/manic episodes were not consistent with having bipolar disorder. Such respondents (n=1) were excluded from the analyses. The individuals from the two general practices were considered to be controls (without a history of affective disorder) unless they reported to have experienced a hypomanic/manic/mixed episode and/or if their response to the questions pertaining to use of social media (questions 26-36) or online dating (questions 49-57) during hypomanic/manic episodes was clearly indicative of bipolar disorder (n=6 - these six individuals were considered to have bipolar disorder and were included as cases instead of controls), or ii) if they reported to have experienced a depressive episode (and no hypomanic/manic/mixed episode) and/or provided answers consistent with having a history of depression to the questions pertaining to use of social media (questions 22-25) or online dating (questions 47 and 48) during episodes of depression (these individuals (n=78) were excluded from the analyses). Hence, the final study sample consisted of 320 individuals, namely 124 with bipolar disorder (118 from the outpatient unit and six from the general practices) and 196 controls without affective disorder from the general practices.

### **Ethics**

On the front page of the questionnaire, potential participants were informed about the purpose of the study. It was also stated that handing in the questionnaire would be considered as consent for use of the provided data for research purposes. The study was registered with the Danish Data Protection Agency. In Denmark, ethical review board approval is not required for questionnaire-based surveys.

### **Outcomes**

The questions and responses used to define the outcomes required to address the five aims of the study are described below.

Aim I: The investigation of regretted behavior on social media was based on response to the following question: "*Have you ever regretted any of the following actions on social media? (you may tick several boxes)*", where the answer options were: "*Writing private messages*", "*Sending photos privately*", "*Sending videos privately*", "*Posting photos publicly*", "*Posting videos*"

*publicly*", "*Writing public post*" and "*No*". Ticking any box other than "*No*" was considered as a confirmation of regretted behavior on social media (outcome). For the investigation of regretted behavior in relation to use of online dating, the equivalent question/response was: "*Have you ever regretted any of the following actions on online dating sites? (you may tick several boxes)*", where the following boxes could be ticked: "*Writing private messages*", "*Sending photos privately*", "*Sending videos privately*", "*Writing public post*", "*Posting photos publicly*", "*Meeting a person*", "*Having sex*" and "*No*". Ticking any box other than "*No*" was considered as a confirmation of regretted behavior on online dating sites (outcome). Similarly, the investigation of transgressive behavior on social media was based on response to the following question: "*Have your family, friends, or other acquaintances ever told you that they found your behavior on social media inappropriate and/or transgressive?*" For the investigation of transgressive behavior in relation to use of online dating, the corresponding question was as follows: "*Have your family, friends, or other acquaintances ever told you that they found your behavior – in relation to your use of online dating sites/apps – to be inappropriate and/or transgressive?*" For both questions, the answer options were: "*Yes, to a high degree*", "*Yes, to a lesser degree*" and "*No*". Choosing either one of the two affirmative answers was considered as confirmation of transgressive behavior on social media and online dating sites, respectively (two separate outcomes).

Aim II: For the analyses of types of regretted behavior on social media and online dating sites, the individual answer options outlined under Aim I were considered as individual outcomes.

Aim III: The investigation of negative interpersonal consequences of social media use was based on response to the following question: "*Has your use of social media ever had a negative impact on your relations with other people (e.g., family relations, boyfriend/girlfriend, friendships, work life, or similar)?*" For the investigation of negative interpersonal consequences of online dating, the equivalent question was: "*Has your use of online dating apps/sites ever had a negative impact on your relations with other people (e.g., family relations, boyfriend/girlfriend, friendship, work life, or similar)?*" For both questions, the answer options were: "*Yes, to a high degree*", "*Yes, to a lesser degree*" and "*No*". Choosing either one of the two affirmative answers was considered as confirmation of transgressive behavior on social media and online dating sites, respectively (two separate outcomes).

Aim IV: The analyses of the impact of regretted online behavior during hypomanic/manic episodes on subsequent mood were based on response to the following question: *“If you have regretted one or several of the actions above (reference to questions on regretted behavior on social media and online dating sites, respectively, during hypomanic/manic episodes), did it subsequently influence your mood negatively?”* The answer options were: *“Yes, to a high degree”*, *“Yes, to a lesser degree”* and *“No”*. The investigation of the potential impact of regretted online behavior during hypomanic/manic episodes on depressive episodes was based on response to the following questions: *“If you have regretted one or several of the actions above (reference to the relevant questions on regretted behavior on social media and online dating sites, respectively), do you believe that this contributed to the onset of a subsequent depressive phase?”* and *“Have you experienced that your behavior on social media during a manic or hypomanic episode caused negative thoughts in a subsequent depressive phase?”* and *“Have you experienced that your online dating behavior during a manic or hypomanic episode caused negative thoughts in a subsequent depressive phase?”* For these questions, the answer options were: *“Yes”* and *“No”*. For all of these questions, choosing an affirmative answer was considered as confirmation of negative impact of regretted online behavior during hypomanic/manic episodes on subsequent mood/depressive episodes.

Aim V: For the assessment of experiences with restrictions on online access during hospital admission for manic episodes, we relied on response from the fraction of respondents who had been hospitalized during a manic episode and who were users of social media or online dating sites at the time of the admission – and who confirmed that their online access (via phone, computer, tablet) had been restricted during the admission. Specifically, the assessment was based on response to the following questions: *“Did you experience that this limited access to social media had a negative or a positive effect on the course of your illness?”* and *“Did you experience that this limited access to online dating sites had a negative or a positive effect on the course of your illness?”*, respectively. For both questions, the answer options were: *“A very negative effect”*, *“A somewhat negative effect”*, *“No effect”*, *“A somewhat positive effect”* and *“A very positive effect”*. Choosing either one of the two answers indicative of a positive effect was considered as confirmation of a beneficial effect of the restrictions. Furthermore, the same respondents answered the following two questions: *“Do you wish that the staff had limited your access to online dating sites to a lesser or greater extent than was the case?”* and *“Do you wish that the staff had limited*

*your access to social media to a lesser or greater extent than was the case?"* For both questions, the answer options were: *"To a much lesser extent"*, *"To a lesser extent"*, *"No, it was appropriate"* and *"To a greater extent"* and *"To a much greater extent"*. Choosing either one of the two answers indicative of a positive effect or the neutral answer (appropriate) was considered as satisfaction with the restrictions on online access.

### **Statistical analyses**

The study population – stratified on bipolar disorder and control status – was characterized using descriptive statistics. Aims I-III: The association between bipolar disorder and regretted behavior (including specific regretted behaviors), transgressive behavior, interpersonal consequences of behavior on social media/online dating sites was investigated by means of logistic regression adjusted for age and sex. Furthermore, analogue sex- and age-stratified (median split) analyses were performed for aims I and III (underpowered for Aim II). We refrained from further adjustment (using e.g. relationship status, parental status and education level) as this would likely result in overadjustment and underestimation of the strength of the true association between bipolar disorder and the investigated outcomes (23). Aim IV: We reported the proportion of individuals with bipolar disorder confirming that subsequently regretted behavior on social media and online dating occurring during hypomanic/manic episodes had a negative effect on their mood, increased the risk of a depressive episode, or lead to negative thoughts during depressive episodes. Aim V: We reported the proportion of respondents who had their online access (via phone, computer, tablet) restricted and who experienced improvement/were satisfied with these restrictions. For the logistic regression analyses, the threshold for statistical significance was set at  $<0.05$ . Correction for multiple testing was not employed due to the highly interdependent nature of the investigated outcomes. The logistic regression analyses were assessed for appropriate fit by means of the link test developed by Pregibon and influential observations were diagnosed by Pearson's residual, deviance residual and Pregibon's leverage (24). Due to concerns about the robustness of the logistic regressions, a bootstrap with 50 replications were performed as sensitivity analysis.

### **Software**

All analyses were conducted using STATA 16 (StataCorp LP, College Station, TX).

## Results

### Respondents

Table 1 shows the characteristics of the respondents with regard to socio-demographics, self-reported mood over the past three days at the time of completion of the questionnaire (a scale going from extremely lowered (-10), markedly lowered (-5), neutral (0), markedly elevated (+5) to extremely elevated (+10)), history of bipolar disorder, and their use of social media and online dating. The majority of respondents were female (equally distributed between the two groups). The median age was 30 years (interquartile range: 25-39) for the respondents with bipolar disorder and 36 years (interquartile range: 25-53) for the controls. The median self-reported mood score was 0 (interquartile range: -3;-1) for the respondents with bipolar disorder, and 1 (interquartile range: 0;4) for the controls. All respondents except one individual in the control group were current or past users of social media, while 40% of the controls and 68% of the respondents with bipolar disorder were current or past users of online dating.

*Table 1 approximately here*

### Regretted behavior, transgressive behavior and negative interpersonal consequences

Figure 1 shows the prevalence of regretted behavior, transgressive behavior and negative interpersonal consequences of social media (Figure 1A) and online dating (Figure 1B) use for the respondents with bipolar disorder and the controls, respectively. The age- and sex-adjusted odds ratios (AOR) with 95% confidence intervals (95%CI) for the association between bipolar disorder and regretted behavior (Social media: AOR=3.6, 95%CI=2.2;5.9. Online dating: AOR=4.1, 95%CI=2.1;8.0), transgressive behavior (Social media: AOR=5.3, 95% CI=2.5;11.1. Online dating: AOR=5.2, 95%CI=1.7;16.3) and negative interpersonal consequences (Social media: AOR=2.7, 95%CI=1.5;4.6. Online dating: AOR=4.9, 95%CI=2.1;11.5) of social media and online dating use, respectively, are also shown (unadjusted odds ratios are available in Supplementary Table 1 in Supplementary Material 3). All six investigated associations are positive and statistically significant. In other words, bipolar disorder is associated with an elevated risk of experiencing regretted behavior, transgressive behavior and negative interpersonal consequences due to use of both social media and online dating.

*Figure 1 approximately here*

Based upon a suggestion from a reviewer, we included adjustment for the respondents' self-reported mood at the time of the completion of the questionnaire (past three days) in post hoc analyses of the six associations shown in Figure 1A and 1B (in addition to adjustment for age and sex). The results of these analyses were highly consistent with those reported in Figure 1A and 1B and the associations between bipolar disorder and regretted behavior, transgressive behavior and negative interpersonal consequences all remained positive and statistically significant (the adjusted odds ratios are available in Supplementary Table 2 in Supplementary Material 3).

### **Types of regretted behavior**

Figure 2 show the prevalence of different types of regretted behavior on social media (Figure 2A) and online dating sites (Figure 2B) among the fraction of individuals with bipolar disorder and controls reporting regretted behavior on these online platforms. The odds ratios for the association between bipolar disorder and the specific regretted behaviors are also shown. With regard to social media, the positive associations between bipolar disorder and regret of "*Writing private messages*", "*Sending photos privately*" and "*Sending videos privately*" were statistically significant. With regard to online dating, the positive associations between bipolar disorder and regret of "*Writing private messages*" and "*Sending photos privately*" were statistically significant. The association between bipolar disorder and regretting "*Having sex*" in relation to online dating was also positive, but not statistically significant (OR= 2.6, 95%CI: 1.0; 7.1).

*Figure 2 approximately here*

### **Impact of regretted online behavior during hypomanic/manic episodes on subsequent mood**

A total of 82 individuals with bipolar disorder (66% of the respondents with bipolar disorder) confirmed that they had regretted behavior in relation to use of social media occurring during hypomanic/manic episodes. Similarly, a total of 53 individuals with bipolar disorder (43% of the respondents with bipolar disorder) confirmed that they had regretted behavior in relation to use of online dating sites occurring during hypomanic/manic episodes. Figure 3A shows that substantial



proportions of these respondents found the regretted behavior to have a negative impact on their mood and that it increased the risk of a subsequent depressive episode. The respondents with bipolar disorder who had used social media (n=110, 89% of the respondents with bipolar disorder) and online dating sites (n=67, 54% of the respondents with bipolar disorder) during hypomanic/manic episodes were asked to report whether they found that their online behavior during these episodes induced negative thoughts during a subsequent depressive episode. Figure 3B shows that substantial proportions of these respondents reported that this was the case.

*Figure 3 approximately here*

### **Experiences with restricted access to social media and online dating sites during a hospital admission for a manic episode**

A total of 47 respondents with bipolar disorder (38% of the respondents with bipolar disorder) reported to have been admitted for treatment of a manic episode at a time when they were using social media and/or online dating. Among these 47 respondents, 16 (34%) reported that they had experienced restriction of internet access (smartphones and computers access) during an admission, which had limited their access to social media and/or online dating sites. Among these 16 individuals, the vast majority (the exact numbers cannot be reported due to small numbers and hence risk of identification of individuals) reported that the restrictions had a positive impact on their course of illness and that they would prefer either the same level of restrictions or more restrictions during a future admission.

### **Age- and sex stratified analyses**

The results of the sex-stratified analyses of the association between bipolar disorder and regretted behavior, transgressive behavior and negative interpersonal consequences in relation to use of social media and online dating are shown in Table 2. The results for all strata showed the same overall tendency as those from the primary analyses, although some were not statistically significant, possibly due to reduced power. Furthermore, due to a relatively low number of individuals reporting transgressive behavior and/or negative interpersonal consequences in some of the strata, the results of these analyses must be interpreted with extra caution (see Table 2).

*Table 2 approximately here*

### **Test of the fit of the logistic regression analyses**

The results of the link test are suggestive of appropriate fit. Furthermore, the residuals and leverage plots indicated no influential observations.

## Discussion

This study addressed five sequential research questions related to the use of social media and online dating among individuals with bipolar disorder compared to controls without affective disorder. The findings were as follows: I) Bipolar disorder was found to be associated with use of social media and online dating sites that is subsequently regretted and/or that others have considered to be transgressive. II) Among the respondents reporting regretted behavior, those with bipolar disorder were substantially and statistically significantly more likely to attribute it to “*Writing private messages*” (both on social media and online dating sites), “*Sending photos privately*” (both on social media and online dating sites), and “*Sending videos privately*” (only on social media), compared to the controls. III) Bipolar disorder was also found to be strongly associated with experiencing negative interpersonal consequences in relation to use of social media as well as online dating sites. IV) Regretted behavior in relation to use of social media and online dating sites occurring during hypomanic/manic episodes was associated with a perceived negative effect on mood as well as increased risk of a subsequent depressive episode. V) Finally, the majority of those having experienced restrictions in their use of social media and online dating sites during a hospitalization with mania reported that the restrictions had a positive impact on the course of illness, and that they would prefer similar or more extensive restrictions in relation to potential future hospitalizations.

The results of this study are generally in line with the literature on the association between bipolar disorder and transgressive/inappropriate/regretted behavior in relation to “offline” behavior (1-10). To our knowledge, however, the present study is among the very first to show that such behavior extends to the online realm. In addition to regretted online behavior being more common among those with bipolar disorder compared to controls, the nature of the regretted behavior also differed. Specifically, among the respondents reporting regretted behavior, those with bipolar disorder were more likely to attribute it to “*Writing private messages*” and to “*Sending photos/videos privately*”, compared to the controls. Notably, this appears to be among the more “severe” forms of online behaviors in that such communication can often not be erased and may therefore leave permanent traces (14). Furthermore, it seems likely that content shared in private messages is more often of personal character compared to publicly shared content – potentially even of sexual nature,

although this was not investigated specifically. This would be in accordance with the finding of more prevalent regret of having sex in relation to use of online dating among those with bipolar disorder, which is consistent with the impulsive (3, 25) and hypersexual behavior (9, 19) observed among some individuals with bipolar disorder – especially during hypomanic/manic episodes. Relatedly, a large proportion of the respondents reporting regretted behavior in relation to use of social media and online dating sites during hypomanic/manic episodes had the impression that it had a negative impact on their mood and increased the risk of a subsequent depressive episode. Despite the self-reported nature of these results, they underline the negative emotional impact that online behavior during hypomanic/manic episodes may have on the course of bipolar disorder.

The proportion of the respondents with bipolar disorder having experienced restricted access to social media and online dating sites during admissions with mania was relatively small. The vast majority of those reported that the restrictions had a positive impact on their course of illness, and that they would prefer either the same level of restrictions or more extensive restrictions during potential future admissions. This finding offers some support to clinicians in the challenging management of internet/smartphone access during admissions. However, since restrictions to e.g., smartphone access could potentially escalate conflicts that may, in turn, lead to coercion, they should be enforced with caution (26). If agreements regarding online access during potential admissions could be made with patients in advance (when they are euthymic), it would be preferable (27). Relatedly, given the results of this study, it may be beneficial to have a general discussion of the implications of online behavior with individuals that are in treatment for bipolar disorder. Over the past decades, psychoeducation has been demonstrated to be an effective supplement to standard treatment of bipolar disorder (28-30). In light of the results of this study, it could be considered to include guidance on healthy and safe use of social media and online dating in psychoeducation programs for bipolar disorder. It is our impression that such content could readily be integrated. When used wisely and safely, social media networks may empower and support individuals with mental illness (31, 32).

As reported in detail elsewhere (22), there are limitations to this study, which must be taken into consideration. First, as the recruitment of participants was organized by the individual sites in order to fit the local logistics/clinical practices, a selection bias may have been introduced due to the questionnaires being distributed differently at the three study sites providing data for this

analysis. Specifically, at the outpatient unit for bipolar disorder the questionnaires were handed out by the treatment-providers, which they may have done selectively (consciously or subconsciously). At the rural general practice, which has only one practicing doctor, the questionnaire was also handed out to the patients, but more systematically than was the case at the outpatient unit for bipolar disorder. At the urban general practice with several practicing doctors, the questionnaire was available in the waiting room. Taken together, these differences may have led to a bias in the estimation of the strength of the association between bipolar disorder and regretted/transgressive behavior on social media/online dating sites in the present study. Therefore, future studies should aim for a more consistent recruitment strategy across sites. Second, this study is based on self-reported data, which renders it sensitive to the negative cognitive bias that often accompanies depression (33, 34). Specifically, as depression is the predominant mood pole in bipolar disorder (35-37), negative cognitive bias may have led the participants with bipolar disorder to overestimate the negative consequences of their use of social media and online dating, translating into an overestimation of the strength of the association between bipolar disorder and regretted/transgressive behavior on social media/online dating sites in the present study. The post hoc analyses including adjustment for the respondents' self-reported mood at the time of the completion of the questionnaire, did, however, not suggest that such a bias should have a strong impact on the results. Third, we did not include questions focusing on the duration of the perceived negative consequences of regretted/transgressive behavior on social media/online dating sites. If this duration was only brief, the clinical importance may be equally limited. Future studies of this association should therefore aim at collecting more objective and longitudinal data on the influence of the use on social media and online dating. Fourth, we do not have data on the treatment of the participants with bipolar disorder, which would be useful for ascertaining the generalizability of the results. However, in a recent study based on nationwide data from Denmark (38), we showed that patients with bipolar disorder generally receive relevant pharmacological treatment. These findings likely generalize to the participants with bipolar disorder in the present study. Fifth, we do also not have data on comorbidities of bipolar disorder such as sleep disorder, substance use, attention-deficit/hyperactivity disorder, anxiety disorders, and posttraumatic stress disorder that may also impact the use of social media and online dating. Sixth, with regard to the generalizability of the findings of this study, we have no reason to believe that the reported associations should be particular to Denmark. Relatedly, the use of social media in Denmark seems comparable to that observed in other western countries (39).

In conclusion, the results of this study suggest that offline risk-taking behavior and subsequent regret among individuals with bipolar disorder extend to the online realm, and may have substantial negative clinical (worsening of illness) and interpersonal consequences. Therefore, cautious use of these platforms seems particularly prudent for individuals with bipolar disorder. From a clinical perspective, it may be warranted to include information on potential consequences of social media- and online dating use in the psychoeducation provided as part of the treatment of bipolar disorder.

### **Data availability statement**

As the data used for this study can be linked to individual participants (patients), it cannot be shared.

### **Author contributions**

All authors contributed to the design of the study. Ms. Rydahl and Dr. Brund conducted the analyses. The manuscript was drafted by Ms. Rydahl and Dr. Østergaard, and was critically revised for important intellectual content by the remaining authors. The final version of the manuscript was approved by all authors prior to submission. Ms. Rydahl and Dr. Brund had full access to all of the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

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### **Statement of interest**

Dr. Straszek has received fees for speaking and for contribution to educational material from Lundbeck A/S. Dr. Østergaard has received the 2020 Lundbeck Foundation Young Investigator Prize. Furthermore, SDØ owns units of mutual funds with stock tickers DKIGI and WEKAFKI, as well as units of exchange traded funds with stock tickers TRET, 2B76, EXH2, QDVE, QDVH, USPY and BATE. The remaining authors declare no conflicts of interest.

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**Table 1.** Demographic, clinical and social media/online dating characteristics of the sample

	<b>Bipolar disorder</b>	<b>Controls</b>
	<b>n= 124</b>	<b>n=196</b>
<b>Female sex, n (%)</b>		
	98 (79)	140 (71)
<b>Age, median, (Q: 25%;75%)</b>		
	30 (25;40)	36 (25;53)
<b>Place of Birth, n (%)</b>		
Denmark	115 (93)	187 (95)
Outside Denmark	9 (7)	9 (5)
<b>Marital Status, n (%)</b>		
Single	50 (40)	33 (17)
Partner, lives alone	22 (18)	18 (9)
Living with a partner	30 (24)	54 (28)
Married	18 (15)	80 (41)
Divorced/separated	4 (3)	11 (6)
<b>Children, n (%)</b>		
Yes	44 (35)	110 (56)
No	80 (65)	86 (44)
<b>Highest achieved education level, n (%)</b>		
Primary & secondary school	15 (12)	13 (7)
Upper Secondary School	41 (33)	42 (21)
Vocational Education	6 (5)	17 (9)
Short-cycle higher education	9 (7)	27 (14)
Medium-cycle higher education	36 (29)	52 (27)
Long-cycle higher education	17 (14)	45 (23)
<b>Average mood past three days, median, (Q: 25%;75%)</b>		
	0 (-3;-1)	1 (0;4)

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**Age at onset of depression, n (%)**

< 18 years old	44 (37)
18-24 years old	46 (38)
25-34 years old	16 (13)
≥35 years old	14 (12)
Respondents, n	120

**Number of depressive episodes, n (%)**

1 episode	14 (12)
2-5 episodes	57 (48)
6-10 episodes	22 (18)
≥ 11 episodes	26 (22)
Respondents, n	119

**Age at onset of hypomanic/ manic episodes, n (%)**

< 18 years old	5 (5)
18-24 years old	50 (46)
25-34 years old	30 (28)
≥35 years old	24 (22)
Respondents, n	109

**Number of manic episodes, n (%)**

1 episode	31 (29)
2-5 episodes	44 (41)
6-10 episodes	14 (13)
≥ 11 episodes	19 (18)
Respondents, n	108

**Age at onset of mixed episodes, n (%)**

< 18 years old	5 (5)
18-24 years old	45 (47)
25-34 years old	24 (25)
≥/ >35 years old	22 (23)
Respondents, n	96

**Number of mixed episodes, n (%)**

1 episode	24 (26)
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2-5 episodes	33 (35)	
6-10 episodes	9 (10)	
≥ 11 episodes	27 (29)	
Respondents, n	93	
<b>Social media users, n (%)</b>		
Social media user (current or prior use)	124 (100)	195 (99) <sup>a</sup>
Respondents, n	124	195
<b>Time spent on social media, median, (Q: 25%;75%)</b>		
Minutes per day	90 (60;180)	68 (45;120)
Respondents, n	122	191
<b>Social media account created, n (%)</b>		
0-5 years ago	7 (6)	34 (17)
6-8 years ago	27 (22)	53 (27)
≥ 9 years ago	90 (73)	108 (55)
Respondents, n	124	195
<b>Online dating users, n (%)</b>		
Online dating user (current or prior use)	84 (68)	79 (40)
Respondents, n	120	194
<b>Time spent on online dating, median, (Q: 25%;75%)</b>		
Minutes per day	60 (29;120)	30 (20;60)
Respondents, n	78	77
<b>Online dating account created, n (%)</b>		
< 1 year ago	6 (7)	4 (5)
1-2 years ago	15 (18)	11 (14)
3-5 years ago	27 (33)	33 (42)
6-8 years ago	16 (19)	12 (15)
≥ 9 years ago	19 (23)	19 (24)
Respondents, n	83	79

**Table 2.** The association between bipolar disorder and regretted behavior, transgressive behavior and negative interpersonal consequences due to use of social media and online dating, stratified on sex and age (median split).

	Social media		Online dating	
	OR	95% CI	OR	95% CI
<b>Regretted behavior</b>				
Women (adjusted for age)	<b>3.5</b>	(2.0;6.3)	Women (adjusted for age)	<b>4.6</b> (2.1;10.1)
Men (adjusted for age)	<b>3.9</b>	(1.4;11.2)	Men (adjusted for age)	<b>8.9</b> (1.6;49.6)
Age ≤32 years (adjusted for sex)	<b>2.6</b>	(2.2;5.9)	Age ≤29 years (adjusted for sex)	<b>4.0</b> (1.5;10.2)
Age >32 years (adjusted for sex)	<b>6.9</b>	(3.2;14.7)	Age >29 years (adjusted for sex)	<b>7.3</b> (2.5;21.7)
<b>Transgressive behavior</b>				
Women (adjusted for age)	<b>5.9</b>	(2.4;14.5)	Women (adjusted for age)	<b>18.3*</b> (2.3;147.6)
Men (adjusted for age)	<b>5.1*</b>	(1.2;20.7)	Men (adjusted for age)	1.3* (0.2;7.9)
Age ≤32 years (adjusted for sex)	<b>3.7</b>	(1.5;9.2)	Age ≤29 years (adjusted for sex)	5.1* (0.9;28.1)!
Age >32 years (adjusted for sex)	<b>13.1*</b>	(3.5;49.0)	Age >29 years (adjusted for sex)	<b>5.6*</b> (1.1;28.2)
<b>Negative interpersonal consequenc</b>				

Women (adjusted for age)	<b>2.2</b>	(1.2;4.2)	Women (adjusted for age)	<b>11.3</b>	(3.1;42.1)
Men (adjusted for age)	<b>5.5</b>	(1.7;17.5)	Men (adjusted for age)	1.5	(0.4;5.8)
Age $\leq$ 32 years (adjusted for sex)	1.9	(0.9;3.9)	Age $\leq$ 29 years (adjusted for sex)	<b>8.9*</b>	(2.2;36.0)!
Age >32 years (adjusted for sex)	<b>5.4</b>	(2.3;13.1)	Age >29 years (adjusted for sex)	<b>3.5*</b>	(1.2;11.0)

*Statistically significant odds ratios are in bold text.*

*\*Less than 5 cases in the control group.*

*!Increases the confidence intervals dramatically using the bootstrap resampling.*

Figure 1. Consequences of using social media and online dating sites

Figure 1.A. Use of social media

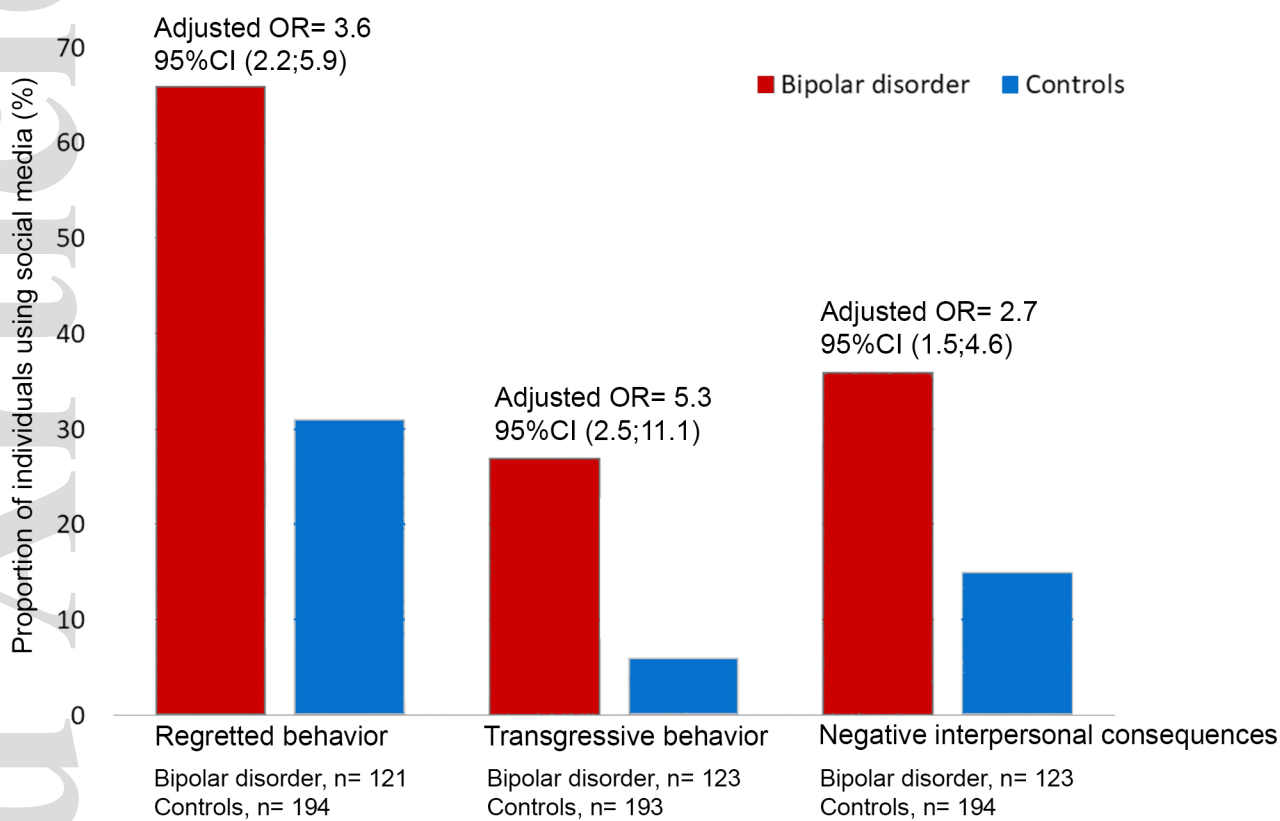
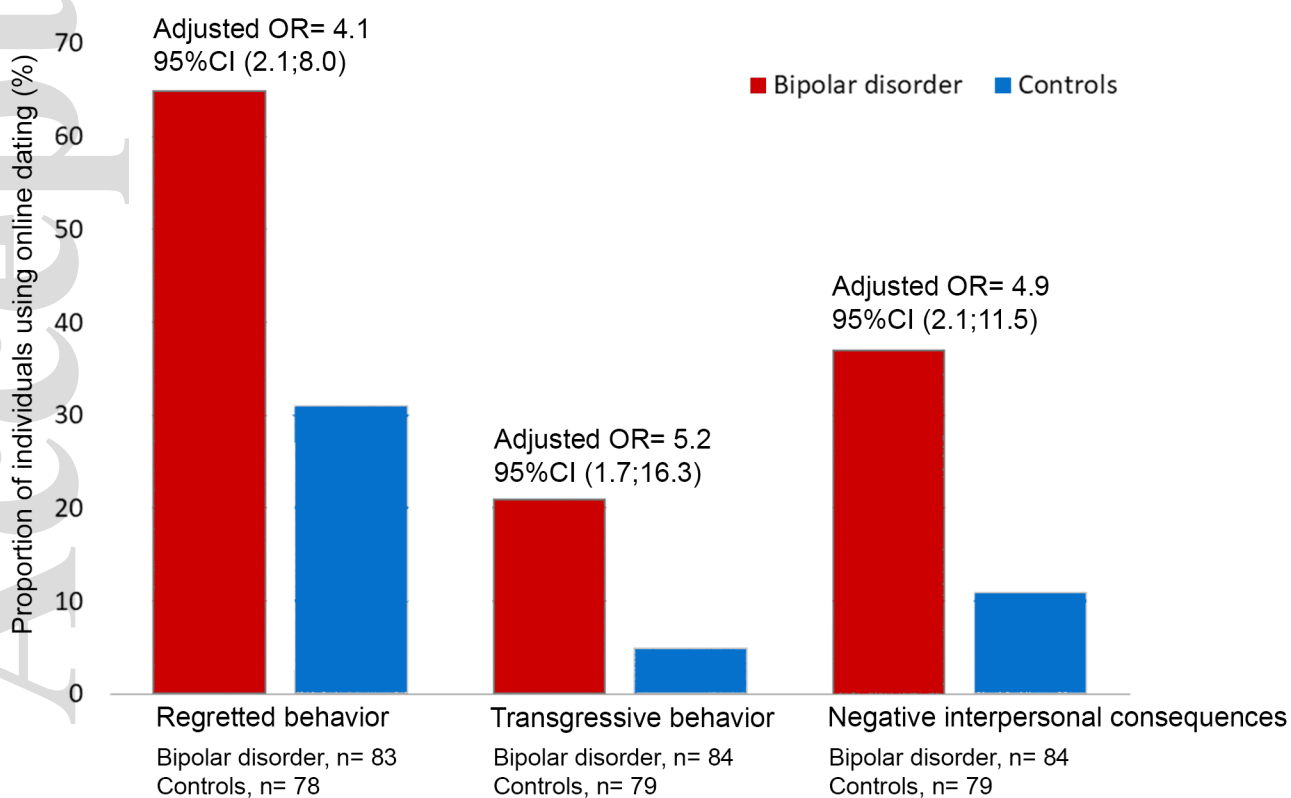


Figure 1.B Use of online dating sites



Odds ratios (OR) are adjusted for age and sex.



Figure 2. Types of regretted behavior on social media and online dating sites

Figure 2.A. Regretted behavior on social media (n=139)

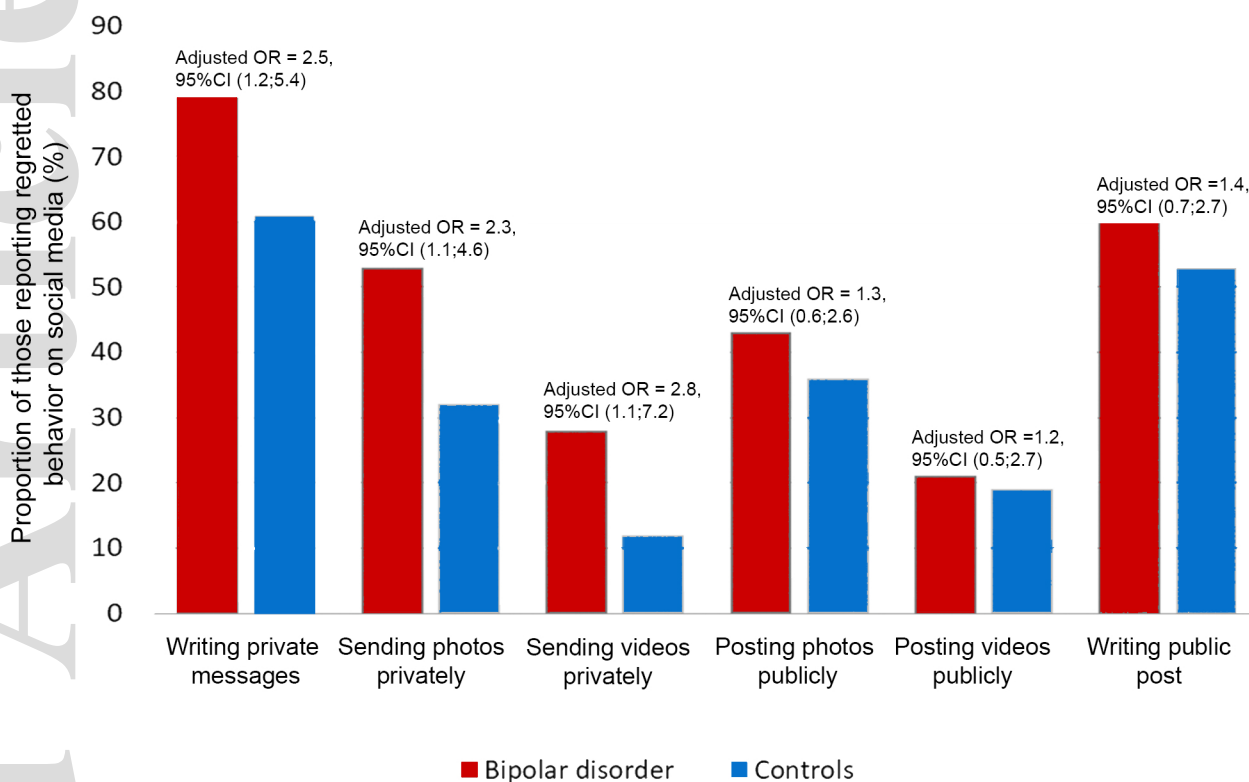
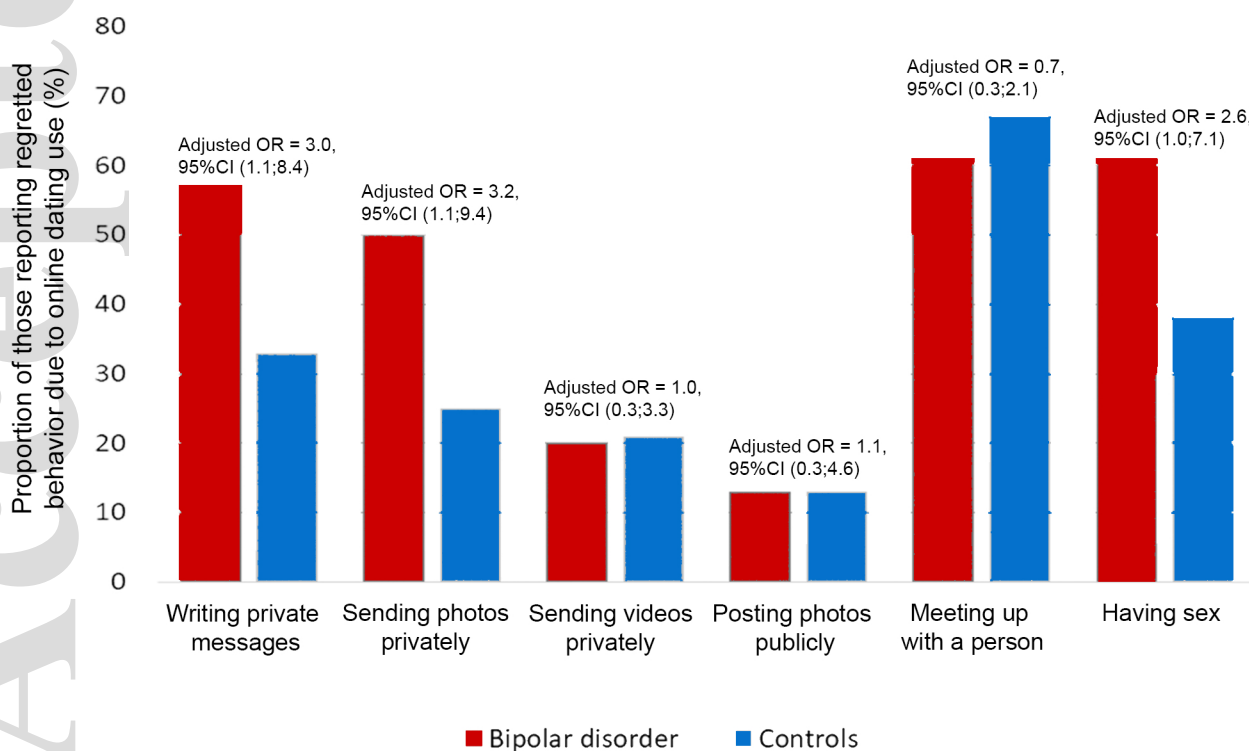


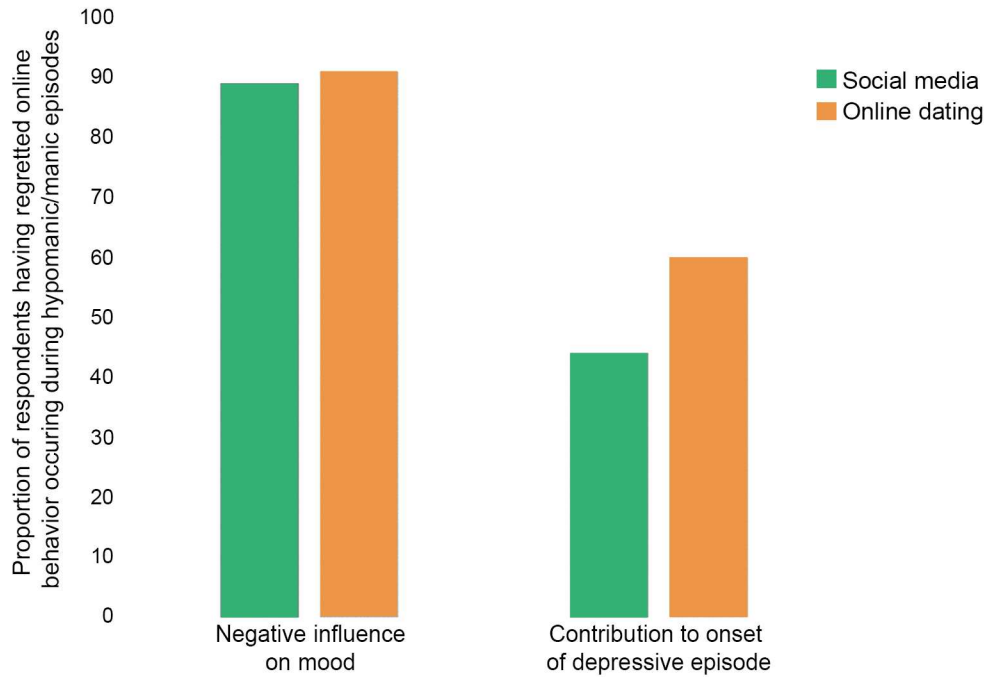
Figure 2.B. Regretted behavior on online dating sites (n=78)



Odds ratios (OR) are adjusted for age and sex.

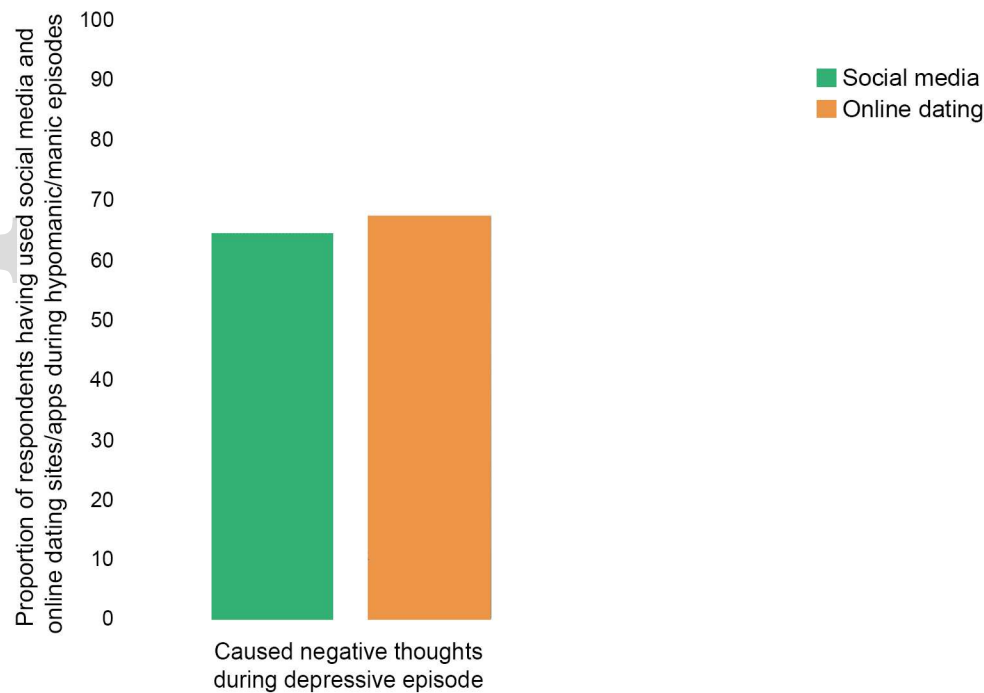
# Figure 3. Impact of online behavior during hypomanic/manic episodes on mood state and depressive episodes among individuals with bipolar disorder

Figure 3.A. Impact of regretted behavior on social media and online dating sites during hypomanic/manic episodes on subsequent mood.



*The number of respondents with bipolar disorder having regretted behavior on social media and/or online dating sites occurring during hypomanic/manic episodes (the denominator in the calculation of the proportions displayed in the figure) is 82 and 53, respectively*

Figure 3.B. Impact of using social media and online dating sites during hypomanic/manic episodes on subsequent depressive episodes.



*The number of respondents with bipolar disorder having used social media and/or online dating during hypomanic/manic episodes (the denominator in the calculation of the proportions displayed in the figure) is 116 and 67, respectively*