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Giving and receiving social support in online substance use disorder forums: How self-efficacy moderates effects on relapse

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ABSTRACT

Objective: Individuals in recovery for substance use disorders (SUDs) increasingly use online social support forums, necessitating research on how communicating through these forums can affect recovery. This study examines how giving and receiving support within an SUDs recovery forum predict substance use, and considers whether effects vary according to participants' self-efficacy.
Methods: We applied content analysis to 3440 messages that were posted by 231 participants in an online SUDs forum. Surveys assessed social support reception and substance use at three timepoints. We assessed relationships between giving and receiving support and substance use (risky drinking days, illicit drug use days), and the interactions between self-efficacy and social support in predicting substance use outcomes.
Results: Receiving more emotional support was associated with reduced illicit drug use at 6 and 12 months. For those with low self-efficacy, giving more emotional support predicted less risky drinking at month 12, whereas giving more informational support predicted more risky drinking at month 12.
Conclusion: These results suggest conditional benefits of exchanging support in an online SUDs forum, depending upon type of support (informational versus emotional), the participants' role (giver or receiver), and their self-efficacy.
Practice implications: We discuss implications for designing and using peer-to-peer support platforms.
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1. Introduction

Substance use disorders (SUDs) affect millions of people, precipitating substantial distress and potential consequences such as conflict, reduced productivity, injury, health complications, and early death [1,2]. SUDs represent a complex and chronic challenge, with cessation often followed by resumption of problematic substance use [3,4]. Scholars have proposed those in recovery benefit from emotional support — to address feelings like loneliness and frustration — and from informational support — to bolster coping skills and resolve stressors [5–7].

Through advances in technology, a range of online and mobile interventions have emerged to facilitate ongoing recovery support [8]. These interventions can reinforce coping skills, provide resources to prevent or respond to relapse, and connect individuals with supportive peers [8]. One study estimated at least 10 % of American adults with SUDs turned to online resources to support recovery [9], but few digital SUDs interventions to date have been assessed for clinical efficacy [10–12]. One exception is the Addiction-Comprehensive Health Enhancement Support System (A–CHESS), a smartphone-based intervention. In a randomized clinical trial, A–CHESS reduced risky drinking by nearly half among those with alcohol use disorder [13].A–CHESS offers individuals in recovery access to informational content, recovery tools, and ongoing contact with a peer group via an asynchronous text-based forum. Since interventions like A–CHESS produce a digital record, they also offer opportunities to investigate how specific patterns of peer-to-peer communication may support recovery.

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In this study, we examine the role of social support in recovery among users of the A–CHESS system. While social support has been indicated as broadly helpful in recovery, it remains unclear how emotional and informational forms of support contribute. Furthermore, research typically focuses on benefits of receiving support, but individuals in recovery also routinely act as support providers. Prior work suggests that helping others can have benefits in peer-to-peer contexts [14,15].

It is also unclear how effects of exchanging social support are influenced by individuals' self-efficacy. Self-efficacy has been a reliable psychological contributor to initiating and maintaining behavior change [16,17], including in SUDs [18]. Yet prior findings are inconsistent regarding relative benefits of receiving social support for those with higher versus lower self-efficacy [19,20]. As far as giving support, it is possible that individuals with lower self-efficacy might feel burdened or conflicted by helping others while managing their own recovery [21].

This study combines survey data and content analysis of messages exchanged within an online SUDs support forum, to examine substance use outcomes associated with receiving and giving emotional and informational support. We assess self-efficacy as a potential moderator of these effects.

1.1. SUDs and social support

SUDs often precipitate isolation and loneliness [22]. These issues may escalate when individuals increase substance use. SUDs interventions can break this cycle by bolstering positive relationships between peers [23–26], as occurs through Alcoholics Anonymous and Narcotics Anonymous [27], as well as in recovery centers, behavioral health agencies, and other social services [28,29]. Benefits of peer support include availability of peers compared to professional providers and shared experience that may increase rapport and allow for especially relevant informational support [30,31].

With advances in Internet connectivity and smartphones, opportunities for peer support in SUDs have expanded [32,33]. Smartphone adoption extends across demographic and social groups [34], including those with SUDs [35,36]. Members of mutual help programs now use smartphones to maintain relationships outside of in-person meetings via voice calls and texting [37]. Peer-to-peer support can also be accessed via online support groups [38,39].

Social support can take various forms, including informational, emotional, tangible, esteem, and social integration support [40], with informational and emotional support being frequently offered in support group contexts [41–43]. Evidence suggests benefits of receiving both emotional and informational support. Emotional support (conveying empathy, caring, or concern) helps manage emotional states, and receiving it can play an important role in health, compensating for uncertainty, distress, and stigma [15,44–46]. Prior work has also found that receiving emotional support predicts abstinence among cocaine-abusing patients [7] and reduced needle sharing among drug-injecting patients [47]. Receiving emotional support in an in-person support group for women with alcohol use disorder also led participants to feel inspired, valued, and listened to [46].

Informational support includes suggestions or perspectives to guide day-to-day recovery activities [46]. Given the complexity of SUD recovery (e.g., changing routines, managing cravings, seeking medical care), informational support can play an important role [5,38]. Yet, some research suggests it has a narrower realm of usefulness, appealing particularly to those with a rational thinking style [48]. In addition, informational support may not be useful in relation to uncontrollable stressors [49] or when support is too "directive" [50]. Thus, while informational support has shown value, it may be unsuitable in some conditions.

Providing support to others may also bring benefits. Research suggests that altruism can aid in the healing process, possibly because individuals want to feel needed [51–53]. Providing emotional support may also help providers feel more energized and efficacious [15,54,55]. Giving informational support may facilitate self-reflection and reappraisal of one's own problems [56]. Giving support can also contribute to the strength of a support network that one turns to in times of need [57]. In recovery, giving support may also decrease self-absorption and self-pity [58]. In SUDs, those who help others during recovery show reduced relapse risk relative to non-helpers [58–61].

Yet giving support does not always benefit helpers. One issue is burnout, where the demands of giving support lead to exhaustion, reduced feelings of personal capability, declining concern for support recipients, and declines in future helping behavior [62,63]. Providing support may also be burdensome, limiting resources for facing one's own challenges. Thus, caregiving burden may be problematic for those who have serious stressors or less developed skills for managing them.

1.2. Self-efficacy and social support in SUDs

Self-efficacy refers to the belief that one can carry out behaviors necessary to achieve a desired outcome [64,65]. Research shows that self-efficacy influences how people feel, think, and behave, and it is one of the strongest predictors of health behavior change [66,67]. It is also important to recognize that self-efficacy is multifaceted and domain specific [64]. In a SUDs context, self-efficacy refers to confidence that one can successfully avoid relapse [68,69]. Given that those with high self-efficacy toward recovery are more likely to expend the needed effort to succeed, a positive association has been found between self-efficacy and recovery outcomes, including abstinence among smokers [70] and reduction of alcohol and illicit drug use [18,71–73].

Effects of receiving social support can vary depending upon individuals' self-efficacy. In one study, those with low self-efficacy benefited more from support, perhaps since they need more encouragement and information [74]. Similarly, when patients with low self-efficacy had support from counselors in the form of a strong therapeutic alliance, they had abstinence rates comparable to those with high self-efficacy [19]. This is consistent with research showing that those with low self-efficacy may be more susceptible to external influences [66]. Yet, not all research supports greater effects of social support among those with low self-efficacy. In fact, those with high self-efficacy sometimes benefit greatly from social support reception [75], perhaps because they are more open to support and better equipped to make use of it. Those with low self-efficacy may view social support through a pessimistic lens as a signal of their inadequacy [20].

Limited research has addressed the moderating role of self-efficacy in support giving. For those with low self-efficacy, the benefits of supporting others (e.g., connectedness, self-reflection) might build confidence and lead to greater investment in recovery, if giving support is not too taxing. However, those who are more confident may be better able to manage the burden of helping or find applications of the help they give to their own recovery.

1.3. Hypotheses

Our first hypotheses concern benefits of receiving social support (emotional and informational). Emotional support has been shown to enhance well-being and connections to others, reduce distress, and improve physical health. Other studies suggest benefits from receiving informational support, including through adopting new perspectives and solutions. However, insights mainly come from face-to-face contexts. In this study, we expect

positive effects of receiving both emotional and informational support:

Receiving more emotional support (H1a) and informational support (H1b) in an online SUDs support group will be negatively associated with substance use.

Our second set of hypotheses addresses the benefits of giving social support (emotional and informational). Fewer studies have assessed the effects of giving support, but these have largely shown positive effects on coping strategies and emotional well-being [15,55]. We have outlined mechanisms by which providing information could also benefit support givers in their recovery. Therefore, we propose:

Giving more emotional support (H2a) and informational support (H2b) through online SUDs support groups will be negatively associated with substance use.

Prior literature is mixed regarding the role of self-efficacy in conditioning the effect of receiving and giving social support. We therefore formulate research questions about how self-efficacy might moderate these effects:

RQ1: What role does self-efficacy play in moderating the relationship between receiving social support and substance use, including emotional (1a) and informational support (1b)?

RQ2: What role does self-efficacy play in moderating the relationship between giving social support and substance use, including emotional (2a) and informational support (2b)?

2. Methods

2.1. Study context

Data come from a smartphone-based relapse prevention system (A–CHESS) designed to help individuals manage SUDs [76]. A–CHESS offers interactive coping skills training, tools for addressing high-risk situations, links to recovery resources (e.g., 12-step meetings) and access to peer support via a text-based discussion forum. Results from a trial of the system reported elsewhere show that participants who received the system reduced their risky drinking and illicit drug use over six months [77].

The present study draws from an implementation trial, in which participants were enrolled via their primary care provider. The research team retained a record of each participant's username, and an associated numeric identifier. All uses of the study app were logged alongside the study identifier, as were all completed survey measures. To conduct our analyses, we used the study identifier to merge the messages exchanged within the discussion forums, system use logs, and survey data.

2.2. Participants

Three federally qualified health centers enrolled patients ($\geq$18 years) with SUDs diagnoses, absent severe psychotic disorders or current acute medical problems requiring inpatient treatment, who provided informed consent in English. A provider helped each participant to download the study app and to set up an account, associated with a unique study identifier. This study focused on 231 participants who posted messages during their 12 months of access to the system, with 189 (83 %) of these participants completing a six-month survey and 135 (59 %) completing a 12-month survey to assess substance use outcomes.

2.3. Content coding

Support reception was self-reported on surveys; support giving was not. To understand the extent of support giving, we applied a content codebook to messages posted by each participant. The 231 patients generated 14,393 messages during their 12 months on study. For those posting under 24 messages, we coded all of them. For those posting more, we randomly sampled 23. In total, this resulted in 3440 messages (nearly 24 % of the total) coded for presence of social support.

All replies to the initial message in a thread were coded for whether they offered social support and, if so, the type(s) offered: emotional and/or informational (see below). If both were offered in the same message, both codes were applied. In an overlapping sample of 500 messages, intercoder reliability estimates between two trained coders were deemed acceptable [78], with a Cohen's Kappa of 0.73 for emotional support and 0.78 for informational support.

2.3.1. Emotional support

Emotional support refers to messages that lead the recipient to believe he or she is understood, admired, respected, loved, and/or that others are available to provide caring and security. For example: "I want the best for you!"

2.3.2. Informational support

Informational support refers to information, knowledge, and/or advice to help the recipient understand the world and adjust to changes within it. For example: "Exercise helps for anxiety."

2.4. Person-level support giving

Like prior studies [55], we generated person-level data from the coded messages by 1) summing, for each participant, the number of messages of each type (informational or emotional), and 2) dividing by the total number of coded messages for that individual. For instance, if 23 messages were sampled for a participant, and 15 exhibited emotional support, emotional support giving would be 15/23. While some prior work has simply counted the number of messages falling in a content category [79], we used percentage of total messages to capture the rate at which an individual focused on support-giving [55,80]. The mean rate at which messages conveyed emotional support was *0.343 (SD = .246)* in the first six months, and *0.291 (SD = .211)* over twelve months. The mean rate of conveying informational support was *0.196 (SD = .206*) in the first six months, and *0.199 (SD = .203)* over twelve months.

2.5. Action log data

Each study participant had a unique login allowing the research team to automatically collect application usage data in server log files for later analysis. For each user, we summed their total hours spent on system use from pretest to six months *(M = 9.899;SD = 13.267)* and from pretest to 12 months *(M = 15.281;SD = 34.352)*.

2.6. Survey data

Content-coded messages were combined with multi-wave survey data from baseline (in person), and follow-ups at six months and 12 months (by phone).

2.6.1. Social support reception

For emotional support reception, participants responded on a 5-point Likert scale (1=Never, 5=Nearly always) to the following: "I've been getting emotional support from others dealing with substance abuse" (*M = 3.77, SD = 1.298* at six months; *M = 3.7, SD = 1.434* at 12 months). For informational support reception, participants responded on the same 5-point Likert scale to the following: "I can get information from others dealing with substance abuse" (*M = 4.14, SD = 1.125* at six months; *M = 4.16, SD = 1.289* at 12 months).

2.6.2. Self-efficacy

Self-efficacy was measured by asking participants to respond, on a 10-point scale (1=not at all confident, 10=extremely confident), to the following: "How confident are you that you will be completely abstinent in one year?" (*M = 7.39, SD = 2.394* at pretest; *M = 7.81, SD = 2.405* at six months; *M = 7.71, SD = 2.302* at 12 months).

2.6.3. Risky drinking days

The study defined risky drinking days as days when participants drank to excess. Participants reported their number of risky drinking days in the previous 30 days (*M = 3.76, SD = 5.78* at pretest; *M = 2.84, SD = 1.89* at six months; *M = 3.37, SD = 7.94* at 12 months).

2.6.4. Drug use days

Drug use days were measured by asking participants to report the number of days that they used illegal/street drugs (e.g., cocaine, heroin) or abused prescription medications in the previous 30 days (*M = 3.02, SD = 7.378* at pretest; *M = 2.41, SD = 6.55* at six months; *M = 1.20, SD = 4.63* at 12 months).

2.7. Analysis

To test our hypotheses and research questions, we performed hierarchical Ordinary Least Square (OLS) regression analyses. Demographic variables and substance use at pretest were entered in the first block, followed by a second block with time spent in A–CHESS, and a third block with self-efficacy at pretest. The fourth block included social support exchange. Finally, four interaction terms were entered to test if recovery self-efficacy moderated effects of giving and receiving social support. All interaction terms were constructed by multiplying standardized values of the main effect variables[2] [81]. Since substance use outcomes (risky drinking and illicit drug use days) were right skewed, we used square root transformation to approximate the normal distribution [82].

3. Results

3.1. User profile

Of the 231 participants who posted messages over the course of a year, 53 % were male, and 66 % were white or Caucasian. The mean age was 42 years (*SD = 10.69*). For education, 3.5 % never attended high school; 47.6 % had some high school or a high school diploma; 49.0 % completed some college or higher.

3.2. Main effects

H1a and H1b predicted that receiving emotional and informational support would predict less substance use. H1a was partially supported: receiving emotional support was significantly associated with reduced drug use at six months (β=-0.250, $p < .01$) and 12 months (β=-.307, $p < .01$) (Table 2) but unassociated with risky drinking. H1b was not supported: receiving informational support was unrelated to risky drinking or drug use at either timepoint.

H2a and H2b predicted that giving emotional and informational support would predict less substance use. These hypotheses were not supported; giving emotional and informational support did not have effects on alcohol and drug use at either timepoint (Table 1).

[2] To address possible multicollinearity between out multiple interaction terms, we also tested versions of the same model where we added each interaction term separately. The results were substantively the same, except one more sig result that supports our hypothesis.

3.3. Self-efficacy as a moderator

RQ1 and RQ2 investigated the role of self-efficacy in the relationship between substance use and support reception and expression, respectively (Table 2). For RQ1, self-efficacy did not moderate the relationship between support reception and substance use outcomes at either timepoint.

As regards RQ2, we found significant interaction effects between self-efficacy and both informational and emotional support provision in predicting risky drinking days at 12 months (self-efficacy * informational support provision: β=-0.239, $p < .01$; self-efficacy * emotional support provision: $\beta = .174$, $p < .05$; see Table 1). Greater informational support provision was negatively associated with risky drinking for those with higher self-efficacy, but positively associated with risky drinking for those with lower self-efficacy (Fig. 1). Post hoc tests (Tukey HSD) found those with lower self-efficacy had significantly more risky drinking days at 12 months than those with higher self-efficacy when providing higher levels of informational support. Conversely, those with lower self-efficacy showed reduced risky drinking when providing more emotional support (Fig. 2). Post hoc tests found that risky drinking days at 12 months were significantly higher among those with low self-efficacy who provided less emotional support relative to the three other groups.

4. Discussion and conclusion

4.1. Discussion

This study investigated effects of online social support exchange patterns on SUDs recovery outcomes, and explored the moderating role of self-efficacy. Receiving more emotional support was associated with reduced drug use both at six and 12 months. On the other hand, giving social support did not have main effects on substance use; instead, effects of giving support on risky drinking were contingent on helpers' self-efficacy. Those who had higher self-efficacy reduced their risky drinking when they provided informational help, whereas those who had lower self-efficacy reduced their risky drinking when they provided emotional support.

4.1.1. Support reception

Our findings related to receiving emotional support are consistent with prior work. Receiving emotional support is important in recovery since individuals must continuously cope with triggers, stress, and negative emotional states [83–85]. Receiving emotional support may buffer those with SUDs from effects of these stressors and compensate for feelings of isolation [86]. Studies in face-to-face treatment also found that higher levels of emotional support reception were associated with abstinence from drugs and alcohol [7,47,87]. However, this study only replicated these beneficial effects of receiving emotional support in reducing drug use; support reception was not related to risky drinking.

Our results did not find effects of receiving informational support, which may be consistent with work showing that such support may have a relatively narrow realm within which it is helpful [48–50]. In a SUDs context, past work also shows less gratitude expression after receiving informational relative to emotional support [88]. Participants in recovery groups may primarily be dealing with feelings of loneliness and uncertainty — issues that might not be optimally addressed by information [40]. In addition, compared to the need for emotional support, the need for informational support may be short-term and fulfilled in a single interaction [89].

Table 1
Hierarchical Regression Analysis Assessing Effects of Social Support, Self-efficacy, and their Interaction, on Risky Drinking Days at 6 Months and 12 months.

	Pretest-6 m (n = 180)				Pretest-12 m (n = 132)		
	B	SE	β		B	SE	β
Demographic characteristics & substance use (pretest)				**Demographic characteristics & substance use (pretest)**			
Age	−.005	.005	−.068	Age	.006	.006	.074
Gender (Male = 1)	.049	.111	.033	Gender (Male = 1)	.009	.124	.006
Education	.042	.041	.077	Education	.011	.046	.018
Race (White = 1)	−.104	.118	−.066	Race (White = 1)	.023	.134	.014
Risky drinking days	.042	.014	.226***	Risky drinking days	.126	.019	.520***
R^2 Δ	.070*			R^2 Δ	0.274***		
System use (6 m)				**System use (12 m)**			
Time spent	.002	.004	.037	Time spent	−.001	.001	−.062
R^2 Δ	.001*			R^2 Δ	0.004***		
Self-efficacy (SE) (6 m)				**Self-efficacy (SE) (12 m)**			
Self-efficacy (SE)	−.083	.025	−.246***	Self-efficacy (SE)	−.056	.026	−.168**
R^2 Δ	.057***			R^2 Δ	0.026***		
Social support exchange (6 m)				**Social support exchange (12 m)**			
Receiving emotional support	−.031	.051	−.054	Receiving emotional support	−.051	.050	−.092
Receiving informational support	.013	.058	.020	Receiving informational support	.051	.055	.083
Providing emotional support	−.277	.287	−.077	Providing emotional support	−.095	.321	−.024
Providing informational support	−.322	.303	−.085	Providing informational support	.350	.344	.082
R^2 Δ	.019**			R^2 Δ	0.013***		
Interactions (6 m)				**Interactions (12 m)**			
Providing emotional support*SE	.100	.058	.139	Providing emotional support*SE	.146	.073	.174*
Providing informational support *SE	.041	.070	.047	Providing informational support *SE	−.250	.091	−.239**
Receiving emotional support*SE	−.049	.067	−.068	Receiving emotional support*SE	−.066	.059	−.098
Receiving informational support*SE	.049	.056	.083	Receiving informational support*SE	−.030	.062	−.038
R^2 Δ	.029**			R^2 Δ	0.069***		

Note. * p < .05, ** p < .01, ***p< = 0.001.

Table 2
Hierarchical Regression Analysis Assessing Effects of Social Support, Self-efficacy, and their Interaction, on Drug Use Days at 6 Months and 12 months.

	Pretest-6 m (n = 180)				Pretest-12 m (n = 129)		
	B	SE	β		B	SE	β
Demographic characteristics & substance use (pretest)				**Demographic characteristics & substance use (pretest)**			
Age	−.004	.009	−.031	Age	.002	.009	.024
Gender (Male = 1)	.007	.193	.003	Gender (Male = 1)	−.045	.185	−.022
Education	−.059	.071	−.060	Education	.041	.066	.054
Race (White = 1)	.252	.207	.089	Race (White = 1)	.309	.202	.135
Drug use days	.059	.013	.333***	Drug use days	.045	.014	.276**
R^2 Δ	.126***			R^2 Δ	.091*		
System use (6 months)				**System use (12 m)**			
Time spent	.002	.007	.024	Time spent	−.001	.002	−.049
R^2 Δ	.001***			R^2 Δ	.002		
Self-efficacy (SE) (6 m)				**Self-efficacy (SE) (12 m)**			
Self-efficacy (SE)	−.109	.043	−.181	Self-efficacy (SE)	−.068	.039	−.156
R^2 Δ	.031***			R^2 Δ	.023*		
Social support exchange (6 m)				**Social support exchange (12 m)**			
Receiving emotional support	−.255	.089	−.250**	Receiving emotional support	−.225	.070	−.307**
Receiving informational support	.068	.101	.058	Receiving informational support	.151	.080	.186
Providing emotional support	−.177	.498	−.027	Providing emotional support	.181	.462	.035
Providing informational support	.069	.524	.010	Providing informational support	−.272	.489	−.049
R^2 Δ	.046***			R^2 Δ	.079**		
Interactions (6 m)				**Interactions (12 m)**			
Providing emotional support*SE	−.146	.100	−.114	Providing emotional support*SE	−.143	.110	−.131
Providing informational support *SE	.236	.123	.153	Providing informational support *SE	.098	.136	.072
Receiving emotional support*SE	.120	.116	.094	Receiving emotional support*SE	.078	.088	.089
Receiving informational support*SE	−.008	.097	−.008	Receiving informational support*SE	−.160	.097	−.153
R^2 Δ	.028***			R^2 Δ	.032**		

* $p <$ .05, ** $p <$ .01, ***$p <$ = .001.

4.1.2. Support provision

Our study failed to find main effects of giving either emotional or informational support. Many prior studies finding benefits of support giving are qualitative or use cross-sectional correlational data [e.g., 54,90], raising the possibility of reversed causality in these studies, with patients offering support to others because their health trajectory is positive. It is also possible that the benefits of giving support do not extend to this online context, perhaps because helping may be less beneficial when it is too burdensome [91,92]. Our forum features individuals struggling with serious health issues, for whom focusing on others at the expense of themselves may be detrimental. Yet, as the next section describes, giving support did have some benefits, conditional on self-efficacy.

4.1.3. Self-efficacy and social support provision

Prior research on the role of self-efficacy in social support reception is equivocal [74,75]. Our study did not find interactions

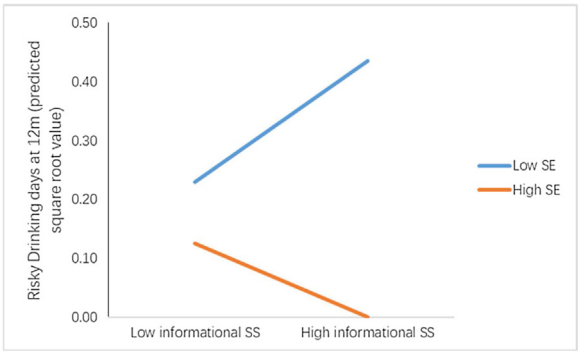

Fig. 1. Interaction between self-efficacy and information provision on risky drinking days at 12 months. SS = social support. SE = self-efficacy.
Note. For illustration purposes, this plots represent the predicted means of the square root of risky drinking days at 12 months for four subgroups: (1) low informational support expression/low self-efficacy; (2) low informational support expression/high self-efficacy; (3) high informational support expression/low self-efficacy; and (4) high informational support expression/high self-efficacy. We used median splits for categorizing informational support expression and self-efficacy.

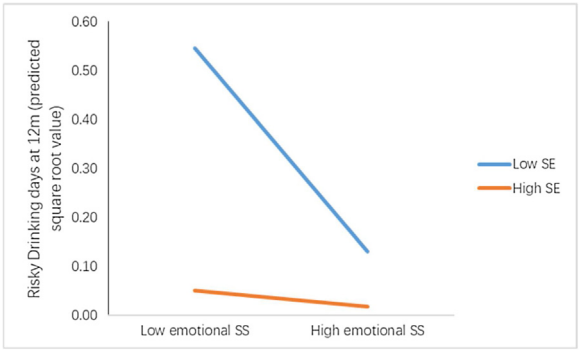

Fig. 2. Interaction between self-efficacy and emotional support provision on risky drinking days at 12 months. SS = social support. SE = self-efficacy.
Note. For illustration purposes, this plots represent the predicted means of the square root of risky drinking days at 12 months for four subgroups: (1) low emotional support expression/low self-efficacy; (2) low emotional support expression/high self-efficacy; (3) high emotional support expression/low self-efficacy; and (4) high emotional support expression/high self-efficacy. We used median splits for categorizing low and high informational support expression and self-efficacy.

between support reception and self-efficacy in predicting substance use. However, past work has not considered whether self-efficacy might moderate the effects of giving support. Our results show the helpfulness of giving support seems to depend on which type of support was offered, in combination with the provider's self-efficacy. Specifically, giving more informational support predicted reduced risky drinking among those with high self-efficacy, while those with low self-efficacy who gave more informational support increased risky drinking. These results may reflect that, for those with less self-efficacy, trying to solve others' problems may come at the expense of resolving one's own. Indeed, individuals who are not confident in their recovery ability (e.g., in early recovery) are sometimes discouraged from offering help to others [14], including in 12-step programs where attending to others' problems is sometimes viewed as a way to avoid dealing with one's own [93,94].

In contrast, those with lower self-efficacy appeared to benefit when giving emotional support. This finding may indicate that giving emotional support is less burdensome, demands limited mastery of skills, and builds caring relationships with others, potentially counteracting feelings of helplessness and leading to greater investment of effort in recovery. To the extent that giving emotional support builds reciprocal bonds [55], those with low self-efficacy may also have benefitted when their support provision yielded support *reception* during times of need. In sum, giving emotional support might be a promising step for those less confident in managing recovery, whereas providing information might be a more challenging step that comes with experience and confidence.

Interestingly, effects of support giving were only present for risky drinking, but not for drug use. The reasons for this finding warrant further investigation, but may reflect that drug use captures heterogeneous behaviors, whereas alcohol use refers to a more singular behavior. That is, giving social support may play different roles according to the type of drug involved (opioids, marijuana, cocaine, etc.), perhaps helping in some cases and not in others.

4.1.4. Limitations and future directions

This study has limitations. One limitation is that self-efficacy was measured through a single item measure. While some prior research supports the validity of similar single-item self-efficacy measures in the SUDs context [69], future research may seek to replicate our findings using validated multi-item self-efficacy measures (e.g., the Alcohol and Drug Abstinence Self-Efficacy Scale) [69].

We also used different measurement strategies for support giving and receiving. For support giving, we used behavioral data, coding participants' actual messages. For reception, we relied on self-assessments which are potentially subject to recall bias. Some studies have tried to quantify objective support reception in online forums. For instance, support reception can be defined as the number of supportive messages that are aimed at a specific individual [88]. Alternatively, support reception has been defined as the number of messages *read* that contain social support, whether directed at the reader or another participant [55]. Given this ambiguity in a group context, we relied on the more conventional method of subjective assessment [95]. Future research should compare objective with subjective measures. It is also worth noting that social support provision measured in this study was captured only within the discussion forum, but our measurement of social support reception was more broad, capturing perceptions of support received from peers in recovery, which could include those in the A–CHESS discussion forum as well as offline peers. While the same measure has previously been an effective indicator of the kind of social support experienced with the introduction of the CHESS system [55,96], future work should seek to differentiate online and offline sources of peer support.

Our data is also limited in that our design does not feature random assignment and we cannot draw causal conclusions. We assessed effects of social support only on later substance use and controlled for potential confounding variables, but there may be additional factors not measured here that contribute to the observed relationships. For instance, social support received may reflect individual characteristics such as receivers' directness in disclosing problems and soliciting help [88]. Additionally, A–CHESS involved additional services, which participants used alongside the discussion forum. These may have influenced substance use outcomes as well as patterns of support exchange. Our analyses controlled for participants' total time using the system, but future analyses may wish to consider synergistic use of intervention components.

Future research should also consider whether effects of social support exchange are moderated by gender. The prior literature finds gender differences in social support-related behaviors, including that women seek, receive, and give more support than

men, especially emotional support [97]. While we controlled for gender in our analyses, we did not assess gender as a potential moderator of giving or receiving support of different types.

Future research may examine other types of social support. In conducting this study, we were guided by prior literature that has highlighted the predominance of informational and emotional support as the two major categories of support delivered in online settings [41,42,98], with tangible support often being poorly suited to online groups [99]. We were also guided by preliminary review of our data. While "esteem support" and "social integration support" did occur in our data, they occurred infrequently. We piloted a broader content analysis that included social integration support, but we found that such support was offered much less frequent than either emotional support or informational support. Such less-used forms of social support may nonetheless have important implications for recovery [5,100], and their effects may also be moderated by self-efficacy.

4.2. Conclusion

The results of this study clarify the conditions under which social support exchange benefits those in online recovery support groups. The study underscores potential benefits of receiving emotional support for reducing drug use. We also illustrate the role of self-efficacy in shaping benefits of giving support. Insofar as online forums are playing a growing role in recovery, these findings may contribute to a better understanding of how to monitor and structure interactions to maximize the benefits achieved for providers and receivers.

4.3. Practice implications

Our findings have practical implications for guiding users and designers of online systems. Given the interaction effect of support giving and self-efficacy, it may be worthwhile to assess self-efficacy of people with SUDs to recommend ways participants can benefit most from their participation. Individuals who have lower self-efficacy might be encouraged to express emotional support to fellow group members, while those more confident in recovery may be better able to take on a role that includes providing information. Our results also suggest the importance of receiving emotional support, especially for illicit drug users. Developers of SUDs interventions may wish to encourage or augment delivery of such support, including training participants to provide it, employing moderators to establish forum norms, or adopting design features that can simplify the process of conveying support [101].

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