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Exploring the Role of Online Social Support in Eating Disorder Recovery

A Quantitative Computational Study

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Abstract

Eating disorders are highly prevalent and serious mental illnesses, that are embedded in wider social structures of inequalities and oppression. While social isolation is a key triggering and perpetuating factor, social support emerges as a gateway towards recovery. The online sphere holds great potential to connect eating disorder individuals, creating a space for social support towards recovery. The thesis applies quantitative computational analysis on Reddit data to evaluate whether social support experienced in an online pro-recovery community can be linked to eating disorder recovery. The results show a significant relationship between online social support and eating disorder recovery, with the emotional content of the support being the sole driving factor. The results prompt further research on the causal process between the two phenomena, as well as remind us not to neglect the well-established options in eating disorder treatment. Further methodological and theoretical implications of the main findings pertaining to digital social scientific research are discussed.

Keywords: eating disorder recovery, online social support, Reddit, traditional computational analysis, social network analysis, natural language processing, quantitative modeling

Word Count: 18,543

Popular Science Summary

Eating disorders are common and serious mental illnesses, that are part of broader social issues. If the individual feels isolated from others, that can cause one to develop an eating disorder. Also, those already suffering from eating disorders can gradually feel more distant from others, which further maintains their mental health problem. Therefore, it is very important to provide eating disorder individuals the social support they need, to promote their recovery.

In the online world, people dealing with eating disorders can also have their dedicated forums and communities. These communities have the potential to make their members feel understood and supported, thereby helping them recover from eating disorders. This thesis investigates one such community, the r/EatingDisorders subreddit on Reddit. It is tested whether social support received from this online community can be linked to eating disorder recovery.

The results show that indeed, online social support is associated with eating disorder recovery. Notably, neither the features of one's interactions nor the quality of one's network is linked to recovery. It is the emotional content of the comments from others that influences eating disorder recovery. The more positive interactions one receives from others on the subreddit, the higher the chance they recover. Recovered individuals generally contribute more positive content to the subreddit, but this effect holds even when accounting for that. However, the findings are not sufficient to say whether greater social support causes eating disorder recovery, or vice versa.

The results also indicate that even though online social support matters, traditional treatment options are still more relevant when it comes to eating disorder recovery promotion.

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List of Abbreviations

ED	Eating Disorder
PRO-ED	Pro Eating Disorder
PRO-RECOVERY	Pro Eating Disorder Recovery
AN	Anorexia Nervosa
BN	Bulimia Nervosa
BED	Binge Eating Disorder
OSFED	Other Specified Feeding or Eating Disorder
UFED	Unspecified Feeding or Eating Disorder

I. Introduction

Mental health diagnoses, often labeled as individual conditions, may also be seen as reflections of society. Just as hysteria during Freud's time (Breuer & Freud, 1893), or the phenomenon of suicide as explored by Durkheim (1951), contemporary eating disorders may also be diagnostic snapshots of their respective society. Therefore, it is worthwhile and necessary to interpret and analyze them through the lens of social sciences.

Eating disorders have devastating effects on individuals, both physically and mentally. They also present a significant societal challenge, affecting individuals from a young age and carrying serious consequences not only for the afflicted individual but also for their support networks and society as a whole. Moreover, eating disorders are not isolated conditions; they are deeply intertwined with broader social contexts, often reflecting and perpetuating issues of inequality, oppression, and discrimination.

The online social space has unveiled the ability for social scientific research to observe unobtrusive, unfiltered behaviors of humans in a quality, scale, and nature that has never been known before. The availability of vast (and ever-growing) amounts of digital traces opens the possibility to scrutinize social phenomena that were previously hidden from academic research. Previous qualitative studies indicated that online support networks can be beneficial for individuals with eating disorders by connecting them with others who share their experiences, providing them with a sense of understanding, acceptance, and assurance that recovery is possible. However, quantitative evidence regarding whether social support provided by an online recovery-supporting community is linked to eating disorder recovery is still lacking.

Hence, the current thesis applies a theory-guided, quantitative computational analysis on a selected subreddit, as a case of such a community to answer the questions below.

RQ 1. *Could social support experienced in an online pro-recovery community be linked to eating disorder recovery?*

Depending on whether the statistical relationship between online social support and recovery can be established, the second research question is formulated.

RQ 2. *To what degree could each of the three components of social support contribute to the overall effect of online social support on eating disorder recovery?*

The operationalization of the focal concepts is grounded in theory and blends the methodological toolkit of three distinct approaches: traditional computational analysis, social network analysis, and natural language processing. Additionally, the sampling applies human-annotated labeling. The final analysis utilizes traditional statistical modeling. This thesis, presenting a novel combination of methodological solutions, in addition to the relevant theoretical foundations, could serve as an example of theory-guided, quantitative computational research in the social sciences.

The structure of the thesis is as follows. First, the eating disorder-related scientific frontier is reviewed in an interdisciplinary manner, presenting both the individual-psychological and the societal-sociological understanding of the disease. The review will emphasize the role of social isolation and support in eating disorder recovery. Subsequently, the theoretical schema of the research is presented, followed by a description of the methodological approach. The selected platform, case community, sampling strategy, and operationalization are carefully addressed, as they all play a crucial role in the inferences that can be drawn from the results. The analysis section encompasses the preinspection of key variables, the presentation of the three-stepped multivariate logistic regression analysis, the reflection on the limitations, as well as the considerations of ethical aspects. Finally, the results, theoretical and methodological implications of the research, and further avenues of research are discussed. The thesis concludes with a few final, personal thoughts.

II. Relevant Research

Eating disorders not only present a prevalent societal problem but constitute a complex sociological issue as well. The high prevalence, comorbidity rates, and elevated mortality rate of eating disorders underscore the topic's social relevance. Additionally, eating disorders are not only a burden for the individual but have major consequences for their social surroundings as well as for society as a whole. The sociological aspect of this complex issue is highlighted by the intertwining gender-related and sociocultural aspects that contribute to the perpetuation of these mental health conditions.

Even though very often understood as an individual, solely psychological health condition, the emergence and perpetuation of eating and body-related disturbances are deeply embedded in the current sociocultural context as well. Therefore, understanding the complexity of eating disorders requires an interdisciplinary approach, inclusive of the description of both the individual-psychological and the social influences that contribute to it. In the following section, eating disorders are described from epidemiological and psychological perspectives with special emphasis on the interplay between social support and eating concerns. The introduction of the topic will also cover the sociological and feminist interpretations of eating disorders, including the representation of the issue in the online sphere. Furthermore, it will present how previous scholarly research has shed light on the possible recovery-facilitating nature of pro-recovery online communities, but quantitative evidence underpinning this relationship is still lacking.

II. I. Eating Disorder Epidemiology

Eating disorder is a highly prevalent and deadly global health concern. Around 8-11 percent of women and 2 percent of men experience an eating disorder at some point in their lives (Nagl et al., 2016; Galmiche et al., 2019). A cross-country meta-

analysis has shown that the population average of eating disorder diagnoses increased steadily in the past decades, marking 3.5 percent by 2006. This striking number has further increased to 7.8 percent by 2018 (Galmiche et al., 2019). However, the interpretation of these data must also consider the longitudinal changes in diagnostic criteria (thus in the measurement tool), the increasing awareness and hence reporting of these disorders (Wakeling, 1996), and the potential latency.

According to the latest diagnostic and classification criteria declared in the Diagnostic And Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) in 2013, there are 5 distinct categories of eating disorders distinguished: Anorexia nervosa (AN), Bulimia nervosa (BN), Binge eating disorder (BED), and the two residual categories of 'Other specified feeding or eating disorder' (OSFED) and 'Unspecified feeding or eating disorder' (UFED) (Mancuso et al., 2015).

Among all, AN is the most widely known and the first clinically described illness. Its clinical descriptions date back to the 19th century (Vandereycken, 1995). It is described by the intense obsession with body weight, body shape, and thinness, meticulous daily practices devoted to the control (and in most cases, reduction) of body weight, and the consequences of these practices to the individual's physical and mental health and well-being (Garfinkel, 2002). The mortality rate of clinically diagnosed AN is reported at around 5-20 percent (Sullivan, 2002; Chesney et al., 2014; Qian, 2021), making it the deadliest mental health disorder after substance abuse (Harris & Barraclough, 1998; Chesney et al., 2014; Qian et al., 2021). In addition to this striking number, the mortality rate is found to be increasing by the length of the course of the illness (Steinhausen, 2009). The recovery rate within 10 years after clinical referral is estimated at around 50 percent (Sullivan, 2002).

The description of BN emerged in the context of AN, distinctively categorized from the 1970s (Vandereycken, 2002). The symptomatology of BN includes all the above-described elements of AN but adds episodes of binge eating, followed by compensatory purging behaviors (Garfinkel, 2002). The death rate of BN is

estimated at around 1-2 percent, recovery rate is around 70 percent at 10 years follow-up (Sullivan, 2002; Chesney et al., 2014). There is some evidence indicating that the occurrence of BN decreased since the 1990s (Keel & Brown, 2010; Smink et al., 2012; Qian et al., 2021).

Even though BED has long been known in clinical practice (Grilo, 2002), it was only recognized as a distinct clinical entity in 2013 (Mancuso et al., 2015). BED carries the overeating symptoms of BN in the absence of purging practices. The recovery rate is, similar to BN, at around 70 percent (Keel & Brown, 2010).

The wide category of OSFED highlights five specific subtypes: Atypical AN, Subthreshold BN, Subthreshold BED, Purging disorder, and Night Eating Syndrome (Mancuso et al., 2015). Notably, OSFED is the most prevalent eating disorder category, followed by BED, BN, and AN (Galmiche et al., 2019). This highlights the urge for the scholarly and clinical representation of all the eating disorder subtypes that don't fit into the 'classic' types and are included in the two residual diagnostic categories of OSFED and EDNOS. The inclusion of various types and forms of eating disorders in research is crucial considering the broad range of disordered eating problems that have emerged in recent years. These conditions are well known in the disordered eating/body image community as well as represented in scholarly literature but are yet to be included in the clinical diagnosis scheme. Including conditions like Orthorexia Nervosa, Bigorexia, Drunkorexia, Pregorexia, and Food Addiction (Krug et al., 2022). The seriousness of these marginal conditions is underpinned by the empirical evidence showing that the lives of those patients with a 'residual-category' diagnosis are generally just as much impaired as that of patients with a 'classic' diagnosis (Turner et al., 2009).[1]

[1] Given the prevalent bias towards traditional diagnoses of eating disorders in academic research, the present overview of relevant literature is likely to reflect this imbalance as well.

II. II. Psychological Understanding of Eating Disorders

There are a few prominent psychological features of eating disorders that are the most commonly known by the lay public as well as established by research. These core elements are body dissatisfaction, preoccupation with food, weight, and shape, and ego deficits (Polivy & Herman, 2002; Brechan & Kvalem, 2015). Further markers of the disorders are significant distress (such as depression and anxiety), low self-esteem, and cognitive distortions (such as obsessive thoughts) (Brechan & Kvalem, 2015). Additional triggering and maintaining factors are certain personality features (such as perfectionism, and the need for control), inadequate identity formation, and environmental stressors (such as interpersonal difficulties, peer pressure, and sociocultural influences) (Schmidt, 2002).

AN is associated with perfectionism, obsessionality (Garfinkel, 2002), and black-and-white thinking (Fairburn et al., 2003). The patient is described as introverted, shy, and socially withdrawn (Tchanturia, 2013), with chronicity increasingly dependent on family or therapist, and socially isolated (Garfinkel, 2002). As becoming absorbed by the illness, the person with AN engages gradually less in social leisure activities, focusing exclusively on study or work and other solitary activities (Garfinkel, 2002; Krug et al., 2013; Tchanturia, 2013). Even though AN patients experience severe impairment in various areas of life, the greatest effect is reported in the realm of social leisure (Tchanturia et al., 2013).

Similarly, the mental state of the Bulimic patient is described as anxious and helpless with self-deprecatory thoughts. The core feature that distinguishes BN from AN is impulsivity (Polivy, 2002). As opposed to the obsessional AN, BN is rather characterized by difficulties with impulse control. The binge-purge cycle usually evokes intense guilt feelings but also serves as a way of coping with stress and reducing tension (Garfinkel, 2002). Disturbed interpersonal relations are inherent in BN as well (Garfinkel, 2002). A causally important factor in the development of BN is sexual abuse (Garfinkel, 2002; Schmidt, 2002).

There is a large body of literature supporting that there is a comorbidity between AN and affective disorders (such as major depression), as well as anxiety disorders (such as obsessive-compulsive disorder) (Fava et al., 1997; Bulik, 2002; Råstam et al., 2003), which also increases the risk of suicide (Qian, 2021). This holds true for BN patients as well, in addition to the prevalence of affective disorders (Bulik, 2002; Garfinkel, 2002), personality disorders, and substance abuse (Casper, 1998). BED is also associated with major depressive disorder, anxiety disorders, alcohol and drug abuse disorders, and psychiatric and personality disorders (Grilo, 2002). Moreover, the severity of these comorbid psychopathologies is linked to the severity of eating disorder symptoms, as well as the trajectory and course of the illness (Fava et al., 1997; Herpertz-Dahlmann et al., 2001; Råstam et al., 2003; Wentz et al., 2009; Keel & Brown, 2010; Sander et al., 2021). As a reciprocal effect of the syndromes, those with self-critical or depressive features may be more inclined to fall into eating disorders (Casper, 1998), as well as other psychological disorders may develop as a by-product of eating disorders.

Eating disorders have deleterious consequences not only to the mental health but also to the physical condition of the patients. The medical complications include cardiovascular, endocrine, and gastrointestinal abnormalities, damage to the reproductive function, and complications to the dental, neurological, and immune systems (Pomeroy & Mitchell 2002). Individuals with both BN and BED are more likely to be obese than people without an eating disorder, further increasing the risk of health complications (Hay et al., 2015).

Eating disorders affect the patient's life in a myriad of ways and constitute a challenge not only to them but also to the broader society. Both BN and BED are associated with significant role impairment and work disability. Early-onset BED can reduce the odds of marriage (for females) and employment (for males) (Kessler et al., 2014). AN can be linked to long-term impairments in social functioning and employment (Schmidt et al., 2016). The extent to which the quality of life is reduced for eating disorder patients is similar to those with coronary heart disease and worsens as the illness prolongs (Schmidt et al., 2016). Additionally, caregivers of

eating disorder patients face a significant burden, spending twice as much time on caregiving responsibilities compared to caregivers of depressed or schizophrenic patients (Viana, 2013). The financial costs of the healthcare system are estimated around the same as those of depression or anxiety disorders (Schmidt et al., 2016).

Regardless of the type of the eating disorder, and the corresponding disordered eating behaviors the affected individual engages in (be it restrictive eating, bingeing, or purging), there is one thing undoubtedly common: eating disorder thought patterns and behavioral patterns revolve around the body and eating, carry a significant amount of bodily dissatisfaction and low self-esteem, all contributing to impaired social functioning and overall, to a reduced quality of life. These common characteristics point towards the inclusion of a broader social and cultural context that complements individual factors in understanding the complexity of these disorders.

II. III. Eating Disorders and Social Support

Eating disorders have socially isolating effects. Individuals with eating disorders are shown to have limited social networks and challenges in social functioning (Patel et al., 2016). People with AN and BN show reduced feelings of pleasure from social stimulation, possibly due to the difficulty of identifying and expressing feelings in social settings (Tchanturia et al., 2012). In addition to having smaller social circles, both AN and BN patients set lower ideals for social support, and perceive less emotional and practical support from it (Tiller et al., 1997). Recovered individuals reveal that during their illness they distanced themselves or disconnected completely from peers as the shame induced by their disorder created a barrier between them and their peers. In addition to that, they felt stereotyped and not understood (Linville et al., 2012). They also highlight the various ways in which their unsupportive social circle contributed to their illness (Linville et al., 2012).

The social environment of individuals with AN is described by a limited social network, lack of contact or communication, difficulty understanding the concept of friendship, and focus of attention away from the self (Doris et al., 2014). AN is associated with a significantly lower chance of having a romantic partner or spouse (Tiller et al., 1997). A higher degree of loneliness in AN patients is associated with a more prevalent experience of the 'anorexic voice' (Marffy et al., 2023). Some authors suggest that the co-occurrence of poor social functioning and obsessionality in AN patients is likely due to them belonging to the autism spectrum (Wentz et al., 2009; Doris et al., 2014).

Adolescents with eating disorders experience heightened challenges in their friendships, such as conflicts and feelings of estrangement, and are less inclined to view friends as sources of support and self-validation (Sharpe et al., 2014). Adolescent patients express challenges in disclosing their illness or sharing their feelings and experiences, leading to a reduced inclination to seek social interaction, resulting in self-isolation, which may further increase with hospitalization (Patel et al., 2016).

Research emphasizes the crucial significance of social support, social functioning, and social inclusion in the successful recovery of adults with eating disorders, with the lack of these elements being linked to prolonged recovery (Fairburn et al., 2003; Krug et al., 2013; Leonidas & dos Santos, 2014). In a correlational study, social pathology was found to be one of the six predictors that together can precisely differentiate the patients who recover from those who remain ill (Deter et al., 2005). Long-term recovered AN patients are statistically indifferentiable in regards to psychosocial functioning from normal controls, confirming that with long-term recovery one can return to healthy psychiatric and social functioning (Herpertz-Dahlmann et al., 2001). There is evidence showing that healthy control, fully recovered, and even the partially recovered group is significantly less lonely compared to the active eating disorder group, indicating that enhanced interpersonal functioning and social support could serve as a gateway to a more comprehensive recovery from eating disorders (Harney et al., 2014).

Those who recovered from eating disorders emphasize the significant role of social support and interaction in their recovery journey. Developing supportive relationships is one of the core categories AN patients have identified in interviews evaluating the influencing factors in recovery (Federici & Kaplan, 2008). Supportive individuals can be a powerful resource for someone striving to overcome an eating disorder (Marcos & Cantero, 2009). This is particularly true with mentors who experienced the illness themselves, as their presence not only assures that recovery is possible but also helps the patients feel understood, reducing social isolation (Linville et al., 2012; Ramjan et al., 2017). However, the effect of social support seems to be mediated by the ability and willingness to request and accept help (Federici & Kaplan, 2008), emphasizing the need for the patients' willingness to recover. Research shows the need for the inclusion of broader social networks in treatment, beyond family and healthcare providers (Leonidas & dos Santos, 2014).

Given that AN frequently arises during adolescence, a period crucial for identity formation, the question of identity becomes especially relevant (Bezance & Holliday, 2013). Patients describe that AN goes beyond the fear of weight gain and is part of their personality and style of functioning (Tan et al., 2003). Therefore, detaching from the identity associated with the illness and embracing a recovery-oriented identity is essential for eating disorder recovery (McNamara & Parsons, 2016). AN patients report that the development of a new identity within a supporting, nurturing environment is a significant recovery-promoting factor (Federici & Kaplan, 2008). Support within a shared identity group is seen as more effective than external support, as community interactions help in forming a new collective recovery identity, leading to a shift away from the illness identity and promoting adherence to group norms regarding disclosure and treatment engagement, which process might also be supported in an online environment (Ransom et al., 2010; McNamara & Parsons, 2016).

II. IV. Societal Understanding of Eating Disorders

Eating disorders are not randomly distributed across society but carry distinct socio-demographic profiles. AN and BN traditionally predominantly affect females, especially young women and girls (Hoek, 2002; Smink et al., 2012). Exception from the above-described trend is BED, which affects women and men roughly equally and tends to appear in a relatively older age group (Smink et al., 2012).

Adolescents are the most vulnerable group as the onset of AN and BN is typically between the ages of 15 and 19, at a developmentally critical age (Hoek, 2002; Smink et al., 2012; Golden et al., 2016; Galmiche et al., 2019). The prevalence among young females is reported around 0.3-0.5 percent for AN, and 1-5 percent for BN (Fisher et al., 1995; Hoek, 2002), and measured to be significantly growing (Szabó et al., 2010). There are studies suggesting that the onset of the illness can be as early as 5 to 12 years (Madden et al., 2009; Pinhas et al., 2011). Younger age at onset of AN is associated with a more prolonged course and unfavorable outcome of the disease (Bryant-Waugh et al., 1988). There are medical complications unique to the pubertal phase that make eating disorders even more devastating to adolescents, including growth retardation, pubertal delay or interruption, and peak bone-mass reduction (Fisher et al., 1995; Golden et al., 2016). The severity of early onset is further underpinned by evidence suggesting that younger age enhances the association between anxiety or depression and eating disorder symptomatology (Sander et al., 2021), and that non-suicidal self-injury is overrepresented among younger eating disorder patients (Islam et al., 2015).

The role of family and peers in the early development of eating disorders cannot be underestimated. For the development of AN, the family environment has long been known to be a triggering factor by carrying criticism, enmeshment (Polivy, 2002), or by causing childhood trauma (Schmidt, 2002). It is also observed that the adolescent's eating disorder in some cases stems from their family's intention to prevent obesity or eat "healthy" (Golden et al., 2016). Peer influence is inextricably linked to eating disorders. It has been shown that a teenage girl's disordered eating

behavior can be significantly predicted by her friends' attitudes related to weight and that friend group members share similar dieting and binge eating behaviors (Hutchinson & Rapee, 2007). Alongside depression, negative remarks about eating from teachers, coaches, or siblings are one of the main risk factors in eating disorder development (Jacobi et al., 2011). Peer relations have another route to contributing to eating disorder development in adolescence. Poor quality peer relations are associated with greater body dissatisfaction and depression, consequently, with increased eating pathology (Sharpe et al., 2014).

Classically, eating disorders are thought to be the "privilege" of the upper class, whereas it has been shown to appear in all strata of society (Hoek, 2002). The illness is typically associated with "Westernized" countries, highlighting the role of sociocultural factors. For instance, immigrants in the UK and Germany are found to be more likely to develop an eating disorder than their peers in their country of origin (Hoek, 2002). However, recently it has been shown that eating disorders are also highly prevalent in Asian and Middle Eastern countries (Galmiche et al., 2019).

Even though there is growing evidence that eating disorders also appear among men, body and eating-related issues still remain a women issue (Striegel-Moore et al., 2009). Eating disorders are feminized diseases to the extent that the clinical diagnosis of AN had been tailored to exclusively women (had been including the absence of a menstrual period criterion) up until 2013 (Mancuso et al., 2015). The precedent of sexual abuse often underlying the development of eating disorders also sheds light on the close relationship between eating disorders and other societal issues disproportionally experienced by women. Increasing scholarly awareness is dedicated to the concept of the objectification of the female body (and as a result, female self-objectification) which seems to be the overarching, core precedent phenomenon of both violence against women and self-harm of women manifested in eating disorders. There seems to be a direct relationship between self-objectification and depression, appearance anxiety, body shame, and disordered eating (Muehlenkamp & Saris–Baglama, 2002; Calogero et al., 2011).

It has long been problematized by the sociological literature that the culturally defined, unattainable female beauty ideal is a major contributor to the triggering and perpetuation of body dissatisfaction and disordered eating patterns in women (Striegel-Moore & Smolak, 2002). There is compelling evidence that the internalization of the thin ideal is a causal risk factor for body image and eating disturbances (Thompson & Heinberg, 1999; Thompson & Stice, 2001). A massive body of feminist literature is centered around the problematic and unrealistic female body ideal and the societal pressure and shame experienced by women in relation to it (Rodin et al., 1984; Diamond, 1985; Duncan, 1985). This stream of feminism categorizes the unequal gendered societal expectations in the sphere of body and appearance as a form of oppression of women (Wolf, 1991). Some authors label the issue a "normative discontent" suggesting that body dissatisfaction is a normative, integral part of being a woman (Rodin et al., 1984). Even though some of these feminist texts rather ought to be called a memento than a scientific resource, this school undoubtedly constitutes a massive source of inspiration for eating and body-related scholarly research in the subsequent decades.

A plethora of correlational and experimental studies have shown the role of media on body image concerns and eating disturbances through the glorification of the thin body ideal and the demonization of the fat body (Thompson & Heinberg, 1999; Groesz et al., 2002; Grabe et al., 2008). Even though some of these claims might not hold true to the contemporary media landscape any longer, recent studies focusing on the evolution of body and eating issues shed light on how the problem does not disappear but rather transforms. For instance, the "healthy weight" mainstream media discourse tends to reinforce the internalization of anti-fat attitudes, thereby leading to body preoccupation and disordered eating (Rodgers, 2016). Also, body-shaming messages and oppressive dietary practices are promoted to women through mainstream media channels masked behind feminist empowerment rhetoric (Jovanovski, 2017). Additionally, the new era of the 'thin and toned' female body ideal shows very similar adverse effects on body image, with special regard to the guilt-inducing and weight-stigmatizing messages, dietary

restraint promotion, and unchanged objectifying elements (Boepple & Thompson, 2016; Alberga et al., 2018; Tiggermann & Zaccardo, 2018).

The societal fixation on weight manifests itself not only through the glorification of slenderness but also through the demonization of the fat body (Schwartz, 1986; Stice, 2002). In contemporary culture, there is a devastating stigma towards people living in bigger bodies. The discrimination of larger-bodied people affects key areas of living, such as employment, education, medical and health care, legal areas, interpersonal relationships, media representation, and everyday public situations (Puhl & Brownell, 2002; Puhl & Heuer, 2009). There is strong scientific evidence that higher-weight people experience disparities in employment, wage penalties, and bias in job evaluations and hiring decisions, they are unequally treated due to negative stereotypes and attitudes from healthcare professionals, and they are implicitly and explicitly stigmatized on television, and in film (Puhl & Heuer, 2009). Furthermore, there is compelling evidence that weight stigma contributes to disordered eating behaviors among larger-bodied people (Puhl & Heuer, 2009). Studies suggest that perceived weight discrimination increases vulnerability to depression, low self-esteem, and poor body image (Puhl & Heuer, 2009), thereby further increasing the risk of eating disorders. Perceived weight discrimination has been found to be associated with substantial psychiatric comorbidity, regardless of weight, perceived stress, and received social support (Hatzenbuehler et al., 2009). Explicit weight discrimination is significantly linked to increased depression and binge eating, as well as worse results in weight loss interventions (Wott & Carels, 2010).

Researchers have called for social activism to fight against harmful media messages (Thompson & Heinberg, 1999), and social activism emerged shortly thereafter. There is a new stream of studies arguing that the medical claims about the "obesity health crisis" are tacitly conveying anti-fat attitudes and are not driven by medical evidence but rather motivated by social, political, and economic interests (Campos et al., 2006; Bacon & Aphramor, 2011). These critical scholarly voices blended with feminist and anti-capitalist perspectives when the new era of social movements

emerged to backlash against the anti-fat and slim-glorifying social attitudes. The health at every size movement (Burgard, 2009; Bacon & Aphramor, 2011), the term 'diet culture' (Jovanovski & Jaeger, 2022a), the anti-diet movement (Harrison, 2019; Jovanovski & Jaeger, 2022b), the intuitive eating approach (Tribole & Resch, 2020), the body-positivity movement (Leboeuf, 2019), the size acceptance movement (Sobal, 2017), the idea of weight-inclusivity (Hunger et al., 2020), and the reframing of the body-mass index (BMI) (Gutin, 2018) are just a few examples of the broad social activism that has been reframing our societal beliefs and relationship with eating and the body in recent years. Body-positive content could serve as a promising approach to enhancing the body image of young women, yet some evidence already suggests that exposure to these images induces increased self-objectification just as much as thin-ideal posts (Cohen et al., 2019).

II. V. Eating Disorders and the Online Sphere

Building on the foundation laid out by media studies of the late 1990s and 2000s, in the past decade, the effect of new online technologies on body concerns has also been under scholarly scrutiny. Similarly to traditional media, online media has also been proven to be harmful in this regard, and its effect follows the same pattern as that of traditional media. Image-focused online media consumption was shown to be linked to eating pathology, which relationship is mediated by thin-ideal internalization (Tiggemann & Miller, 2010; Bair et al., 2012). Additionally, smartphone usage is associated with greater eating disorder symptomatology (Tan et al., 2016; Hefner et al., 2016). Smartphone calorie tracker usage is not only a maintenance but a triggering factor in disordered eating as explained by study participants (Levinson et al., 2017; Simpson & Mazzeo, 2017). Time spent on social networking sites is also proven to be influential on body image, self-esteem, and eating disorder symptomatology (Hefner et al., 2016; Santarossa & Woodruff, 2017; Turner & Lefevre, 2017). Appearance-related social media behaviors, such as photo manipulation, photo investment, and selfie posting may be indicative of

eating disorder risk (Lonergan et al., 2020). A systematic review of the literature reveals that problematic internet usage is not only associated with eating disorder symptoms, restrained eating, and drive for thinness, but its effect accumulates over time (Ioannidis et al., 2021). Instagram is a prominent social media platform that has been found to be the most commonly used among eating-disordered patients (Eikey & Booth, 2017), and has been shown as the only mainstream social media platform showing significant association with Orthorexia Nervosa (Turner & Lefevre, 2017).

Notably, eating disorder patients also report that smartphone usage helped facilitate their recovery (Tan et al., 2016). Furthermore, research has also revealed the recovery-aiding effects of Instagram usage among women with eating disorders, such as providing information about recovery and health-promoting lifestyle behavior, tracking their own recovery, reducing stigma, increasing awareness, and remarkably, creating a community for social support (Eikey & Booth, 2017). Even though dominantly framed as harmful, the online sphere and social media are essentially a double-edged sword that can be used both negatively and positively (Chen & Ren, 2022).

There are two main, distinct groups of eating disorder-related online forums: pro-eating disorder (pro-ED) and pro-recovery communities. As the name suggests, the former group (also known as ‘pro-ana’ or ‘ana-mia’ sites) are online spaces explicitly aimed at the support of maintaining these disorders through the discussion of eating disorder content such as tips and techniques, ‘ana’ as a lifestyle choice, and the daily struggles with the illness (Mulveen & Hepworth, 2006; Jurascio et al., 2010; Fettach & Benhiba, 2019). These sites are without any doubt extremely harmful to the users and are linked with increased levels of eating disorder symptomatology (Mulveen & Hepworth, 2006; Fettach & Benhiba, 2019). However, it is worth highlighting that pro-ED sites also offer significant social support for their members (Mulveen & Hepworth, 2006; Fettach & Benhiba, 2019), but their therapeutic effect beyond the temporary relief is doubted (Brotsky & Giles,

2007). The emotional benefit received from social support just partially decreases the damaging effects of these sites (Csipke & Home, 2007).

Pro-recovery communities constitute quite the opposite of pro-ED communities – they are aimed at encouraging their members to seek recovery. Among others, they feature themes such as advice and suggestions, unpleasant emotions, recovery improvement and motivation, professional treatment, information, eating disorder symptoms and thoughts, interpersonal issues, and gratitude (Hersey, 2014). Reasons for engaging with a recovery community on Instagram include social support, emotional validation, and the representation of diverse individuals (Au & Cosh, 2022). Researchers warn that content moderation in recovery-oriented sites is crucial to ensure the benefits and mitigate the adverse effects (Hersey, 2014; Jones et al., 2022).

Online communities have been named by recovered individuals as one of the four main sources of social support in eating disorder recovery, alongside family, peers, and spiritual support (Leonidas & dos Santos, 2014). Participation in online communities provides emotional benefits by serving with the feeling of acceptance and relief, creating a sense of identity (Ransom et al., 2010), and providing coping functions (Mulveen & Hepworth, 2006). Participation in eating disorder forums has also been found to offer temporary relief from offline hostility (Brotsky & Giles, 2007). Members of these forums tend to receive more support from their online relationships compared to their offline relationships, as well as receive less social support overall from their offline circle compared to age-matched controls (Ransom et al., 2010). Participants in eating disorder communities report a sense of understanding and acceptance (Jones et al., 2022) and improved mental state after visiting (Csipke & Horne, 2007).

Studies indicate that individuals trying to deal with their eating disorders might benefit from engaging with carefully selected recovery-focused websites (Hersey, 2014; Branley & Covey, 2017; Jones et al., 2022). Users themselves also describe these forums as potential sources of social support (Leonidas & dos Santos, 2014).

Online communities could assist eating disorder patients in reducing reliance on defense mechanisms, fostering a supportive peer environment, and generating some of the therapeutic factors of group therapy, thereby potentially enhancing motivation for treatment and sustaining progress between therapy sessions (Hersey, 2014). In these communities, both direct advice and indirect emotional support can be recovery-facilitating (Jones et al., 2022). In sum, pro-recovery communities appear to be a promising source of social support for individuals with eating disturbances, and scholars call for further exploration of the various dimensions of social support and social networks (Leonidas & dos Santos, 2014).

As highlighted in this overview of relevant academic literature, previous research, dominantly using qualitative approaches, has already delved into how the support received from online communities focused on recovery can influence the journey of overcoming eating disorders. However, there is still a lack of solid quantitative evidence regarding the connection between online support communities and eating disorder recovery. Thus, the goal of this thesis is to bridge this gap in scholarly knowledge by using statistical analysis to investigate the relationship between online social support and recovery from eating disorders. Moreover, it aims to shed light on the specific ways in which different aspects of social support contribute to the online community's effect on eating disorder recovery.

III. Theory

To grasp the two focal phenomena of the thesis, and their interrelation, a social scientific theoretical schema is introduced. First, the key concept of eating disorder recovery is defined. Recovery in this thesis is understood as the adoption of a recovery identity by the individual. Next, the term social support is conceptualized, and its link to eating disorder recovery is described. In short, social support in this thesis is understood as the network of various social interactions (House et al., 1988). Three key components constitute the social support concept, namely, social integration, social network structure, and relational content. Social support promotes health by facilitating coping and by assisting the forming of a recovery identity.

The theoretical framework suggests, that the higher the social integration and social network structure, and the more positive the relational content, the higher the social support, hence the higher the chance of eating disorder recovery. The conceptual map illustrating the thesis' theoretical schema is presented in Figure 1 below.

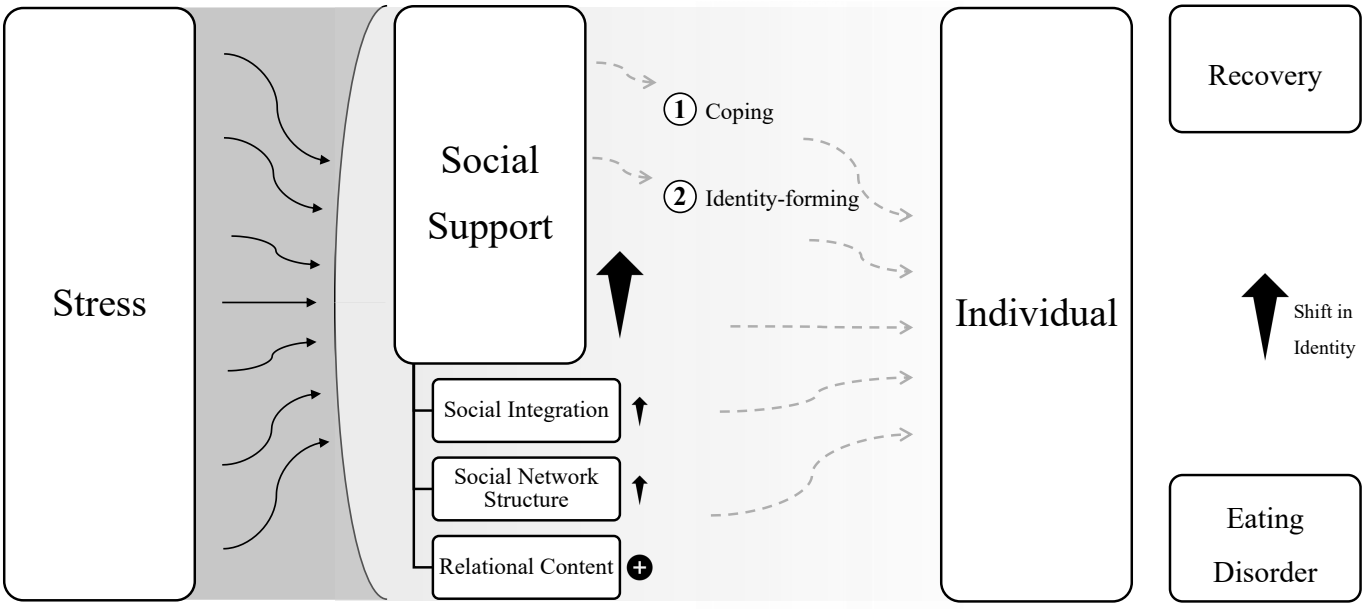

Figure 1. Conceptual Map

III. I. Recovery

Eating disorder recovery is a complex and multi-faceted concept. From a clinical perspective, the definition and criteria of eating disorder recovery are often exclusively based on the restoration of BMI and the remission of essential symptoms (de Vos et al., 2017). However, it has been shown that a definition of recovery that lacks psychological criteria greatly misaligns with patients' understanding of it, as they tend to emphasize the change in thinking rather than the change in behavior (de Vos et al., 2017). Those who experienced eating disorders and recovery interpret recovery as an ongoing process, a journey rather than an outcome (Bardone-Cone et al., 2018; Bohrer et al., 2020). They highlight factors such as hope, self-acceptance, and social support as integral parts of the process of recovery (Bardone-Cone et al., 2018). The therapists of recovered patients emphasized similar attributes, such as psychological, emotional, and social functioning (Noordenbos & Seubring, 2006). In summary, empirical evidence supports a recovery definition that focuses on the quality of life, positive emotional well-being, and other qualitative measures such as the patient's perception of their illness and recovery (Federici & Kaplan, 2008; de Vos et al., 2017; Bohrer et al., 2020).

For participant recruitment, qualitative studies often tend to rely on participants self-identifying as recovered or in recovery (Bardone-Cone et al., 2018). The adoption of a recovery identity has also been shown to be an integral part of recovery (McNamara & Parsons, 2016). Thus, the definition of eating disorder recovery in the current study relies on self-identification. Eating disorder recovery is understood as the adoption of a recovery identity, hence considering oneself recovered.

III. II. Social Support

The second central concept of the present thesis is social support. The concept of social support originates from the longstanding sociological literature on social integration and isolation and is in most cases understood in its relation to individual or societal health (House et al., 1988). Social support in the current research is understood as the network of various social interactions, based on the dual relation of the provider and the recipient (Hupcey, 1988). This study examines the three key phenomena that constitute the social support concept, as identified by House et al. (1988).

The first element of the overarching concept of social support is *social integration,* which "*refers to the existence or quantity of social ties or relationships*" (p. 302). This aspect determines the degree of integration or isolation of the individual given the social environment. House et al. (1988) further argue that this element of social support might be measured as the number of relationships one has with others or the frequency of interaction with them. Additionally, these indicators might be distinguished according to the type of social ties.

The second element of social support is *social network structure*, which refers to *"the structural properties that characterize a set of relationships"* (p. 293). As described by the authors, a dyadic set of relationships can be measured by reciprocity, multiplexity, or durability. Another aspect is a set of relationships that unites a whole network, which can be measured by network variables, such as density, homogeneity, multiplexity, or dispersion.

The third element of social support is called *relational content*, referring to the *"functional nature or quality of social relationships"* (p. 302). This element is different from the previous two in two aspects. Firstly, while *social integration* and *social network structure* are numerically calculatable, *relational content* is a qualitative element. Secondly, the author argues that while the former two are structural characteristics of social support, the element of *relational content* is the

operation of social support. As House et al. (1988) write, *relational content* consists of "*three social processes through which these structures may have their effects"* (p. 293). These three forms of *relational content* are *social support*, *social demands and conflicts*, and *regulation and control.* The former two dimensions point towards a possibly positive (*social support*) and a possibly negative (*social demands and conflicts*) dimension of *relational content,* while the latter can be both positive and negative depending on the behaviors controlled or regulated. The *relational content* component is therefore indispensable for the two structural components to make an impact on health.

III. III. Process Between Social Support and Recovery

The theoretical process connecting eating disorder recovery to social support is twofold. First, social support can act as a stress buffer which helps the recipient cope with their disorder (House et al., 1988). Second, it can encourage the individual to adopt the group recovery identity, thereby promoting recovery.

House et al. (1988) name various social mechanisms through which social support affects health, which may be behavioral, psychological, and biological, as well as social. The main process this thesis highlights is the social support's stress-buffering effect. An increased degree and good quality social support can form a protective layer between the individual and the disorder-maintaining stress sources, such as mental health problems, cultural pressure, or genetic risk factors (elaborated in detail in section II. Relevant Research).

Additionally, in the context of a recovery-promoting community, social support can be seen as an effective way of encouraging the individual to adopt the group identity, to shift away from an illness identity toward a recovery identity (Ransom et al., 2010; McNamara & Parsons, 2016). Consequently, the proposed theoretical schema suggests that the higher the degree of social support, and the more positive the social support, the higher the probability of recovery.

IV. Methodology

To uncover the relationship between the chances of recovery and social support experienced in the selected pro-recovery online community, the current research applies a three-stepped multivariate logistic regression analysis. The dataset constitutes online interactions from a pro-recovery online community on Reddit, called r/EatingDisorders. Human annotation is used to gather information on the users' recovery status, thereby selecting the key users central to the analysis, which is followed by the collection of the dataset via Reddit's official API (Reddit, n.d.). The methodological toolkit of traditional computational analysis, social network analysis, and natural language processing is utilized to empirically measure the complex focal concept of social support. The relationship between two focal concepts, eating disorder recovery and social support is further investigated in a statistical elaboration model. The final analyzed dataset consists of 673 submissions and 7270 comments from 3192 unique users, with special regard to the focal 160 users whose recovery status was manually annotated.

IV. I. Selected Platform

Reddit, the self-proclaimed "front page of the Internet", is one of the most influential social media platforms worldwide. It is marked as the 13th most visited website (as of February 2023; Alexa, 2023), with over 70 million daily active users, and over 100 thousand active communities (as of October 2023; Reddit, 2023). Reddit's social influence is even more highlighted by the significant amount of lurkers, those reading the content but not engaging with the platform, estimated at over 6 million users per day (Protalinski, 2017). Its popularity not only underpins its social relevance but highlights the vast amount of rich data available for academic research.

There are several characteristics unique to Reddit that separate it from other main social media platforms and make it the most fitting to the current research. The primary distinction of Reddit is the platform's architecture, which revolves around user-created communities united by specific topics, called subreddits. As opposed to other major social media platforms, where users follow other users, on Reddit, users follow these topic-specific online forums. Subreddits act as distinct ecologies organized around self-identified themes, with their own, self-moderated rules, user engagement characteristics, language features (such as unique abbreviations and slang), and even inside jokes (Amaya, 2021). This feature provides researchers with the opportunity to easily identify specific niches in society that are inaccessible with traditional survey research and are significantly less available via the investigation of other platforms.

Additionally, Reddit's environment offers anonymity to the users, by encouraging the usage of fictional usernames and by not collecting demographical or other personal information of the users. This feature, on the one hand, shifts the focus from the user even more to the content of the topical discussion, and on the other hand, fosters authentic and honest discussions around sensitive or controversial topics. For instance, Sowles et al. (2018) have been able to identify discussions on Reddit, where individuals opposed to seeking professional help for their eating disorder received reinforcing attitudes from other users, which behavior might have been impossible to detect in a non-anonymous online environment.

Thirdly, the majority of Reddit's subreddit is open to the public, making the content available to anyone, even without the need to register or join the community. Along the same lines, the extraction of the data is available with a relatively low entry threshold via Reddit's official API (Reddit, n.d.). This openness contributes to the validity of the research by eliminating the researcher's intrusive presence within the studied environment, ensuring the unobtrusiveness of the data (Hine, 2015).

IV. II. Case Justification

To be able to gain in-depth insight into the relationship between eating disorder recovery and online social support, one case community is selected. As described above, subreddits present distinct online communities, thus, one subreddit is selected as a case for an online community. Since the focal issue of the research revolves around the support for eating disorder recovery, another case selection criterion narrows down the options: the selected subreddit must be recovery-supporting (Ragin, 1992; Walton, 1992).

There is a multitude of different subreddits around the general topic of eating disorders, in addition to the even higher number of communities united by specific types of eating disorders (such as r/BingeEatingDisorder, r/AnorexiaNervosa, r/bulimia, r/ARFID, etc.). Since Reddit is actively banning[2] and quarantining[3] pro-eating disorder (pro-ED) communities, the open communities should theoretically all be the sphere of recovery support. However, there are still many to be found that are about supporting individuals in dealing with their disorder, rather than supporting their recovery. For instance, the About info of r/EdAnonymousAdults starts with: "*We are not a recovery Subreddit*." To ensure the collected data consists of social support towards recovery and not the maintenance of the disorder, the selection of a clearly recovery-oriented subreddit was inevitable.

The subreddit r/EatingDisorders presents a perfectly suitable case for the study, as it self-identifies as "*a community dedicated to providing support, resources, and encouragement for individuals dealing with eating disorders*[4]" (Reddit.com, 2024).

[2] The most influential ban of the r/proED community with around 33 thousand members happened in 2018. How this affected previous members can be illustrated in the discussion here.
[3] Reddit enforces the moderation technique of quarantining on subreddits that contain content that is considered inappropriate for the wider public to easily access. This might be due to misogynous content (Chandrasekharan et al., 2022), communities "*dedicated to promoting hoaxes*" (Reddit.com, 2021), or even eating disorder-promoting discussion. Quarantined subreddits no longer appear among the search results and recommendations, and visitors trying to access them will see "*a warning that requires users to explicitly opt-in to viewing the content*" (Reddit.com, 2021).
[4] The subreddit's full About info describing its aim and internal rules can be found in Appendix I. About: r/EatingDisorders.

Moreover, it articulates its intolerance towards pro-ED material in multiple ways, such as prohibiting content *"that promotes or glorifies eating disorders*", content that is linked to pro-ED forums such as binge and purge confessions, and reference to exact weight, calorie, or BMI numbers (Reddit.com, 2024). With 92 thousand members (at the time of this writing, February 2024) it marks the third-largest eating disorder subreddit (after r/EDAnonymous and r/EDanonymemes both consisting of 123 thousand members). Previous research emphasizes the importance of content moderation in preserving the beneficial quality of recovery-oriented sites (Hersey, 2014; Jones et al., 2022), thus it is key that the subreddit r/EatingDisorders operates under the moderation of 10 users (at the time of this writing, February 2024). The subreddit only contains English-language posts (Reddit.com, 2024).

IV. III. Data Collection

There are 160 usernames (80 recovered and 80 non-recovered) collected by the author via manual sampling using Reddit's interface. The search includes reading through submissions and comments from newest to oldest. Purposeful sampling is applied, meaning, that the sample is selected strategically based on the selection criterion[5] imperative for the research objective, to provide the most informative data (Yin, 2009).

The user history of the selected users and of their networks (those users they had interaction with) is accessed via Reddit's official API[6] (Reddit, n.d.). As the Reddit API enables targeted data extraction (Amaya et al., 2021), only the user history of the selected users, within the selected subreddit is retrieved[7]. As the research question encompasses the entirety of an individual's social interactions within the

[5] The criteria for the sampling are elaborated in section IV. IV. Operationalization, the original codebook can be found in Appendix II. Coding Scheme.
[6] API stands for Application Programming Interface. The widely used PRAW (Python Reddit API Wrapper) package was utilized to access the API (PRAW, 2023).
[7] How the limitations of API data collection are addressed is elaborated on in V. VIII. Limitations.

online community, the data is collected without time restrictions. In addition to the textual content of these posts and comments, the data provides their corresponding metadata such as timestamp, link, score, and ID. Thanks to the structure of the datasets, not only the submission–comment relationships but also the comment–reply response trees are reconstructible (Amaya et al., 2021). This architecture facilitates the detailed examination of the online support received by the two selected user groups from the onset of their interactions within the selected online pro-recovery eating disorder community.

IV. IV. Operationalization

One of the two central concepts of this research is eating disorder recovery. Derived from the theoretical schema (as presented in sectio), in the current study, eating disorder recovery is understood as the adoption of a recovery identity, hence considering oneself recovered. The operationalization of users who identify as recovered or ill also greatly depends on the data at hand: online posts and comments. Consequently, the distinction between recovered and non-recovered individuals relies on their online textual expressions. The users who mentioned that they consider themselves recovered were annotated in the 'recovered' group, whereas those expressing that they are still actively battling with the illness, were categorized into the 'non-recovered' group[8]. Only those users were categorized who openly expressed either one of the described conditions, those not mentioning any of the two were not included in the focal sample.

The second central concept of the study is social support. As introduced in section III. II. Social Support, this study conceptualizes social support as an overarching term uniting three key phenomena: *social integration*, *social network structure*, and *relational content* (House et al., 1988).

[8] A detailed elaboration of the coding guideline and practical examples can be found in the original coding scheme in Appendix II. Coding Scheme.

Table 1. Operationalization of the Three Components of Social Support

COMPONENT	INDICATOR	CALCULATION
SOCIAL INTEGRATION	Number of Interactions	*number of inbound interactions* *(received submission upvotes + received comment upvotes + received comments (for submissions) + received replies (for comments))* *+* *number of outbound interactions* *(written submissions + written comments (including replies))*
	Number of Connections	*number of users one had textual interaction with*
	Temporal Frequency of Interactions	$\frac{median\ of\ hours\ spent\ between}{two\ neighboring\ textual\ interactions} \times (-1)$
SOCIAL NETWORK STRUCTURE	Reciprocity	$\frac{all\ reciprocal\ connections}{all\ connections}$
	Ego-Network Density	$\frac{all\ existing\ connections}{all\ possible\ connections}$
	Eigenvector Centrality	*eigenvector centrality score*
RELATIONAL CONTENT	Sentiment Score	*average sentiment score* of received comments (for submissions) and replies (for comments)* ** score on a scale ranging from -1 to 1 where -1 stands for negative, 0 stands for neutral, and 1 stands for positive sentiment*

Social integration, which "*refers to the existence or quantity of social ties or relationships*" (p. 302) in this study is measured by three quantitative indicators as follows. 1) The Number of Interactions which refers to the sum of all inbound interactions and outbound interactions. 2) The Number of Connections which encompasses the distinct count of all other users one had textual interaction with. Textual interaction refers to one of the following relations (see Table 2). 3) The Temporal Frequency of Interactions which indicates the median number of hours spent between two textual interactions following each other. The median central tendency indicator is used instead of the average to correct for extreme outliers, such as weeks or months spent between two neighboring interactions. Since the operationalization of more frequent interactions is needed, the calculated scale was reversed, thus, larger values represent more frequent, whereas smaller values represent less frequent interactions.

Table 2. Textual Interaction Relations

USER X	USER Y
submission author	comment author
comment author	submission author
comment author	reply author
reply author	comment author

Social network structure, referring to *"the structural properties that characterize a set of relationships"* (p. 293) will be translated into three empirical indicators as follows. 1) Reciprocity which is the ratio of all reciprocal ties out of all ties.

Multiple interactions between the same two users are calculated as multiple, thus, the same two users can have one (or multiple) reciprocal and one (or multiple) non-reciprocal ties at the same time. 2) Ego-Network Density which is the ratio between the number of existing ties out of all possible ties, calculated in each user's own eco-system. Assuming the users' own eco-system is an interactional environment where interactions stand for comments and submissions, and the boundaries of the environment extend to the other users they interacted with, but not beyond. 3) Eigenvector Centrality which is a centrality measure quantifying the relative importance of a node within a network. It assigns scores to nodes based not only on their direct connections but also on the connections of their neighbors, indicating the prominence of a node within the network more effectively than other centrality indicators.

Relational content is the third, qualitative element of social support, referring to the *"functional nature or quality of social relationships"* (p. 302). This qualitative element requires a fundamentally different measurement. As this qualitative dimension is the most challenging to grasp, in the present study, the element of *relational content* is simplified to a positive and a negative dimension, that may be empirically measured by the received interactions' positive and negative sentiments. Building on the recent developments of natural language processing methods in social scientific research, a pre-trained sentiment detector model is deployed to provide the categorization of the textual data in terms of the positive or negative sentiment it conveys (Cardiff NLP, 2022). The applied model was selected carefully by comparing its performance to alternative sentiment detectors, considering the vast amount of data it has been trained on, and supervising its results via human judgment. How the limitations of this method were addressed is elaborated in detail in V. VIII. Limitations.

IV. V. Analytical Strategy

Once the final dataset is collected, the cleaning and inspection of the dataset is crucial. The data cleaning, and data verification steps, in addition to the preparatory steps taken for statistical appropriateness, are explained in detail in Appendix III. Data Cleaning, Verification, and Preparation. After the fundamental data processing, the variables required for the analysis are computed. Since the unit of the analysis is the user, these indicators are calculated on the user level, and exclusive to the focal users. First, the indicators that constitute *social integration* are computed using traditional computational analysis. In the subsequent step, the *social network structure* variables are computed utilizing methodological principles of social network analysis. For both quantitative elements, their three corresponding sub-indicators are merged into one compound variable. Next, *relational content* is evaluated via the selected sentiment analysis model (Cardiff NLP, 2022). Finally, the three elements of social support are averaged into one single indicator. This way, the final analyzed data table is produced. Before modeling, bivariate correlations are demonstrated, as well as the assumptions of the established models are tested. As the outcome variable is binary, logistic regression is chosen as the appropriate statistical method.

The analytical strategy follows the elaboration model as described by Aneshensel (2012). As a first step, the two focal variables, namely *recovery* as the dependent and *social support* as the independent variable, are included in a bivariate model, to inspect if there is a statistically significant association between them. In the next step, the relationship between the focal variables is further investigated in an elaboration model by analyzing the relationship between the three elements of *social support* and the dependent variable. In the last step, an exclusionary model is established, aimed at ruling out the possibility of spuriousness caused by the confounder *outbound relational content* variable. The analysis is conducted using Python and RStudio programming environments. The entire workflow can be replicated by accessing the scripts in the corresponding GitHub repository here.

V. Analysis

The analysis aims to answer whether *social support experienced in an online pro-recovery community could be linked to eating disorder recovery* (RQ 1). In case the statistical relationship between online social support and recovery can be established, the analysis examines *the degree to which each of the three components of social support contributes to the overall effect of online social support on eating disorder recovery* (RQ 2). Further, the possibly confounding effect of rival variables is examined.

The analysis first demonstrates all computed indicators and the final three components that constitute the *social support* concept. Then, the binary relationships between the independent variables, the *social support* components, and the dependent variable, the *recovery* label are presented, followed by the visualization of that between the compound *social support* index and the *recovery* variable. In the subsequent step, the relationships between the three *social support* components are examined, to further understand the relationship between the predictor variables. Then, a baseline model is established, confirming that the degree of *social support* received in this online community is in a statistically significant relationship with the characteristic of one identifying oneself as recovered or not. This association is further unveiled in the elaboration model, which proves that the *relational content* variable is the single significant predictor of recovery. Lastly, a possibly confounding variable, the *relational content of outbound interactions* is proposed and introduced in an exclusionary model. This model confirms that the effect of the *relational content* of the received online interactions on *eating disorder recovery* is not due to the sentiment of the written posts or comments. Still, it holds explanatory power on its own. The analytical section concludes with some reflections on both the limitations and the ethical implications of the study.

V. I. Descriptive Analysis of Computed Variables

V.I.I. Social Integration

Social integration is measured by a compound index that encompasses three sub-indicators. It shows how many interactions one had (Number of Interactions) including received comments, comment replies, upvotes, and written posts and comments, how many other users one interacted with (Number of Connections) considering only textual interactions, as well as how frequent these textual interactions are on the analyzed eating disorder forum throughout the user's history. The *social integration* index is higher if the Number of Connections and the Number of Interactions is higher, and if the Frequency of the Interactions is lower (The indicator is reversed before being included in the compound index). Figure 2 shows the distribution of the sub-indicators. It is worth noting that all of them follow a count-variable pattern, with most cases closer to 0, and only a few cases with high values.

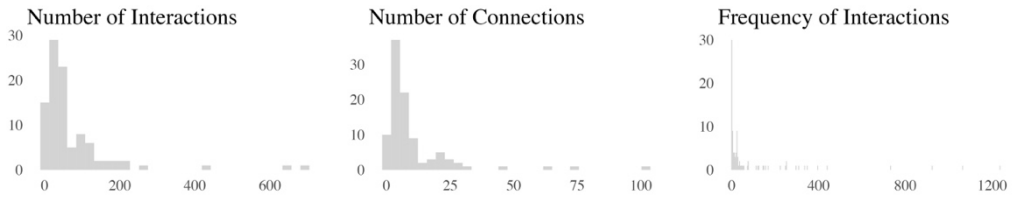

Figure 2. Sub-indicators of the Social Integration Index

These sub-indicators were standardized and averaged into the compound variable *Social Integration* Index. Figure 3 shows that this standardized index ranges from around -3 to 4, and as expected, is centered around 0. It can be regarded as falling onto the normal distribution curve, and thus, can be included in the statistical model.

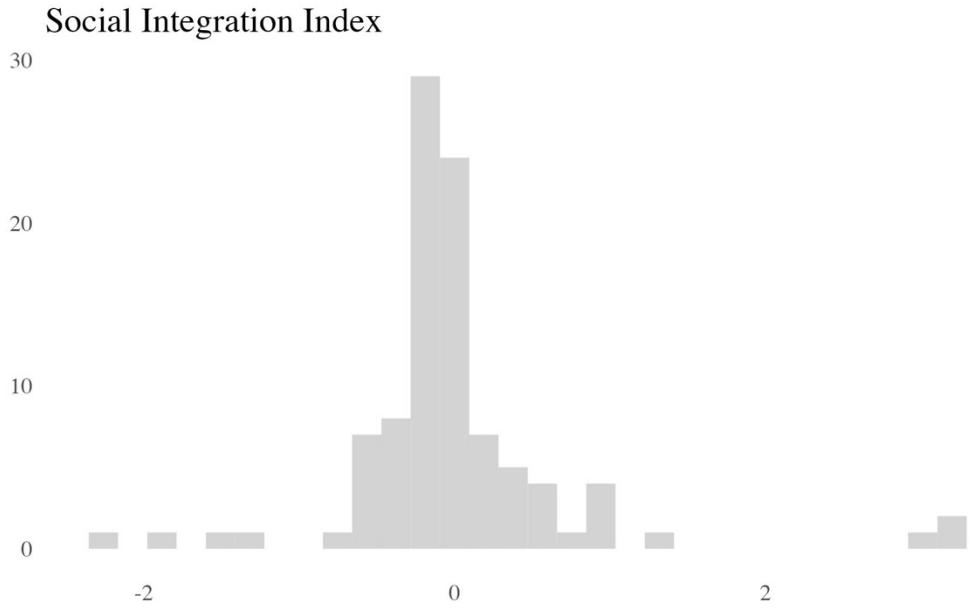

Figure 3. Distribution of the Social Integration Index

V.I.II. Social Network Structure

Social network structure refers to the density, reciprocal nature of the users' social network, as well as considers the centrality of their position within their network. Thus, the *Social Network* Index is computed using three sub-indicators: Ego-Network Density which refers to how dense one's network is (how many connections exist out of all possible connections), Eigenvector Centrality which is a social network analytical indicator of one's centrality position within their own network, and Reciprocity that encompasses how many of one's interactions received a response from the other party. Figure 4 shows the distribution of these measures. Since the Eigenvector Centrality values are exceptionally small, their log is taken to visualize them in the below histogram.

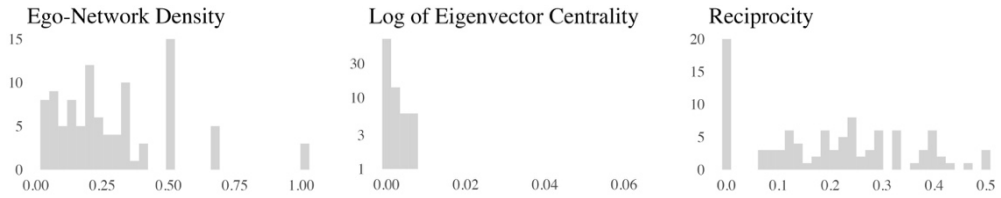

Figure 4. Sub-indicators of the Social Network Structure Index

The described three measurements were standardized before being included in the compound Social Network Structure Index. The Social Network variable is higher for the user if their Ego-Network is denser, their Eigenvector Centrality score is higher, and their Reciprocity ratio is larger. The more reciprocal and dense the network of the user, and the more central their position, the higher their *social network structur*e value. Figure 5 below shows the distribution of this index, which ranges from around -1 to 3, and roughly follows a normality distribution, with a small "tail" to the positive values. This index can also be included in the statistical model as a predictor variable.

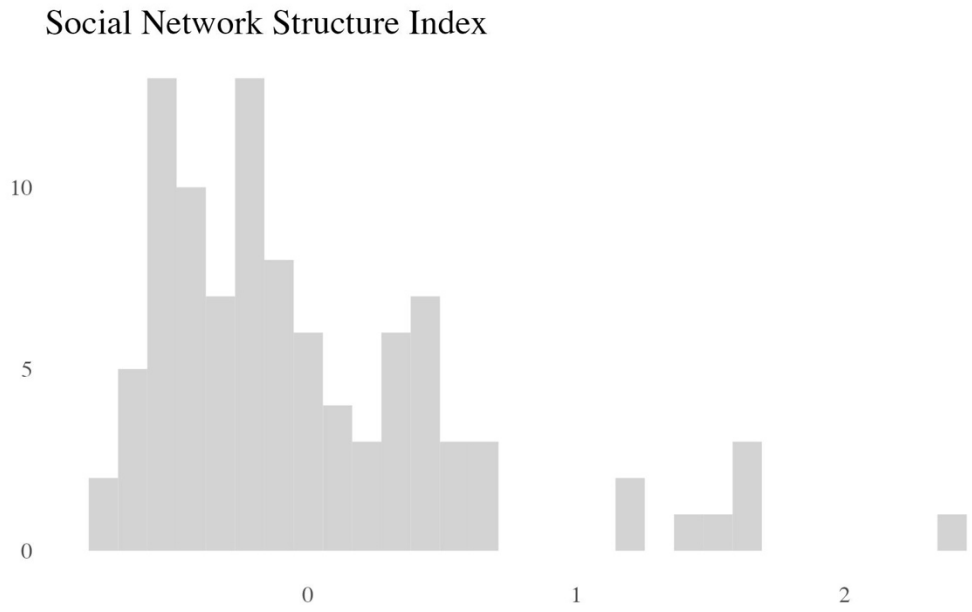

Figure 5. Distribution of the Social Network Structure Index

V.I.III. Relational Content

The *Relational content* indicator refers to the qualitative nature of the interactions the user had on the online eating disorder forum. It is translated into empirical measurement via a pre-trained sentiment analysis model (Cardiff NLP, 2022) that labels the textual units (posts, comments, replies) as positive, negative, or neutral. These labels are transformed into a numerical variable, which is then aggregated at the user level in an average sentiment score. The *Relational content* indicator only includes the received comments and replies by the user and excludes those written by the user. (The sentiment score of the content written by the user is included as a confounder variable in section V. VI. Possible Confounding Effect.) The more positive the average sentiment of the comments the user received, the higher their value on the *Relational Content* indicator. This sentiment score constitutes the third element of *social support* alongside *social integration* and *social network structure*. As Figure 6 showcases, the *Relational Content* variable also roughly follows a normality distribution, with two exceptional peaks at 0 and 1.

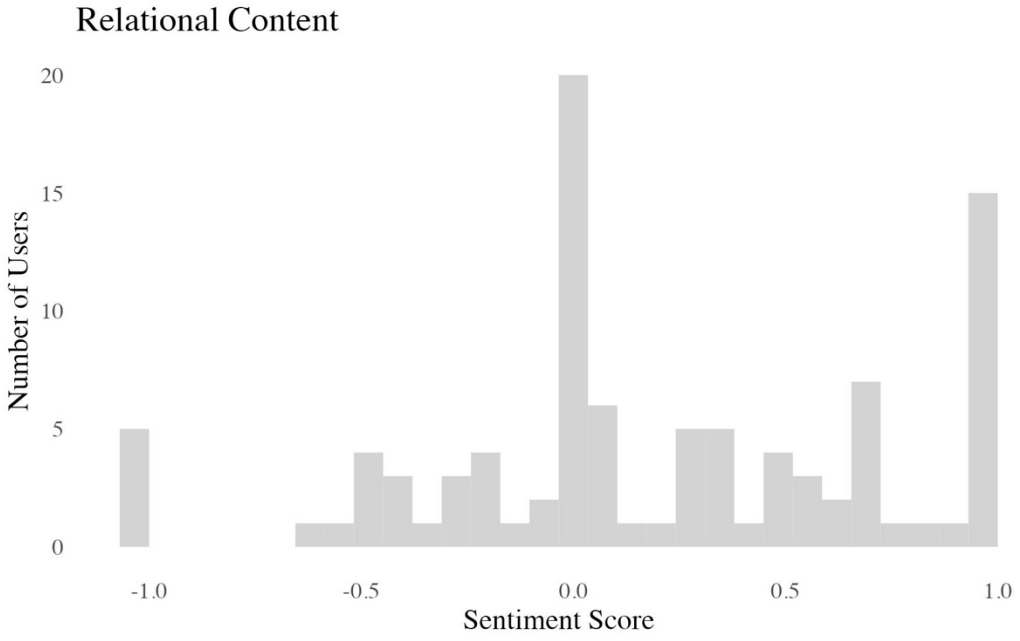

Figure 6. Distribution of the Relational Content Component

V.I.III. Social Support

The compound variable that encompasses all three components and serves as the core predictor variable in this analysis is the *Social Support* Index. It is computed as the average of its three elements (*social integration*, *social network structure,* and *relational content*) to cover all three areas of *social support* as conceptualized by House et al. (1988). In summary, the more the user is integrated into the online community, the better the users' network qualities, and the more positive the content of their relations, the higher their *social support*. The compound variable roughly follows a normal distribution curve, ranging between around -2 and 2.

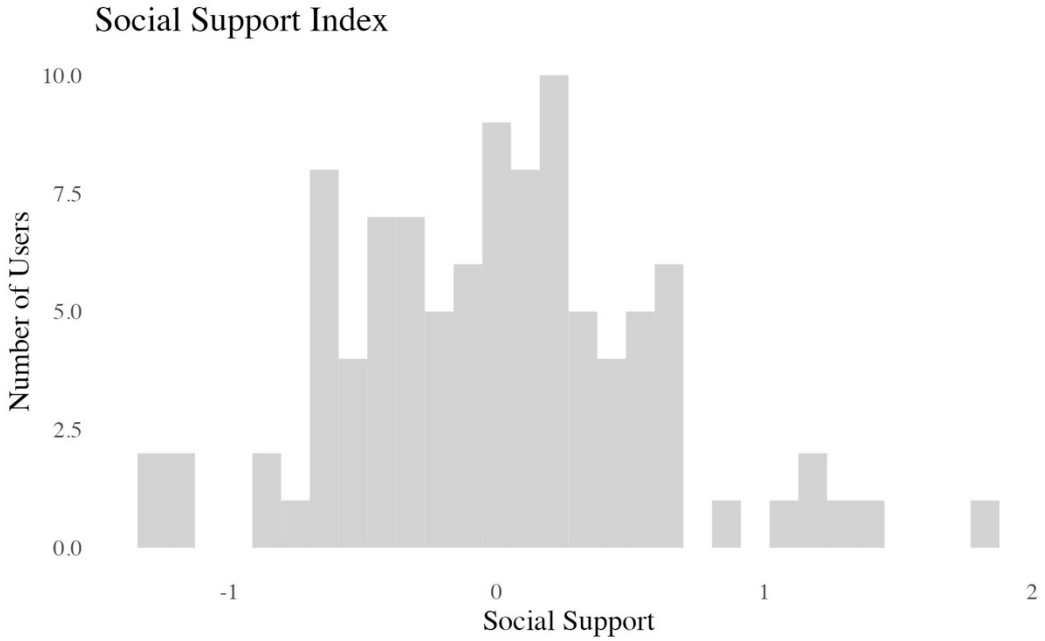

Figure 7. Distribution of Social Support

V.I.III. Recovery

The dependent variable of the current analysis is *eating disorder recovery*. This is indicated by a binary variable that is based on the human annotation of the author. This process is further elaborated on in section IV. III. Data Collection, section IV. IV. Operationalization, and the coding guide can be reviewed in Appendix II.

Coding Scheme. The final, modeled dataset includes 58 recovered and 40 non-recovered users. The reasons for the sample size drop is further elaborated on in Appendix IV. Reasons for Excluded Observations.

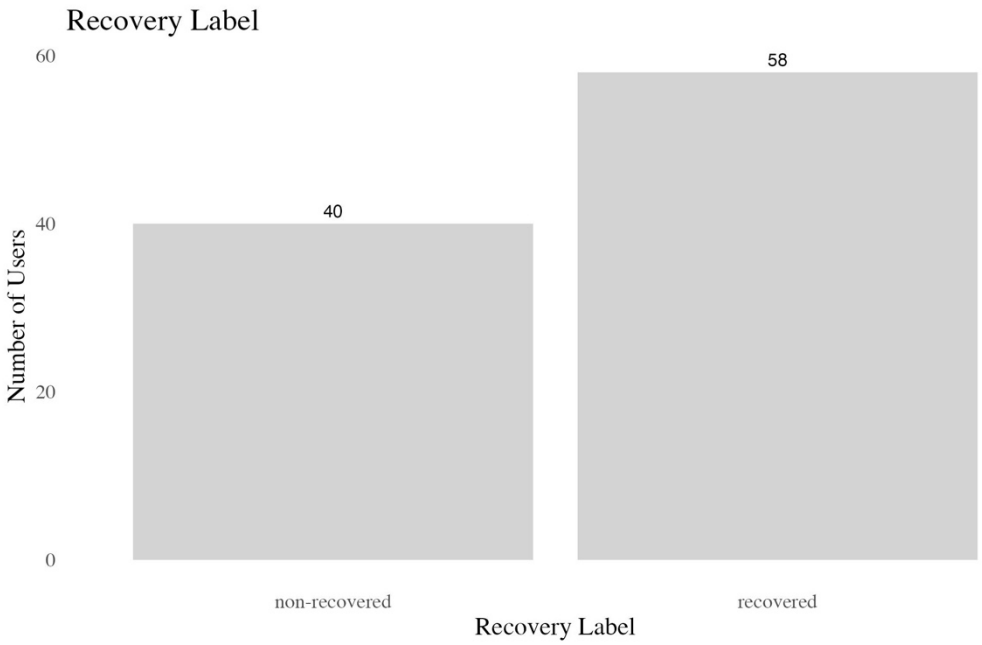

Figure 8. Distribution of Recovery Label

V. II. Bivariate Relationships

Prior to statistical modeling, the bivariate relationships between each of the predictor dimensions, namely, *social integration*, *social network structure,* and *relational content,* and the outcome variable, the *recovery* label are demonstrated visually.

V.II.I. Social Integration and Recovery

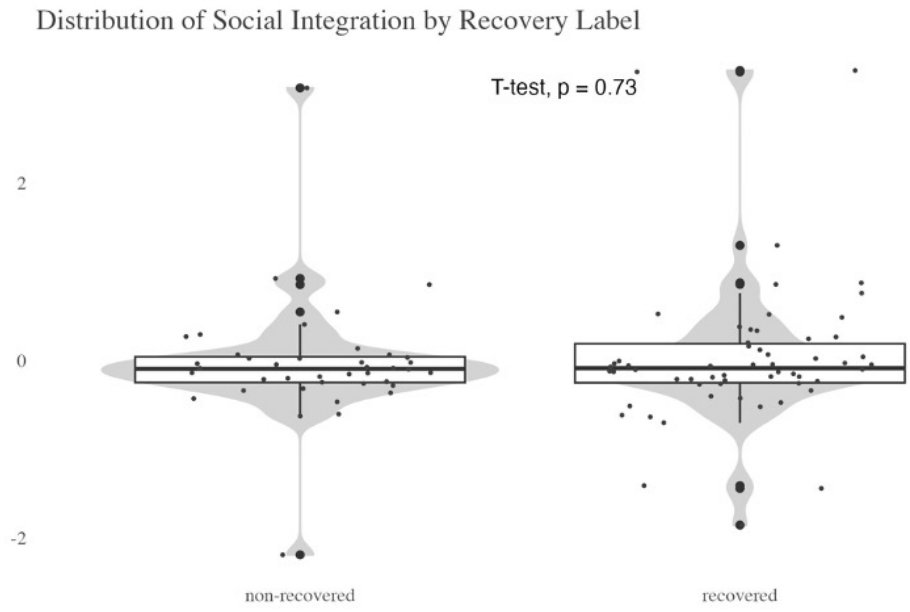

Figure 9. Bivariate Relationship between Social Integration and Recovery

Figure 9 shows that the distribution of *social integration* in both the recovered and the non-recovered user groups includes edge cases, with a denser representation around the median. Even though the median *social integration* value for the recovered and non-recovered users is slightly slipped, the overlap of the two boxplots suggests that this difference is statistically not significant. The T-test confirms that the average of the two groups does not differ significantly ($p = 0.73$).

V.II.II. Social Network Structure and Recovery

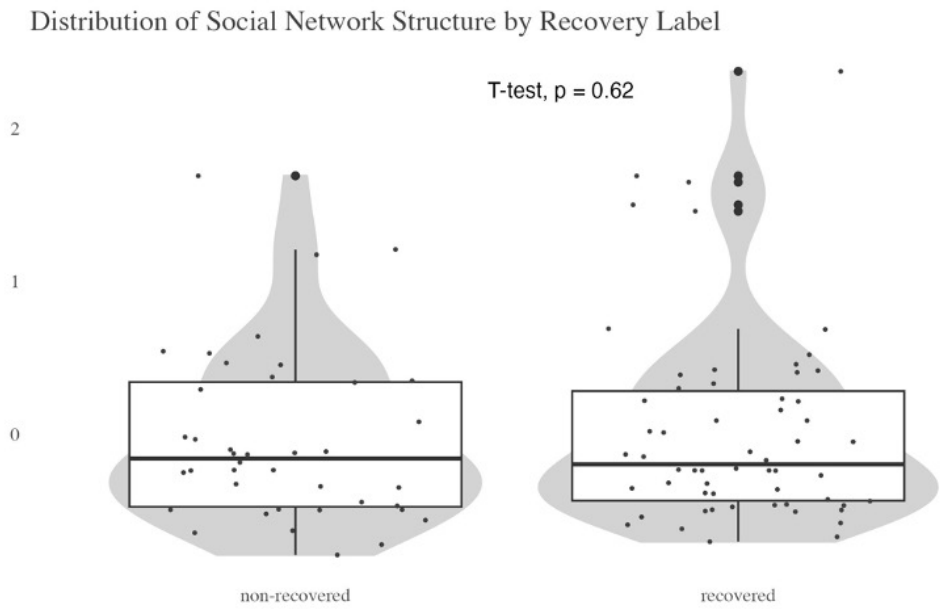

Figure 10. Bivariate Relationship between Social Network Structure and Recovery

Figure 10 suggests that the *social network structure* of the two analyzed groups is roughly the same, as the medians seem to be around the same value, slightly below 0. Additionally, the two boxplots greatly overlap. The T-test performed to test whether the averages of the recovered and non-recovered groups differ statistically confirms this suspicion, with a p-value of 0.62. *Social network structure* and *eating disorder recovery* are not statistically related.

V.II.III. Relational Content and Recovery

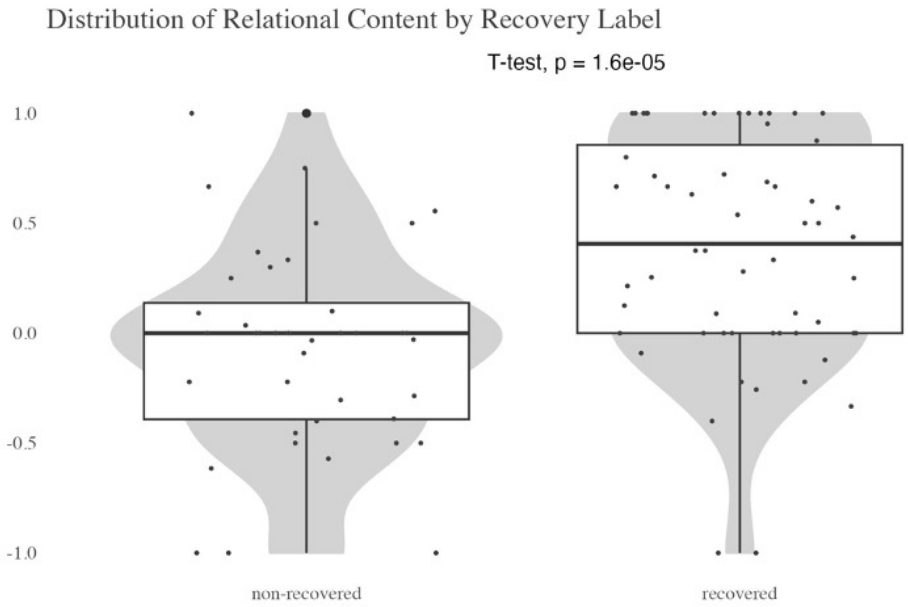

Figure 11. Bivariate Relationship between Relational Content and Recovery

The *relational content* variable shows a notable difference between the distribution of the two groups (see Figure 11). The median relational content value of the non-recovered group is around 0, whereas the recovered users have a median of roughly 0.4, indicating emotionally more positive received messages. The medians fall outside the overlap of the two boxplots, suggesting that this is a statistically significant relationship. The T-test returns a strikingly low p-value (< 0.001), confirming that the *relational content* and the *recovery label* variables are statistically associated.

V.II.IV. Social Support and Recovery

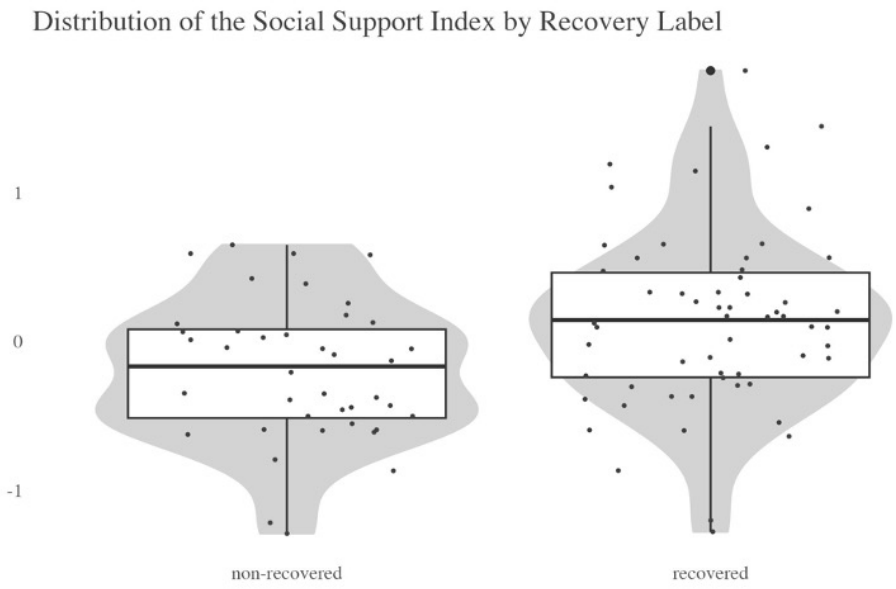

Figure 12. Bivariate Relationship between Social Support and Recovery

Lastly, I inspect the bivariate relationship between the compound *social support* variable computed as the index of the three formerly presented indicators and the *recovery* variable. Figure 12 indicates that the group of recovered users includes all the users with the highest *social support* values. Additionally, the recovered group has an around 0.5 higher median of *social support* than the group of non-recovered users. Also, the median values fall outside of the overlap of the two boxplots, suggesting a statistically significant difference. The statistical relationship between these variables is further investigated in section V. IV. Baseline Model.

V. III. Interaction between Independent Variables

To better understand the variables under study, the interrelations between the independent variables are further scrutinized. This is key to understanding their possibly interacting effects in the statistical model.

V.III.I. Social Integration and Social Network Structure

The *social integration* and the *social network structure* variables are both compound variables, created as the merge of three sub-indicators as described in Table 1. Operationalization of the Three Components of Social Support. The *social integration* index measures the users' interaction count, interaction frequency, and connection count. *Social network structure* encompasses the users' network density, reciprocity ratio, and position centrality. One might assume that these two properties can be in a linear relationship, as the more one is integrated into the online community with ties and connections, the better their network qualities can be. However, Figure 13 reveals that no such interaction can be seen in the current dataset. The p-value of the linear correlation is around 0.5. These two variables, even if affecting eating disorder recovery, then independent of each other.

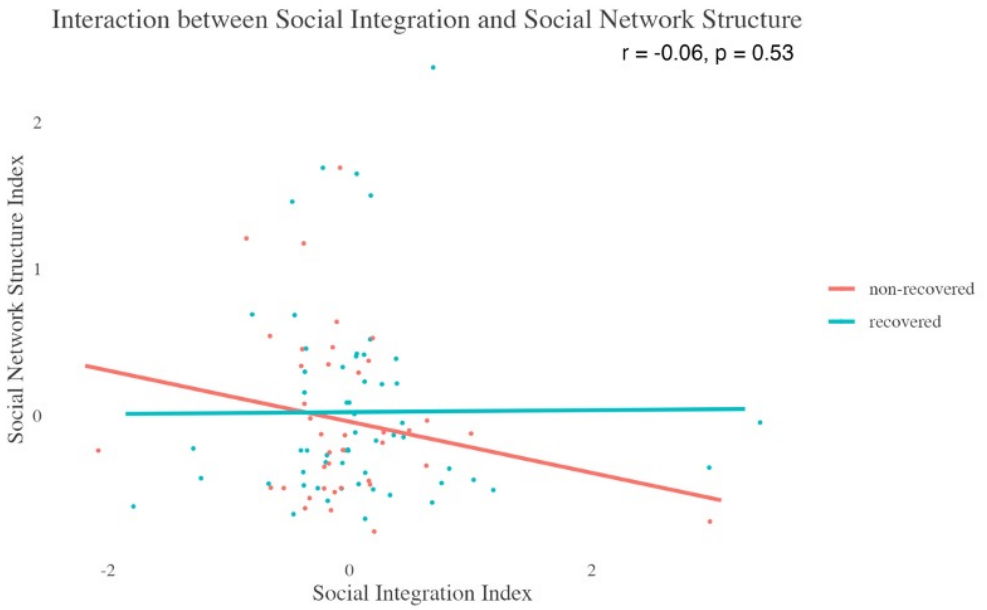

Figure 13. Interaction between Social Integration and Social Network Structure

V.III.II. Social Integration and Relational Content

Relational content is measured by the average sentiment score aggregated from the positive, negative, or neutral label of the received comments by a user. Figure 14 shows the interplay between *social integration* and *relational content* in the analyzed user base. The scatter plot does not indicate any linear relationship between the two. The p-value of the linear correlation confirms this suspicion (p = 0.43). These two independent variables do not seem to interact when predicting *eating disorder recovery*.

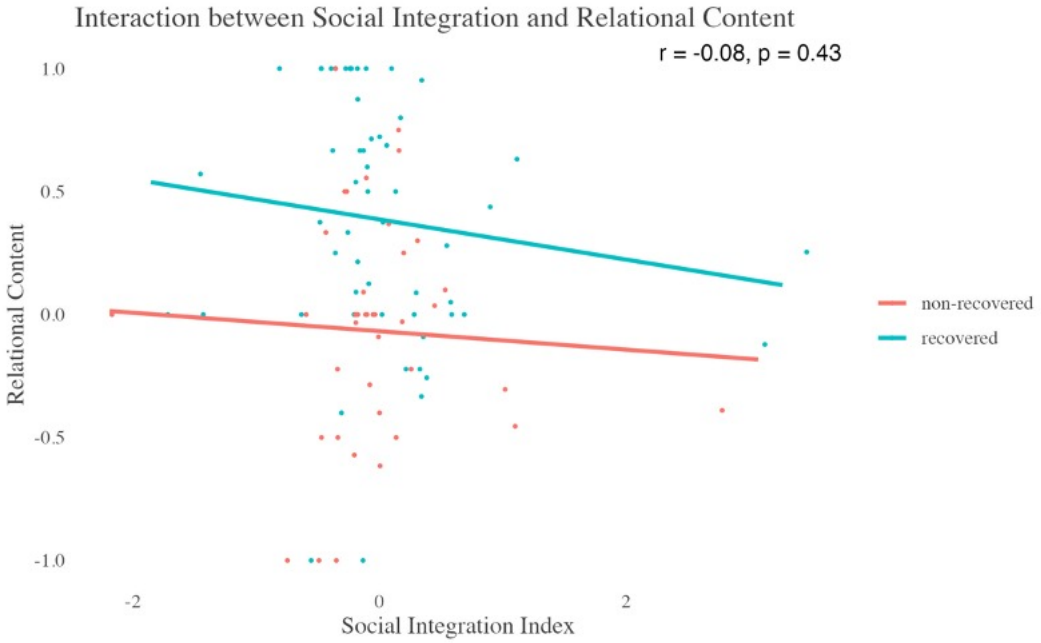

Figure 14. Interaction between Social Integration and Relational Content

V.III.III. Social Network Structure and Relational Content

Lastly, the linear relationship between *social network structure* and *relational content* is reviewed. As can be seen in Figure 15, these two predictor variables are most likely independent of one another. The p-value of the linear correlation is 0.17, confirming that there is no linear relationship between these variables. However, there is a noticeable difference in the distribution of recovered and non-recovered

users in this two-dimensional space. While low *social network struc*ture value and low *relational content* value are mainly true for non-recovered users (bottom left corner of the chart), high numbers on both indicators are rather applicable for recovered individuals (upper right corner of the chart).

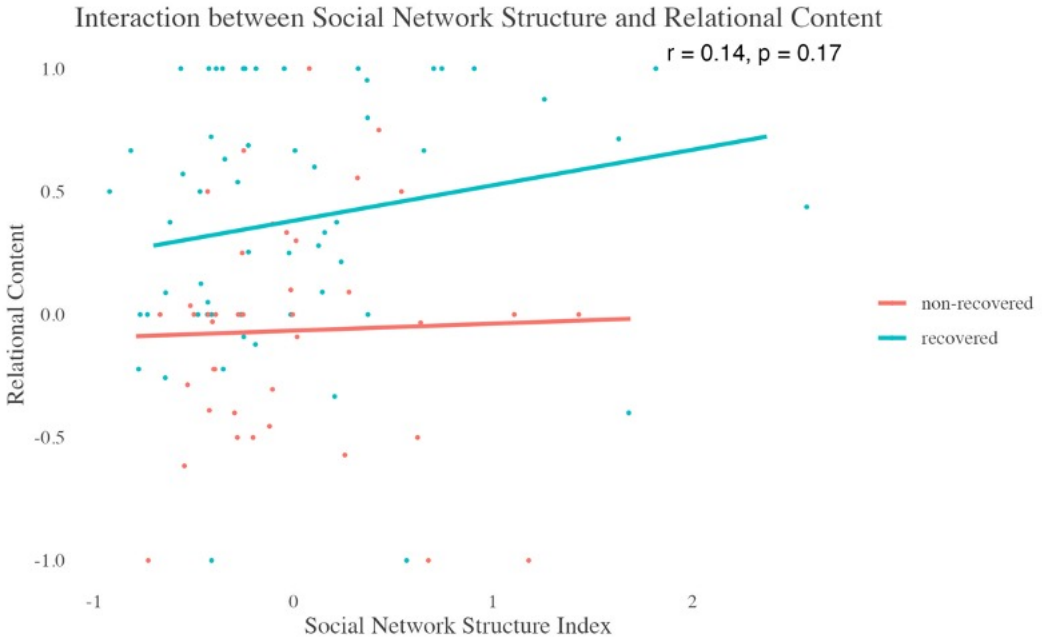

Figure 15. Interaction between Social Network Structure and Relational Content

V. IV. Baseline Model

To evaluate *whether there is a relationship between social support received in the analyzed pro-recovery online community and eating disorder recovery* (RQ 1), a logistic regression model is applied.

The predictor variable is the compound *social support* variable computed as the index of the three formerly presented indicators, whereas the outcome variable is the *recovery label* variable containing humanly annotated information about one's recovery status.

Baseline Model

	Dependent variable:
	Recovery
Intercept: non-recovered	0.413 (0.217)
Social Support	1.160** (0.426)
Observations	98
Note:	*p<0.05; **p<0.01; ***p<0.001

Figure 16. Summary of the Baseline Model

The baseline model shows that there is a statistically significant relationship between *social support* and *recovery* ($p < 0.01$), confirming the initial suspicion derived from the bivariate visualization (see Figure 12). As the intercept signifies the non-recovered group and the coefficient of social support is positive, this association means that the more social support one receives, the higher the probability of recovery. This result answers research question 1, by confirming that *social support* experienced in an online pro-recovery community can indeed be linked to *eating disorder recovery*.

The general equation formula of the binary logistic regression model reads as follows.

$$\text{logit}(p_{\text{Recovery}}) = \beta_{\text{Intercept}} + \beta_{\text{Social Support}} + \varepsilon$$

Which formula substituted with the calculated coefficients looks as below.

$$\text{logit}(p_{\text{Recovery}}) = 0.413 + 1.16 * \text{Social Support} + \varepsilon$$

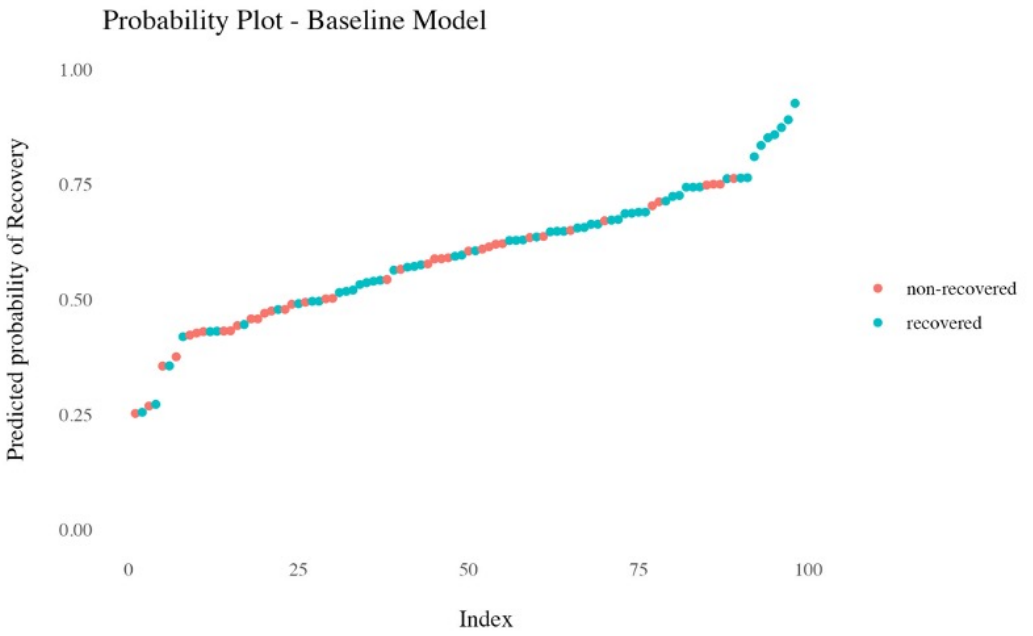

Figure 17. Probability plot of the Baseline Model

According to McFadden's (1974) Pseudo R-squared calculation, the model explains 6.6 percent of the total variance of the *recovery* variable. The degree of freedom is 96, which can be considered a sufficient explanatory power given the small sample size. The general assumptions of the model are satisfied. The probability plot, showing the probability of recovery as predicted by the baseline model and the actual recovery status, presents the relatively low precision of the baseline model (see Figure 17).

V. V. Elaboration Model

The Baseline Model confirms that *social support* and *eating disorder recovery* are in a statistically significant relationship (RQ 1). In the subsequent analytical step, I aim to uncover *the degree to which each of the three components of social support contributes to its overall effect on recovery* (RQ 2). These dimensions, as previously presented in bivariate visualizations, are *social integration* measured as an additive index of three sub-indicators, *social network structure* represented also by an index

merging three sub-indicators, and *relational content,* captured by a general sentiment score characterizing the users' discussion ecosystem. This step, on the one hand, is crucial to address the second research question of the thesis, and on the other hand, is also a statistically informed step. Section V. II. Bivariate Relationships revealed that not all of the three components of social support are associated with recovery, only *relational content*. Additionally, the inspection of the V. III. Interaction between Independent Variables showed that the three components are not linearly related. Informed by these initial results, one could assume that the three measured components are not equally contributing to the effect of *social support* on *recovery*. Moreover, the explained variance of the Baseline Model is remarkably low, below 7 percent. Thus, a more detailed model is imperative.

Elaboration Model

	Dependent variable:
	Recovery
Intercept: non-recovered	0.438 (0.229)
Social Integration	0.152 (0.220)
Social Network Structure	-0.015 (0.237)
Relational Content	1.017^{***} (0.271)
Observations	98
Note:	*p<0.05; **p<0.01; ***p<0.001

Figure 18. Summary of the Elaboration Model

The elaboration model reveals that only one component is statistically related to *recovery*. It is striking that the P-value of the *relational content* variable is extremely low ($p < 0.001$), with a high estimate value ($r = 1.017$), meaning that the more positive the relational content of the individual, the higher the chance of being recovered. *Relational content,* thus, is alone responsible for the effect of *social support* on eating disorder recovery. *Social network structure* and *social integration* do not show any significant association in the presented sample. These findings shed light on the underlying workings of these components in influencing eating

disorder recovery, providing answers to the second research question. These results are also in line with the initial assumptions derived from the inspection of the V. II. Bivariate Relationships.

The general equation formula of the elaboration model reads as follows.

$$\text{logit}(p_{\text{Recovery}}) = \beta_{\text{Intercept: non-recovered}} + \beta_{\text{Social Integration}} + \beta_{\text{Social Network Structure}} + \beta_{\text{Relational Content}} + \varepsilon$$

Which formula substituted with the calculated coefficients looks as below. The non-significant predictor variables, such as *social integration* and *social network structure* are omitted from the formula.

$$\text{logit}(p_{\text{Recovery}}) = 0.438 + 1.017 * \text{Relational Content} + \varepsilon$$

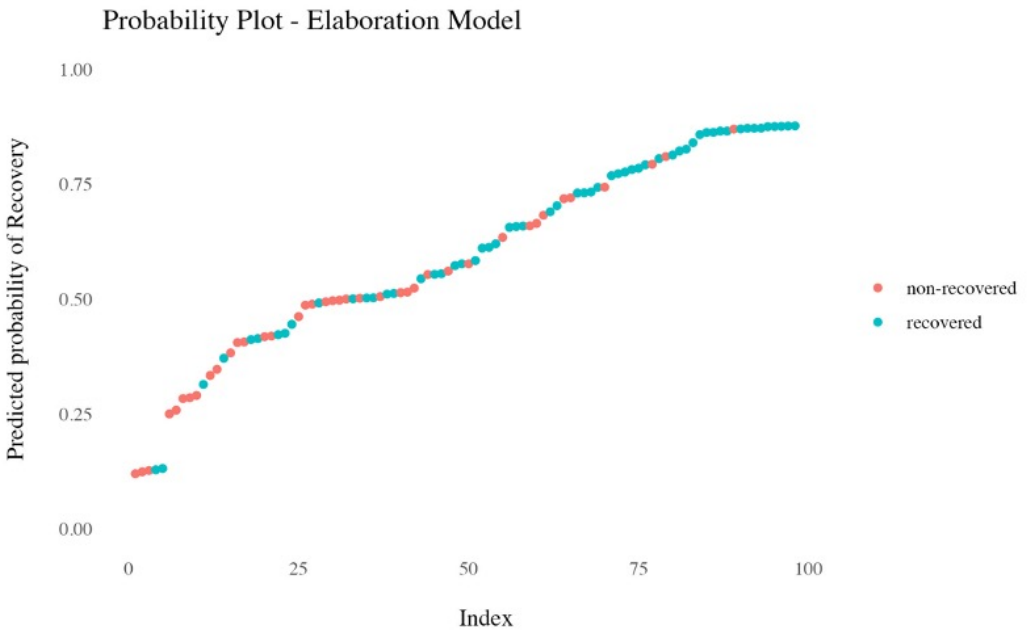

Figure 19. Probability plot of the Elaboration Model

The degree of freedom of the elaboration model is 94, and it explains around 14.1 percent of the total variance of the outcome variable, which is notably higher than the 6.6 percent of the baseline model. The explained variance doubled when including the three components individually compared to when they were included as merged into one index. This indicates that the effect of *relational content* was suppressed by the other two components in the Baseline Model. The general

assumptions of the model are satisfied. The probability plot of the elaboration model already presents a generally more precise prediction (see Figure 19).

V. VI. Possible Confounding Effect

As we can see in the V. V. Elaboration Model, *Relational content* is alone responsible for the effect of *social support* on *recovery.* Meaning that recovered individuals received messages from other users on the forum that carry more positive emotional meaning. Upon closer qualitative examination of the data, it becomes apparent that these users also contribute more positive content on the online forum. If one would like to challenge the results of the Elaboration Model, one could say that recovered users' positive outbound messages in turn generate more positive reactions. Thus, one could suspect that the more positive *relational content* they received may be attributed to the more positive *relational content* they have given. In short, positive content begets positive responses. In the search for possible confounding variables, the outbound sentiment score emerges as an influential one that is worthy of testing.

To investigate whether this holds true, the *Outbound relational content* variable is introduced, which is measured by the sentiment score of the users' outbound interactions: the aggregated score of the sentiment label of the submissions they have posted and the comments they have written. The difference between the original (Inbound) Relational Content and the confounder, Outbound Relational Content indicator is showcased in Table 3.

Table 3. Operationalization of the Confounder Indicator

	INDICATOR	CALCULATION
(INBOUND) RELATIONAL CONTENT	**Inbound** Sentiment Score	*average sentiment score* of **received** comments (for submissions) and replies (for comments)*
OUTBOUND RELATIONAL CONTENT	**Outbound** Sentiment Score	*average sentiment score* of **written** posts, comments, and replies* ** score on a scale ranging from -1 to 1 where -1 stands for negative, 0 stands for neutral, and 1 stands for positive sentiment*

To reveal whether the emotional content of the inbound and the outbound interactions of a user could be interacting in the statistical model, their relationship is reviewed in the scatterplot in Figure 20. There is a clear linear relationship between the two variables. The p-value is lower than 0.001, and the correlation coefficient indicates a moderate linear relationship ($r = 0.4$). Hence, the suspicion that positive content begets positive response appears to hold true – even on a user-aggregated level. However, it is not clear whether the *outbound relational content* variable has an effect on *eating disorder re*covery in the context of this study.

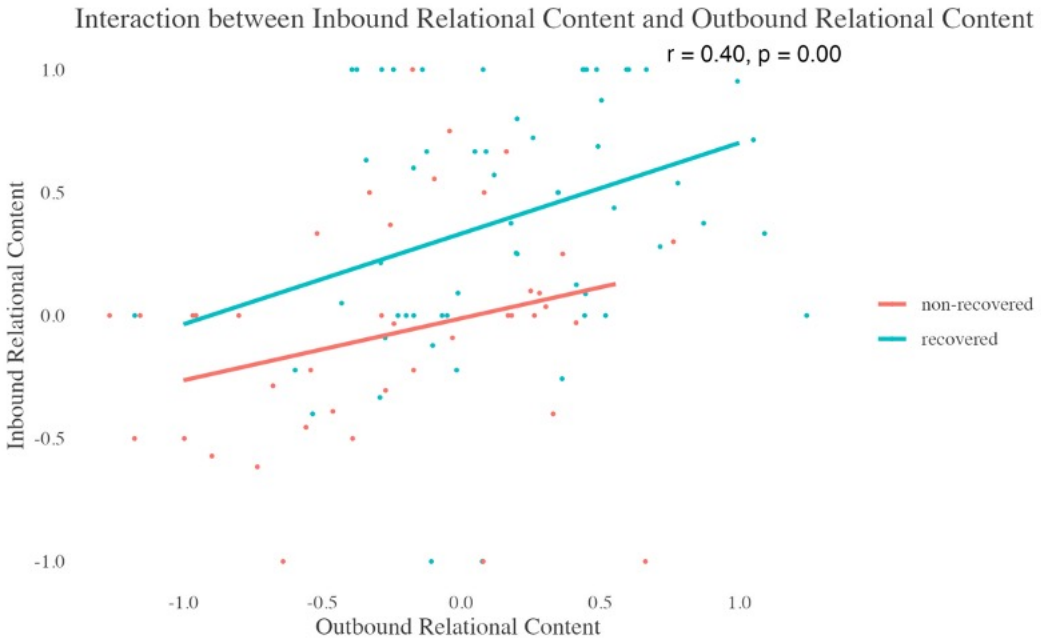

Figure 20. Interaction between the Inbound Relational Content and the Outbound Relational Content

Figure 21 below presents the bivariate relationship between the *outbound relational content* and the *recovery* of a user. The emotional content of the outbound interactions of the recovered users seems to be higher overall than that of non-recovered users. However, the median of the two groups shows only a small discrepancy. The T-test confirms that the averages of the two groups differ significantly ($p < 0.001$). Hence, the *outbound relational content* variable and the *recovery* variable are in a statistically significant relationship.

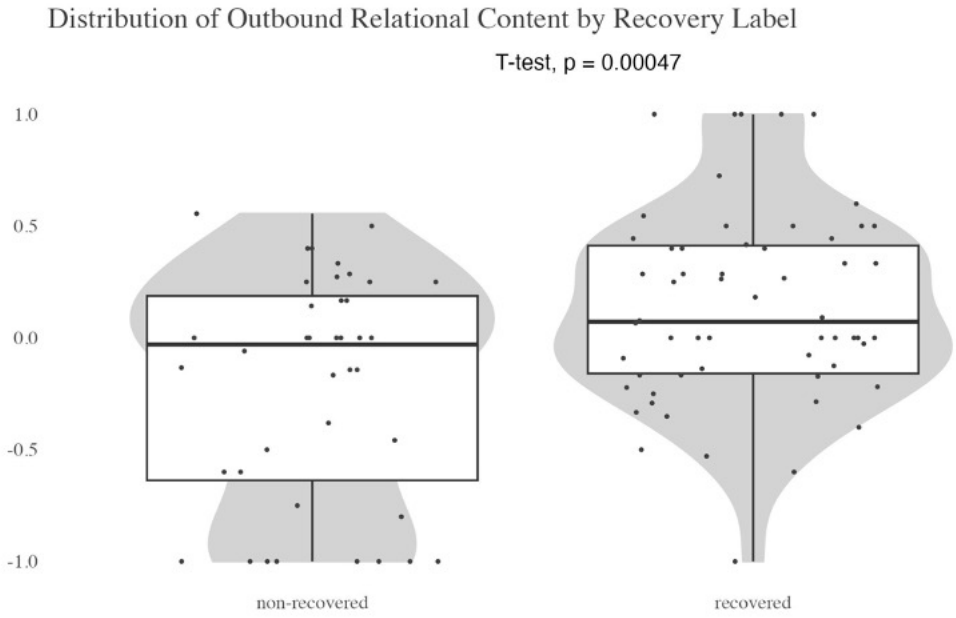

Figure 21. Bivariate Relationship between Outbound Relational Content and Recovery

V. VII. Exclusionary Model

In the last analytical step, an Exclusionary Model is presented, aiming to rule out the possibly confounding effect of the revealed rival variable. Consequently, in the Exclusionary Model, all components of *social support* are included, namely *social integration*, *social network,* and *relational content,* as well as the confounder variable is added: the *outbound relational content* variable. The results of the model are presented in the model summary output in Figure 22.

Exclusionary Model

	Dependent variable:
	Recovery
Intercept: non-recovered	0.447 (0.236)
Social Integration	0.106 (0.222)
Social Network Structure	-0.063 (0.254)
Relational Content	0.805** (0.277)
Confounder: Outbound Relational Content	0.550* (0.268)
Observations	98
Note:	*p<0.05; **p<0.01; ***p<0.001

Figure 22. Summary of the Exclusionary Model

The exclusionary model shows that the effect of the *relational content of the inbound interactions* on *eating disorder recovery* remains statistically significant ($p < 0.01$) even when controlling for the *relational content of the outbound interactions*. In other words, the emotionally more positive messages the recovered users received cannot be fully explained by the more positive messages they have written to others or in the form of a post. The coefficient of the *relational content* component decreases to some extent (from 1.08 to 0.805) with the inclusion of the confounder *outbound relational content* variable. Its level of significance also decreases, from $p < 0.001$ to $p < 0.01$. Meaning, that the *outbound relational content* variable partially explains the effect of *inbound relational content* on *recovery*, but not entirely. The effect of *relational content* still remains significant and can be regarded as influential – even when controlled for the confounder variable.

These results reinforce the findings of the Baseline Model and the Elaboration Model. The answers to research questions 1 and 2 remain unaffected – *social support* is linked to *eating disorder recovery*, with *relational content* being the sole driving factor. This finding holds true even when controlling for the confounding effect of *outbound relational content*.

Notably, the confounder *outbound relational content* variable also proves significant in the model ($p < 0.5$). Its positive coefficient indicates that recovered

individuals have significantly more positive outbound interactions than non-recovered individuals: their posts and comments on the channel are more positive in nature. This confirms the suspicion derived from the visual overview of the two variables (see Figure 21).

The general equation formula of the exclusionary model reads as follows.

$$\text{logit}(p_{\text{Recovery}}) = \beta_{\text{Intercept: non-recovered}} + \beta_{\text{Social Integration}} + \beta_{\text{Social Network Structure}} + \beta_{\text{Inbound Relational Content}} + \beta_{\text{Outbound Relational Content}} + \varepsilon$$

Which formula substituted with the calculated coefficients looks as below. The non-significant independent variables (*social integration* and *social network structure)* are eliminated from the equation.

$$\text{logit}(p_{\text{Recovery}}) = 0.447 + 0.805 * \text{Inbound Relational Content} + 0.55 * \text{Outbound Relational Content} + \varepsilon$$

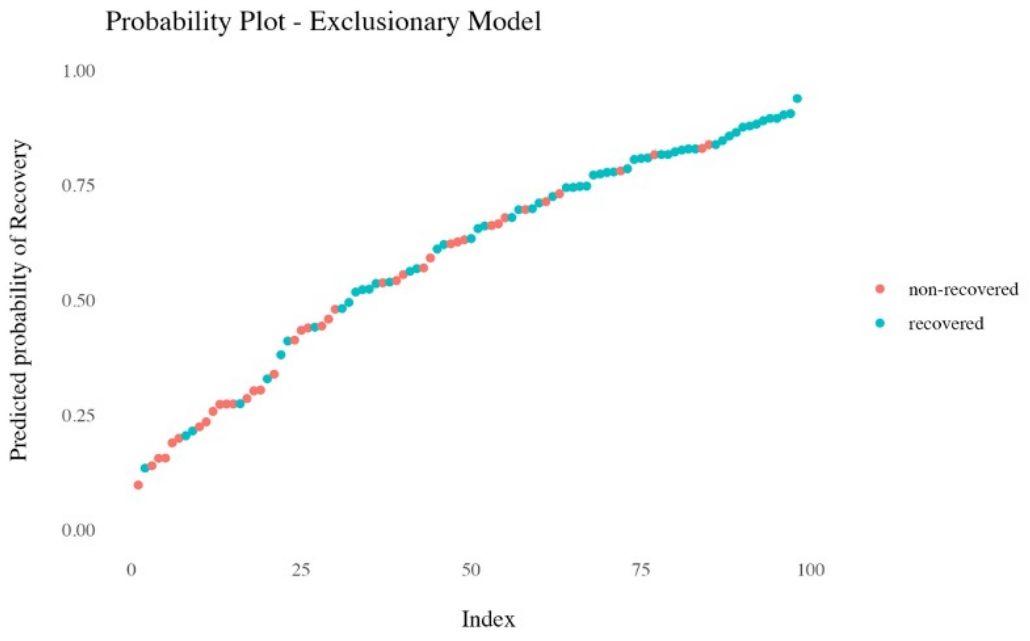

Figure 23. Probability plot of the Exclusionary Model

The exclusionary model has a degree of freedom of 93, with all general assumptions satisfied. The probability curve of the exclusionary model is the most balanced among the three models presented, as it fits the most on a straight line. This indicates that the exclusionary model accounts best for the outlier users in the data. The exclusionary model explains 17.6 percent of the total variance of the recovery variable, which is the highest R-squared value of all the models. However, it still leaves over four-fifths of the recovery variable unexplained, highlighting the generally low explanatory power of *online social support* on *eating disorder recovery*.

In summary, the three-stepped analysis shows that *social support* received from an online pro-recovery eating disorder community is associated with *eating disorder recovery*. Out of the three components of *social support*, only one indicator seems to be the driving factor in this relationship: the emotional content of the interactions. The more positive the received textual interactions, the higher the chance of recovery. This result holds even when controlling for the confounding effect of the emotional content of the outbound interactions. The final model explains around 18 percent of the total variance of *recovery*.

V. VIII. Limitations

V.VIII.I. Research on Digital Data

Utilizing Reddit data in social scientific research is thought to carry a low degree of generalizability to the general population. The socio-demographic and language composition of Reddit users is not representative of the general population (Singer et al., 2014; Barthel et al., 2016; Amaya, et al., 2021; Sattelberg, 2021). These demographical imbalances become entirely unknown, as well as irrelevant when it comes to subreddits, as the users interested in certain topics will naturally carry demographical commonalities, making their demographical composition skewed in other ways. Additionally, this type of data has an inherent bias towards active users

and is almost unable to collect traces of lurkers (Lomborg, 2016). However, given the current research questions focusing on social support experienced in an online community, the studied population will naturally exclude lurkers. Additionally, the research design applied a theoretically founded case selection, highlighting the analysis of a case subreddit, thereby mitigating the relevance of the representativity of the user base.

The unknown algorithm inherent in the Reddit platform inevitably influences the interactions and discussions it is hosting. The design of the platform (such as post-ranking algorithms, and system-wide moderation) directly impacts how users experience it and engage with it (Medvedev et al., 2019). For instance, the process of prioritizing popular content over less popular content results in a multiplying effect that amplifies the variability in popularity, ultimately leading to a significant portion of posts being overlooked (Gilbert, 2013; Lakkaraju et al., 2013). This limitation impacts the research in two ways. Firstly, the online interaction data analyzed in the current study inherently reflects this enhanced engagement around popular posts. Secondly, since the primary user selection is done using the Reddit platform itself, the data collection is also prone to the underlying play of the algorithm, which may result in biasing the user base along certain user characteristics by prioritizing more popular submissions compared to less popular ones. Hence, the analysis will inherently exclude users whose interactions have gone buried or overlooked due to the inherent algorithm bias. Therefore, some voices may be lost. Most likely those that have gotten deprioritized by the unknown preferences of the algorithm.

The reliability of the data is another challenge the researcher faces when working with the Reddit API (Lomborg et al., 2014). As highlighted by Tromble (2021, p. 2.), "*platforms and their APIs have always been proprietary black boxes, never intended for scholarly use*." Since oftentimes researchers lack comprehensive documentation about the quality and exhaustiveness of the data made available via APIs, a generally low degree of transparency characterizes these types of datasets. Illustrative to this, previous studies have reported some inconsistencies in the

Reddit API data, such as missing data (Gaffney & Matias, 2018), and the high ratio of [deleted] and [removed] content (Medvedev et al., 2019). To evaluate the reliability of the data, the following data validation check was conducted. Based on 5 randomly selected users from both groups, the API-provided data was manually compared to that available on the platform. This step of the data check concluded that all – and even more – submissions and comments were available in the dataset retrieved from the API than searchable on the platform itself.

Additionally, as well as all APIs, the Reddit Official API also has limits in regard to the volume of data pulled by each call. Depending on the type of the call, the limit of the number of rows accessible varies between 100 and 1,000 (Reddit.com, n.d.)[9]. To address this technical constraint, the dataset was extracted from the API on a per-user per-subreddit basis, divided between submissions and posts. This means that theoretically, each user's complete interaction history was pulled – unless they had over 1,000 submissions or over 1,000 comments in the r/EatingDisorders subreddit. In that case, only the first 1,000 rows were collected.

V.VIII.II. Methodological Caveats

Further methodological nuances are highlighted. One potential limitation of the applied methods could stem from the human annotation process involved in sampling users. While the standard approach typically involves the annotation by a minimum of two coders with the assessment of intercoder agreement (Rossini, 2022), it wasn't practical to execute this within the constraints of the current individual thesis. To address this limitation, a meticulously designed and streamlined coding scheme was developed (see: Appendix II. Coding Scheme).

In regards to the utilization of a pre-trained sentiment detector (Cardiff NLP, 2022), relying on a pre-trained sentiment analysis model may lead to a decrease in precision or accuracy when extracting the emotional nuances from comments.

[9] The fact that this limit is enforced by Reddit Official API was also confirmed in a conversation with the author of the RedditExtractoR RStudio package.

Natural language processing belongs to the broader domain of Artificial Intelligence. Its fundamental goal is to train algorithms capable of understanding and processing human languages (Kedia and Rasu, 2020, p. 7). However, prioritizing an algorithm over human judgment inherently results in a loss of accuracy. The chosen model (Cardiff NLP, 2022) underwent thorough scrutiny before selecting, comparing its performance against four other pre-trained models. Not only did the selected model closely align with human-evaluated sentiment labels, but it was also trained on an extensive corpus of texts (approximately 124 million tweets). While there is always a risk that the algorithm might overlook certain subtleties like irony or cynicism present in the texts, leveraging a dependable sentiment model could help mitigate biases inherent in human-annotated labeling, as well as increase the scale of the analytical capacity significantly.

V.VIII.III. Research Design

One of the main limitations of the research design is the validity of the applied measurements. The operationalization of the theoretical constructs always depends on the interdependent relationship between the theoretical concepts and the features of the empirical data at hand, thus, both domains were carefully consulted while translating the two focal concepts into empirically measurable indicators. However, the initial theoretical schema utilized in this research (House et al., 1988) has been formulated solely within the context of offline relationships, devoid of any consideration for the emergence of online realms and their associated relationships. Thus, there are nuances to this theory that are immeasurable since impossible to translate to the data at hand (such as the type or homogeneity of social ties). Additionally, there might be notions of the theory that are simply not applicable to this very new form of online social connectedness, which is further elaborated on in section VI. Discussion.

The small sample size of the final statistical models impacts greatly the extent to which inferences can be drawn from them. The reasons for the significant shrinking

of the sample size (from 160 collected usernames to 98 in the final model) are elaborated on in Appendix IV. Reasons for Excluded Observations.

V. IX. Ethical Reflections

The ethical considerations of social scientific understanding should always think beyond compliance with the local ethical legislation and strict guidelines (Franzke et al., 2020). Following the distinction of Guillemin & Gillam (2004), reflections regarding "procedural ethics" and "ethics in practice" are elaborated on.

The procedural ethical considerations include legal aspects. Without question, the current research project is considered as research on human subjects, therefore, the European General Data Protection Regulation (GDPR), and the Swedish Ethics Law (Franzke et al., 2020) apply to it. To comply with these regulations, data was gathered via Reddit's platform interface and official API, which both reflect any changes in the content (deletion or removal) dynamically (Amaya et al., 2021). Another legal requirement is compliance with the Terms and Conditions of Reddit (Markham & Buchanan, 2012; Franzke et al., 2020). Due to the data provided by their public API, it is unnecessary and nearly impossible to violate their rules (Fiesler et al., 2024). One could argue that since the data gathered in this research project is publicly available (Fiesler et al., 2024), as well as anonymous, it can be gathered and analyzed freely (Israel, 2014). However, it has been highlighted that procedural ethics does not nearly cover the entirety of ethical dilemmas that arise throughout a research project (Guillemin & Gillam, 2004; Israel, 2014). Even though the data is freely visible, issues such as privacy, consent, and harm remain (Fiesler et al., 2024).

The notion of "ethics in practice" refers to the researcher's reflexivity as a source of ethical reflection in day-to-day situations that fall out of the scope of legislation (Guillemin & Gillam, 2004) – everything "beyond regulatory compliance" (Israel, 2014). In the current research, reflexivity is exercised to introduce a cultural

dimension of ethics (Franzke et al., 2020), as well as the concept of contextual integrity (Nissenbaum, 2009).

The cultural aspect of ethics requires alignment with the studied community's own rules and norms (Franzke et al., 2020), which is especially relevant in the case of subreddits, which all have their unique, self-regulated ecosystem (Amaya, 2021; Fiesler et al., 2024). The About info of the subreddit r/EatingDisorders does not prohibit the study of the forum, but there is no explicit consent either[10] (Reddit.com, 2024). Nevertheless, in the current research, no informed consent was collected from the study subjects. To avoid harm, the following steps were taken.

The framework of contextual integrity highlights that the availability of personal information is not either private or public, but rather dependent on the social context that hosts it (Nissenbaum, 2009; Fiesler et al., 2024). This notion translated to the research project warrants that while the individuals might have engaged with the subreddit thereby making their personal information publicly available, this does not justify that it can also be exposed to a different audience. Revealing this information (especially in a condensed, summarized, and scrutinized manner) could result in unwanted harm to the users. Keeping contextual integrity is especially relevant considering 1) the highly sensitive nature of the studied conversation, 2) the possibility that users might not be fully aware of the true publicness of their data and the tools available for researchers to extract and interpret them (Fiesler et al., 2024), 3) that anonymity is not guaranteed behind the fictional usernames as this still can be regarded as highly identifiable information (Franzke et al., 2020) with varying levels of additional personal data revealed within the reach of one string search, and 4) the fact that solely the participation in the studied subreddit may be sensitive personal information – health data (Swedish Research Council, 2017).

The subjects of this study are highly vulnerable individuals, and the studied community is designed for their support (Franzke et al., 2020). Hence, avoiding

[10] The subreddit's full About info describing its aim and internal rules can be found in Appendix I. About: r/EatingDisorders.

harm both for the users and the community as a whole is the primary ethical concern. Therefore, keeping in mind both the legislative and the reflective elements of ethical research, neither the base username collection (involving information about recovery status) nor the pulled dataset (which is static and does not reflect the changes in content after its collection) is kept after the completion of the analysis. Fellow researchers can and are encouraged to replicate the analysis by using the original script[11] and their own base user collection. Additionally, no direct quotes are published, as those would make the subjects identifiable through a basic string search (Franzke et al., 2020).

In addition to minimizing harm, ethical research should also consider maximizing benefits for the study subjects (Fiesler et al., 2024). The benefit of the current research is its very aim to uncover novel strategies to better support individuals dealing with eating disorders and facilitate their journey toward recovery.

[11] The GitHub repository can be accessed here.

VI. Discussion

The academic discourse on eating disorders has shown the potential of pro-recovery eating disorder communities. Studies indicate that individuals trying to deal with their eating disorders might benefit from engaging with carefully selected recovery-focused websites (Hersey, 2014; Branley & Covey, 2017; Jones et al., 2022), as they may be powerful sources of social support (Leonidas & dos Santos, 2014). However, scholarly work has not yet shown if social support received from an online community can be linked to eating disorder recovery. Hence, the current thesis set the goal of bridging the scholarly gap by addressing two core questions. First, whether social support received from an online community could be linked to eating disorder recovery. Second, if a relationship can be established, to which degree each of the components of social support contributes to its effect on recovery.

The results of the study show that social support experienced in an online pro-recovery community is indeed linked to eating disorder recovery, as recovered individuals received a higher degree of social support than non-recovered individuals throughout their presence in the studied community. This result confirms the suspicion derived from previous studies (Hersey, 2014; Leonidas & dos Santos, 2014; Branley & Covey, 2017; Jones et al., 2022). However, it seems that individuals who have recovered and those still ill do not differ in terms of their integration with, and social network position within the community. The only indicator showing a great difference is the content of their relations: while recovered individuals receive strikingly more positive interactions, their in-recovery peers' relations are rather negative in sentiment. Some of the described effect is due to the more positive content recovered individuals contribute to the community, but the relationship between relational content and social support holds true even when accounting for this. This result indicates that in the online realm, the emotional quality of the relationships may carry the health-promoting effects of social support.

In sum, social support received from a pro-recovery community is statistically associated with eating disorder recovery (RQ 1). In this relationship, the relational content component of social support is the sole driving factor, whereas social integration and social network structure do not have a significant effect on recovery, in the context of an online pro-recovery community (RQ 2). These findings hold true even when accounting for possible confounding effects.

With caution to the small sample size (n = 98), low explained variance (17.6 percent in the final model), and the inherent popularity bias in the analyzed data (see V.VIII.I. Research on Digital Data), the following interpretation can be arguably derived from the results. Regarding the number of connections, interactions, and the frequency of those interactions, recovered and non-recovered individuals do not differ. This finding offers a sense of reassurance – it suggests that both cohorts are equally engaged with the community. Whether recovered or not, users receive attention, are heard and reacted to, indicating that everyone is integrated into the community regardless of their recovery status. This can both be due to the online and the recovery-supportive nature of the studied case community.

The network centrality position, the reciprocal tie ratio, and the density of one's discursive environment do not distinguish between recovered and non-recovered individuals either. This aligns with the practical understanding that network dynamics of an online social environment differ greatly from that of offline. Instead of entering one singular social arena, online participants engage in distinct discussions (threads). Thus, one perceives the connectivity of other participants, and therefore, the network position of oneself to a limited extent. In an online environment, the structural properties of the individual can be therefore less influential in contributing to social support.

The results suggest that the emotional content of the relations is the sole factor linking social support to eating disorder recovery. This finding can be interpreted in two ways. One could be that more positive online relationships indeed promote recovery. However, the results of the current study do not definitively support this

interpretation. Without establishing a clear chronological order between the dependent and independent variables, causality cannot be determined. To explore causality further, future research could employ a more fine-grained research design potentially collecting data from users at two points: one would be the point where they declared they have not yet recovered, and followingly, the time where they declared that they have recovered. Analyzing online interactions and social support received between these two data points could allow for establishing causality – while considering alternative processes that may also contribute to recovery, such as professional treatment and offline social support.

The alternative interpretation focuses on the essence of the finding, suggesting that recovered individuals receive interactions with more positive sentiment compared to non-recovered individuals, as well as contribute more positive content to the online community. Without excluding the possibility that social support received in the online community may indeed be a causal factor, this alternative explanation suggests a fascinating difference between the ways in which these two cohorts engage with the community. The emerging discursive pattern suggests a mentor-mentee relation between the two groups of users, which relation is also indicated by previous qualitative research (Linville et al., 2012; Ramjan et al., 2017). Subsequent research could delve deeper into these discursive elements of the community, particularly focusing on the dynamics between recovered and non-recovered user cohorts.

The findings indicate theoretical implications. The outlined theoretical schema proposed that social support has health-promoting effects through enhancing coping by acting as a stress buffer and by offering an alternative recovery identity, thereby contributing to eating disorder recovery. The link between social support and recovery has been established by this research quantitatively, hence reinforcing the plausibility of the theory. However, causality, as well as the process through which these phenomena are connected remain uncovered.

The three-component social support theory, as suggested by House et al. (1988) is applied in the current research. This framework did not definitively apply to the studied recovery-oriented, anonymous, online eating disorder forum. It is essential to underscore that the theory has been developed to describe social support from in-person, human connection, and thus not necessarily transferable to an online environment. In the absence of alternative theoretical frameworks, one plausible theoretical inference that could be arguably derived from the results is that the emotional content of social support is the only component of social support associated with improving mental illness in an online setting. This finding could be tested in further research replicating the presented research design across varied online mental health support communities.

The methodological limitations entail broader implications for social scientific understanding, particularly regarding the inherent biases in digital data analysis. The initial user selection involved interaction with the platform's interface, hence inherently introducing visibility and popularity biases, that are also reflected in the gathered dataset itself (Gilbert, 2013; Lakkaraju et al., 2013; Medvedev et al., 2019). The subsequent analytical steps required the creation of metrics computed only for those with a minimum interaction count, perpetuating inequalities by excluding individuals receiving less attention. Furthermore, the research question and data parameters exclude the study of lurkers. All these underlying processes result in any analysis based on digital traces of human behavior inherently biased towards the "loud" - those actively engaged and acknowledged. Hence, it disregards individuals with limited engagement or whose voices go unheard, and those who refrain from participating in the digital conversation but still observe it and are influenced by it.

VII. Conclusion

In recent decades, myriad facets of eating disorders have been approached, understood, or even explained by scholarly work. Yet, these findings often lack significance until one reflects on a distant memory of a friend, classmate, teammate, sister, or daughter whose vibrant personality dimmed as they got gradually immersed into their eating disorder. These personal experiences infuse depth into the work of scientists across various disciplines that have been conducted to actively combat these detrimental mental health conditions and the plethora of factors that fuel them.

The thesis concludes that online social support can indeed be linked to eating disorder recovery, with the emotional content component as the sole driving factor, even when accounting for the confounding effect of outbound emotional content. This finding in itself has promising implications for those impacted by eating disorders – be it the ill person, their support network, or professional treatment providers. However, it prompts further investigation into the causal relationship between these variables. However, the results also serve as a reminder not to overlook established treatment methods in favor of solely relying on online support.

The presented study enriches the scientific discourse on this critical topic by quantitatively establishing a link between online social support and eating disorder recovery and providing nuances on its workings. Further, the thesis presents how the field's existing theories are only reservationally transferable to the online sphere, and emphasizes that digital social scientific research will always, inherently be a research on the "loud." Nevertheless, it is essential for social scientific academic research to uphold its focus in continuously seeking novel approaches to understand and support individuals suffering from eating disorders, just as much as other vulnerable groups within society.

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Appendices

Appendix I. About: r/EatingDisorders

ABOUT COMMUNITY

Eating Disorders

r/EatingDisorders is a community dedicated to providing support, resources, and encouragement for individuals dealing with eating disorders. Whether you're in recovery, supporting a loved one, or seeking information, this subreddit is a supportive space with the aim to provide you with the support you need.

RULES

1. Be Kind

Treat others with respect. Discrimination, hate speech, and bullying are not allowed. This includes any form of mistreatment based on race, gender, sexual orientation, age, disability, or other characteristics.

2. No Pro Eating Disorder Content

Content that promotes or glorifies eating disorders is strictly prohibited. This includes images, text, or any material that may be triggering. Intentionally posting said content will result in an immediate permanent ban.

3. No Requests for Medical Advice or Diagnosis

Do not ask for medical advice, diagnoses or medication from the community. Our members are not qualified healthcare professionals and any advice given can not be verified. For accurate information about your health, consult with a medical professional.

4. Clear, Recovery-Focused Questions

Questions should be stated clearly in the post title. This community is focused on recovery. Any questions asking how to develop an ED, lose weight or engage in unhealthy behavior will be removed.

5. No Rants, Vents, or Binge/Purge Confessions

Do not post rants, vents or detailed confessions about binge/purge behavior. Posts should focus on recovery.

6. No Mention of Numbers

Do not discuss numbers related to weight, calories, or BMI. Please refrain from posting overly detailed descriptions of servings, bites and meal frequencies.

7. Surveys from Accredited Institutions Only

Surveys are permitted only if they are from accredited universities or research programs. Non-academic surveys will be removed. Please message us through modmail if you would like to post your study.

8. No Advertising/Spam

Any form of advertising or spam is not allowed. This includes promoting products, services, or self-promotion.

HELPFUL RESOURCES

[In the rest of the About section, further eating disorder recovery-related are provided.]

(Reddit.com, 2024)

Appendix II. Coding Scheme

Purpose and Aim

The purpose of this codebook is to identify Reddit users who identify themselves as recovered from their eating disorder or as not yet recovered. The current study understands eating disorder recovery as the adoption of a recovery identity. This definition translates to practical measurement as one considers oneself recovered or not. This assessment is described in the Coding Criteria. Coding may follow the Flow of the Coder.

Flow of the Coder

- Open the r/EatingDisorders subreddit.
- Read through the submissions and comments you come across.
  (If necessary, targeted search by keywords is possible using Reddit's search bar.)
- Identify users according to the Coding Criteria.
- Document the identified user's username in the corresponding Excel sheet. The unique ID of the key document (submission or comment) may also be documented.

Coding Criteria

The code is binary: either recovered or non-recovered. Categories are exclusive of one another. The coding aims to collect a list of users who perfectly meet one of the two categories, therefore, the majority of the users will be left out of the coding entirely.

The unit of the analysis is a text which may be either a submission or a comment. Reading through each text carefully is crucial. When considering a comment, the context of the comment may be regarded, such as its parent submission or preceding comment discussion.

When coding, ask yourself the question:

Does the user explicitly disclose their recovery status?
Does the user state "I am recovered" or "I am not yet recovered"?

Table 4. Code Instructions

CODE	DESCRIPTION	EXAMPLES[12]
RECOVERED	The user explicitly says that he/she has recovered.	*"I consider myself recovered."*
	Understand the text as a whole – the phrase "I am recovered" is extremely rare – intuitively assign the code for texts that are undeniably describing a recovered state.	*"I am saying this as someone from the other side – recovery is possible!"*
		"Sharing my story to assure everyone that recovery is possible."
	Disregard the sentiment of the text (even though they talk in a negative tone or express struggles, they can be recovered).	*"I will always have those days when I fight the voice even though I am recovered for 3 years now."*
NON-RECOVERED	The user explicitly says that he/she has not yet recovered.	*"I honestly don't know if I will be able to recover anytime soon."*
	Also: users who explicitly declared that they feel that they will never recover, they don't want to recover, they feel like the disease is part of their lives in some way or the other, or that they are struggling from the disease at the moment.	*"I cannot seem to get out of this cycle."*
		"I think I just really don't want to recover. I like having my eating disorder."

[12] Quotes are altered while keeping their meaning for ethical reasons.

Appendix III. Data Cleaning, Verification, and Preparation

Data Cleaning Steps

- Deduplication of rows, based on the body text field.
- Assignment of real authors. There is a popular practice to be observed in the r/EatingDisorders subreddit, in which users post via the moderator account 'EDPostRequests' but respond to the comments in the thread with their original account. There were a few cases where the key text (where the author declares their status towards recovery) belonged to this moderator account. These cases were manually edited to present their real author instead of EDPostRequests.
- Attachment of the human-annotated recovery status labels to the API-extracted dataset.
- Removal of content belonging to deleted or removed users. This step is crucial not only for analytical purposes but for user privacy reasons as well.

Data Verification Steps

- Controlling for the user overlap between the two focal groups: recovered and non-recovered. This could arise if a user recovered or relapsed, and their data was collected in both groups. No such case was found.
- The quality of the data was verified. It is ambiguous whether the Reddit API data pull results in an exhaustive and comprehensive dataset, as highlighted by the relevant research frontier. Thus, 5 users per group were selected, and their comment and submission data was compared between the API result and the data available on the platform. The cross-check concluded that the API data was exhaustive and richer than that on the platform interface.

- The validity of the recovery status annotation was confirmed. As the human annotation was done on a per-text basis, the question of whether an annotated user is in the present are recovered or not, was unclear. Therefore, all the labeled users' newer interactions were inspected. Did any of the recovered users relapse since they expressed their recovery? Did any of the non-recovered users recover eventually? As a result of the investigation, 3 users were identified and excluded from the analysis.

Statistical Preparation Steps

- Missing values were handled. There were 54 users in the selection who had unknown values in at least 1 of the analyzed variables. These are the variables that require a minimum interaction or connection count. Likely, these users did not have much interaction on the subreddit. However, the possibility cannot be excluded that these missing values are due to the unreliability of the API, so in order to maintain the precision of the analysis, these users were excluded from the sample.
- The distribution of the key predictor variables was visualized. The distributions revealed a few extreme outliers that were also omitted from the final dataset.
- Numerical variables were standardized. Each continuous indicator was standardized before modeling, to ensure the commensurability of the coefficients.

Appendix IV. Reasons for Excluded Observations

Table 5. Excluded Observation Overview

STEP	REASON	NO OF OBS
DATA PROCESSING	Users relapsed or recovered since the detected status declaration.	3
ANALYSIS	Less than 2 available interaction or connection in the dataset. Indicators such as Temporal Frequency or Ego-Network Density require a minimum interaction/connection number.	54
MODELING	Too influential outliers.	5
TOTAL		**62**