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## **Moderated online social therapy (MOST) for depression relapse prevention in young people: Pilot study of a 'next generation' online intervention**

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## ABSTRACT

**Aim:** Implementation of targeted e-mental health interventions offer a promising solution to reducing the burden of disease associated with youth depression. A single group pilot study was conducted to evaluate the acceptability, feasibility, usability and safety, of a novel, moderated online social therapy (MOST) intervention (entitled Rebound), for depression relapse prevention in young people.

**Methods:** Participants were 42 young people (15-25 years) (50% male; mean age=18.5 years) in partial or full remission. Participants had access to the Rebound platform for at least 12-weeks, including the social networking, peer and clinical moderator, and therapy components.

**Results:** Follow-up data were available for 39 (92.9%) participants. There was high system usage, with 3,034 user logins (mean=72.2 per user), and 2,146 posts (mean=51.1). Almost 70% of users had  $\geq 10$  logins over the 12-weeks, with 78.5% logging in over at least 2-months of the pilot. A total of 32 (84%) participants rated the intervention as helpful. There was significant improvement between the number of participants in full remission at baseline ( $n=5$ ; none of whom relapsed) relative to  $n=19$  at 12-week follow-up ( $p<.001$ ). Six (14.3%) participants relapsed to full threshold symptoms at 12-weeks. There was a significant improvement to interviewer rated depression scores (MADRS;  $p=0.014$ ,  $d=0.45$ ) and a trend for improved strengths use ( $p=.088$ ,  $d=0.29$ ). The single-group design and 12-week treatment phase preclude a full understanding of the clinical benefits of the Rebound intervention.

**Conclusions:** The Rebound intervention was shown to be acceptable, feasible, highly usable and safe in young people with major depression.

**Keywords:** Depression; secondary prevention; recurrence; internet; adolescent

## INTRODUCTION

It is estimated that as many as 1 in 4 young people will experience an episode of major depressive disorder by age 19.<sup>(1, 2)</sup> Depression typically first manifests during adolescence or young adulthood (up to 25 years)<sup>(3)</sup> and tends to display a worsening pattern over the course of repeated episodes, including a lack of responsiveness to initially effective treatments.<sup>(4)</sup> Depression can be associated with significant distress and impairment for the individual and their family<sup>(5, 6)</sup> and may interrupt critical developmental phases<sup>(1)</sup> resulting in long-term impairment and social exclusion/isolation. Depression is the leading cause of disability in developed countries, and is projected to be the leading cause of disability globally by 2030.<sup>(7)</sup> Given the substantial social and economic costs associated with depressive disorders, effective early intervention,<sup>(8)</sup> and maintenance of acute phase treatment effects is of critical importance.<sup>(9, 10)</sup> A recent Cochrane review of depression relapse prevention studies in young people, however, found little evidence to support any particular treatment approach in preventing relapse or recurrence of depressive episodes.<sup>(11)</sup> Randomised controlled trials in young people have shown that medication is only modestly effective in preventing relapse of depression and improving functioning in the longer term,<sup>(12-14)</sup> with meta-analyses casting doubt on the risk-benefit ratio of antidepressant use in those under 25 years in acute treatment<sup>(15, 16)</sup>. Recent evidence suggests that targeted clinician-delivered psychological intervention, focusing on residual symptoms via a personal strengths and wellbeing

framework significantly reduces risk of relapse in young people (as opposed to medication alone),<sup>(17)</sup> though such face-to-face intervention is resource intensive and non-scalable. Given the increasing prevalence of depression, there is a clear need for the development of low cost programmes that are highly accessible and engaging. This is especially important given relapse presents a significant risk of impaired functioning (and relapse is less subject to external pressures over time), with the period of relapse risk extending far beyond typical treatment. Hence, there is a need to increase tenure of care in less intensive formats over the longer term.<sup>(18)</sup>

The recently developed World Health Organisation Mental Health Action Plan (2013-2020)<sup>(19)</sup> calls for worldwide expansion of innovative community-based e-mental health interventions that make better use of mobile technologies, cohesive online professional and peer support, stepped care and engaging self-help. Such models enable people to initially engage in self- and peer-support, with access to more intensive help if needed. Within this framework, one of the most promising means of offsetting longer-term depression-related health burden among depressed young people is the development of engaging, innovative, online psychosocial interventions.<sup>(20)</sup> Young people's enthusiasm for internet-based communication means that novel online interventions hold great promise for advancing long-term depression outcomes through the provision of engaging, acceptable, time-unlimited support.<sup>(21)</sup>

Due to their rapidly evolving nature, e-mental health interventions are expected to become increasingly appealing and available to young people over the next decade and beyond.<sup>(22)</sup> Given their immediacy, 24-hour accessibility, and geographical scope, online interventions

have potential to reach young people who may not be inclined or able to seek help from traditional sources.<sup>(23)</sup> Many young people prefer online peer support over face-to-face interventions due to the stigma associated with mental illness, making online interventions a good alternative for those unlikely to engage in traditional treatment.<sup>(24)</sup> Internet use has been shown to be effective in bolstering social support, which is known to protect against depression,<sup>(25)</sup> with systematic reviews highlighting the effectiveness of online interventions for treating depression in young people.<sup>(26, 27)</sup> Nonetheless, attrition remains a significant issue for e-mental health interventions,<sup>(28)</sup> with a substantial proportion of users dropping out in the early phase of treatment,<sup>(29)</sup> with treatment completion rates ranging as low as 0.5% for depression-based interventions.<sup>(30)</sup> Innovative solutions are required to better manage attrition in e-mental health interventions, and next-generation interventions are required for relapse prevention, including inbuilt real-time social networking peer support, ongoing engagement, responsive professional moderation and engaging self-help content.<sup>(27, 31)</sup>

Social networking interventions enable people with a shared goal (i.e., improving symptom management, social functioning and connectedness) to help and support each other, share experiences and ask questions.<sup>(32, 33)</sup> The provision of peer support is thought to alter patterns of negative thinking and self-blame.<sup>(34)</sup> A meta-analysis of peer support based interventions showed that peer support improves depression relative to usual care, with effects comparable to those seen for group-based cognitive behavioural interventions.<sup>(35)</sup> More specifically in young people, recently published systematic reviews support the use of social networking enabled interventions for the management of high prevalence conditions such as depression<sup>(36)</sup> and suicide risk.<sup>(22)</sup>

While there is significant interest on the part of consumers for the opportunity to access online peer support for mental health concerns,<sup>(37)</sup> evidence suggests that existing online interventions do not meet the specific needs of young people<sup>(38)</sup> with few studies evaluating the effectiveness of peer support.<sup>(39)</sup> Young people identify professional mental health practitioner involvement (i.e., non-automated), peer support and referral information as important intervention components that are currently missing from many online interventions.<sup>(38)</sup> To our knowledge, there are currently no e-mental health social networking enabled interventions available for depression relapse prevention in young people. Such interventions are potentially important as peer support and social networking may enhance engagement with online interventions, proving useful in reducing mental health-related stigma, social isolation, and in addressing longer-term attrition and problems in maintenance treatment.

### **Aims & Hypotheses**

The Rebound pilot study was designed to evaluate the acceptability, feasibility, usability and safety of an innovative moderated online social therapy (MOST) for depression relapse prevention in young people. The Rebound intervention was expected to demonstrate acceptability, feasibility, usability and safety amongst the pilot cohort at conclusion of treatment (e.g., after 12-weeks of intervention participation). Acceptability and feasibility were evaluated via the number of logins to the system (i.e., with acceptability achieved if most participants logged on at least 10 times, over 2-months), in addition to favourable patterns of regular use of the system and perceived usefulness of the intervention. Usability was indicated by user ratings of the Rebound website ranking above the 50<sup>th</sup> percentile

against benchmarked commercially developed sites. Safety of the Rebound system was indicated by (i) participants reporting feeling adequately supported by moderators, measured via an end-of-treatment semi-structured interview; (ii) no unlawful entries into the Rebound system; (iii) all participants perceiving the system to be safe. Finally, indicative clinical benefit was assessed by improvements to depression remission rates, and interviewer-rated symptoms, between baseline and follow-up.

## **METHODS**

### **Participant recruitment**

A total of 103 referrals were received from practicing youth mental health clinicians from three participating early intervention clinics in Melbourne, Australia (the Youth Mood Clinic at Orygen Youth Health, and two headspace centres in the Western suburbs of Melbourne). Following initial screening 27 referrals were deemed ineligible due to comorbidity, symptom severity, or lack of treatment response (see criteria below). In addition, n=18 declined to participate, and n=11 were unable to be contacted. Following the full baseline interview a further n=5 referrals were deemed ineligible (based on severity of major depressive disorder; MDD). This resulted in n=42 eligible consenting participants who completed intervention induction and commenced the intervention.

### **Inclusion, exclusion, and relapse criteria**

Broad inclusion criteria were adopted to reflect the clinical characteristics of young people with depression: (i) age of 15 to 24 years inclusive; (ii) a diagnosis of MDD using the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; Fourth Edition) criteria<sup>(40)</sup> within the last 6 months; (iii) either partial remission for MDD (i.e., overall symptomatic

improvement no longer meeting DSM-IV criteria but continuing to experience more than minimal symptoms) or full remission for MDD (i.e., asymptomatic for at least 2-months with no more than minimal symptoms); (iv) adequate response to specialised treatment for MDD, as assessed by a score of either 1 (very much improved) or 2 (much improved) on the Clinical Global Impression scale<sup>(41)</sup> by the treating clinician; (v) no evidence of severe suicidality as assessed by a score of 4 or below on the suicidality item of the Brief Psychiatric Rating Scale (BPRS)<sup>(42)</sup> for the month preceding study entry; (vi) ability to give informed consent and comply with study procedures; (vii) regular and ongoing internet access. Participants meeting any of the following exclusion criteria were not approached for the Rebound pilot: (i) intellectual disability, (ii) inability to converse in, or read English, (iii) medical conditions requiring a high level of care, (iv) diagnosis of conduct, antisocial or borderline personality disorder from treating clinician.

### **Design and Procedure**

Ethical approval for the project was received from the Melbourne Health Human Research Ethics Committee (Approval: 2013.276). The study utilised an uncontrolled single-group design. Study participants were recruited over a 6-month period (June 2014 – December 2014), with the treatment completion phase concluding at the end of March 2015. All participants were referred by treating clinicians, upon which the study research assistant (RA) conducted an initial eligibility screen. After participant informed consent (and parental consent for those <18 years) was obtained, and the baseline assessment completed, the RA undertook an induction session with each participant. The induction session included providing participants with unique login details, helping them set up and personalise their

account (e.g., selecting a profile picture), orienting them to the Rebound system, and explaining the terms of use. Moderators welcomed new users and encouraged existing users to interact with them within 24 hours of enrolment.

Throughout the intervention phase Rebound was monitored daily (i.e. at least 2 h/day during week-days, and 1 h/day during weekends) by the clinical moderation team. The clinical moderation team comprised seven clinical psychologists and a clinical social worker. In addition, moderation of specific topics was also provided by an expert vocational worker and an expert in youth participation. Moderation integrity was ensured through a detailed moderation manual, and weekly group supervision sessions with senior clinical researchers (SR, MAJ, JG) from the research team. Participants were assessed at baseline and 12-weeks follow-up on outcomes described below.

### **Intervention**

Rebound is based on the moderated online social therapy (MOST) model<sup>(21, 43, 44)</sup> which uses a positive psychology, mindfulness and strengths-based intervention uniquely integrating: i) peer-to-peer online social networking; ii) individually tailored interactive psychosocial interventions; and (iii) involvement of expert mental health and peer moderators. Rebound was developed as a purpose-built online platform to supplement to traditional face-to-face interventions for major depressive disorder. Components of the Rebound intervention were refined and adapted from a similar intervention developed for long term recovery in first episode psychosis.<sup>(45)</sup>

The basis of the Rebound intervention has been developed over a five-year period using participatory design principles.<sup>(46, 47)</sup> Intervention design has been based on continual

feedback and testing with focus groups of stakeholders (i.e., service consumers and their families, youth representatives and specialist youth mental health clinicians). The development of Rebound draws on an expansive multidisciplinary collaboration including clinical psychologists, psychiatrists, social workers, vocational and peer support experts, in addition to human-computer interaction researchers, software programmers, professional creative writers, artists, and graphic and web designers.

The design of Rebound was informed by recommendations and previous research targeting mechanisms of change (via positive psychology strengths-based interventions) for relapse prevention in young people.<sup>(17, 48)</sup> This includes interventions addressing residual symptoms<sup>(11)</sup>, improved social connectedness,<sup>(49, 50)</sup> and the enhancement of personal strengths, wellbeing and positive emotion,<sup>(48)</sup> rather than simply addressing young people's symptoms and deficits. An action-oriented approach was used, through which participants identified, discussed and exercised key personal strengths to enhance self-efficacy, improve social functioning and reduce symptoms of depression. User character strengths were identified through an interactive online card-sort task, based on the positive psychology framework.<sup>(51)</sup> The card-sort task enabled users to progress through animated descriptions of 24 character strengths<sup>(52)</sup>, enabling them to identify the five top strengths (e.g., creativity, humour, love of learning) that resonated most closely for them. Once selected, key strengths were then saved within the online platform, and clinical moderators could refer back to them, thereby reinforcing and encouraging users to put their key strengths into action.

The online social networking component of Rebound was designed to reinforce therapeutic content available within the intervention, promote ongoing engagement and bolster social

support. Evidence-based therapeutic content within Rebound was designed to be flexible and user-driven, and could be completed as discrete brief *Steps* (i.e., material covering a single concept, each requiring approximately 20 minutes; see Table 1 for examples of therapeutic content). While moderators suggest relevant therapeutic content to users, users are free to explore all aspects of the site at their own pace, without a set order of completion. The 56 separate therapy *Steps* in Rebound target known risk factors for relapse of depression (i.e., rumination, substance misuse, self-criticism), as well as promoting wellbeing and social connectedness.

Embedded with the therapy content were over 400 unique behavioural experiments,<sup>(53)</sup> referred to as *Actions*, whereby users employ the therapy content (and their key strengths) within the offline world, with the aim of bolstering adaptive coping repertoires. Actions enable users to apply mindfulness, self-compassion and personal strengths in real world situations specifically relevant to them (i.e., social context, school, work, alone). The use of context specific, action-based suggestions through online interventions has been recommended to increase practice and generalisation of skills to real life situations.<sup>(54)</sup> The following excerpt from Rebound discusses a strength-based action for users to try: “*Strengths are like muscles; the more you exercise them, the stronger they get. Use your strengths diary to count up how many times you used your strength this week, and try to beat it next week. It'll feel a bit weird and artificial at first (just like bike-riding and texting with your thumbs did at first), but once it becomes a habit to exercise your strengths the homework feeling will go away and you'll keep getting the benefits.*”

The Rebound system and the MOST model have been specifically designed to ensure constant content flow between the therapy and social networking components. This design feature creates an online relapse prevention therapeutic milieu, where participants can engage in safe and supported self-disclosure, take positive interpersonal risks, gain new perspectives, and obtain encouragement and validation.<sup>(45)</sup>

The Rebound intervention also included a group-based structured problem solving intervention (referred to as *Talk it Out*). This function used an evidence based problem solving framework.<sup>(55, 56)</sup> Offered solutions and users' experiences were saved, providing a database for participants to refer to throughout the intervention. Each proposed *Talk it Out* was moderated in a structured manualised manner, through an iterative process of problem definition, brainstorming solutions, identifying pros and cons, and summarising possible choices.

The peer and clinical moderation component of Rebound followed the 'supportive accountability' theory-driven model of online engagement,<sup>(57)</sup> focusing on experienced, trustworthy and accountable peer and expert moderators. Peer moderators were trained and supported young people with a recent lived experience of mental ill health. Clinical moderators were experienced youth mental health clinicians. Clinical moderators ensured the safety of the Rebound site through daily monitoring, and developed a formulation based treatment approach (using available information) for each allocated user. The clinical moderation team was supported through weekly supervision meetings (90 minutes) and additional ad hoc supervision where required. Rebound also incorporated specialised software to assist with moderation and safety of the site (i.e., a log for secure communication

between moderators, an auto-detect risk management system for identified key words, real-time usage statistics including a word-cloud for tracking most frequently posted terms).

**Insert Table 1 Here**

**Materials**

Baseline and follow-up diagnosis of major depressive disorder were assessed via Structured Clinical Interview for DSM-IV (SCID; patient version).<sup>(65)</sup> Symptom rating measures at baseline and follow-up included two interviewer administered measures: the Montgomery–Asberg Depression Rating Scale (MADRS<sup>(66)</sup>), and the Social and Occupational Functioning Scale (SOFAS<sup>(67)</sup>). In addition, participants provided self-report data using the Strengths Use Scale<sup>(68)</sup>, the Penn State Worry Questionnaire,<sup>(69)</sup> the Medical Outcomes Social Support Survey<sup>(70)</sup> (to assess social connectedness), the 2-Way Social Support Scale<sup>(71)</sup> (to assess social support) and the Anxiety Subscale taken from the Depression Anxiety Stress Scales.<sup>(72)</sup> User experience of Rebound was assessed (by an independent report and benchmarking) via the Website Analysis and Measurement Inventory (WAMMI).<sup>(73)</sup>

All standardised scales reported satisfactory internal consistency (see Table 4 for Cronbach alpha coefficients). Participants also provided data at follow-up on their subjective experience of the Rebound platform. Quantitative ratings were made for items specifically designed for the present study assessing safety, helpfulness, and perceived benefits in relation to social connectedness and empowerment, in addition to moderation (see Table 3 for all items). Participants were also asked whether they would recommend Rebound to another young person with depression.

## Statistical analysis

Intervention acceptability, feasibility and safety were determined by frequency ratings and patterns of use (means and standard deviations). Initial treatment benefit (relapse rate) was evaluated through McNemar's  $\chi^2$  test. This was used to determine the statistical significance of the change in number of participants in full remission at baseline, and full remission at 12-week follow-up. Paired samples t-tests were conducted and within-group effect sizes reported for changes between baseline and follow-up clinical measures.

## RESULTS

Of the 42 participants recruited, 7.1% (n=3) were lost to follow-up with 92.9% completing the 12-week follow-up assessment. The mean age at baseline was 18.5 years (SD=2.1) with 50.0% (n=21) of participants male. All participants were unmarried, and no participants reported having children. A total of 95.2% (n=40) of participants were born in Australia, with 97.6% (n=41) of participants native English speakers. A total of 92.9% (n=39) lived with their family (i.e., parents or other relatives), while the remainder lived in rented accommodation. Most (54.8%, n=23) participants were not working, however 64.3% (n=27) were studying full-time, 7.1% (n=3) were studying part-time, and 28.6% (n=12) identified as not studying. Clinician ratings on the Clinical Global Impression Scale<sup>(41)</sup> at baseline indicated that 81.0% (n=34) of participants were much improved, while the remaining 19% (n=8) were very much improved in their clinical presentation since initial treatment commencement. On average, participants had been receiving mental health care for 12.21 months (SD=11.07). At follow-up, 33.3% (n=13) of participants had been discharged from

clinical care. A total of 97.6% (n=41) reported general daily internet use. Most (57.1%, n=24) estimated their daily internet use as >4 hours per day.

### **Acceptability**

Acceptability was achieved if most participants logged on  $\geq 10$  times, over 2-months of the pilot. A total of 66.7% (n=28) of users met this criteria. In addition, 60% (n=25) of participants utilised the system at least monthly over the 12-week intervention phase.

### **Feasibility**

High system use was observed across the participants, with a total of 3034 system logins (see Table 2 for descriptive statistics). The social networking component (posts, comments, likes and contributions to *Talk it Out*'s) was used by all 42 participants. Throughout the intervention there were 751 unique posts, with 50% (n=21) of users authoring  $\geq 10$  posts. In addition there were 819 likes (where a user clicks the 'Like' function on another users post) with 40.5% (n=17) of users clicking  $\geq 10$  'likes', and 576 user generated comments with 31.0% (n=13) authoring  $\geq 10$  comments. A total of 19 distinct *Talk it Out* topics were proposed by 33.3% (n=14) of participants. In terms of therapeutic content, 42.9% (n=18) of users completed  $\geq 5$  therapy steps, and 26.2% (n=11) of users completed  $\geq 5$  behavioural experiments (referred to as actions).

***Insert Table 2 Here***

Participants provided positive ratings of their experience with Rebound (see Table 3), rating the site favourably in terms of safety, user experience, and confidentiality. Mean ratings also

indicated that participants experienced Rebound to be helpful for feeling more socially connected, and also for controlling their mood. All but one participant (n=37, 97.4%) reported they would recommend Rebound to a young person experiencing depression. All ratings of self-report questions regarding moderation of Rebound were within the positive range (see Table 3).

### **Usability**

Participant user experience data was collected via the WAMMI.<sup>(73)</sup> The WAMMI is a standardised industry tool for benchmarking websites based on a propriety algorithm.<sup>(74, 75)</sup> WAMMI data was analysed independently by user experience researchers based at the University of Cork, Ireland. Reporting of the 5 WAMMI domains, and a global utility score (GUS), are expressed as percentiles. Based on mean values from 38 participant responses, the Rebound website scored above average on all five WAMMI domains of attractiveness 56.6 (SD=27.3), controllability 61.5 (SD=24.8), efficiency 56.9 (SD=26.9), helpfulness 59.5 (SD=22.7), and learnability 65.5 (SD=21.6), achieving a global usability score (GUS) percentile rank of 59.6 (SD=18.9). The WAMMI also includes a secondary analysis of GUS scores according to the relative importance of the website to the user (i.e., *'How important for you is the kind of website you have just been rating'*). Of the 38 respondents, n=9 (23%) rated Rebound as 'Extremely important' to them, with this group demonstrating a relatively high mean GUS=70.4. Thereafter, n=21 (55%) rated the site as 'Important' with a mean GUS=58.3, n=7 (18%) rated the site as 'Not very important' with a mean GUS=48.0, and n=1 rated the site as "Not important at all", mean GUS=69.0.

## **Safety**

All participants reported feeling safe when using the Rebound intervention (see Table 3). No inappropriate usage of the system occurred throughout the intervention. There was one serious adverse event reported during the treatment phase, though this was unrelated to the intervention (suicide attempt, not requiring hospital admission). Importantly, analysis indicated no overall worsening of depression symptoms or functioning across the intervention phase (see Table 4). Similarly, there were no increased anxiety or worry as a result of using the system and interacting with other users.

**Insert Table 3 Here**

## **Clinical variables**

Between baseline and follow-up there was a significant increase in the number of participants achieving full remission (i.e., no longer meeting DSM-IV criteria for MDD over the previous two months, based on clinical interview<sup>(65)</sup>). At baseline  $n=5$  (11.9%) participants were in full remission for MDD, which increased to  $n=19$  (45.2%) at 12-week follow-up, McNemar's  $\chi^2$  (1,  $N=39$ ) = 13.0,  $p<.001$ . All five participants who were in full remission at baseline sustained their full remission through to 12-week follow-up. There were six (14.3%) participants who experienced a relapse of threshold depression symptoms at 12-weeks. All remaining participants met criteria for either single episode ( $n=5$ ) or recurrent ( $n=9$ ) MDD in partial remission (i.e., some MDD symptoms present at follow-up, but either full criteria not met, or there was a period without any significant mood symptoms lasting less than 2

months<sup>(65)</sup>). The overall improvement in remission rates was mirrored by significant improvement in interviewer rated MADRS scores, of small-moderate effect ( $d=0.45$ ) (see Table 4).

Results also indicated no deterioration in social or occupational functioning as assessed by the SOFAS (see Table 4). On the self-report measures there was trend ( $p < .10$ ) observed for improved strengths use. There was no significant increase in social connectedness, or social support, and no significant improvement for self-reported worry or anxiety at follow-up.

**Insert Table 4 Here**

## **DISCUSSION**

### **Principal Results**

Preliminary findings showed the Rebound intervention to be engaging, feasible, usable, and safe. In addition, favourable system usage statistics suggest that young people were willing to use Rebound, at least in the medium term, as part of their recovery from depression. The social networking aspect of the study was used most frequently. In Rebound, social networking provides the context for a broader therapeutic milieu, operating to both maintain participant engagement while introducing and reinforcing therapeutic content (i.e., mindfulness, self-compassion) with expert and peer support. The inclusion of social networking is a point of difference of the MOST theory-driven model, where social networking and therapy are in effect combined. The favourable system usage statistics are an important finding, given the high attrition rates known to plague many online

interventions.<sup>(29)</sup> Participants were almost unanimous in indicating that they would recommend Rebound to a fellow young person experiencing depression, and usability ratings demonstrated that the website performed well, relative to commercially developed sites. Highly favourable ratings were provided for the moderation component of the platform. Changes to clinical variables were also observed and the trend for improved strengths use, and the maintenance of social and occupational functioning is encouraging. Given the single group design, these results must be interpreted with caution and require evaluation in a controlled study. That said, the present results compare favourably with remission rates observed in controlled studies of youth MDD<sup>(76)</sup> where remission rates at 12-weeks are relatively low (i.e., 30-40%)<sup>(77, 78)</sup>, although differences in baseline participant characteristics are acknowledged. Nonetheless, based on the significant improvement in the remission rate for depression (and the maintenance of remission for those asymptomatic at baseline) the Rebound intervention may be beneficial in achieving and sustaining symptom improvement (i.e., relapse prevention) in young people. We note that there was no significant change to the rating scale assessments of social connectedness or social support. Given the social networking focus of the intervention, this was surprising. It may be that the rating scales used were not sensitive to support provided specifically in the online environment. Indeed favourable participant responses (i.e., mean and median ratings) to the specific question of whether Rebound helped users feel more socially connected would support this.

### **Comparison with Prior Work**

To our knowledge, this is the first comprehensive online intervention for youth depression that incorporates real-time social networking, peer and clinical moderation and interactive

therapy content. To date, no studies have evaluated online interventions for specifically reducing risk of depression relapse in young people.<sup>(36)</sup> Previous research from un-moderated online forums has demonstrated that negatively focused user generated content can become contagious and adversely impact wellbeing and mood of other users.<sup>(79, 80)</sup> Using a moderated system such as Rebound, which focuses on a strengths-based approach, may improve depressive symptoms while simultaneously minimizing exposure to deficit focused content, which may otherwise increase the likelihood of adverse effects (i.e., user anxiety or worry).

Comparable second generation e-mental health interventions for young people experiencing depression (i.e., those including some level of moderator or peer-support involvement) include the *Bite Back* positive psychology program,<sup>(81)</sup> which used an asynchronous moderator-approved comment function, and the *Master Your Mood* intervention<sup>(82)</sup> which used synchronous group chat facilitated by a clinician. These interventions have both demonstrated effectiveness in reducing depressive symptoms relative to a control condition. Similarly, the *Problem Solving Therapy* online intervention<sup>(83)</sup> utilised asynchronous email feedback from clinicians to enhance problem-solving skills in depressed young people, and was found to be effective in comparison to a waitlist control condition. More recently, the innovative *Panoply* crowdsourced peer-to-peer intervention<sup>(31)</sup> used remuneration-based crowdsourcing (whereby non-clinicians are hired to review and respond to user posts related to stressful situations and negative automatic thoughts) in those aged 18 to 35 years. While *Panoply* was observed to improve depression scores over 3-weeks, the intervention group failed to differentiate from the control condition involving online expressive writing without feedback. Reporting of usage statistics in other studies makes it difficult to directly compare

our findings (e.g., usage / logins over time). Regardless, the Rebound intervention is distinct and unique when compared to the above studies, in that it concurrently offers users 24-hour access to evidence-based content, and the possibility of using real-time social networking (i.e., where user generated is posted immediately to the network without moderator preapproval), embedded within ongoing input from supervised peer moderators.

The most comparable intervention to the present study is the *Horyzons* pilot study.<sup>(45)</sup> The *Horyzons* pilot also used the MOST model for relapse prevention, but recruited a sample of young people experiencing psychosis. Of note, the *Horyzons* pilot study reported a similar effect size as the present study did for change in depression, ( $d=0.60$ ) however, it was limited to a 4-week period. As in the present study however, the *Horyzons* pilot observed no significant change in self-reported anxiety. In sum, initial results from the Rebound intervention compare favourably with recent innovative e-mental health interventions for depression. Usage statistics (i.e., average, and median user logins) are either comparable, or exceed those established by previous similar studies.<sup>(45)</sup>

### **Limitations and future directions**

The present study was designed to provide proof of concept by assessing feasibility, acceptability, usability and safety. Given this, the true clinical benefits and scope of Rebound remain unknown until a controlled evaluation can be undertaken, where participants have access to the intervention over a suitably longer duration of time e.g., > 12 months. While the present study incorporated the use of a diagnostic interview and interviewer rated measures for depression and functioning, the single group design precluded the use of blinded

assessments. Whilst reduction of symptoms does not demonstrate a direct benefit in terms of relapse prevention, it does provide promising data and warrants progress to a full randomised controlled trial focused on relapse prevention.

In order for the next generation of e-mental health interventions to be engaging and effective, an increasing amount of interactivity and support from peers and moderators will be required or possibly even expected by users.<sup>(36)</sup> Embedding peer support within e-mental health interventions not only serves to meet recent global targets established within the WHO's Mental Health Action Plan,<sup>(19)</sup> but also works to mobilise available community-based resources, decrease stigma and bolster adaptive coping. That said, greater interactivity between users, peer moderators and clinicians comes at a resourcing cost (i.e., to maintain the safety and fidelity of the intervention). It will be necessary for future generations of e-mental health interventions to carefully balance these costs, and include detailed economic evaluations.

Given moderation in part guides user interactions within online platforms, the moderation model of any online clinical intervention warrants attention. The present study has shown that a positive psychology strengths-based approach can be effectively implemented within an online platform. With the burgeoning popularity of online interventions, further articulation, development and refinement of online moderation models is needed to ensure interventions maintain longer-term treatment engagement, are undertaken with sufficient fidelity, and maximise the likelihood of effectiveness. Finally, it is suggested that future online intervention studies provide detailed temporal usage statistics.<sup>(84)</sup> This should include the proportion of users being engaged over time, as well as frequency of usage.

## **Conclusions**

The Rebound pilot study demonstrated the MOST model of online intervention to be engaging, feasible, usable and safe for young people in recovery from depression. Favourable user feedback regarding intervention content, design and moderation, in addition to high overall usage rates, indicates the overall acceptability of the platform. While controlled evaluation is required to determine intervention efficacy and economic evaluations, initial results suggest possible treatment benefits in terms of reduced relapse rates and symptomology. In summary, the MOST model may be a promising longer term next-generation e-mental health intervention.

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### **Competing Interests**

The authors report no conflicts of interest for this research.

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Table 1: Frequency of Rebound therapy module usage

Therapy component (Step)	Description	n (%) <sup>a</sup>
<i>How Rebound works</i>	This module provided users an overview of the key features of Rebound including the social networking, private messaging, the role of peer and expert moderators, the Talk It Out function and general privacy information.	42 (100)
<i>Find your strengths</i>	In this module users were introduced with the concept of personal strengths. The modules used an interactive online card sort game where users identify their ‘signature’ strengths. Assessment of strengths was informed by the positive psychology framework. <sup>(58, 59)</sup>	42 (100)
<i>How to flourish</i>	In this module users were encouraged to put their identified strengths into practice. Users reflected and interacted with each other regarding their future goals, engaging with meaningful activities and overcoming barriers. <sup>(60)</sup>	30 (71)
<i>Everybody hurts</i>	This module provided users with psychoeducation regarding precipitants and perpetuating factors related to depression, and factors that contribute to resilience and recovery.	14 (33)
<i>Small is big</i>	This module focused on behaviour change. Users were provided with a structured goal setting framework. Users were encouraged to deconstruct seemingly unsurmountable tasks into achievable elements, and helped to notice and enjoy the process of behaviour change.	13 (31)
<i>Can a pencil make you happy</i>	This module introduced the construct of behavioural experiments <sup>(55)</sup> used throughout Rebound. In this experiment users were encouraged to interact with others (i.e., sharing positive experiences) and break their usual routine, through a basic task eliciting positive affect. <sup>(61)</sup>	10 (24)
<i>Relaxation skills</i>	This module aimed to up-skill users in progressive muscle relaxation (PMR) techniques and relaxation breathing. Users were able to download purpose made audio tracks teaching PMR and breathing	9 (21)

	techniques.	
<i>Compassion for others</i>	This module integrated self-compassion techniques <sup>(62)</sup> for managing difficult emotions and situations. Purpose made audio tracks are available for users to download.	9 (21)
<i>Savouring</i>	This modules drew on the positive psychology technique of savouring <sup>(63)</sup> and provided users with a range of skills and behaviours to help them make the most of positive experiences.	8 (19)
<i>Rumination</i>	This module assisted users to identify helpful and unhelpful ruminative thought process, and provided examples of ways to break these cycles. The modules adopted Watkins <sup>(64)</sup> model of managing unconstructive repetitive thought.	6 (14)
<i>Job finding tools</i>	This targeted module provided developmentally appropriate practical vocational assistance on writing an effective resume and cover letter, including advice on how to address key selection criteria.	5 (12)

<sup>a</sup>Percentage of participants who undertook the module

Table 2: Logins and individual usage of the main components of the Rebound intervention (n=42).

<b>Site component</b>	<b>Total</b>	<b>M</b>	<b>SD</b>	<b>Mdn</b>
Logins	3,034	70.6	123.3	16.5
Social networking – posts	751	17.9	24.0	9.5
Social networking – likes	819	19.5	39.7	3.5
Social networking – comments	576	13.7	22.7	4.0
Therapy modules (Steps)	195	4.6	4.5	4.0
Actions	158	3.8	5.3	2.0

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Table 3: Participant impressions of the Rebound intervention (n=39).

Rebound experience	M	SD	Mdn	Range	n (%) <sup>a</sup>
<i>General</i>					
I felt safe on Rebound <sup>b</sup>	4.7	0.6	5.0	3 - 5	37 (100)
I felt my profile was confidential <sup>c</sup>	4.5	0.7	5.0	2 - 5	34 (91.9)
Rebound was a positive experience <sup>b</sup>	4.2	0.7	4.0	3 - 5	38 (100)
Rebound was helpful <sup>b</sup>	3.6	1.2	4.0	1 - 5	32 (84.2)
Rebound helped me feel more socially connected <sup>b</sup>	3.5	1.2	4.0	1 - 5	35 (94.6)
Rebound helped me control my mood <sup>b</sup>	3.1	1.0	3.0	1 - 5	26 (70.3)
<i>Moderation</i>					
The moderators encourage open discussion <sup>d</sup>	6.0	1.1	6.0	4 - 7	38 (100)
I felt that the moderators accepted me <sup>d</sup>	5.8	1.1	6.0	4 - 7	38 (100)
I felt the moderators provided me with choices <sup>d</sup>	5.5	1.1	6.0	4 - 7	38 (100)
The moderators listen to how I would like use Rebound <sup>d</sup>	5.6	1.1	5.5	4 - 7	38 (100)

<sup>a</sup>Number of cases responding in the positive range, based on complete responses, denominator of % varies based on missing data.

<sup>b</sup>Items rated from 1 = not at all; 5 = very much.

<sup>c</sup>Items rated from 1 = not at all confidential; 5 = very confidential

<sup>d</sup>Items rated from 1 = strongly disagree; 7 = strongly agree.

Table 4: Change between baseline and 12-week follow-up for clinical outcome variables

Measure	Baseline			12-week follow-up			Statistic	
	$\alpha$	M	SD	$\alpha$	M	SD	$p$	$d$
MADRS	.73	16.2	6.9	.93	12.1	11.4	<b>.014</b>	0.45
SOFAS	-	67.3	12.2	-	68.1	10.7	.716	0.03
Strengths use	.96	4.4	1.2	.96	4.7	1.3	<b>.088</b>	0.29
Social connectedness	.96	3.9	0.9	.95	3.9	0.9	.711	0.06
Social support	.94	3.7	0.9	.94	3.8	0.9	.470	0.08
Worry	.76	3.5	0.8	.81	3.6	0.9	.391	0.05
Anxiety	.79	6.1	4.7	.89	6.8	6.0	.184	0.13

*Note.* Refer to reference list for full information on outcome measures MADRS,<sup>(66)</sup> SOFAS,<sup>(67)</sup> Strengths use,<sup>(68)</sup> Social connectedness,<sup>(70)</sup> Social support,<sup>(71)</sup> Worry,<sup>(69)</sup> Anxiety.<sup>(72)</sup>

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