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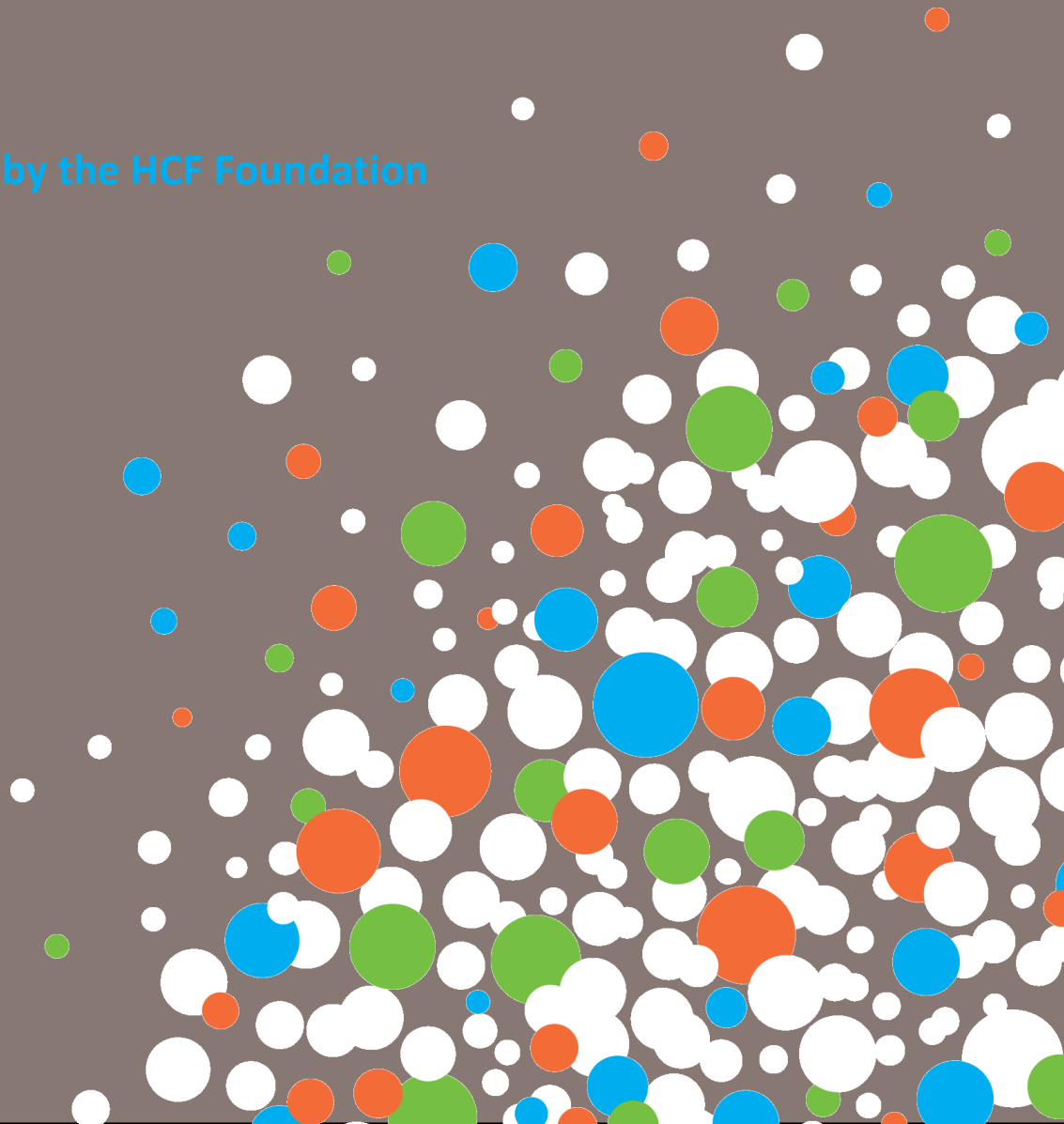
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# Preventing relapse of major depressive disorder in young people (15-25 years): Development of a moderated online social therapy intervention

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Final Report  
June, 2015

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## Acknowledgement

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## Orygen, The National Centre of Excellence in Youth Mental Health

Orygen, The National Centre of Excellence in Youth Mental Health (Orygen) is the world's leading research and knowledge translation organisation focusing on mental ill-health in young people. At Orygen, our leadership and staff work to deliver cutting-edge research, policy development, innovative clinical services, and evidence-based training and education to ensure that there is continuous improvement in the treatments and care provided to young people experiencing mental ill-health.

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Our work has created a new, more positive approach to the prevention and treatment of mental disorders, and has developed new models of care for young people with emerging disorders. This work has been translated into a worldwide shift in services and treatments to include a primary focus on getting well and staying well, and health care models that include partnerships with young people and families.



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## Executive summary

Depression is projected to be the leading cause of disability globally by 2030. It typically first manifests during adolescence or young adulthood and tends to become increasingly severe over the course of repeated episodes. Implementation of targeted e-mental health relapse prevention interventions offer a likely promising solution, though longer term engagement tends to be poor. Further, existing interventions lack integration of other beneficial, and user preferred components, including social networking, ongoing peer support and expert clinician input. The present study was designed to evaluate an innovative moderated online social therapy (MOST) intervention (entitled *Latitudes*) for depression relapse prevention in young people (15-25 years). The study sought to evaluate the acceptability, feasibility, safety and preliminary treatment benefit of *Latitudes*; a world-first positive psychology strengths-based social networking enabled, peer and clinical moderator supported web-based platform, providing evidence based intervention. A single-group pilot study was undertaken with 42 participants (50% male; mean age= 18.52 years) in partial or full remission from major depressive disorder. Participants were recruited from three specialist youth mental health services in Melbourne, Australia. All participants had access to the *Latitudes* platform for at least 12-weeks. Participants completed outcome assessments at baseline, and 12-weeks, including a structured clinical interview for depression and interviewer-rated symptomology. 12-week follow-up data were available for 39 participants (92.86%).

Results from the study indicated high system usage, with a total of 3,034 user logins (mean=72.23 per user), and 2,146 posts (mean=51.10) during the pilot. 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. All participants used the social networking features. The intervention was considered by all participants to be safe. A total of 32 (84%) participants rated the intervention as helpful, while 35 (94.59%) and 26 (70.27%) participants rated it as improving social connectedness and empowerment respectively. All but one participant indicated they would recommend *Latitudes* to another young person experiencing depression. These are strong results in terms of participant engagement and compare well with previous literature regarding engagement in online interventions in youth mental health. *Latitudes* therefore provides an entirely new therapeutic milieu in which participants can safely self-disclose, take positive interpersonal risks, gain perspective, broaden and rehearse coping skills, obtain encouragement and validation, and learn how to solve problems.

Participants were also assessed at baseline and follow-up to examine potential preliminary associations in symptom improvement. We note that these associations cannot be interpreted as intervention effectiveness, which requires a substantially larger randomised controlled trial of longer duration (i.e., 2-years). Over the 12-weeks of the study there was a significant increase in the number of participants in full remission at baseline (n=5; none of whom relapsed) compared to n=19 at 12-week follow-up ( $p < .001$ ). Six (14.29%) participants relapsed to full threshold symptoms at 12-weeks. There was also a significant improvement to interviewer rated depression scores

(MADRS;  $p=0.14$ ,  $d=0.45$ ) and a trend for improved strengths use ( $p=.088$ ,  $d=-0.29$ ), however as indicated, the direct impact of the intervention on these effects remains unclear. Finally, independent analysis regarding user experience of the Latitudes website indicated that it fell well above the 50<sup>th</sup> percentile on the five domains assessed. As such, the Latitudes site performed better than most commercially developed website for attractiveness, controllability, efficiency, helpfulness, and learnability.

In summary, the *Latitudes* intervention was shown to be acceptable, feasible and safe for young people with a recent experience of major depressive disorder. While associations with symptom improvement were encouraging, intervention effectiveness has not yet been established, requiring a longer-term controlled evaluation. Nonetheless, findings from the *Latitudes* pilot study are encouraging, and suggest that the moderated online social therapy model may be a promising next-generation e-mental health relapse prevention intervention for young people experiencing depression.

## Project Background

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]</sup>. Depression typically first manifests during adolescence or young adulthood (up to 25 years)<sup>[2]</sup> and tends to display a worsening pattern over the course of repeated episodes, including a lack of responsiveness to initially effective treatments<sup>[3]</sup>. Depression can be associated with significant distress and impairment for the individual and their family<sup>[4]</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>[5]</sup>.

Given the substantial social and economic costs associated with depressive disorders, effective early intervention, and maintenance of acute phase treatment effects is of critical importance<sup>[6]</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>[7]</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>[8-10]</sup> with meta-analyses casting doubt on the risk-benefit ratio of antidepressant use in those under 25 years in acute treatment<sup>[11, 12]</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>[13]</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>[14]</sup>.

The recently developed World Health Organisation Mental Health Action Plan (2013-2020)<sup>[15]</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>[16]</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>[17]</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>[18-20]</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>[18, 21]</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>[22, 23]</sup>. Internet use has been shown to be effective in bolstering social support, which is known to protect against depression<sup>[24]</sup>, with systematic reviews highlighting the effectiveness of online interventions for treating depression in young people<sup>[25, 26]</sup>. Nonetheless, attrition remains a significant issue for e-mental health interventions, with a substantial proportion of users dropping out in the early phase of treatment<sup>[27]</sup>, with treatment completion rates ranging as low as 0.5% for depression-based interventions<sup>[28]</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>[26, 29]</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>[30, 31]</sup>. The provision of peer support is thought to alter patterns of negative thinking and self-blame<sup>[32]</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>[33]</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>[22]</sup> and suicide risk<sup>[19]</sup>.

While there is significant interest on the part of consumers for the opportunity to access online peer support for mental health concerns<sup>[34]</sup>, evidence suggests that existing online interventions do not meet the specific needs of young people<sup>[35]</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>[35]</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 *Latitudes* pilot study was designed to evaluate the acceptability, feasibility, and safety of an innovative moderated online social therapy (MOST) for depression relapse prevention in young people aged 15–25 years. The *Latitudes* intervention was expected to demonstrate acceptability,

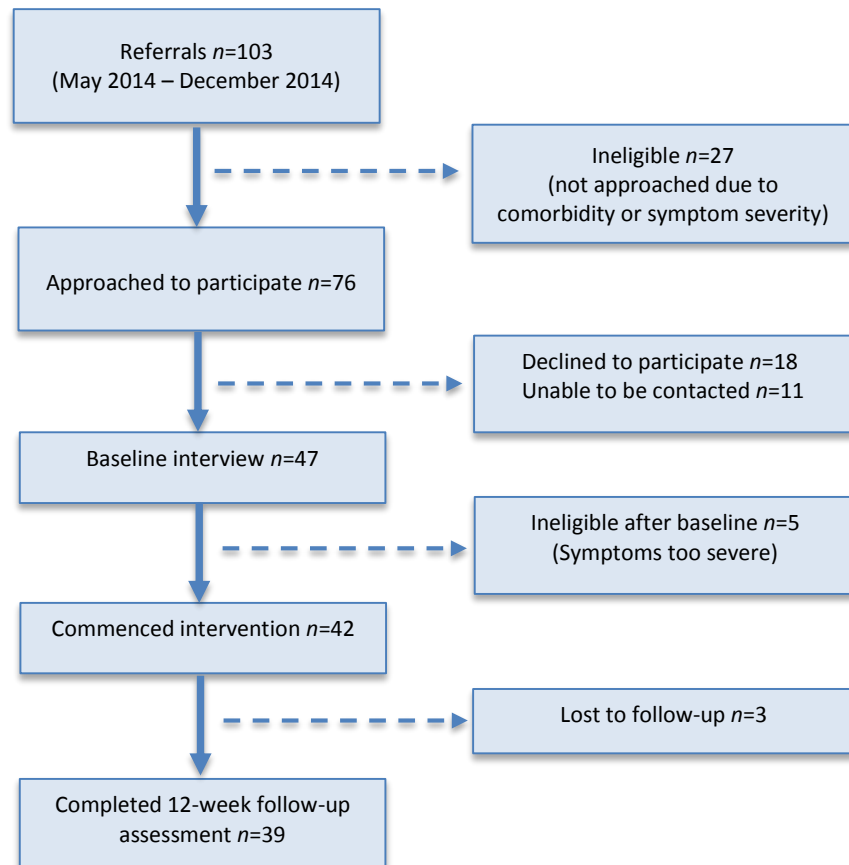
feasibility, and safety amongst the pilot cohort at conclusion of treatment (e.g., after 12-weeks of intervention participation). Acceptability and feasibility were evaluated via the number of logins to the system (i.e., with acceptability achieved if most participants logged on at least 10 times, over 3-months), in addition to favourable patterns of regular use of the system and perceived usefulness of the intervention. Safety of the *Latitudes* 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 *Latitudes* system; (iii) all participants perceiving the system to be safe.

## Research Methodology

### Participant recruitment

The recruitment target for the *Latitudes* study was n=50. The participant flow diagram below outlines recruitment and participant retention at week-12 (see Figure 1 below). During the recruitment phase (May 2014 – December 2014) 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 in the Orygen Youth Health Clinical Program, and two headspace centres in the Western suburbs of Melbourne). Following initial screening 27 referrals were deemed ineligible due to comorbidity, symptom severity (presentation of acute symptoms), 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.





*Figure 1: Latitudes participant flow diagram 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>[36]</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>[37]</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>[38]</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 *Latitudes* 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 (May 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 *Latitudes* 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 *Latitudes* was monitored daily (i.e. at least 2 h/day during weekdays, 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 design and development

*Latitudes* is based on the moderated online social therapy (MOST) model<sup>[17, 39, 40]</sup> which uses a positive psychology, 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 (see Figure 2). *Latitudes* was developed as a purpose-built online platform to supplement traditional face-to-face interventions for major depressive disorder. Components of the *Latitudes* intervention were refined and adapted from a similar intervention developed for long term recovery in first episode psychosis<sup>[41]</sup>.

The basis of the *Latitudes* intervention has been developed over a five-year period using participatory design principles<sup>[42, 43]</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 *Latitudes* 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.

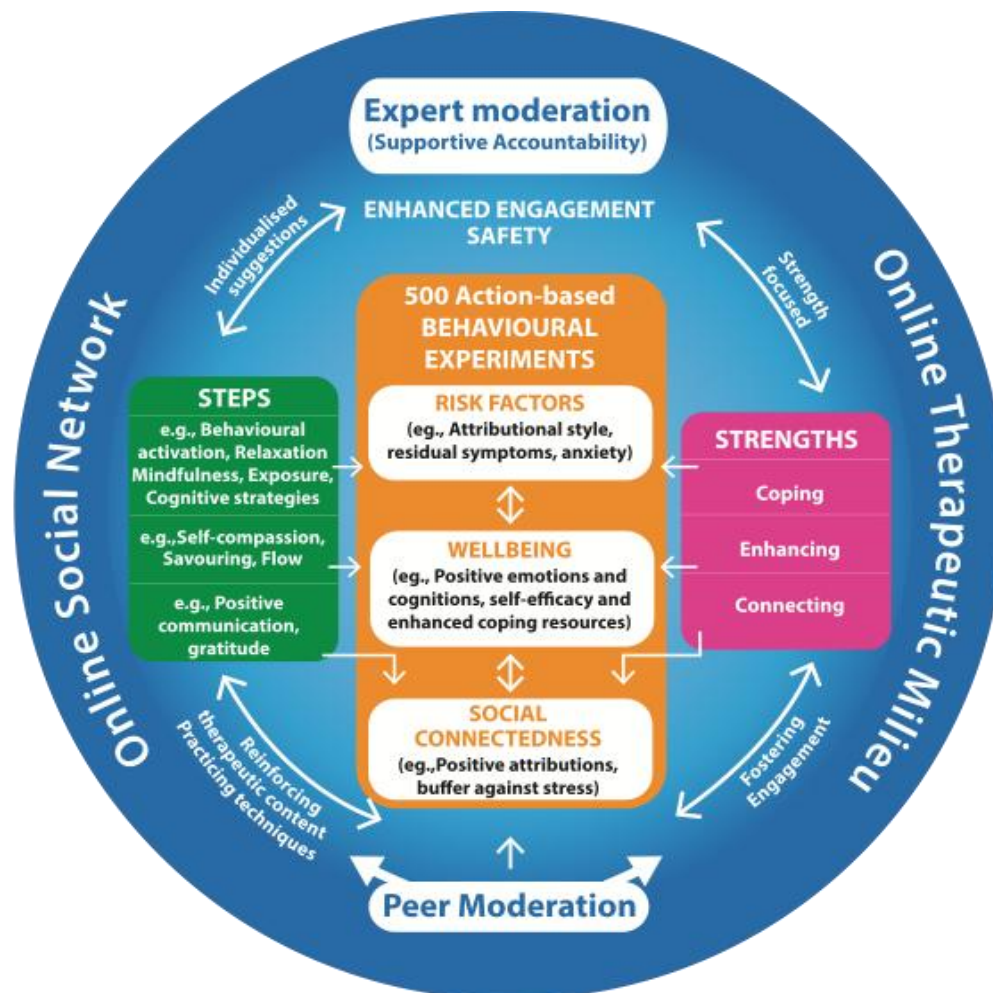


Figure 2: Overview of *Latitudes* intervention

The design of *Latitudes* was informed by recommendations and previous research targeting mechanisms of change (via positive psychology strengths-based interventions) for relapse prevention in young people<sup>[13, 44]</sup>. This includes interventions addressing residual symptoms<sup>[7]</sup>, improved social connectedness<sup>[45, 46]</sup>, and the enhancement of personal strengths, wellbeing and positive emotion<sup>[44]</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>[47]</sup>. Once selected, key strengths are 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 *Latitudes* was designed to reinforce therapeutic content available within the intervention, promote ongoing engagement and bolster social support.

Evidence-based therapeutic content within *Latitudes* 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). The 56 separate therapy *Steps* in *Latitudes* 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>[48]</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. The *Latitudes* platform has been specifically designed to ensure constant content flow between therapy and social networking component. 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>[41]</sup>. *Latitudes* 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>[49, 50]</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 *Latitudes* followed the 'supportive accountability' theory-driven model of online engagement<sup>[51]</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 *Latitudes* 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. Peer moderators received regular face-to-face, and online supervision from the *Latitudes* Youth Peer Support Coordinator. *Latitudes* 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).

Table 1: Frequently used *Latitudes* therapy modules

Therapy component (Step)	Description	n (%) <sup>a</sup>
<i>How Latitudes works</i>	This module provided users an overview of the key features of <i>Latitudes</i> 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>[52, 53]</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>[54]</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>[48]</sup> used throughout <i>Latitudes</i> . 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>[55]</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 techniques.	9 (21)
<i>Compassion for others</i>	This module integrated self-compassion techniques <sup>[56]</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>[57]</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>[58]</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

## Materials

Baseline and follow-up diagnosis of major depressive disorder were assessed via Structured Clinical Interview for DSM-IV (SCID; patient version)<sup>[59]</sup>. Symptom rating measures at baseline and follow-up

included two interviewer administered measures: the Montgomery–Asberg Depression Rating Scale (MADRS<sup>[60]</sup>), and the Social and Occupational Functioning Scale (SOFAS<sup>[61]</sup>). In addition, participants provided self-report data using the Strengths Use Scale<sup>[62]</sup>, the Penn State Worry Questionnaire<sup>[63]</sup>, the Medical Outcomes Social Support Survey<sup>[64]</sup> (to assess social connectedness), the 2-Way Social Support Scale<sup>[65]</sup> (to assess social support) and the Anxiety Subscale taken from the Depression Anxiety Stress Scales<sup>[66]</sup>. All scales reported satisfactory internal consistency (see Table 4 for Cronbach alpha coefficients). Participants also provided data at follow-up on their experience of *Latitudes*. 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 *Latitudes* to another young person with depression. In addition, participants were invited to provide in-real time data based on Smartphone Ecological Momentary Assessment (SEMA). SEMA is a novel method of *in vivo* assessment (see Appendix for SEMA questions) for capturing real time data, from smartphone devices. Participants who consented to this aspect of the study provided SEMA data in weeks-1 and 12 only. Finally, participants completed standardised ratings of the *Latitudes* website, assessing key domains of website attractiveness, controllability, efficiency, helpfulness, and learnability, using the Website Analysis and Measurement Inventory (WAMMI)<sup>[67]</sup>.

## Statistical analysis

Intervention acceptability, feasibility and safety were determined by frequency ratings and patterns of use (means and standard deviations). Changes to depression and remission were 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, however given the single-group design used, these changes cannot be directly attributed to the intervention. Paired samples t-tests were conducted and within-group effect sizes reported for changes between baseline and follow-up clinical measures.

## Research Findings

Demographic data are summarised in Table 2 (see below). 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.

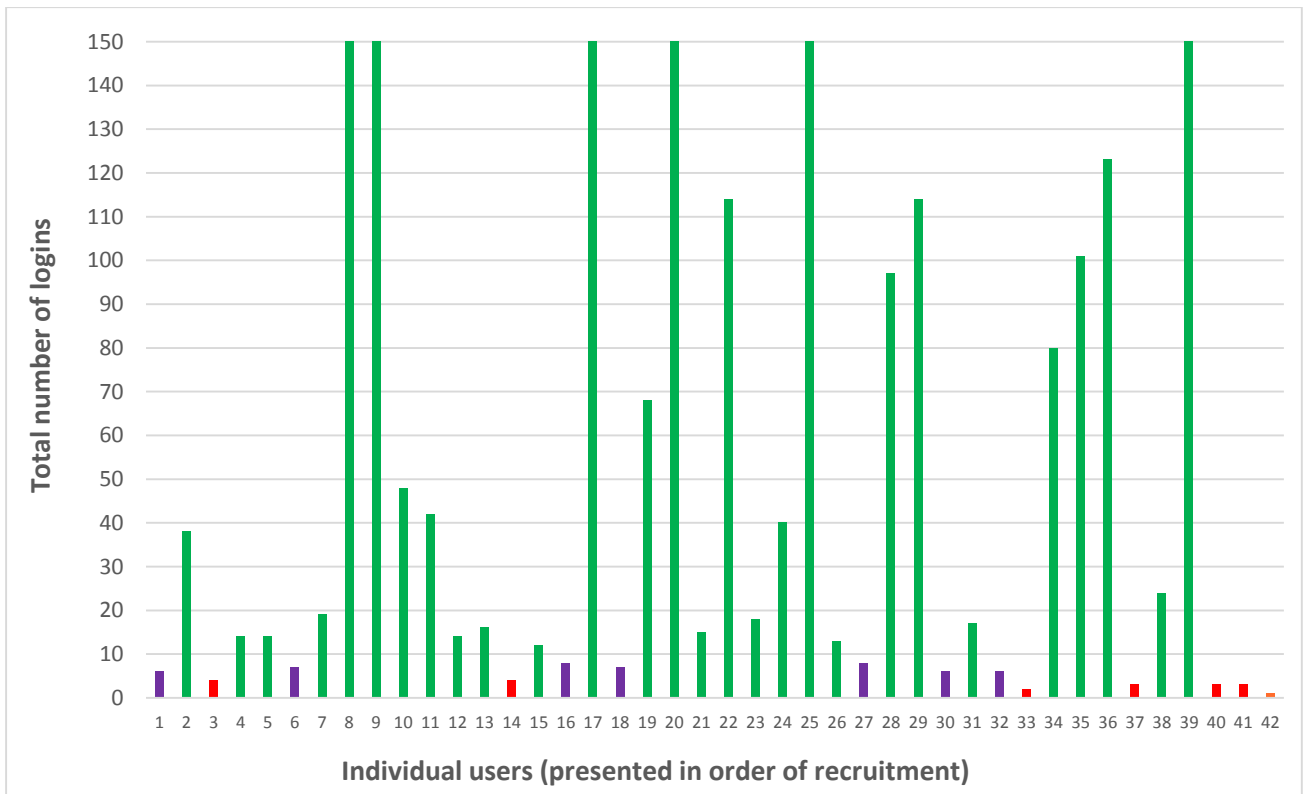
Table 2: Summary of participant demographics

	n (%)
Males	21 (50)
Born in Australian	42 (100)
Participants with dependants	0 (0)
Native English speaking	21 (97.6)
Living arrangement	
Currently living with family	39 (92.9)
Rental housing	3 (7.1)
Education	
Studying fulltime	27 (64.3)
Studying part-time	3 (7.1)
Not studying	12 (28.6)

Clinician ratings on the Clinical Global Impression Scale<sup>[37]</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 daily general internet use. Most (57.1%, n=24) estimated their daily internet use as >4 hours per day.

## Acceptability & Feasibility

Data on the usage of *Latitudes* indicated that 60% of participants utilised the system at least monthly over the 12-week intervention phase. There were a total of 3034 system logins from participants (see Table 3 for descriptive statistics) with an average of 72.23 logins. The total number of logins ranged from a low of 1 (n=1), to a high of 593 (median = 16.5 logins). In terms of low engagement, 16.7% (n=7) of participants logged on to *Latitudes* on less than 5 occasions. In contrast, 66.7% (n=28) of participants logged on at least 10 occasions. Of these, 45.2% (n=19) logged on 20 times or more, with 14.3% (n=6) logging on >150 times. The spread of per participant logins is displayed below in Figure 3.



**Note:** Red bars depict low engagement (<5 logins), purple bars depict moderate engagement (5-9 logins), green bars depict high engagement (10+ logins). There were 6 cases with very high engagement (>150 logins; 161, 185, 225, 284, 477, 593 logins respectively).

Figure 3: Summary of individual user logins

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, 819 likes (where a user clicks the 'Like' function on another users post), and 576 comments. A total of 19 distinct *Talk it Out* topics were proposed by 33.3% (n=14) of participants.



**Table 3: Logins and individual usage of the main components of the Latitudes intervention (n=42).**

Site component	Total	M	SD	Mdn	n (%)
Logins	3,034	72.23	123.32	16.50	28 (66.7) <sup>a</sup>
Social networking – posts	751	17.88	24.03	9.50	21 (50.0) <sup>b</sup>
Social networking – likes	819	19.50	39.68	3.50	17 (40.5) <sup>b</sup>
Social networking – comments	576	13.71	22.68	4.00	13 (31.0) <sup>b</sup>
Therapy modules (steps)	195	4.64	4.52	4.00	18 (42.9) <sup>c</sup>
Actions	158	3.76	5.29	2.00	11 (26.2) <sup>c</sup>

<sup>a</sup> Percentage of participants with ≥10 logins.

<sup>b</sup> Percentage of participants with ≥10 interactions.

<sup>c</sup> Percentage of participants completed ≥5 steps/actions.

Participants provided positive ratings of their experience with *Latitudes* (see Table 4), rating the site favourably in terms of safety, user experience, and confidentiality. Mean ratings also indicated that participants experienced *Latitudes* to be helpful for feeling more socially connected, and also for controlling their mood. All but one participant (n=37, 97.37%) reported they would recommend *Latitudes* to a young person experiencing depression. All ratings of self-report questions regarding moderation of *Latitudes* were within the positive range (see Table 4).

**Table 4: Participant impressions of the Latitudes intervention (n=39).**

Latitudes experience	M	SD	Mdn	Range	n (%) <sup>a</sup>
<i>General</i>					
I felt safe on <i>Latitudes</i> <sup>b</sup>	4.65	0.59	5.00	3 - 5	37 (100)
I felt my profile was confidential <sup>c</sup>	4.46	0.73	5.00	2 - 5	34 (91.89)
<i>Latitudes</i> was a positive experience <sup>b</sup>	4.16	0.72	4.00	3 - 5	38 (100)
<i>Latitudes</i> was helpful <sup>b</sup>	3.61	1.18	4.00	1 - 5	32 (84.21)
<i>Latitudes</i> helped me feel more socially connected <sup>b</sup>	3.46	1.22	4.00	1 - 5	35 (94.59)
<i>Latitudes</i> helped me control my mood <sup>b</sup>	3.08	1.01	3.00	1 - 5	26 (70.27)
<i>Moderation</i>					
The moderators encourage open discussion <sup>d</sup>	5.95	1.13	6.00	4 - 7	38 (100)
I felt that the moderators accepted me <sup>d</sup>	5.78	1.06	6.00	4 - 7	38 (100)
I felt the moderators provided me with choices <sup>d</sup>	5.53	1.06	6.00	4 - 7	38 (100)
The moderators listen to how I would like use <i>Latitudes</i> <sup>d</sup>	5.55	1.05	5.50	4 - 7	38 (100)

<sup>a</sup>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.

## Safety

All participants reported feeling safe when using the *Latitudes* intervention (see Table 3). No inappropriate usage of the system occurred throughout the intervention. There was one serious adverse event (minor overdose) reported during the treatment phase, though this was unrelated to the intervention and did not require hospital admission. Importantly, analysis indicated no worsening of depression symptoms or functioning across the intervention phase (see Table 5).

Table 5: 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	16.21	6.91	.93	12.05	11.42	<b>.014</b>	0.45
SOFAS	-	67.32	12.17	-	68.11	10.67	.716	0.03
Strengths use	.96	4.41	1.22	.96	4.65	1.31	<b>.088</b>	0.29
Social connectedness	.96	3.87	0.94	.95	3.92	0.86	.711	0.06
Social support	.94	3.73	0.92	.94	3.80	0.90	.470	0.08
Worry	.76	3.54	0.78	.81	3.63	0.91	.391	0.05
Anxiety	.79	6.08	4.71	.89	6.78	6.00	.184	0.13

Note. MADRS (Montgomery-Asberg Depression Rating Scale) is an interviewer-administered scale assessing severity of depression symptoms, SOFAS (Social and Functioning Assessment Scale).

## Clinical variables

Participants were assessed at baseline and follow-up to examine potential preliminary associations in symptom improvement. We note that these associations cannot be interpreted as intervention effectiveness, which requires a substantially larger randomised controlled trial of longer duration (i.e., 2-years). The effectiveness of *Latitudes* will be assessed through a large randomised controlled trial, recruiting 400 patients from 4 headspace early intervention services (funding application for this is currently under review with the National Health and Medical Research Council).

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>[59]</sup>). At baseline  $n=5$  (11.9%) participants were in full remission for MDD, which increased to  $n=19$  (45.24%) at 12-week follow-up, McNemar's  $\chi^2$  (1,  $N=39$ ) = 13.00,  $p < .001$ . All five participants who were in full remission at baseline sustained their full remission through to 12-week follow-up. There were six (14.29%) 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>[59]</sup>). There was also a significant improvement in interviewer rated depression (MADRS) scores, of small-moderate effect ( $d=0.45$ ) (see Table 5).

Results also indicated no deterioration in social or occupational functioning (see Table 5). On the self-report measures there was a 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.

## Standardised Website Analysis

Participant ratings on the 20-item WAMMI<sup>[67]</sup> questionnaire were used to assess user experience of the Latitudes website. Participant data for the WAMMI was entered into a secure online portal, and analysed independently by leading user experience researchers based at the University of Cork, Ireland. A report was subsequently provided for the performance of the Latitudes website by the authors of the WAMMI. By way of brief explanation, at any time, the WAMMI standardisation database reflects data collected from approximately 200 different websites (updated annually). These websites are selected to be a representative sample from the hundreds of sites recently analysed, including highly developed commercial websites. The entire WAMMI database contains several hundred thousand sets of user-responses, from hundreds of websites worldwide.

Reporting of the 5 subscales of the WAMMI (attractiveness, controllability, efficiency, helpfulness, and learnability), and the global utility score are expressed as percentiles. This means that a score of 50, for instance, represents the average score for the scale: i.e., 50% of websites in the database achieve a score of less than 50, and 50% of websites will get a score of 50 or more. As can be seen in Figure 4 below, the Latitudes website scored above the 50<sup>th</sup> percentile on all WAMMI subscales, with an overall usability index of 59.58 (SD=18.89). These findings highlight that the Latitudes website compared very favourable when benchmarked against a large database of commercially developed websites.

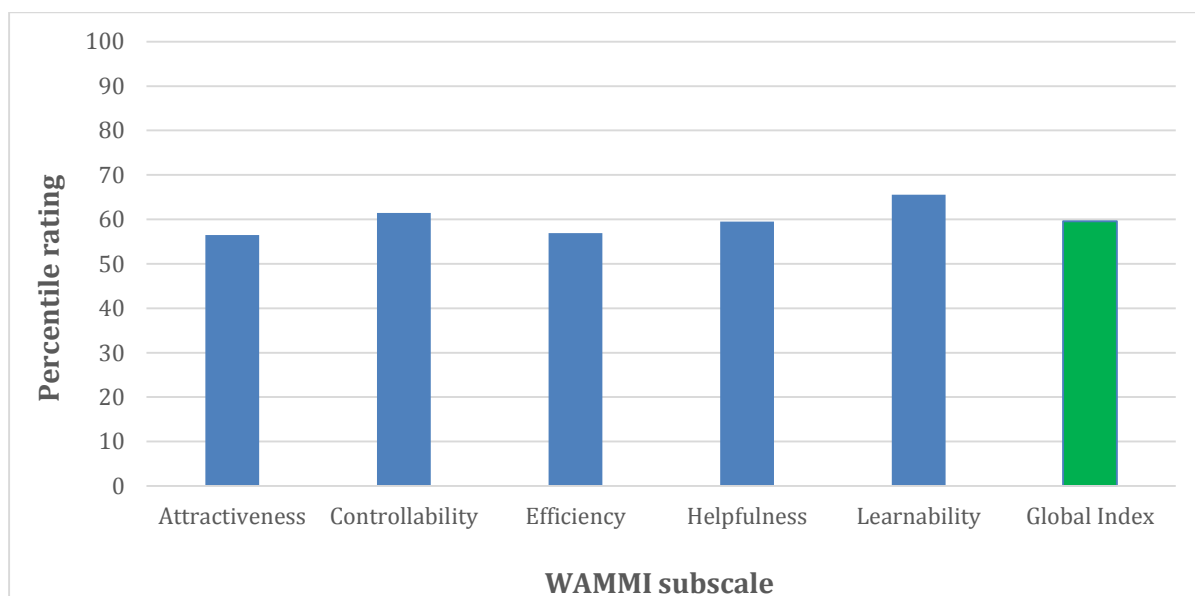


Figure 4: Summary of user experience ratings of the Latitudes website

## Additional analyses

There are a number of additional analyses currently underway, and further analyses planned. These additional analyses are outlined below, and will focus on (i). An indicative economic analysis, (ii). Smartphone ecological momentary assessment data, (iii). Findings related to qualitative outcomes from the semi-structured interviews and focus groups, (iv). Findings related to specific usage patterns of *Latitudes*, and any co-occurring clinical support (i.e., case management, individual therapy) and associations to functional and clinical outcomes, and (v). Findings from textual analysis of user-generated content throughout the duration of the intervention.

### Indicative economic analysis

An initial exploratory cost-utility analysis of the *Latitudes* pilot data is currently being undertaken. The goals of this initial analysis are to explore the potential for *Latitudes* to be cost-effective under a number of potential scenarios, and to identify potential key drivers of cost-effectiveness results. A Discrete Event Simulation (DES) is being developed using the *R* modeling program that synthesises data from the *Latitudes* pilot with published literature, in order to simulate a control group. Simulation outputs will be compared with the *Latitudes* pilot study in order to estimate incremental cost-effectiveness results and associated uncertainty based on alternative assumptions relating to the impact of *Latitudes*. The cost-utility analysis will also examine how alternative implementation scenarios (e.g., some unit costs would be expected to fall as the number of *Latitudes* users grow) might impact on cost-utility results. In addition to providing some tentative, indicative results about the potential for *Latitudes* to be cost-effective, the DES model will provide a simulation environment that can be used for a more robust analysis of results from any future trial of *Latitudes* (e.g., to extrapolate results beyond the trial follow-up period). An advantage of developing the DES is that data from a future trial can be used as part of the process of validating and refining the DES (for example, by comparing Trial results with results predicted by the DES).

### Smartphone ecological momentary assessment data

Smartphone Ecological Momentary Assessment (SEMA) enables longitudinal, real-time assessments of relationships between social interactions, thoughts, feelings, and behaviors. Specifically, SEMA consists of purposely-developed mobile application for smart phones designed to capture *in vivo* data on social functioning. SEMA was available for IOS and Android-based smart phones. In *Latitudes* SEMA was centrally programmed to administer 4 electronic interviews per day for 7 days at each of the following time periods: 10:00 am to 13:00 pm; 13:00 pm to 4:00 pm; 4:00 pm to 7:00 pm; and 7:00 pm to 10:00 pm. This occurred in the first and last (i.e., Week 12) week of the intervention. Assessment times were randomized for each participant within each of the time periods. When initiated, SEMA runs through a list of closed questions on social interactions (frequency, type and medium of social interactions; see Appendix), experiences of giving and

receiving emotional support, experiences of being criticized, subjective performance appraisal of social interactions, and positive and negative effect.

At present, the SEMA data is being collated, cleaned and prepared for preliminary analysis. A total of 30 (71.4%) participants consented to the SEMA component of the study. During the early phase (i.e., Week-1 assessments) of SEMA, we observed relatively poor participant compliance with SEMA data collection (i.e., on average, approximately 35% of items completed). As a consequence we submitted an ethics amendment to change the participant reimbursement structure, which boosted compliance (at follow-up average compliance was greater than 50%, which is comparable to similar studies using smartphone ecological assessment). We are aiming to explore intervention usage, and clinical outcomes, relative to key patterns in social interaction and positive / negative affect observed in SEMA.

## Qualitative outcomes: Semi-structured interviews & focus groups

Semi-structured interview data has been obtained from 38 participants. In addition, 2 focus groups were held (lasting 45 minutes each) in order to obtain more detailed group-based feedback on the *Latitudes* intervention. Semi-structured interview questions included *“What did you find most helpful about Latitudes?”*, *“If you could add or change one thing about Latitudes, what would it be?”* And *“What was it like being able to interact with other users on Latitudes?”*

Detailed thematic analysis of the semi-structured data is currently underway, using QSR NVivo 10 software. Initial scanning for representative participant quotes from these interviews yielded the following:

*“I liked the idea that you can go on there whenever”.*

*“A lot to offer, but still simple to use”*

*“Being able to post and not feeling judged”*

*“I like the idea of having a place like that where a focus is on mental health problems. People deactivate Facebook accounts due to bullying and that’s not possible to happen on Latitudes”*

*“The psychologist got back to you very quickly so if you needed to ask something they got back to you quickly” They were really active, easily attainable, posted useful stuff. Wouldn’t change anything, it was really good”.*

The semi-structured interviews also indicated areas of future development and refinement:

*“Have some sort of game. Play against other users and compare scores. [Therefore] more interaction with other users. Games could be about anything.”*

*“Mobile app, only used it on phone via home page icon but would be better as proper app. Found it very slow to load new pages, hard to navigate/ see everything on mobile. Wouldn’t remember password, had to keep typing it in. Wouldn’t change or add anything else.”*

*“Open to a larger group of people or public. More activity and for people not part of the service that can access support if they don’t feel comfortable going to see a psychologist. A lot of people wouldn’t go to see one out of fear or shame- give them the opportunity to be in the community”*

Qualitative data from the focus groups will also be analysed using QSR NVivo 10 software. Initial scanning for key themes indicated direct user feedback regarding the online therapeutic content (i.e., too much reading, willing to read paper but not screen, content not entirely relevant), use of the intervention on mobile devices (i.e., in general the interface was too slow to load on mobile devices, users were annoyed by having to log in repeatedly *“If it’s on your phone, you can stay logged in”*). Positive feedback was provided on the social networking / social interaction aspect, with users indicating that *Latitudes* compared favorably to *Facebook* (i.e., *“There was no arguing and it was just really supportive; and that felt nice”*).

## Usage patterns and associations with study outcomes

Initial analysis of the *Latitudes* intervention suggests substantial variation in usage patterns of the system (see Table 2 above). While the average and median number of logins were encouraging, the range of logins indicates that there were a sub-group of users with relatively few logins (i.e., 7 participants with poor engagement; a further 7 participants with moderate engagement – see Figure 3). A secondary-analysis will be undertaken to determine the ways in which specific usage patterns (i.e., high versus low users) impacted on intervention outcomes, and any demographic or baseline differences between usage groups. This analysis will assist in identifying young people who may be more likely to use / benefit from the *Latitudes* intervention, and in the development of strategies that may increase usage across this cohort of young people.

## Textual analysis of user-generated content throughout the duration of the intervention.

The final additional analysis will focus analyzing user-generated content from the *Latitudes* study. The nature of the intervention is such that a large amount of user-generated content (i.e., posts to the social network, comments, *Talk it Out* topics) was developed. We are in the process of establishing a collaboration with an expert in machine learning (an advanced multivariate statistical

analysis procedure) to determine whether there was a change in the tone and nature of user-generated content as part of the intervention.

## Future directions and conclusions

The present study was designed to provide proof of concept by assessing feasibility, acceptability, and safety. The true clinical benefits and scope of *Latitudes* remain unknown until a controlled evaluation can be undertaken. While the intervention was designed to target relapse prevention, it must be acknowledged that a large proportion (i.e., 67%) of participants remained in active clinical treatment during their use of the *Latitudes* intervention. 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.

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>[20, 22]</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>[15]</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 cost-effectiveness evaluations.

## Conclusions

The *Latitudes* pilot study shows the MOST model of online intervention to be engaging, feasible, and safe when used by young people recovering from depression. Favourable user feedback regarding intervention content, design and moderation, in addition to high overall usage rates, highlights the acceptability of the platform. While controlled evaluation is required to determine intervention efficacy and cost-effectiveness, initial results suggest possible treatment benefits in terms of reduced relapse rates and symptomology. In summary, the MOST model appears to be a promising longer term next-generation e-mental health intervention.

## Strategies for research translation

Throughout the duration of the project a number of key stakeholder groups have been engaged. These groups include young people as end users of the online platform, the Young and Well Cooperative Research Centre, and headspace – Australia’s National Youth Mental Health Foundation.

- Intervention development has focused on youth participatory design principles. This has seen close engagement with young people (i.e., end users of the intervention) throughout the process of intervention design, development, implementation, and refinement.
- Investigators from the project are closely aligned with the Young and Well Cooperative Research Centre – an organisation that focus on the development of policy and advocacy for the use and dissemination of technology in improving young people’s mental health. Importantly, the success of the current project has enabled us to secure additional funding to expand the moderated online social therapy model to a population-based environment.
- We have recently signed an agreement with eheadspace ([eheadspace.org.au](http://eheadspace.org.au)) to develop and pilot a version of the moderated online social therapy platform that can be accessed by all Australian young people experiencing psychological distress. The aim of this project is to increase the absolute number of young people who can be provided timely evidence-based mental health support, thus reducing the likelihood of longstanding symptoms, functional impairment, and the need for hospital-based inpatient or outpatient treatment.
- Investigators from the research team are now actively engaged in the development of best practice guidelines for the design, dissemination, and application (i.e., clinical and peer moderation) of online intervention in youth mental health. Once developed, it is hoped that these guidelines will contribute to further policy development and leadership.
- The principal investigator (SR) has been actively disseminating knowledge developed as part of the Latitudes study, including publications and conference presentations. Other noteworthy forums include:
  - The Suicide Prevention Summit hosted by Facebook Inc. at their Silicon Valley headquarters in Menlo Park, California (*Social Networking and Youth Mental Health: Intervention, Connection, Meaning* (19/02/14).
  - The School of Medicine, Stanford University, California – Departmental Presentation (*Youth Mental Health and Social Networking: Opportunities for Intervention and Connection* (20/02/14).



# Appendix:

Questions used in SEMA assessments:

## BASELINE ASSESSMENT

### SOCIAL FUNCTIONING

1. Since the last beep how much **time** have you **spent with others**?

**Response** (Sliding Scale)



### TYPE OF SOCIAL INTERACTION

2. Who have you **spent most time with** since the last beep? (**choose 1 option; radio**)

**Response** (Box Check)

- Not applicable
- Friends
- Family
- Co-workers/classmates
- People you don't know

3. How have you **interacted with people** since the last beep? (**several options; multiple choice**)

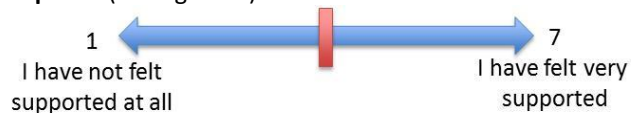
**Response** (Box Check)

- Face to face
- Phone (landline or mobile phone conversation)
- Online (desktop computer or laptop)
- Mobile (SMS or mobile apps)

### QUALITY AND APPRAISALS OF SOCIAL INTERACTIONS

4. Since the last beep have you **felt supported or encouraged** by other people?

**Response** (Sliding Scale)



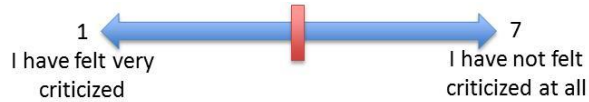
5. Since the last beep have you **encouraged or given someone emotional support**?

**Response (Sliding Scale)**



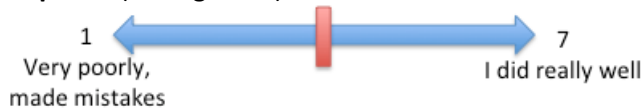
6. Since the last beep have you felt that others **criticized or judged** you?

**Response (Sliding Scale)**



7. How well do you think you **handled your social interactions** since the last beep?

**Response (Sliding Scale)**



8. Since the last beep how have you **felt in relation to others**?



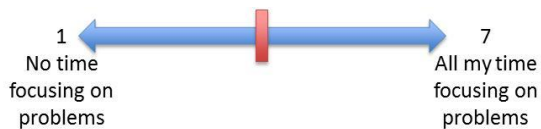
9. Since the last beep how **isolated** have you felt from others?



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**RUMINATION**

10. Since the last beep how much time have you spent **focusing on your problems**?



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## AFFECT

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11. How **happy** do you feel right now?

**Response** (Sliding Scale) PANAS



12. How **sad** do you feel right now?

**Response** (Sliding Scale)



13. How **stressed** do you feel right now?

**Response** (Sliding Scale)



## ADDITIONAL QUESTIONS FOR FOLLOW-UP ASSEMENTS

15. Since the last beep have you **experienced any of the following emotions?**

**Response** (Box Check)

- Amusement
- Gratitude
- Hope
  - Interest
  - Love

16. Since the last beep have you **practiced any of these skills?**

**Response** (Box Check)

- Being present in the moment (mindfulness)
- Kind thoughts towards yourself and others
- Focused on, remembered or anticipated pleasant experiences?

17. Since the last beep have you **thought about or used any of your personal strengths?**

**Response** (Box Check) Tailored question (response categories include individualised user strengths)

- Strength 1
- Strength 2
- Strength 3...

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