

A Novel Blended Transdiagnostic Intervention for Youth Psychosis and Borderline Personality Disorder: the eOxygen Pilot Study

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Abstract

Background: Integrating innovative digital mental health interventions within specialist services is a promising strategy to address the shortcomings associated with both face-to-face and online mental health services. However, despite young people's preferences and calls for integration of these services, current mental health services rarely offer blended models of care.

Objective: This pilot study tested an integrated digital and face-to-face transdiagnostic intervention (eOrygen) as a blended model of care for young people with youth psychosis and borderline personality disorder. The primary aim was to evaluate the feasibility, acceptability, and safety of eOrygen. The secondary aim was to assess pre-post changes on key clinical and psychosocial outcomes. An exploratory aim was to explore the barriers and facilitators identified by young people and clinicians in implementing a blended model of care into practice.

Methods: Thirty-three young people (15-25 years) and 18 clinicians were recruited over 4 months from two youth mental health services in Melbourne, Australia: (1) the EPPIC clinic, an early intervention service for first-episode psychosis and; (2) the HYPE clinic, an early intervention service for borderline personality disorder in young people. The feasibility, acceptability and safety of eOrygen were evaluated via an uncontrolled single-group study. Repeated measured t-tests assessed changes on clinical and psychosocial outcomes between pre- and post-intervention (3 months). Interviews with 8 young people and 15 clinicians were also conducted post-intervention.

Results: eOrygen was found to be feasible, acceptable and safe. Feasibility was established due to a low refusal rate of 25% and by exceeding our target of young people recruited to the study per clinician, despite challenges with clinician recruitment. Acceptability was established, as 92% (28/30) of young people recommended eOrygen to others, and safety was established as no adverse events or unlawful entries were recorded. In terms of potential clinical effects, significant improvements were observed on 9 out of 12 clinical and psychosocial outcomes between pre- to post-intervention, with Cohen d effect sizes ranging from 0.56-0.89. Most young people reported using eOrygen in a blended way, describing using it both within sessions and between sessions with their clinician, but some young people shared concerns at the prospect of their clinician viewing their activity on the platform. Clinicians reported that eOrygen complemented their work and acted as a facilitator of engagement and communication within sessions with young people. Familiarity with the platform was seen as necessary for successful integration, but this was perceived by clinicians as time-consuming.

Conclusions: eOrygen as a blended transdiagnostic intervention has the potential to increase therapeutic continuity, engagement, alliance, intensity and, ultimately, effectiveness. Future research will need to establish the effectiveness of blended models of

care for young people with complex mental health conditions and determine how to optimise the implementation such models into specialised services.

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Original Paper

A Novel Blended Transdiagnostic Intervention for Youth Psychosis and Borderline Personality Disorder: the eOrygen Pilot Study

Abstract

Introduction: Integrating innovative digital mental health interventions within specialist services is a promising strategy to address the shortcomings of both face-to-face and online mental health services. However, despite young people's preferences and calls for integration of these services, current mental health services rarely offer blended models of care.

Objectives: This pilot study tested an integrated digital and face-to-face transdiagnostic intervention (eOrygen) as a blended model of care for young people with youth psychosis and borderline personality disorder. The primary aim was to evaluate the feasibility, acceptability, and safety of eOrygen. The secondary aim was to assess pre-post changes on key clinical and psychosocial outcomes. An exploratory aim was to explore the barriers and facilitators identified by young people and clinicians in implementing a blended model of care into practice.

Methods: Thirty-three young people (15-25 years) and 18 clinicians were recruited over 4 months from two youth mental health services in Melbourne, Australia: (1) the EPPIC clinic, an early intervention service for first-episode psychosis and; (2) the HYPE clinic, an early intervention service for borderline personality disorder in young people. The feasibility, acceptability and safety of eOrygen were evaluated via an uncontrolled single-group study. Repeated measured t-tests assessed changes on clinical and psychosocial outcomes between pre- and post-intervention (3 months). Eight semi-structured qualitative interviews were conducted with young people and three focus groups, attended by 15 clinicians, were conducted post-intervention.

Results: eOrygen was found to be feasible, acceptable and safe. Feasibility was established due to a low refusal rate of 25% and by exceeding our target of young people recruited to the study per clinician, despite challenges with clinician recruitment. Acceptability was established, as 92% (28/30) of young people recommended eOrygen to others, and safety was established as no adverse events or unlawful entries were recorded. In terms of potential clinical effects, significant improvements were observed on 9 out of 11 outcomes between pre- to post-intervention, with Cohen *d* effect sizes ranging from 0.5-0.95. Interviews with young people identified facilitators to engagement such as peer support and personalised therapy content, while barriers were identified

such as low motivation, social anxiety and privacy concerns. Clinician focus groups identified evidence-based content as an implementation facilitator, while lack of familiarity with the platform was identified as a barrier due to clinicians' competing priorities, such as concerns related to risk, handling acute presentations, and the challenge of being understaffed.

Conclusion: eOrygen as a blended transdiagnostic intervention has the potential to increase therapeutic continuity, engagement, alliance and intensity. Future research will need to establish the effectiveness of blended models of care for young people with complex mental health conditions and determine how to optimise the implementation such models into specialised services.

Keywords

Digital intervention; blended care; youth mental health; transdiagnostic intervention; psychotic disorders; borderline personality disorder; digital health

Introduction

Background

The evolution of specialist early intervention services for youth represents a major global reform of mental health services [1-3]. However, there are shortcomings that remain to be addressed for these services to fully deliver on their promise. For example, 42% of young people drop out of treatment by the third therapy session [4], indicating low engagement rates with early intervention services [5]. Furthermore, those who continue treatment receive time-limited support [6], and up to 80% of young people with severe mental health conditions will incur repeated relapses, leading to long-term disability and high societal cost [7, 8]. Estimates suggest that costs associated with recurring mental ill-health is up to five times that of non-relapsing presentations [9]. Even when young people receive evidence-based treatment, its effectiveness is limited [10]. For example, between one to two thirds of young people do not experience symptom reduction [11], and functional impairment often remains an issue after remission [12].

Digital technologies have the potential to address these challenges and limitations by enhancing the accessibility, impact, reach and cost-effectiveness of youth mental health (YMH) services [13, 14]. Many young people, recognising their need for help, are turning to technology, including smartphone applications (apps), websites, and social media, to self-manage their mental well-being [15]. Research findings support the efficacy of digital mental health interventions in improving treatment outcomes in severe mental health conditions such as psychosis [16-18] and borderline personality disorder (BPD) [19]. Web-based treatment programs have also demonstrated efficacy

comparable to face-to-face psychotherapy [20-22], and self-guided smartphone-based mental health interventions are proving to be promising self-management tools for depression and anxiety symptoms [23].

However, despite the evidence for the effectiveness of digital interventions, limitations have also been reported, such as high attrition rates [24, 25], a focus on mild to moderate mental health conditions [26-28], a focus on single disorders ignoring potential comorbidity [29], and a lack of integration within clinical settings [30, 31]. Factors affecting attrition and dropout from digital interventions have been identified such as a lack of personalisation within digital interventions, and severe mental disorders hampering engagement with interventions [32]. Most of the first generation of digital interventions have also been deployed and evaluated without face-to-face care, generating a divide between face-to-face and digital supports [33]. Furthermore, clinical trials of digital interventions often recruit highly motivated early adopters from the community, resulting in poor generalisability of findings in clinical settings [33, 34].

Blended care refers to treatment that includes face-to-face and digital elements, both of which contribute to the treatment process and can be integrated or offered sequentially [35, 36]. Blended models of care offer an innovative approach to address the limitations of both face-to-face and digital therapy for young people with serious mental illness, while maintaining the strengths of both modalities [36, 37]. This integrated approach is in line with World Health Organization recommendations [38] and young people's preferences, as well as national and international calls for the integration of online and in-person mental health services [39]. Young people have indicated that blended models of care could enhance clinical care by increasing accessibility and continuity of care, providing access to post-therapy support and strengthening the relationship with their clinician [40]. However, despite young people's preferences and calls for integration of face-to-face and online services [16, 41], current mental health services rarely provide this type of integrated online support [42]. Barriers to implementing digital interventions in clinical settings have also been identified, such as lack of time for clinicians and scepticism towards digital intervention [43], and these need to be taken into account when developing blended interventions. Furthermore, there is limited research testing blended models of care as a treatment approach [37, 44], despite the demonstrated efficacy of standalone digital interventions [45-47].

Furthermore, transdiagnostic interventions that target underlying mechanisms or symptoms that are common across multiple mental disorders have the potential to provide more effective,

personalised and engaging treatment, addressing comorbidity and being applicable to a wider range of young people [48, 49]. Evidence also suggests that transdiagnostic interventions may be at least as effective, more engaging and easier to scale up in real world clinical settings compared with single-disorder interventions [50, 51].

As blended transdiagnostic interventions for first-episode psychosis and borderline personality disorder have not yet been evaluated, a 3-month pilot evaluation of a blended transdiagnostic digital intervention (eOrygen) designed to enhance the accessibility, responsiveness and impact of face-to-face specialised YMH clinical services for youth psychosis and borderline personality disorder (BPD) was carried out. Pilot studies are an important first step before running a full-powered clinical trial, as they focus on whether an intervention can be carried out, if it would be worth proceeding with it, and how to proceed, before focusing on evaluating the effectiveness of the intervention [52].

Objectives

The primary objective of the eOrygen pilot was to evaluate the feasibility, acceptability and safety of an integrated virtual clinic that blends moderated online social therapy support with face-to-face specialised YMH clinical services for youth psychosis and BPD. A secondary aim of the pilot was to assess changes in key clinical and psychosocial outcomes for young people from the point of enrolment in eOrygen to post-intervention. Furthermore, the failure to integrate digital technologies into routine practice is well documented [53], and, therefore, an additional objective of this study was to understand young people's and clinicians' experiences of barriers and enablers in utilizing a blended model of care in clinical practice.

Methods

Study Design

This was a 3-month multisite pre–post single-group pilot study conducted at the Early Psychosis Prevention and Intervention Centre (EPPIC) and the Helping Young People Early (HYPE) clinic at Orygen Youth Health (OYH), Melbourne, Australia. EPPIC provides services for young people aged 15–25 years experiencing their first episode of psychosis, and admission to the service is based on a clinical assessment determining the presence of full threshold first-episode psychosis including full threshold psychotic symptoms such as hallucinations, delusions or formal thought disorder [54]. The HYPE clinic is an early intervention program for youth aged 15–25 years with BPD, and intake to the service is based on meeting three or more BPD criteria according to the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition, Text Revision [55]. These services deliver specialised early

interventions, with treatment offered from six months to a maximum of two years. Each young person at OYH receives case management by a dedicated mental health clinician, with additional assessment and treatment support provided by a psychiatrist. Approximately 155 young people access HYPE services and approximately 250 young people access EPPIC services each year.

Sample Size

It is recommended that the sample size of a pilot study represents approximately 10% of the sample projected for the larger parent study [56]. At present, there is little definitive research available to determine the sample size of the larger parent RCT for a transdiagnostic blended model of care, hence, the importance of conducting this pilot feasibility study. In a recent study utilising the same technology, a total sample of 140 participants was determined to detect changes in social functioning at 90% power, accounting for attrition of 20% [57]. Given this, we proposed to recruit 25 clinicians and 1-2 young people per clinician, resulting in an anticipated 25-50 young people in the study.

Ethics Approval

Ethical approval was obtained from the Melbourne Health Human Research Ethics Committee (HREC/49492/MH-2019).

Participants and Procedure

Participants comprised 18 mental health clinicians and 33 young people recruited by participating clinicians and the Orygen research team across HYPE and EPPIC clinical services. Clinician recruitment took place over a 2-month period and recruitment of young people took place over a 4-month period from May to September 2020.

Young People

Inclusion and Exclusion Criteria

Young people were recruited via their clinician and the research team. Clinicians within each service were invited to identify potentially eligible young people based on the following criteria: (1) 15 to 25 years of age (inclusive); (2) currently receiving treatment at HYPE or EPPIC; (3) engaged with treatment as judged by the treating clinician and not approaching discharge from service; (4) willing to nominate an emergency contact person; (5) regular and ongoing internet and telephone access; and (6) the ability to give informed consent and comply with study procedures. The exclusion criteria were as follows: (1) young people with an intellectual disability who were unable to meet the cognitive demands of the online intervention, interfering with the likelihood to benefit from the

intervention as judged by their treating clinician; and (2) young people with an inability to converse in or read English. There were no specific exclusion criteria related to level of suicide risk or interpersonal hostility, i.e., a consideration for harm to self or others whilst engaging within an online social network. Clinicians were, however, consulted on a case-by-case basis regarding participant suitability and clinician judgement regarding suitability could be reassessed at any time. The exclusion criteria for the pilot study were kept to a minimum both to facilitate the recruitment process and to ensure that the intervention was tested and adequately mirrored the real-world characteristics of the broad population of young people accessing specialist youth mental health services. Furthermore, to mirror intended real-world implementation of eOrygen, these exclusion criteria were assessed and monitored by participating clinicians.

Recruitment Process

Once eligibility was determined, eligible young people were invited to participate in the study by the research team. Of the HYPE clients, 106 young people were assessed for eligibility for the current study. Forty-two young people (40%) from the HYPE clinic met inclusion criteria but 33 of these young people could not be approached due to involvement with another research study. Nineteen young people were approached to participate, and 15 young people (79%) agreed to participate and enrolled in the study, while four people declined. Sixty-four young people (60%) were ineligible to participate in the current study due to clinical risk, poor engagement with treatment, lack of access to technology, age, or due to approaching discharge.

Of the EPPIC clients, 59 young people were assessed for eligibility. Forty-three young people (73%) from the EPPIC clinic met the inclusion criteria, but three young people were already participating in another research study. Forty young people were approached to participate, and 20 young people agreed to participate, while 11 young people declined and nine people could not be contacted by the research team. Of the 20 young people who agreed to participate, two young people could not be contacted to complete their baseline assessments and did not enrol to the study. The remaining 18 young people (45%) enrolled in the study, while seven of these young people were lost to follow-up during the study period; three prior to onboarding to the eOrygen platform and four prior to completing the 3-month follow-up assessments. The young people lost to follow-up were unresponsive to calls and messages from the research team, but were still engaged with face-to-face treatment with their clinicians. Sixteen young people (27%) were ineligible to participate in the current study for the same reasons mentioned above.

Participant consent was obtained from those interested in participating and parental/guardian consent was also obtained for young people under 18 years.

Assessments

Consenting young people were then contacted at baseline via email and phone to complete baseline measures prior to setting up their eOrygen user account. Young people then continued treatment with their clinician while having access to the eOrygen platform for 3 months. Young people were contacted again at the end of the 3-month intervention to complete the post-intervention assessments.

During post-intervention follow-up phone call assessments, young people were asked if they were willing to be contacted for a subsequent qualitative interview and 19 young people agreed to be followed up. Following the intervention phase, a randomly selected subgroup comprising 12 out of the 19 young people who agreed to be contacted were invited via text to participate. These semi-structured qualitative interviews were designed to explore their experiences with the eOrygen platform. The primary goal of these interviews was to identify both barriers and facilitators to their engagement with the intervention.

Out of the 12 young people approached post-intervention, one declined to participate (no reason provided), and two agreed to participate but did not attend the scheduled interviews and were not able to be contacted. Nine participants successfully completed the interview process. However, a technical issue resulted in a recording failure during one interview, such that it could not be included in the subsequent analysis.

The interviews were all conducted via Zoom, and interview times ranged between 22 and 38 minutes. Participants were recruited and interviewed by study RA and author EC. Interview questions were underpinned by a user-centred design approach [24] and focused on the following: what initially interested participants about using the eOrygen platform, the experience of onboarding, hopes and expectations, barriers and facilitators, and the overall experience of the therapy journeys, clinical and peer support, and community features of the platform.

Clinicians

All mental health clinicians employed in HYPE and EPPIC were eligible for inclusion in the current study. Clinicians attended a workshop focused on learning about the background of the intervention, including previous empirical findings utilising the same technology and how to use the eOrygen platform. The latter aspect described how to use the intervention functions, set up their account, with

suggestions provided on how to integrate this into their work with young people, with the possibility of using it within and between face-to-face sessions as they felt appropriate. This included clinical case studies which applied to the populations of both HYPE and EPPIC services, and was co-authored by clinicians at these services. Clinicians were also provided a training manual which was used to help navigate the platform during the workshop, and also to keep and re-use as necessary when navigating the intervention platform independently. As the workshop was held before recruiting young people to the study, clinicians were provided with a training video at a later date describing once again how to use the intervention platform features.

Eligible clinicians were then invited to identify eligible young people who met the inclusion criteria described above. All participating clinicians had at least 1 young person using the eOrygen platform. Clinicians were contacted via email at baseline to complete the clinician-rated measures. Clinicians were then invited to use the eOrygen platform with their clients for 3 months. At the end of the intervention, clinicians were contacted again via email to complete the post-intervention clinician-rated measures.

Following the post-intervention phase, an invitation was extended to all 18 clinicians to participate in a structured focus group session. The aim of this session was to delve into the factors both obstructive and conducive to influencing the effective implementation of the eOrygen platform into routine clinical practice. This evaluative process was grounded in the The Consolidated Framework for Implementation Research (CFIR), a recognized and widely employed framework for assessing the determinants influencing implementation in healthcare settings [58]. The interview schedule was designed by author LV and based on the CFIR constructs that were identified via both formal and informal consultation with the specialist service settings throughout the intervention period. Among the notable constructs under consideration were those related to evidence, adaptability, complexity, needs and resources, and self-efficacy.

Clinicians were invited via email and supported by their line managers to attend. Fifteen clinicians were available to participate in the focus group which was conducted online over zoom. Due to the number of clinicians available to participate, the focus groups were divided into three distinct sessions to facilitate more extensive discussions and allow individual clinicians ample opportunity to share their insights and experiences. Authors LV, DC, and EK each conducted one of the three parallel sessions.

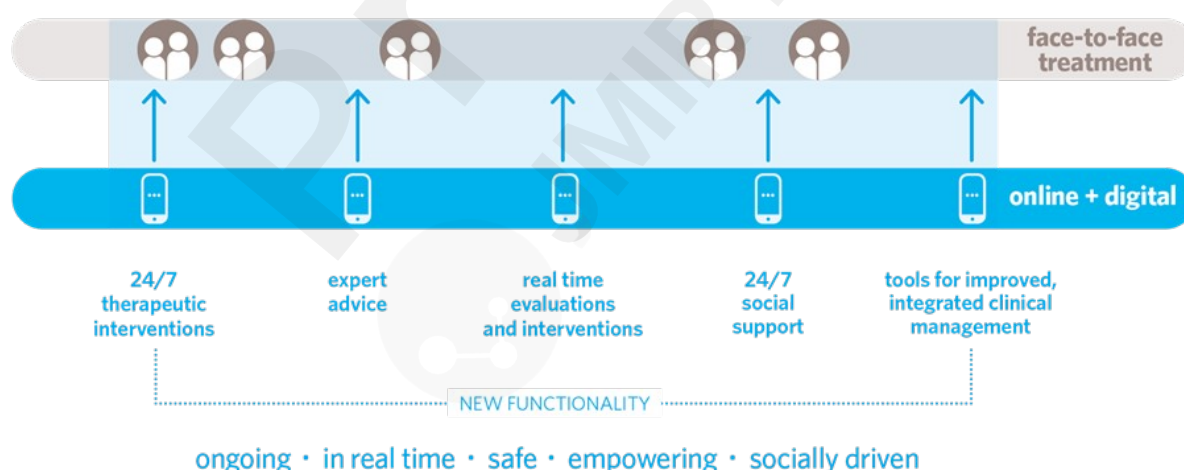
Intervention: eOrygen

The eOrygen intervention was based on Orygen Digital's Moderated Online Social Therapy (MOST)

model, which was the first digital solution to offer continuous, integrated face-to-face and digital care to young people across the mental health diagnostic and severity spectrum and stages of treatment [59-61]. In partnership with young people, the MOST model was iteratively developed by a multidisciplinary team of researchers, clinical psychologists, programmers, creative writers, graphic artists and experts in human computer interaction [61-63]. A recent clinical trial with young people with psychosis demonstrated that an intervention based on the MOST model was effective in improving vocational and educational outcomes, reduce utilization of emergency services, and was cost-effective with evidence of a dose-response effect [60, 64, 65].

The eOrygen intervention was an interactive, purpose-built online platform designed to integrate face-to-face and online support for young people experiencing mental ill-health (see Figure 1). This was achieved through the use of both clinician and young person user accounts, making it possible for young people and their treating clinician to use the platform throughout the treatment process, during their face-to-face sessions or between sessions. Young people could also use the platform in a self-directed way, but no automated prompts or reminders were provided for young people to use eOrygen in between sessions, unless clinicians made suggestions to their young people using the platform.

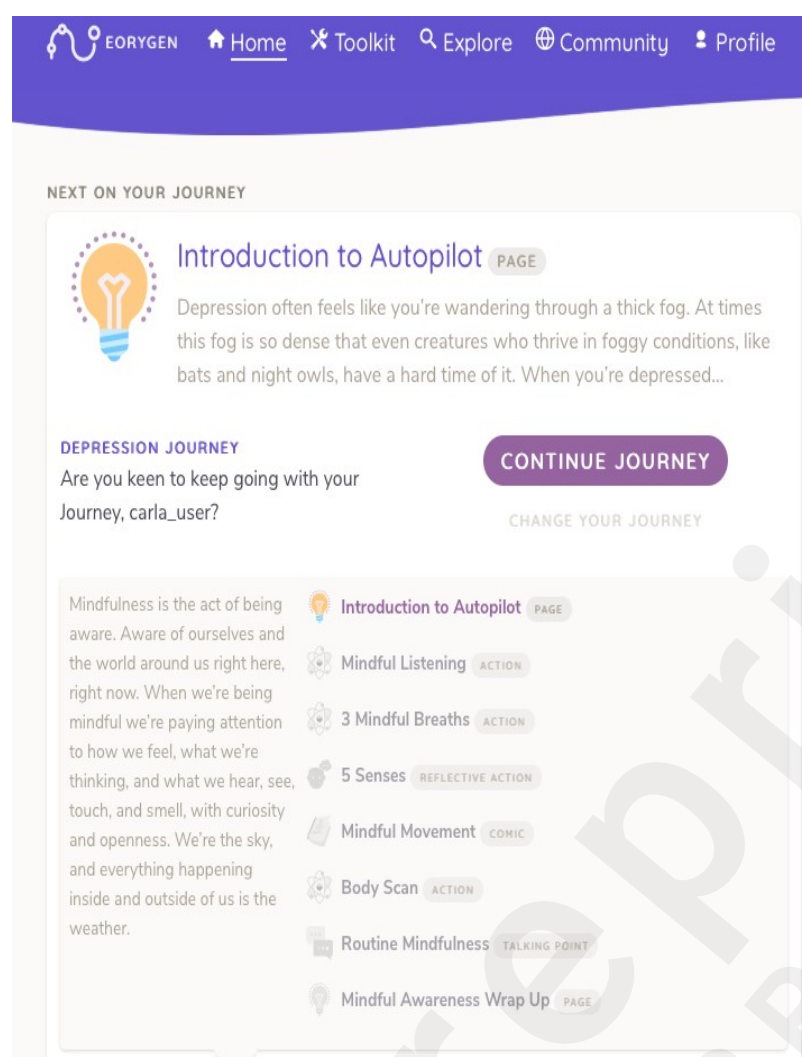
Figure 1. eOrygen as a Blended Model of Care.



The platform intended to enhance, not replace, recommended treatments for mental health conditions e.g., clinician-administered cognitive behavioural therapy. eOrygen comprised interactive, user-directed psychosocial interventions (*therapy journeys*), a social network, clinical moderation and

peer support.

Therapy journeys comprised collections of *therapy activities* relating to different themes. Themes related to the treatment of mental ill-health, such as managing social anxiety, anxiety, depression and social functioning. Users were assigned a suggested *therapy journey* based on their responses to a questionnaire they completed after onboarding to the eOrygen platform, providing personalised content specific to their individual mental health concerns (see Figure 2). Users could complete multiple *therapy journeys*, and clinicians or young people could change the assigned journey.

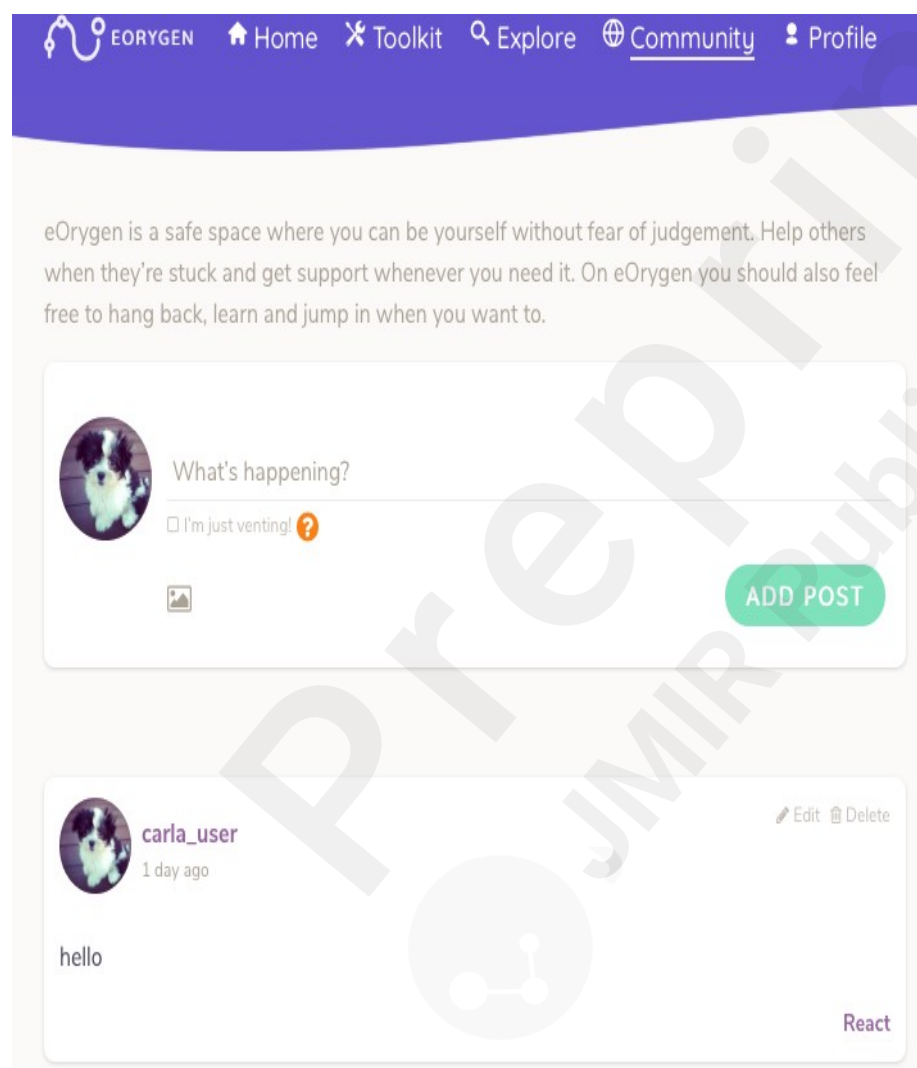
Figure 2. eOrygen Therapy Journey,

Therapy activities could be accessed as part of a *therapy journey*, or as standalone activities via the *explore* function. The *explore* function enabled young people to use a search bar to locate therapy content of interest, and eOrygen clinicians could also recommend personalised content to young people using this function. *Therapy activities* included *activities*, *comics*, *talking points*, and *actions*. *Activities* comprised written content and *comics* comprised storyboard panels focusing on a particular therapeutic theme and target related to the treatment of mental ill health challenges. *Talking points* enabled participants to propose a solution to identified problems (e.g., how to incorporate mindfulness into everyday activities), which encouraged social problem solving and effective peer modelling. *Actions* were behavioural prompts that young people could complete to translate learning on a mental health topic into behavioural change.

The eOrygen *social network* was moderated by trained peer-workers, who were young people who

had a lived experience of mental illness. The *social network* included a community newsfeed and individual profile pages where participants and peer-workers could create *posts* to share thoughts, information, pictures, and videos (see Figure 3). They could also respond to other users' posts through *comments* or *reactions*. *Reactions* were designed to facilitate social support, for example, "I get you" and "thinking of you." Likewise, *talking points* were designed as collaborative spaces to discuss specific topics by leaving *comments*. Young people were also able to receive direct support from peer workers and clinicians on the platform via private *messages*.

Figure 3. eOrygen Social Network.



Outcome Measures

Feasibility

Feasibility of eOrygen was measured by tracking recruitment to the study, which is in line with other

studies testing the feasibility of digital interventions [66]. While no a priori minimum or maximum number of participants per clinician or per clinic was specified, in order to accurately assess feasibility, we anticipated recruiting approximately: 15 clinicians from EPPIC, recruiting approximately 1-2 young people from each participating clinician and 10 clinicians from HYPE, recruiting approximately 1-2 young people per clinician.

Feasibility was indicated if: (i) the recruitment target was met and; (ii) the participant refusal rate was less than 50%. If the recruitment target was not met following 2 months of recruitment, barriers to recruitment were to be identified.

Acceptability

Intervention acceptability was measured via responses to a feedback questionnaire. The pilot was considered to indicate acceptability of the eOrygen intervention if at least 90% of young people reported that they would recommend it to others, which is in line with a previous pilot study testing the acceptability of a digital mental health intervention [59].

Safety

Intervention safety was measured by analysing reports of any adverse events, tracking the security of the online system, and analysing responses to a feedback questionnaire, following a similar protocol to a previous study [7, 67]. An adverse event was defined as any unfavourable or unintended sign, symptom, or disease temporally associated with the use of the intervention, whether or not related to the intervention. A serious adverse event was defined as any untoward medical occurrence that could be life-threatening, result in death, require inpatient hospitalisation or result in persistent or significant disability. All participants were closely monitored by clinical moderators for adverse events and serious adverse events. The research team were trained in study procedures including adverse event assessments and attended good clinical practice training. In addition, treating clinicians were asked to report any adverse events, including suicide attempt and serious self-harm, to the research team.

The pilot was considered to indicate safety of eOrygen if: (i) there were no unlawful entries into the eOrygen system during the pilot; (ii) no young people experienced a serious adverse event as a result of their engagement with the system during their 3-month intervention period; (iii) at least 95% of young people reported it to be safe via feedback questionnaire and; (iv) clinical and social measures did not show a worsening pattern over the course of the study.

Safety was also reported by assessing pre-post changes on BPD symptomatology for HYPE

participants as measured by the Borderline Severity List (BSL-23) [68], and pre-post changes on psychotic symptoms for EPPIC participants as measured by three items of the Brief Psychiatric Rating Scale (BPRS) scale expanded (version 4.0), including suspiciousness, hallucinations and unusual thought content [69].

Potential Clinical Effects

Potential clinical effects were assessed by measuring pre- to post-intervention changes on clinical and psychosocial outcomes at baseline and 3-months. Clinician-rated measures included social and occupational functioning as measured by the Social and Occupational Functioning Assessment Scale (SOFAS) [70], and therapeutic alliance (TA) as measured by the Working Alliance Inventory – Short Revised - Therapist Version (WAI-SRT) [71].

Young people self-report measures included depression as measured by the Patient Health Questionnaire-9 (PHQ-9) [72], TA with their face-to-face clinician as measured by the Working Alliance Inventory - Short Revised – Client Version (WAI-SRC) [73], psychological wellbeing as measured by the Flourishing Scale [74], self-determination as measured by the Basic Psychological Needs Satisfaction Questionnaire (BPNS) [75], loneliness as measured by the UCLA Loneliness Scale (Version 3) [76], social isolation as measured by the Friendship Scale [77], social anxiety as measured by the Social Interaction Anxiety Scale (SIAS) [78], stress as measured by the Perceived Stress Scale (PSS) [79], and psychological distress as measured by the Kessler Psychological Distress Scale (K10) [80]. These measures have been validated in a youth population and chosen for their demonstrated reliability. All baseline measures were completed prior to onboarding to the eOyrgen platform and all assessments were completed via Qualtrics where possible, or otherwise administered by a research assistant over the phone.

Satisfaction Survey Feedback

Purpose-designed questionnaires administered via Qualtrics were used to assess user satisfaction and user feedback.

Statistical Analyses

This study used a mixed-methods design involving both quantitative and qualitative data, which allowed for a more robust analysis [81]. Quantitative data assessing the feasibility, acceptability, safety and potential clinical effects of the intervention were measured at baseline and at 3-months follow-up. Qualitative data were used to assess young people's and clinicians' barriers and facilitators to implementing eOyrgen within clinical services, which enhanced our understanding of

the feasibility and acceptability aspects of the intervention, and provided valuable information for designing a full-powered trial that would have not been achieved through quantitative data strands alone.

Quantitative Analyses

Chi-square tests showed no differences between clinical sites on baseline demographic and clinical and psychosocial outcomes. Therefore, data were pooled and repeated measured t-tests were conducted and within-group effect sizes (Cohen *d*) were reported for changes in pre- to post-intervention scores on effectiveness outcome measures. Parametric and non-parametric correlations were conducted to explore the association between usage of eOxygen and the degree of change between pre- to post-intervention on effectiveness outcome measures, but no relationships between usage and effectiveness outcomes were found.

Aggregated data from the user satisfaction questionnaire and descriptive statistics from insights into using eOxygen were reported as exploratory findings. The data for the acceptability criterion of whether young people would recommend eOxygen to others were derived from insights into eOxygen descriptive statistics. The data for one of the safety criteria regarding whether young people felt safe using eOxygen were derived from the user satisfaction questionnaire. Statistical analyses were performed using IBM SPSS Statistics Version 27.

Qualitative Analyses

Young People

Given the user-centred design approach, thematic analysis was considered the most appropriate method of data analysis [82]. The data analysis was conducted by Author EC under the supervision of Author LV.

The analysis process employed a deductive approach, in which EC examined young people's experiences for themes relating to barriers and facilitators to young people's engagement with the blended model of care. To gain familiarity with the dataset, the interview transcripts were read and re-read. Subsequently, initial codes were applied to the transcripts to denote and capture their underlying meanings. Any recurring codes, both within and across different transcripts, were identified and recorded.

Following the principles of thematic analysis, these codes were then grouped into preliminary themes and subjected to thorough review in relation to all other identified themes. Some themes emerged as superordinate, representing broader categories of analysis, while others assumed subordinate

positions, forming subthemes, as delineated by previous scholarship.

Clinicians

Three focus groups were conducted by authors DC, EK, and LV with 15 service clinicians overall. Focus groups comprised of a mix of both HYPE and EPPIC clinicians and lasted between 31 and 44 minutes. Interview questions were underpinned by the Consolidated Framework for Implementation Research (CFIR) [58]. The CFIR is one of the most utilized frameworks to identify contextual factors that positively or negatively impact implementation [83]. The CFIR comprises of 39 constructs across 5 domains. The domains identified as most relevant to this implementation setting in the pre-implementation phase were *inner and outer settings*, *individual characteristics*, and *innovation characteristics*. The clinician focus groups underwent deductive coding by JN and LV, in adherence to the CFIR framework. JN and LV then engaged in a rigorous discussion to examine how the attributes within the identified domains acted as either obstacles or enablers to the implementation of eOrygen in this clinical setting.

Usage Metrics

Usage metrics were used to measure engagement with eOrygen. *Number of active days* was used as an overall metric for platform usage and referred to the number of days a young person accessed eOrygen after completing onboarding until the end of the 3-month intervention period.

Therapy views comprised the number of times a young person opened therapy activities via a *therapy journey* or via a search function. Users were encouraged to revisit activities, and repeat views were counted within number of *therapy views*. *Journey components completed* was a count of the number of unique therapy activities a user completed within a *therapy journey*.

Engagement with the social networking component of eOrygen was measured by the *number of posts, comments and reactions made* by young people on the social network. This included *posts made* on the newsfeed and on individual users' profiles. *Comments made* could be made in response to *posts made* by other users or peer workers, or *talking point* therapy activities. *Reactions made* could be made to any post or comment on the social network.

There was also a chat function where young people could communicate with eOrygen staff (clinicians and peer workers) through private direct messages on the platform. Engagement with clinicians and peer workers was measured by the *number of messages sent* (by young people) and the *number of messages received* (from clinicians or peer workers).

Results

Demographics

Young people were aged between 15-24 years old (mean 19.48, SD = 2.84), the majority of which (64%, 21/33) were female. Of the 33 young people, 27 (82%) were born in Australia, 7 (21%) spoke languages other than English at home, 3 (9%) identified as Aboriginal and/or Torres Strait Islander, 9 (27%) were engaged in paid work and 22 (66%) were studying part- or full-time (see Table 1).

Table 1. Sample Descriptive Statistics (Total and by each Clinical Site).

	Total Sample, N (%) 33 (100)	Clinical Sites	
		HYPE, <i>n</i> (%) 15 (36.6)	EPPIC, <i>n</i> (%) 18 (43.9)
Age (years), mean (SD)	19.48 (2.84)	18.8 (2.70)	20.21 (2.89)
< 18 years	13 (44.8)	8 (53.3)	5 (35.7)
> 18 years	16 (55.2)	7 (46.7)	9 (64.3)
Gender:			
Male	7 (21.2)	3 (20.0)	4 (22.2)
Female	21 (63.6)	11 (73.3)	10 (55.6)
Transgender, Genderqueer/non-conforming, and other (including multiple gender selections)	5 (15.2)	1 (6.7)	4 (22.2)
Aboriginal or Torres Strait Islander:			
Yes	3 (9.1)	2 (13.3)	1 (5.6)
No	29 (87.9)	13 (86.7)	16 (88.8)
Unsure	1 (3.0)	0 (0.0)	1 (5.6)
Currently Studying:			
Yes	22 (66.7)	10 (66.7)	12 (66.7)
No	11 (33.3)	5 (33.3)	6 (33.3)
Currently Employed:			
Yes	9 (27.3)	4 (26.7)	5 (27.8)
No	24 (72.7)	11 (73.3)	13 (72.2)

Feasibility

The final number of clinicians recruited to the study was 18 (78% of our target, 18/25) and the final number of young people was 33 (which exceeded our target of 1 young person per clinician). We also anticipated that the refusal rate would be less than 50%, which it was at 25%.

Acceptability

We exceeded our acceptability target, with 92% (22/24) of young people reporting that they would recommend eOxygen to others (see Multimedia Appendix 1).

Safety

There were no unlawful entries to the eOxygen platform during the study, there were no serious adverse events experienced by participants, there were no worsening on clinical and social outcome measures, and 96% (24/25) of young people felt safe using the platform (see Multimedia Appendix 2).

In terms of symptom monitoring, the mean score for BPD symptomatology for HYPE participants reduced from 2.65 ($SD = 0.75$) at baseline to 1.99 ($SD = 0.83$) post-intervention. For the assessment

of psychotic symptoms in EPPIC participants, the mean score for suspiciousness reduced from 2.72 ($SD = 1.64$) at baseline to 0.94 ($SD = 3.78$) at post-intervention. The mean score for hallucinations reduced from 2.89 ($SD = 1.97$) at baseline to 1.22 ($SD = 4.11$) at post-intervention, and the mean score for unusual thought content reduced from 1.72 ($SD = 1.13$) at baseline to 0.67 ($SD = 3.74$) at post-intervention.

Potential Clinical Effects

Significant pre- to post-intervention improvements were observed for 9 out of 12 of the clinical outcome measures including social and occupational functioning, depression, psychological distress, social anxiety, social isolation, stress, borderline symptoms, loneliness, and all aspects of therapist-rated working alliance including goals, tasks and bond with effect sizes ranging from 0.56-0.89 (see Table 2).

Table 2. Inferential Statistics Exploring the Differences between Pre- and Post-Intervention on Wellbeing and Mental Health Symptomology.

	N	Pre-	Post-	M_{diff} [95% CI]	Repeated-Measures t -Test	Cohen d
		mean (SD)	mean (SD)			
Autonomy (BPNS) ^a	26	4.38 (1.08)	4.36 (1.02)	0.02 [-0.40, 0.46]	$t(25) = 0.13$, $P = .90$	0.03
Competence (BPNS) ^a	25	3.70 (0.89)	3.95 (1.01)	-0.25 [-0.64, 0.15]	$t(24) = -1.30$, $P = .21$	-0.26
Relatedness (BPNS) ^a	26	4.44 (1.18)	4.62 (1.01)	-0.18 [-0.54, 0.17]	$t(25) = -1.05$, $P = .30$	-0.21
Depression (PHQ9) ^c	25	15.92 (7.57)	13.44 (7.93)	2.48 [0.82, 4.14]	$t(24) = 3.08$, $P = .005$	0.62
Loneliness (UCLA) ^d	25	54.92 (10.54)	50.38 (10.55)	4.54 [0.75, 8.32]	$t(24) = 2.47$, $P = .02$	0.50
Flourishing	24	33.62 (10.04)	36.79 (9.63)	-3.17 [-6.51, 0.16]	$t(23) = -1.97$, $P = .06$	-0.40
Social Isolation	24	13.08 (5.71)	9.83 (5.51)	3.25 [1.19, 5.30]	$t(23) = 3.28$, $P = .003$	0.70
Social Anxiety (SIAS) ^e	24	44.55 (14.43)	39.07 (15.28)	5.48 [2.34, 8.62]	$t(23) = 3.61$, $P = .001$	0.74
Stress (PSS) ^f	24	25.33 (6.89)	19.92 (6.43)	5.42 [3.01, 7.83]	$t(23) = 4.65$, $P < .001$	0.95
Psychological Distress (K10) ^g	24	33.24 (9.82)	29.30 (9.31)	3.94 [1.09, 6.80]	$t(23) = 2.86$, $P = .009$	0.58
Client Working Alliance:						
- Goal (WAIC) ^h	24	9.63 (2.12)	9.67 (1.61)	-0.04 [-1.11, 1.03]	$t(23) = -0.08$, $P = .94$	-0.02
- Task (WAIC) ^h	24	11.83 (1.17)	11.83 (1.46)	0.00 [-0.63, 0.63]	$t(23) = 0.00$, $P = > .99$	0.00

- Bond (WAIC) ^h	23	12.39 (2.73)	12.78 (2.95)	-0.39 [-1.59, 0.81]	$t(22) = -0.68$, $P = .51$	-0.14
Therapist Working Alliance:						
- Goal (WAIT) ⁱ	17	10.76 (2.08)	11.88 (2.45)	-1.11 [-1.86, -0.37]	$t(16) = -3.17$, $P = .006$	-0.77
- Task (WAIT) ⁱ	17	10.00 (1.66)	11.00 (2.09)	-1.00 [-1.93, -0.07]	$t(16) = -2.29$, $P = .04$	-0.56
- Bond (WAIT) ⁱ	17	16.65 (2.55)	17.53 (2.03)	-0.88 [-1.58, -0.18]	$t(16) = -2.67$, $P = .002$	-0.65
Functioning (SOFAS) ^j	18	57.50 (14.63)	64.28 (17.22)	-6.78 [-10.71, -2.85]	$t(17) = -3.92$, $P < .001$	-0.86

^aBPNS = Basic Psychological Needs Satisfaction Scale.

^bBLS = Borderline Symptoms List.

^cPHQ9 = Patient Health Questionnaire (9-Item) Scale.

^dUCLA = University of California, Los Angeles Loneliness Scale.

^eSIAS = Social Interaction Anxiety Scale.

^fPSS = Perceived Stress Scale.

^gK10 = Kessler Psychological Distress Scale (10-Item).

^hWAI-SRC = Working Alliance Inventory – Short Revised – Client Version.

ⁱWAI-SRT = Working Alliance Inventory – Short Revised – Therapist Version.

^jSOFAS = Social and Occupational Functioning Assessment Scale (clinician rated).

Young People's Satisfaction Survey Feedback

In terms of client feedback, 88% (21/24) of young people reported that they would use eOxygen again. The top initial reasons of interest in using eOxygen included: (1) practicing wellbeing skills (92%, 22/24); (2) contributing to research (92%, 22/24); (3) getting support from clinicians (71%, 17/24); (4) connecting with others with similar mental health experiences (71%, 17/24); and (5) learning and wellbeing (71%, 17/24). See Multimedia 1 for a full list of reasons for young people's use of eOxygen.

In terms of young people's satisfaction with eOxygen, 96% (23/24) rated it as a positive experience, 88% (22/25) rated it as easy to use, and 83% (20/25) rated it as helpful (see Multimedia 2).

Engagement

Thirty young people were onboarded to eOxygen; 15 young people from HYPE and 15 from EPPIC. The mean *number of active days* on eOxygen was 8.4 days, whereby 50% (15/30) of young people had between 6 – 30 *active days*, 43% (13/30) had between 2 – 5 *active days* and 7% (2/30) of young people had 1 *active day* (see Table 3). 12 young people (40%, 12/30) used the platform at least once per fortnight during the initial 6 weeks of the intervention and 6 young people (20%, 6/30) maintained fortnightly access across the entire 12 weeks.

Table 3. User Engagement with eOrygen.

Number of	All Sites, N = 30	EPPIC, N = 15	HYPE, N = 15
	Mean (SD, Range)	Mean (SD, Range)	Mean (SD, Range)
Active Days	8.4 (7.5, 1 - 30)	10.4 (8.6, 1 - 30)	6.3 (5.7, 1 - 23)
Therapy Views	9.1 (21.5, 0 - 115)	12.9 (29.2, 0 - 115)	5.3 (8.5, 0 - 29)
Journey Components Completed	6.0 (18.3, 0 - 100)	9.3 (25.4, 0 - 100)	2.7 (5.2, 0 - 18)
Posts/Comments Made	3.3 (4.3, 1 - 22)	4.1 (5.4, 1 - 22)	2.6 (2.9, 1 - 11)
Reactions Made	2.2 (4.3, 0 - 16)	3.3 (5.1, 0 - 16)	1.1 (3.1, 0 - 12)
Messages Sent	4.6 (11.6, 0 - 62)	8.0 (15.8, 0 - 62)	1.1 (1.8, 0 - 6)
Messages Received	8.1 (11.3, 0 - 60)	11.1 (15.3, 0 - 60)	5.2 (3.6, 1 - 15)

In terms of therapy engagement specifically, 40% (12/30) of young people viewed 3 or more therapy activities, 23% (7/30) viewed 1-2 therapy activities and 37% (11/30) of users did not view any therapy activities. Half of onboarded young people (50%, 15/30) began a therapy journey, while 40% (12/30) of young people completed at least one journey component (i.e., therapy activity within a therapy journey), 20% (6/30) completed 2-7 journey components and 20% (6/30) completed 10 or more journey components. See Table 3 for a summary of all therapy engagement metrics.

In terms of social network engagement, it was mandatory for young people to make an introductory post to the community as part of the onboarding process. However, almost half (47%, 14/30) of young people made at least one additional post and/or comment, while 10% (3/30) made 2 additional posts and/or comments, 20% (6/30) made 3 – 5 additional posts and/or comments and 17% (5/30) made more than 6 additional posts and/or comments. Furthermore, 47% (14/30) of young people reacted to at least one post or comment on the social network, while 27% (8/30) reacted to more than one post or comment. See Table 3 for a summary of all therapy engagement metrics.

In relation to private messages with eOrygen staff using the chat function, 47% (14/30) of young people sent at least one message, while 13% (4/30) sent 1 – 2 messages, 13% (4/30) sent 3 – 6 messages, and 20% (6/30) sent 10 or more messages. On the other hand, 97% (29/30) of young people received at least one private chat message from a clinician or peer worker, while 37% (11/30) received 1 – 3 messages, 37% (11/30) received 4 – 9 messages, and 23% (7/30) received 14 or more messages. See Table 3 for a summary of these metrics.

Qualitative Findings

Young People

A thematic analysis of interviews with young people was conducted, regarding their experiences with eOrygen, with the aim of identifying facilitators and barriers to their engagement with the platform (refer to Table 4). Facilitators included clinician endorsement, which increased trust in the platform; the presence of peer support workers, fostering a sense of safety and support; a sense of community and connection with other users; personalised therapy content recommended by clinicians; the use of eOrygen for between-session work, supported by follow-up discussions; and an easy-to-use interface. Conversely, barriers to engagement included general low motivation, social anxiety hindering social interactions, privacy concerns, inflexible progression in modules, and periods of limited content and interactions on the platform. Addressing these barriers and leveraging the facilitators can enhance the platform's appeal and effectiveness for a broader range of users seeking mental health support.

Table 4. Facilitators and Barriers to Young People's Engagement with eOrygen as a blended model of care integrated into specialised services.

Effect	Title	Description
Facilitator	Clinician Endorsement	Clinician endorsement of eOrygen appeared to increase young people's trust in the platform. Several participants mentioned that their clinician's recommendation to use eOrygen was central to their signing up to use the platform.
Facilitator	Professional Peer Support Workers	The presence of professional peer support workers on the platform was engaging and increased young people's sense of safety in the community space.
Facilitator	Community, Connection, & Belonging	Participants appreciated interacting with other young people or sharing space on the platform, even if they didn't post much themselves. The sense of community and connection was a facilitator for engagement.
Facilitator	Personalised Therapy Content	Young people found it helpful when clinicians recommended specific content aligned with their therapeutic work in face-to-face sessions. Therapeutic modules and resources within the platform were seen as valuable, trustworthy and informative.
Facilitator	Blended Care	Young people commonly reported eOrygen was used for between session work. Follow-up

		discussions in session regarding the 'homework' were described as helpful and valuable for consolidating learning and providing accountability to support homework completion.
Facilitator	Ease of Use	When participants found the platform easy to navigate and understand, it positively impacted their engagement.
Barrier	Low Motivation	Several participants mentioned a general lack of motivation as a barrier to engagement.
Barrier	Social Anxiety	Some participants experienced anxiety or insecurity related to social interactions on the platform. This social anxiety acted as a barrier, and young people reported feeling too anxious to post or reply to other young people's posts. Several young people felt anxiety about the perceived lack of clarity regarding the rules of the online community.
Barrier	Privacy Concerns	Privacy and confidentiality concerns were mentioned by some participants, impacting their willingness to engage fully with the platform. Some young people reported that uncertainty about who could see their posts or information raised anxiety. Several young people expressed discomfort at the thought of their face-to-face clinician viewing personal content that they may post on the platform's social network
Barrier	Inflexible Module Progression	One interview identified the inability to skip sections or activities within a therapy module as a barrier and requested more autonomy when engaging with therapy modules. Some participants described desiring more flexibility with how they engaged with content, such as wanting to change therapy journeys for example from depression to anxiety, but not being able to.
Barrier	Limited content and Interactions	Periods of low activity or limited content being posted by other young people on the platform could lead to reduced engagement. Participants mentioned that the lack of new posts or interactions could be discouraging. More young people and greater interaction was requested by several young people.

Clinicians

The analysis of the clinician focus group grounded in the CFIR framework identified various barriers and facilitators to the successful implementation and utilisation of the eOxygen intervention. Among the notable barriers were the length of the onboarding process for young people, a need for increased confidence in utilising the platform, a perceived lack of practical knowledge regarding its features and how these features are related to benefits for young people, and competing priorities, such as addressing risk and acute presentations amidst understaffing, consistently disrupted platform utilisation. Conversely, the platform's positive reputation and alignment with evidence-based frameworks emerged as a facilitator. Additionally, the ability to access trustworthy content was highlighted as advantageous for clinicians. These findings underscore the multifaceted nature of implementing digital mental health resources and the importance of addressing both barriers and facilitators to optimise their effectiveness.

Table 5. Summary of Factors Impacting Clinician Implementation of eOxygen Using the CFIR

CFIR Construct	Description	Quote	Effect
Self-efficacy	Clinicians expressed varying levels of confidence when it came to implementing the intervention. This variance in confidence had a notable influence on their motivation/capacity to use the platform as part of their clinical practice.	"...hard when I didn't know exactly what I was prompting them to do sometimes."	Barrier
Relative Priority	Clinicians frequently cited competing priorities, including concerns related to young people's risk, handling acute presentations, and the challenge of being understaffed, as significant barriers that	"Might've been a little bit me as well of not feeling like I had the time or just forgetting sometimes to just the other priorities I have."	Barrier

	impended their ability to engage with and become familiar with the eOrygen platform.		
Young people's needs and resources	Clinicians demonstrated a strong understanding of young people's needs, including the complexities associated with addressing these needs effectively. This encompassed under-addressed comorbid conditions, clinical complexity, and barriers related to motivation and the specific age group within the cohort.	"All the co-morbidities... we don't always get to do the, you know, anxiety management stuff or like skills-based stuff as much as, um, I feel like as much as I did in other clinics."	Facilitator
Innovation participants	Clinicians considered the process for connecting and onboarding young people to the eOrygen platform to be lengthier than what young people typically expect when engaging with technology.	"Cause young people want, unfortunately, they want everything now and right there and then. So, if they click and it doesn't work, they'll be like, 'now there's nothing, it's not working.'"	Barrier
Intervention knowledge/beliefs	Clinicians had positive regard for eOrygen platform overall. However, their implementation was hindered by a lack of comprehensive knowledge about how the platform practically worked.	"we're all probably a bit limited in thinking about how we're using it"	Facilitator/ Barrier
Evidence strength & quality	Clinicians had the perception that the intervention had a	"I didn't have to go and do my own homework or ensure	Facilitator/ Barrier

	strong evidence base and provided quality information to support young people. However, they also had a limited understanding of which components of the intervention lead to effective outcomes.	that I was using like, up to date and relevant information"	
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Discussion

Principal Findings

To the best of our knowledge, this was the first study to test an integrated blended model of care for youth psychosis and borderline personality disorder in young people aged 15-25 years. The results of this study showed that eOrygen was feasible, acceptable and safe. In terms of feasibility, we anticipated recruiting approximately 25 clinicians and 1-2 young people per clinician to the intervention, and that the refusal rate would be less than 50%. Our refusal rate was 25% which indicated one element of feasibility. We recruited 18 clinicians (78% of our target, 18/25) and 33 young people (which exceeded our target) to the study over a 4-month period. Although we did not meet our clinician target, our recruitment took place at the beginning of the COVID-19 pandemic, which proved a difficult period to introduce a new digital intervention to youth mental health services and to train clinicians in the use of a new digital platform. Despite these challenges, we still recruited a relatively high percentage of clinicians to the study and exceeded our target in recruiting young people.

In terms of acceptability, 92% (28/30) of young people onboarded reported that they would recommend eOrygen to others, exceeding our target of 90%. Furthermore, twelve participants (40%, 12/30) used the platform at least once per fortnight during the initial 6 weeks of the intervention period, while only six of those (20%, 6/30) maintained fortnightly access across the entire 12 weeks. These findings compare well with another study reporting decreased engagement over time, with only 3.9% 15-day retention rates and 3.3% 30-day retention rates for the use of mental health apps in the general population [84]. While engagement was strong for the first 6 weeks, more strategies are needed to sustain engagement over longer periods. We did not use any strategies in this pilot to promote young people or clinician engagement and left this to the discretion of participating clinicians, as it was purely an ecological study. Therefore, future studies should implement scalable

strategies to sustain engagement for clinicians and young people such as external support, coaching, automated prompts or reminders.

Higher engagement rates with eOrygen were also observed for young people attending EPPIC (mean 10.4 active days) versus those attending HYPE (mean 6.3 active days). To the best of our knowledge, this was the first blended model tested for youth with BPD. The MOST model was originally developed and optimized for young people with first-episode psychosis [57, 60, 85]. Therefore, lower engagement rates for young people attending HYPE could be due to the therapeutic model used by clinicians in face-to-face care being slightly different than the content in eOrygen, and the MOST model may need further refinement and optimization for youth with BPD. Research has also indicated that young people with BPD are difficult to engage in face-to-face treatment [86-88], and it may also be that this extends to digital mental health care.

In terms of safety, there were no unlawful entries to the online platform, no serious adverse events were experienced by participants and no worsening on clinical or social outcome measures during the intervention. We also anticipated that at least 95% of young people would report feeling safe using the platform, and this target was exceeded with 96% of young people reporting feeling safe. Our primary findings are also in line with a previous pilot study testing Orygen Digital's MOST platform with real-time clinician-delivered web chat counselling, which found that all acceptability and safety indicators exceeded their a priori established criteria [59].

Secondary outcome variables showed significant pre-post improvements in 9 of the 12 outcomes assessed. These included borderline symptoms, depression, loneliness, social isolation, social anxiety, stress, psychological distress, social and occupational functioning, and the therapist reported working alliance. It is important to note that while our study included two clinical sites treating young people with complex mental health disorders (e.g., psychotic disorders and borderline personality disorder), there were no significant differences between sites on outcome variables at baseline. Therefore, improvements on clinical outcomes relate to all participants in the study. The findings also support a previous pilot study (MOST+) integrating MOST with real-time clinician-delivered web chat counselling [59]. MOST+ also found statistically significant improvements in psychological distress, depression, and stress. However, both studies are single-group pilot studies and we cannot make causal inferences from findings, as it cannot be determined from via uncontrolled studies whether observed effects are related to the intervention or external factors such as individual or in-person treatment characteristics. Future research should confirm these findings by conducting controlled studies with larger sample sizes and greater power.

Findings from a recent qualitative study also suggested that blended care has the potential to enhance the therapeutic relationship [40]. It suggested that the therapeutic alliance (TA) developed through blended care can enhance engagement with both face-to-face and online treatment modalities, by offering treatment continuity, personalisation and enhancing therapeutic intensity, which are key areas of concern in the field [24, 40]. In our study, we observed statistically significant improvements for therapist-reported TA but no improvements on client-reported TA. Research has also indicated that TA has moderate but reliable correlations with mental health outcomes [89-91]. Although we observed improvements in therapist-rated TA, they did not correlate with improvements in clinical outcomes and, therefore, future research should further explore this, along with the importance of client-rated TA in relation to outcomes.

On the other hand, qualitative feedback from participants in our study indicated that eOrygen was beneficial when used in a blended way. For example, young people found it helpful when their clinician recommended content to them that aligned with their in-session work and also found homework to complete on the eOrygen platform to be helpful for between-session work. These findings are in line with other research indicating that blended care is beneficial when it is integrated and intensifies treatment [92]. However, research has indicated that blended care may not be effective if perceived as burdensome or time-consuming by clinicians, but this may be related to trial related factors such as reporting to a research team if using the intervention during a clinical trial, or inflexible intervention structure [93]. One way to overcome this could be for developers to work with clinicians to ensure suitable content and features are provided within the intervention, that would enable them to use the intervention with young people in a way that is meaningful, relevant and related to the face-to-face treatment they provide [94].

Limitations

A number of additional limitations should also be noted. The single-group design was chosen to enhance external validity by maximising real-world uptake of the intervention. Therefore, it was important to expose as many young people and clinicians to the intervention as possible to determine real-world uptake with eOrygen, and the inclusion of a control group may have negatively impacted the number of clinicians and young people who signed up to the intervention, potentially limiting our understanding of feasibility in this context. However, this study design limited our ability to determine a cause and effect relationship between the intervention and outcomes [95]. Furthermore, a 3-month timeframe was chosen as this is an acceptable timeframe that is comparable to other pilot studies testing the feasibility, safety and acceptability of digital interventions [59, 66, 96].

Although this study tested an integrated blended model of care, we did not collect data on how young people engaged with face-to-face treatment or how participating clinicians used the eOrygen platform, and future studies should consider this when evaluating blended models of care. Furthermore, our goal to provide flexibility and autonomy to clinicians may have negatively impacted competence in the use of the platform. For example, clinicians attended a one-day workshop and received a printed user manual and training videos on how to use the eOrygen platform. However, as noted in the clinician-identified barriers to implementation, one workshop may be inadequate to gain competence, and there was also a substantial gap in time between clinician training and the implementation of eOrygen due to the COVID-19 pandemic. Therefore, the training may have been forgotten and lack of time to review training materials may have also been an issue. Future studies should consider providing ongoing clinician support in this regard, while also remaining flexible to the needs of clinicians. Furthermore, although the recruitment target was met for the current study, it must be noted that the sample of males in the study was small at only 21.2% of the total sample, limiting the generalisability of these findings and highlighting that significant barriers may still exist for young men to access mental health treatment [97] and that difficulties may also exist in tailoring interventions to young men [98].

Conclusion

In conclusion, our pilot study was an important first step in testing a transdiagnostic blended model of care for youth psychosis and borderline personality disorder in young people ages 15-25 years. We found that eOrygen was feasible, acceptable and safe, there were indications that eOrygen may improve treatment outcomes if tested in a full-powered trial, and the majority of participants and clinicians reported positive experiences of using eOrygen as a blended model of care. However, some participants misunderstood the meaning of blended care and future research should ensure this is clearly outlined prior to integrating a digital tool into clinical practice. Furthermore, some clinicians reported a lack of knowledge and confidence in their ability to implement the intervention, and future research should aim to understand the possible barriers and address these to ensure clinician competence and confidence with the intervention itself. Overall, this pilot study provides promise for integrating blended models of care into specialised services for young people with complex mental health conditions, but a full-scale trial will be needed to test the effectiveness of such an intervention. This study also reaffirms prior findings indicating that blended models of care have the potential to increase therapeutic intensity, continuity, engagement, and effectiveness. Future research needs to focus on the development of tools to integrate blended care into practice

specifically [36], and strategies to support both clinicians and young people in continuous usage of the platform.

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Conflicts of Interest

None declared.

Abbreviations

BLS: Borderline Symptoms List.

BPD: borderline personality disorder.

BPNS: Basic Psychological Needs Satisfaction Scale.

CFIR: Consolidated Framework for Implementation Research.

EPPIC: Early Psychosis Prevention and Intervention Centre.

FEP: first-episode psychosis.

HYPE: Helping Young People Early Centre.

K10: Kessler Psychological Distress Scale (10-Item).

MOST: moderated online social therapy.

OYH: Orygen Youth Health.

PHQ9: Patient Health Questionnaire (9-Item) Scale.

PSS: Perceived Stress Scale.

SIAS: Social Interaction Anxiety Scale.

SOFAS: Social and Occupational Functioning Assessment Scale.

TA: therapeutic alliance.

UCLA: University of California, Los Angeles Loneliness Scale.

WAI-SRC: Working Alliance Inventory – Short Revised – Client Version.

WAI-SRT: Working Alliance Inventory – Short Revised – Therapist Version.

YMH: youth mental health.

Multimedia Appendix

Multimedia Appendix 1. Descriptive Insights Into the Participants' Willingness to Use eOrygen

Again, Whether They Would Recommend It to Others, and Their Initial Reasons of Interest in Using eOrygen.

Multimedia Appendix 2. Young People's Satisfaction with eOrygen (N=25).

Figure 1. eOrygen as a Blended Model of Care.

Figure 2. eOrygen Therapy Journey.

Figure 3. eOrygen Social Network.



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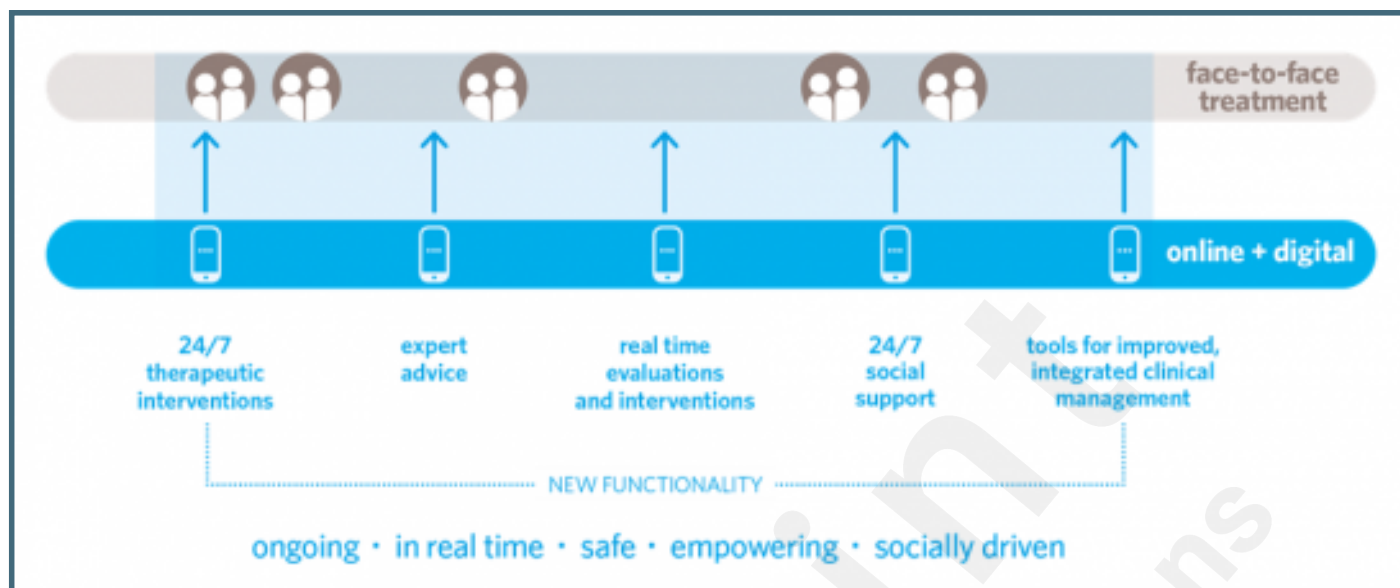
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Supplementary Files

Figures

eOrygen as a Blended Model of Care.



eOxygen Therapy Journey.

The screenshot shows the eOxygen Therapy Journey website. The top navigation bar is purple with white text and icons for Home, Toolkit, Explore, Community, and Profile. Below the navigation bar, a section titled "NEXT ON YOUR JOURNEY" features a lightbulb icon and the heading "Introduction to Autopilot" with a "PAGE" tag. A paragraph of text describes depression as a thick fog. Below this, a "DEPRESSION JOURNEY" section asks if the user is keen to keep going, with a "CONTINUE JOURNEY" button and a "CHANGE YOUR JOURNEY" link. A large list of mindfulness activities is displayed, each with an icon and a tag (e.g., "ACTION", "COMIC", "TALKING POINT").

EORYGEN Home Toolkit Explore Community Profile

NEXT ON YOUR JOURNEY

 **Introduction to Autopilot** PAGE

Depression often feels like you're wandering through a thick fog. At times this fog is so dense that even creatures who thrive in foggy conditions, like bats and night owls, have a hard time of it. When you're depressed...

DEPRESSION JOURNEY

Are you keen to keep going with your Journey, carla_user?

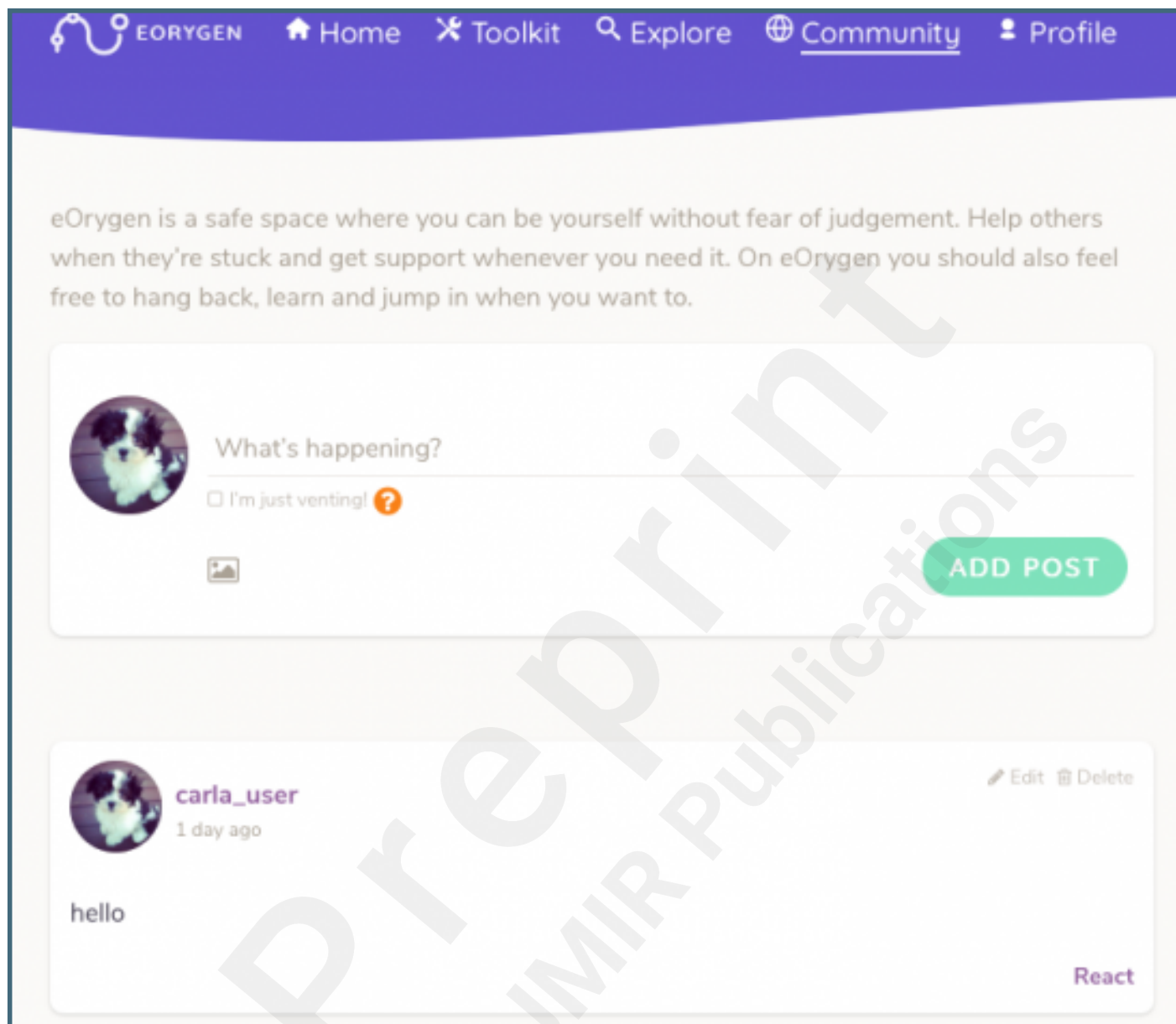
CONTINUE JOURNEY

CHANGE YOUR JOURNEY

Mindfulness is the act of being aware. Aware of ourselves and the world around us right here, right now. When we're being mindful we're paying attention to how we feel, what we're thinking, and what we hear, see, touch, and smell, with curiosity and openness. We're the sky, and everything happening inside and outside of us is the weather.

-  **Introduction to Autopilot** PAGE
-  **Mindful Listening** ACTION
-  **3 Mindful Breaths** ACTION
-  **5 Senses** REFLECTIVE ACTION
-  **Mindful Movement** COMIC
-  **Body Scan** ACTION
-  **Routine Mindfulness** TALKING POINT
-  **Mindful Awareness Wrap Up** PAGE

eOxygen Social Network.



Multimedia Appendixes

Descriptive Insights Into the Participants' Willingness to Use eOxygen Again, Whether They Would Recommend It to Others, and Their Initial Reasons of Interest in Using eOxygen.

URL: <http://asset.jmir.pub/assets/11b7d860aa551268cc14c593dcbe50db.docx>

Young People's Satisfaction with eOxygen (N=25).

URL: <http://asset.jmir.pub/assets/e40b4c33b708cf78ab31e82c6c9a539a.docx>



TOC/Feature image for homepages

TOC image uploaded by Shaunagh O'Sullivan.

