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Enhancing social functioning in young people at Ultra High Risk (UHR) for psychosis: A pilot study of a novel strengths and mindfulness-based online social therapy

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ABSTRACT

Background: Psychological and pharmacological treatments have been shown to reduce rates of transition to psychosis in Ultra High Risk (UHR) young people. However, social functioning deficits have been unresponsive to current treatments.
Aims: The study aims were to: i) describe the theoretical basis and therapeutic targets of a novel intervention targeting social functioning in UHR young people; and ii) examine its acceptability, safety and preliminary effect on social functioning.
Methods: An international, multidisciplinary team developed a new intervention (MOMENTUM) to improve social functioning in UHR young people. MOMENTUM blends two novel approaches to social recovery: strengths and mindfulness-based intervention embedded within a social media environment, and application of the self-determination theory of motivation. The acceptability and safety of MOMENTUM were tested through a 2-month pilot study with 14 UHR participants.
Results: System usage was high, with over 70% of users being actively engaged over the trial. All participants reported a positive experience using MOMENTUM, considered it safe and would recommend it to others. 93% reported it to be helpful. There were large, reliable improvements in social functioning ($d = 1.83$, $p < 0.001$) and subjective wellbeing ($d = 0.75$, $p = 0.03$) at follow-up. There were significant increases in the mechanisms targeted by the intervention including strengths usage ($d = 0.70$, $p = 0.03$), mindfulness skills ($d = 0.66$, $p = 0.04$) and components of social support. Social functioning improvement was significantly correlated with indicators of system usage.
Conclusion: MOMENTUM is engaging and safe. MOMENTUM appeared to engage the hypothesized mechanisms and showed promise as a new avenue to improve social functioning in UHR young people.
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1. Introduction

Interventions have shown to be effective in reducing transition to psychosis in young people at Ultra High Risk (UHR) of developing psychosis (van der Gaag et al., 2013). However, these first generation UHR interventions have had little to no impact on social functioning

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deficits (Hutton and Taylor, 2014; van der Gaag et al., 2013), which are pervasive, significant (Addington et al., 2008; Cotter et al., 2014), and predictive of both transition to psychosis (Cornblatt et al., 2012) and poor long-term functional outcomes (Carrion et al., 2013; Cotter et al., 2014). Notably, while social functioning often remains impaired regardless of transition to psychosis status (Addington et al., 2011; Carrion et al., 2013; Cotter et al., 2014), those who transition are more likely to function poorly (43.8%) at long-term follow-up (i.e., up to 14 years) compared with those who do not develop psychosis (17.4%) (Yung et al., 2015). Indeed, the onset of psychosis can have a devastating psychosocial impact at a critical developmental stage, which may result in entrenched social disability (Crumlish et al., 2009). It is therefore essential to address social functioning deficits before psychosis develops: targeted interventions in the UHR period are more likely to halt and reverse these deficits, reduce their duration and impact and bring about long-term functional improvements (Carrion et al., 2013; Cotter et al., 2014; Crumlish et al., 2009).

In this paper we seek to: i) provide a rationale for the integration of a strengths and mindfulness-based approach, the self-determination theory of motivation, and online social media as a new avenue to improve social functioning in UHR young people; ii) describe the therapeutic targets and features of a world-first, theory-driven online psychosocial intervention (MOMENTUM) designed to improve social functioning in this population; and iii) examine the acceptability, safety and preliminary effect on social functioning of MOMENTUM through a pilot study.

2. A theory driven approach to improve social functioning in UHR

2.1. Strengths-based models, broaden-and-build and self-determination theories

Recent evidence-based psychotherapy models emphasise the role of personal strengths and self-efficacy in fostering social functioning in psychosis (Browne et al., 2018; Vaskinn et al., 2015). A pilot RCT showed that a 7-week intervention focused on eliciting and practicing personal strengths in patients with psychosis was associated with increased self-esteem, decreased psychotic symptoms and improved social functioning compared with treatment as usual (Hall and Tarrier, 2003). Similarly, a recent quasi-experimental study showed that a group-based intervention promoting personal strengths and self-efficacy resulted in improvements in self-esteem and quality of life (Roe et al., 2014). These findings are in keeping with several psychosis studies highlighting that social self-efficacy provides a direct path toward social functioning (Vaskinn et al., 2015), while poor social functioning can develop in response to self-defeatists beliefs about one's social interactions (Beck et al., 2013).

In addition to personal strengths, recent models emphasise the role of positive emotions in promoting social functioning and wellbeing in psychosis (Garland et al., 2010). Backed by extensive evidence, the broaden-and-build theory (Fredrickson, 2001) proposes that positive emotions broaden an individual's thought and behavioural repertoire. Over time, this builds durable biopsychosocial resources such as mindfulness, purpose in life and social support, resulting in enhanced social functioning (Fredrickson, 2001). Two pilot trials found that mindfulness, an intervention that promotes positive emotions (Fredrickson et al., 2008; Garland et al., 2015), was associated with improved symptoms, self-esteem, social functioning and wellbeing in patients with psychosis (Johnson et al., 2011; Meyer et al., 2012). These findings are consistent with two recent meta-analyses demonstrating that mindfulness is acceptable, safe and effective in reducing symptoms in this patient population (Cramer et al., 2016; Khoury et al., 2013). Similarly, the potential of mindfulness to foster social functioning in UHR young people has recently been highlighted (Hickey et al., 2017).

A third line of enquiry of relevance to interventions aimed at improving social functioning is Self Determination Theory (SDT) of motivation (Ryan and Deci, 2000). SDT focuses on the processes and social environments that facilitate or hinder social functioning, personal wellbeing and intrinsic motivation. According to SDT, social environments that address the basic psychological needs of *self-competence* (i.e., belief that one's behavior produces desired outcomes in the social environment), *autonomy* (i.e., sense that one's behavior is freely chosen and volitional) and *relatedness* (i.e., feelings of safety, belonging and connectedness in social interactions) will enhance intrinsic motivation. Greater intrinsic motivation will lead, in turn, to increased engagement and persistence and improved social functioning (Ryan and Deci, 2000). There is good support for this theory, with studies showing that increases in intrinsic motivation predict improvements in social functioning in early psychosis (Nakagami et al., 2010).

2.2. Online social media: a new platform to integrate interventions designed to increase functioning in UHR

A recent survey of 800 people revealed that 79% of young people use social media daily (Sensis, 2015), a frequency that is on the rise (Duggan et al., 2015). Although little is known about online usage in UHR young people, more is known about young people with a first episode of psychosis. Recent surveys show that the social media habits of young people with psychosis resemble that of their peers: virtually all regularly use social media, on average 10 times and 2 h per day (Birnbaum et al., 2017). Particularly relevant to the therapeutic potential of social media, 78% would like to obtain help from clinicians via social media, and 40% increase their use of social media when experiencing symptoms (Birnbaum et al., 2017; Firth et al., 2016).

Research with young people with psychosis revealed that they favoured an integrated online platform merging therapy, social networking, and expert and peer moderation, over less integrated online approaches (Alvarez-Jimenez et al., 2013; Alvarez-Jimenez et al., 2012). Young people with psychosis have also called for empowering online social therapies focused on promoting personal strengths and wellbeing as opposed to merely ameliorating symptoms and deficits (Alvarez-Jimenez et al., 2014; Alvarez-Jimenez et al., 2016). Taken together, these findings indicate that online social media provides a novel opportunity to deliver evidence-based interventions focused on promoting personal strengths, wellbeing and social functioning in UHR young people.

2.3. MOMENTUM: therapy targets and mechanisms

Informed by the theories described above, MOMENTUM was designed to foster self-efficacy and increase positive emotions while providing social support through a purpose-built online social environment. To this end, MOMENTUM merges: (i) interactive online therapy (targeting personal strengths, mindfulness and positive connections with others); (ii) peer-to-peer online social networking; and (iii) expert and peer moderation. The design of MOMENTUM was informed by SDT in two ways. First, through an engaging and motivating therapeutic environment which is easy to use (i.e., promotes self-competence), self-directed (i.e., promotes autonomy) and enables meaningful connections (i.e., promotes relatedness). Second, through approaches thought to improve social functioning: strength-based therapy targeting self-competence, mindfulness targeting autonomy/self-regulation (Ryan et al., 2008) and social network targeting relatedness.

In line with the broaden-and-build and SDT theories, MOMENTUM was designed to generate virtuous cycles of wellbeing and functioning: as self-efficacy (through identifying and exercising personal strengths), social support (through interacting with others) and subjective wellbeing (through practicing mindfulness (Diener, 2000)) improve, these will have a reciprocal effect on each other (e.g., increased social support will reduce loneliness and depression (Sündermann et al., 2014)), motivating the young person to initiate and persist in social activities, and improving overall social functioning.

3. MOMENTUM: development and features

MOMENTUM has been developed by an international team of researchers, clinicians, programmers, creative writers, comic developers, young people and experts in human computer-interaction. MOMENTUM has been designed following *persuasive systems design* (Kelders et al., 2012) and *participatory design principles* (Hagen et al., 2012), which increase user engagement and intervention relevance (Kelders et al., 2012). Young people can log on to MOMENTUM 24 h/day on computer or Internet-enabled mobile devices. Desktop and mobile versions include the same essential components; however, the mobile version (i.e., tablet and mobile phones) includes a customized menu, layout and design to cater for mobile displays.

MOMENTUM merges psychosocial intervention modules ('steps'), online social networking ('the café'), and peer-to-peer and professional moderation in an integrated platform.

3.1. Therapy modules ('steps')

The online 'steps' are discrete, interactive, evidence-based therapy modules addressing (i) personal strengths; (ii) mindfulness; and (iii) connecting with others. With the aim of *enhancing self-efficacy*, MOMENTUM integrates four strengths-based steps. Examples include: 'Find your strengths' (i.e., identifying personal strengths via an interactive card-sort game based on the strength-based framework (Alvarez-Jimenez et al., 2013); Suppl. Fig. 1) or 'Strengths for connecting' (i.e., using personal strengths in social situations). MOMENTUM includes 12 mindfulness-based steps designed to enhance *subjective wellbeing*. Examples include 'Body and breath', 'Mindful emotions', 'Savouring', and 'Self-compassion' (Suppl. Fig. 2). Finally, MOMENTUM comprises 5 steps to foster *positive interpersonal connections*. Examples include: 'Good news talk' (i.e., how to respond to the good news expressed by others), or 'The empathy bus' (i.e., how to respond empathically to others).

3.2. Persuasive system features to promote behavioural change

A key component of the steps, designed to enable their translation into actual *behavioural change* is the use of behavioural prompts called 'Do its'. For example, following a step about identifying personal strengths, the user will find specific behavioural suggestions (or 'Do its') to exercise a core personal strength (e.g., kindness) in specific contexts (e.g., school). A 'playlist' stores any 'Do-its' the young person wants to complete in the future. Users can rate, comment on, and share steps with others via the newsfeed. Finally, users can support others' efforts to engage in specific behavioural changes via the 'team up' function. For example, if a young person posts a team up challenge to 'eat less fast food and cook more healthy foods'; other participants can either take on the challenge or 'follow' their progress (i.e., 'cheer squad').

3.3. Online social network ('the café')

Users are encouraged to communicate with one another through the moderated online social network or 'café' to foster *social support* (Suppl. Fig. 3). Each user creates their own profile with images and can visit the wall of fellow users, where their posts and general activity are displayed. Posts can include 'Icebreakers' (to encourage social interactions, e.g. 'What's the weirdest thing you've ever eaten?'), 'Reactions' (designed to facilitate social support, e.g., 'I get you', 'thinking of you') as well as content related to mental health (e.g., 'trending' steps or 'Do-its') or general interest. Posts can also be tagged so that specific users will receive a notification.

A final feature of MOMENTUM is Talk it out (TiO), a group problem solving function designed to promote self-efficacy and interpersonal problem solving (Suppl. Fig. 4). A TiO allows users to nominate issues (e.g., 'how to deal with low self-esteem about your body?'), which are discussed in moderated groups informed by the evidence-based problem-solving framework (D'Zurilla and Goldfried, 1971).

3.4. Moderation and safety procedures

MOMENTUM uses two types of moderation: *Expert moderation* and *peer moderators*. Expert moderation has been manualised and is carried out by clinicians. Their role is to provide guidance, monitor participants' clinical status and ensure the safety of the social network. Moderation has been informed by the 'supportive accountability' model, where an expert online moderator fosters engagement via a shared goals and expectations in frequency of use and monitoring (Mohr et al., 2011). Each expert moderator is assigned a caseload. Following the initial baseline assessment, the moderator makes contact with the patient for a brief phone meeting reviewing their needs and preferences. Based on the assessment, moderators develop brief case formulations that are presented at weekly supervision meetings. Moderators send each user tailored content suggestions weekly (e.g. a step or action) based on the user's needs, interests and strengths. Suggestions appear on the user's home page and they receive a text notification via an inbuilt SMS function.

Peer moderators are young people with lived experience of mental disorder who undertake peer-support training. Their role includes providing support and fostering engagement. This is done in a number of ways, such as reaching out to reticent users, posting 'ice-breakers', commenting and liking posts, and modeling activity such as contributing to TiOs.

3.5. Safety protocol

The safety protocol is comprised of 3 levels of security including: (1) system and privacy protection; (2) online safety; and (3) clinical safety.

MOMENTUM has inbuilt security and data protection. Potentially fraudulent login attempts are denied after five failed attempts from the same IP address and our system administrator is automatically notified. Also, sensitive database information is encrypted using the Rijndael algorithm, selected by the U.S. National Institute of Standards and Technology for the Advanced Encryption Standard. System login was via a standard user authentication framework, where users were required to provide their username and password. MOMENTUM is hosted on a secured Linux server operated by the University of Melbourne's School of Engineering IT service. The URL via which Momentum was accessed was secured with HTTP over SSL: HTTPS = HTTP Secure. These measures conform to industry best practice as defined by the Open Web Application Security Project (OWASP). Privacy and online safety are managed in accordance with the Australian Communications and Media Authority (ACMA). Specifically, participants are informed of, and required to, accept the terms of use of MOMENTUM which includes clauses on protecting their privacy and that of others as well as guidelines on proscribed behaviours (i.e., disrespectful or offensive comments). Failure to comply with these guidelines may result in temporary or permanent withdrawal from the system.

The MOMENTUM clinical safety protocol includes manual and automated procedures (Alvarez-Jimenez et al., 2013; Gleeson et al., 2014; Rice et al., 2016). First, information related to clinical risk (posts or messages) is screened twice daily by therapists. Second, MOMENTUM incorporates an automatic alert system which monitors self-harm-related terms posted in the social feed. Any detected increased risk activates the safety protocol. The therapist conducts a telephone risk assessment and, where necessary, implements one or more of the following procedures: i) inform the treating clinician; ii) inform nominated emergency contact; and iii) liaise with suitable emergency services. Additional safety features include a reporting function for users and visible 24/7 emergency numbers. This safety protocol has been successfully

implemented in three pilot studies and two ongoing RCTs (Alvarez-Jimenez et al., 2013; Gleeson et al., 2017a; Gleeson et al., 2017b; Gleeson et al., 2014; Rice et al., 2016).

4. The MOMENTUM Pilot study

The aim of the pilot study was to conduct an initial evaluation of MOMENTUM regarding its acceptability, safety and potential to improve social functioning in UHR young people. We hypothesised that MOMENTUM would be regularly used, favourably received, and safe. In addition, we expected that using MOMENTUM would: 1) engage the theory derived therapeutic targets (i.e., strengths usage, mindfulness skills and social support); and 2) be positively correlated with improved social functioning in UHR participants.

4.1. Participants

The sample included 14 patients recruited from the PACE Clinic, a specialised UHR research clinic (Thompson, 2012) located in Melbourne (Australia). Inclusion criteria were: (i) age 15 to 25 years inclusive; and (ii) meeting UHR for psychosis criteria as assessed by the CAARMS (Markulev et al., 2017; Yung et al., 2005). UHR is determined by having sub-threshold psychotic symptoms, having experienced a psychotic episode lasting less than a week that remitted spontaneously, or a family history, together with a decline in, or low level of, functioning (Yung et al., 2003). Exclusion criteria were: (i) past history of a psychotic episode of one week or longer; (ii) intellectual disability; (iii) inability to converse in, or read English; and (iv) inability to provide an emergency contact.

The mean age was 20.3 years (SD = 3.4) with 78% female. All but one participant were born in Australia. Fifty-seven percent of the sample were in paid work, with 71% studying part-time or full-time. Eighty-six percent were never married and 14% were married/de facto. Fifty-seven percent of the samples were living with their family and 43% in rental accommodation.

4.2. Design and procedures

This study employed an uncontrolled single-group design to assess the acceptability, safety and preliminary benefits of a novel psychological intervention (Mueser and Drake, 2005). Participants were identified and approached by the study coordinator in consultation with PACE clinicians. Eligible participants were oriented to the system by the study coordinator via a face-to-face session which included: 1) a brief assessment of needs and preferences, 2) a hands-on explanation of the functionality of the system, and 3) details of the terms of use. Participants continued treatment within the PACE Clinic and were assessed at baseline and at two months follow-up. MOMENTUM was moderated daily (including two safety checks during week-days, and one safety check per day during weekends) following the procedures described above by two clinicians. The study was approved by the Melbourne Health Human Research Ethics Committee.

4.3. Measures

Feasibility and acceptance of MOMENTUM was tracked measuring participants' usage of the online system. A semi-structured interview was developed based on the User Experience approach (Bargas-Avila and Hornbæk, 2011) assessing the following themes: 1) helpfulness; 2) enjoyment; and 3) safety.

Safety was assessed through the following a priori indicators: 1) adverse events (i.e. clinical deterioration related to usage of the system); 2) inappropriate use; 3) participants' reports on inappropriate interactions; and 4) participants' perceived safety. Study safety criteria were defined a priori as: 1) no adverse events related to using the system; 2) no inappropriate use; and 3) 100% of participants reporting feeling safe.

Social functioning was measured by the Global Functioning: Social (GF: Social) scale (Cornblatt et al., 2007). Subjective wellbeing was assessed via the Satisfaction With Life Scale (SWLS; Diener et al., 1985). Self-efficacy was measured by The Self-Efficacy Scale (SES; Sherer and Adams, 1983). Self-esteem was measured via the Self-Esteem Rating Scale-Short Form (SERS-SF; Lecomte et al., 2006). Finally, depression was assessed through the the Montgomery-Asberg Depression Rating Scale (MADRS; Zimmerman et al., 2004) and stress by the Perceived Stress Scale (PSS; Cohen and Williamson, 1988)).

4.3.1. Therapeutic targets

Mindfulness was measured through the Freiburg Mindfulness Inventory (FMI; Walach et al., 2006). Strengths use was measured by the Strengths Use Scale (SUS; Wood et al., 2010). Social support and perceived social isolation were measured via the Social Provisions Scale (SPS; Cutrona and Russell, 1987) and the UCLA Loneliness Scale (Version 3; Russell, 1996), respectively.

4.4. Analysis

Patterns of online use were tracked in real time. Paired samples *t*-tests were conducted and within-group effect sizes (Cohen's *d*) reported for changes between baseline and post-test in study measures. To estimate Cohen's *d*, Morris and DeShon's equation was applied to correct for dependence among means in within group designs (Morris and Deshon, 2002). The Reliable Change Index (RCI) was employed to determine whether the change in individual scores was reliable and statistically significant (Jacobson and Truax, 1991). RCI is computed by dividing the difference between the pre-treatment and post-treatment scores by the standard error of the difference (Jacobson and Truax, 1991). An RCI = or >1.645 (cut score typically used in clinical research (Bowden, 2017)) indicates that the individual change score is significantly greater than it would be expected due to random measurement error (Guhn et al., 2014). Non-parametric correlations were performed to explore the associations between usage of MOMENTUM, changes in social functioning and hypothesized treatment mechanisms.

4.5. Results

4.5.1. Feasibility, acceptance and perceived helpfulness

Thirteen of 14 participants recruited into the study were retained for follow-up interview. One participant was not contactable for the follow-up assessment despite several attempts and was categorized as 'lost to follow-up'. There was a total of 244 logins (mean = 17.4 per user) during the 2-month study, with 72% participants logging on at least 7 times and 64% logging on 12 or more times (Table 1). Usage of the system by distinct participants was consistent over the course of the study, with no evidence of decreased engagement over time (Fig. 1). All participants used the online social networking features, with a total of 807 postings (mean = 57.6) and 57% participants posting 28 or more comments. There was a total of 170 therapy modules completed (mean = 12.1) with 57% participants completing at least 6 therapy modules and 43% completing 9 or more therapy modules. All participants reported a

Table 1
Logins and individual usage of the main components of MOMENTUM ($n = 14$) over the 2-month pilot study.

Site component	M	S.D.	Mdn	Range	%
Logins[a]	17.43	15.21	13.50	1–45	72[a]
Post and comments[b]	57.64	99.93	30.00	2–239	57[b]
Therapy modules[c]	12.14	16.26	6.5	0–52	57[c]

[a] Percentage of participants with >7 logins.
[b] Percentage of participants with >28 posts/comments.
[c] Percentage of participants completing >6 therapy modules.

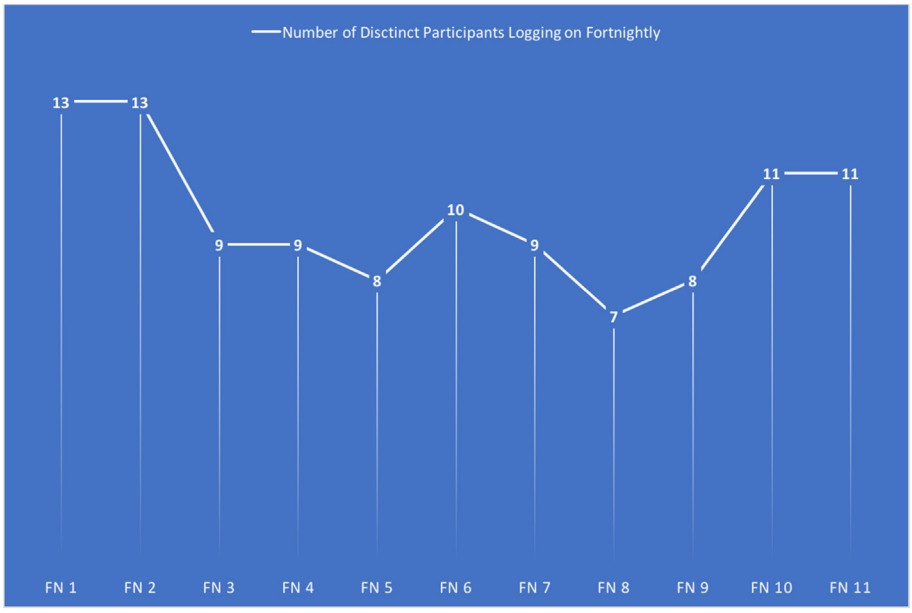

Fig. 1. Number of distinct participants logging on fortnightly over the course of the study ($N = 14$).[a] [a]Includes all participants regardless of whether they were assessed at follow-up.

positive experience using MOMENTUM and would recommend it to others, 93% considered it helpful and 64% felt more in control of their symptoms.

4.5.2. Safety

No adverse events, inappropriate use or reports by participants pertaining to MOMENTUM were detected during the study. All participants reported feeling safe using MOMENTUM. All clinical measures showed a trend toward improved clinical status at 2-month follow-up (Table 2). Similarly, 42% participants improved reliably across all clinical measures, with 25% showing increased depressive symptoms at follow-up. There was no evidence of any association between system use and increased depressive symptoms.

4.5.3. Potential impact on social functioning and mechanistic targets

There was a statistically significant, large improvement in social functioning from baseline to follow-up ($d = 1.83$, $p < 0.001$) (Fig. 2). Consistently, all participants improved reliably in social functioning over the follow-up period (Table 3). Furthermore, we found statistically significant medium to large increases from baseline to follow-up in mechanisms directly targeted by MOMENTUM including: personal strengths use ($d = 0.70$, $p = 0.03$), mindfulness skills ($d = 0.66$, $p = 0.04$), and subscales of social support including attachment ($d = 0.70$, $p = 0.05$) and guidance ($d = 0.75$, $p = 0.03$). These results were largely consistent with RCI analysis, with 42% participants showing reliable improvements in mindfulness skills and four subscales of social support (attachment, integration, reliable alliance and guidance). Conversely, 50% participants showed a decline in the nurturance subscale of social support. Finally, there was a large statistically significant increase in subjective wellbeing (i.e., satisfaction with life) ($d = 0.75$, $p = 0.03$); 42% participants improved reliably in subjective wellbeing and 33% showed a reliable decline in loneliness.

Table 2
Means (M), standard deviation (S.D.), and within-group effect sizes (Cohen's *d*) for clinical measures.

	Baseline		2-month follow-up		*p*	*d*	RCI[a] (N, %)	
	M	S.D.	M	S.D.			Improve	Decline
CAARMS[b]	19.75	7.21	16.67	7.19	0.10	0.51	5, 42%	1, 0.8%
MADRS	18.33	15.30	13.00	9.01	0.11	0.30	5, 42%	3, 25%
PSS	24.33	8.14	21.83	6.82	0.33	0.50	5, 42%	0, 0%

CAARMS = Comprehensive Assessment of At Risk Mental States; MADRS = Montgomery-Asberg Depression Rating Scale; PSS = Perceived Stress Scale.
One participant who was an outlier on all measures and never used the system was excluded from the analysis.
[a] Reliable Change Index using a cut score of 1.645 typically used in clinical research.
[b] Attenuated psychotic symptoms measured by means of the CAARMS.

4.5.4. Exploratory correlations on therapy mechanisms

Given the exploratory nature of these analyses and the small sample size we report hypothesis-driven correlations with a *p* value < 0.10. Improvement in social functioning correlated positively with number of logins ($r_s = 0.63$; $p = 0.02$) and completion of therapy content ($r_s = 0.55$; $p = 0.05$) (Table 4). As expected, there were positive correlations between increased mindfulness skills and subjective wellbeing ($r_s = 0.69$; $p < 0.01$). Moreover, there were non-significant positive correlations between: (i) usage of personal strengths and increase in self-efficacy ($r_s = 0.53$; $p = 0.06$); and (ii) increased perceived social support and reduced depressive symptoms ($r_s = -0.49$; $p = 0.08$) and loneliness ($r_s = -0.48$; $p = 0.09$) (Table 4). Similarly, there was indicative evidence of positive correlations between the therapy mechanisms, with improvements in strengths usage, self-efficacy, mindfulness skills, subjective wellbeing, social support and loneliness being positively intercorrelated ($0.14 \le r_s \le 0.78$). Conversely, improvements in social functioning showed small correlations ($0.18 \le r_s \le 0.27$) with the proposed mechanisms (loneliness, strength-use and subjective wellbeing).

5. Discussion

To the best of our knowledge, this is the first study to develop and test an online intervention designed for UHR young people, with a particular focus on improving social functioning. The results of this pilot study indicated that MOMENTUM was safe, feasible and appealing to UHR young people. The high level of use and indicators of satisfaction provide initial support for the relevance of the intervention content and features for UHR young people.

Our findings indicated that MOMENTUM engaged the theorised therapeutic targets, with significant and reliable increases from baseline to follow-up in strengths use, mindfulness skills and aspects of social support. The increases in the therapeutic targets were associated with corresponding changes in the proposed therapeutic mechanisms

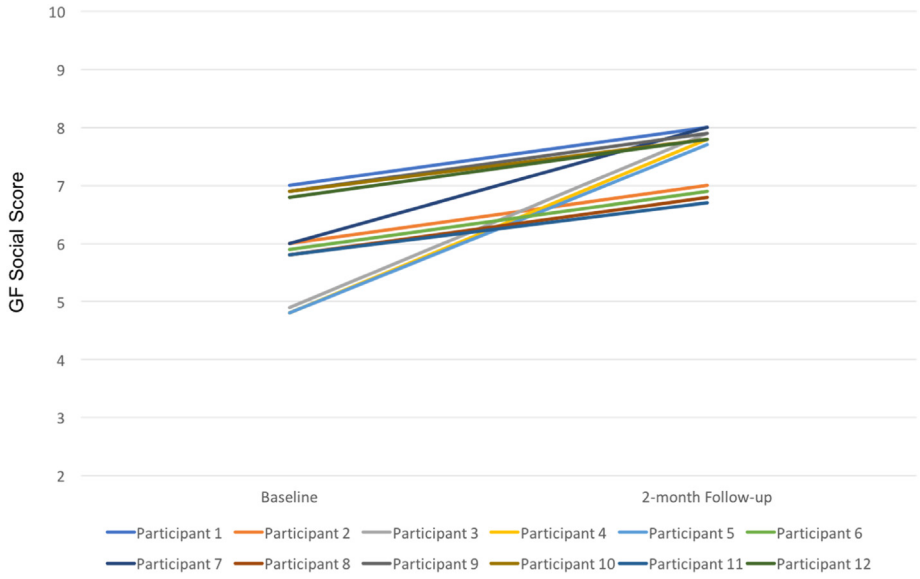

Fig. 2. Individual scores from baseline to 2 months follow-up on the Global Functioning: Social measure[a]. [a]When more than one participant had the same score at baseline and follow-up assessments the scores were changed by 0.1 points for one of them for illustrative purposes. One participant who was an outlier on most measures and never used the system was excluded from the analysis.

(i.e., strength usage correlated with self-efficacy, mindfulness skills with satisfaction with life, and social support with loneliness and depression). In addition, as predicted, the therapeutic targets and mechanisms appeared to have synergistic effects, with significant correlations between increased self-efficacy, mindfulness skills, and reduced loneliness. Taken as a whole, the study findings lend preliminary support to the theoretical underpinnings and hypothesized treatment targets of MOMENTUM, with initial evidence that the combination of a strength-based approach, mindfulness and social support may have treatment benefits for UHR young people.

We found a large and reliable increase in social functioning for study participants from baseline to follow-up ($d = 1.83$; 100% participants showed a reliable improvement in social functioning). While the uncontrolled design of this study does not allow any causal attributions, it is worth noting that the increase in social functioning was positively correlated with several indicators of engagement and usage of the online intervention including number of logins and completion of therapy content. Furthermore, social functioning in UHR young people is unresponsive to current treatment approaches (Fusar-Poli et al., 2013) and tends to remain stable over time (Cornblatt et al., 2007), which highlights the potential clinical significance of this finding. Of note, improvements in social functioning only showed small to moderate correlations with the proposed mechanistic targets. This suggests that social functioning in UHR young people may be a distal target, and as such improvements in social functioning may be multi-factorial and require several proximal therapeutic targets to be addressed simultaneously. Alternatively, the small sample size, range of variation and overall reliability of the measures may account for these findings.

While there is strong evidence for the effectiveness of online interventions, particularly for anxiety and depressive disorders (Richards and Richardson, 2012), the integration of digitally-enabled support with currents models of care and clinical services has failed to be

Table 3
Means (M), standard deviation (S.D.), and within-group effect sizes (Cohen's *d*) for social functioning and mechanistic targets.

	Baseline		2-month follow-up		*p*	*d*	RCI[a] (N, %)	
	M	S.D.	M	S.D.			Improve	Decline
Social functioning								
GF: Social	6.08	0.79	7.67	0.49	<0.00	1.83	12, 100%	0, 0%
Mechanistic targets								
FMI	32.58	7.62	35.25	7.36	0.04	0.66	5, 42%	1, 0.8%
SUS	54.58	16.70	62.08	15.93	0.03	0.70	4, 33%	0, 0%
SPS total	65.08	12.31	66.08	13.54	0.60	0.15	1, 0.8%	1, 0.8%
Attachment	10.18	2.60	11.18	3.22	0.05	0.70	5, 42%	1, 0.8%
Social integration	10.86	2.28	11.36	3.01	0.42	0.27	5, 42%	1, 0.8%
Worth reassurance	11.05	2.51	11.27	2.37	0.65	0.13	2, 17%	1, 0.8%
Reliable alliance	11.05	2.57	12.00	2.00	0.15	0.48	5, 42%	1, 0.8%
Guidance	10.41	2.99	11.64	2.73	0.03	0.75	5, 42%	0, 0%
Nurturance	12.33	2.31	10.33	2.53	0.01	−0.83	0, 0%	6, 50%
Intermediate targets								
SWLS	15.33	5.10	18.25	6.55	0.03	0.75	5, 42%	0, 0%
SES total	150.08	53.17	158.17	42.76	0.33	0.31	3, 25%	0, 0%
SERS-SF	74.25	23.63	80.83	22.87	0.08	0.55	3, 25%	1, 0.8%
UCLA	55.42	11.86	52.50	12.45	0.25	−0.35	4, 33%	0, 0%

GF: Social = Global Functioning: Social; FMI = Freiburg Mindfulness Inventory; SUS = Strengths Use Scale; SPS = Social Provisions Scale; SWLS = Satisfaction With Life Scale; SES = Self-Efficacy Scale; SERS-SF = Self-Esteem Rating Scale-Short Form; UCLA = UCLA Loneliness Scale.
One participant who was an outlier on most measures and never used the system was excluded from the analysis.
[a] Reliable Change Index using a cut score of 1.645 typically used in clinical research.

Table 4
Exploratory non-parametric correlations between change in therapeutic targets from baseline to 2-months follow-up.

	SUM	GF:S	SES	FMI	SWLS	SPS	UCLA	MADRS	PSS	SERS
SUM		0.26	0.53	0.55*	0.55*	0.14	−0.43	0.17	−0.59*	0.22
GF:S	0.26		0.03	0.12	0.12	0.09	0.18	0.10	−0.40	0.27
SES	0.53	0.03		0.78**	0.59*	0.45	−0.72**	−0.34	−0.26	0.69**
FMI	0.55*	0.12	0.78**		0.69**	0.58*	−0.63*	−0.18	−0.03	0.61*
SWLS	0.36	0.18	0.59*	0.69**		0.73**	−0.46	−0.47	−0.30	0.55*
SPS	0.14	0.09	0.45	0.58*	0.73**		−0.48	−0.49	−0.07	0.27
UCLA	−0.43	0.18	−0.72**	−0.63*	−0.46	−0.48		0.33	0.21	−0.48
MADRS	0.17	0.10	−0.34	−0.18	−0.47	−0.49	0.33		0.33	−0.31
PSS	−0.59*	−0.40	−0.26	−0.03	−0.30	−0.07	0.21	0.33		−0.14
SERS	0.22	0.27	0.69**	0.61*	0.55*	0.27	−0.48	−0.31	−0.14	

SUS = Strengths Use Scale; GF:S = Global Functioning: Social; SES = Self-Efficacy Scale; FMI = Freiburg Mindfulness Inventory; SWLS = Satisfaction With Life Scale; SPS = Social Provisions Scale; UCLA = UCLA Loneliness Scale; MADRS = Montgomery-Asberg Depression Rating Scale; PSS = Perceived Stress Scale; SERS = Self-Esteem Rating Scale—short form.
One participant who was an outlier on most measures and never used the system was excluded from the analysis.
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

implemented (Mohr et al., 2018). To address this issue, MOMENTUM was originally designed to be delivered across the network of early intervention services for UHR young people. The pilot study was embedded within the PACE Clinic and the intervention was moderated by clinicians as part of their routine clinical roles. Moderation and training procedures were manualised and require minimum specialised training (2 days). Therapist efficiency within MOMENTUM was estimated to be 5 times higher than that of traditional face-to-face interventions (100 vs. 20 of a typical caseload in an early psychosis clinic). New technologies including natural language processing and machine learning will enable increased moderation efficiency and scalability while maintaining a personalised therapeutic experience and affording prompt support (Alvarez-Jimenez et al., 2015). Ultimately, the dissemination and government investment in online interventions such as MOMENTUM needs to be guided by evidence. For this reason, we will carry out a well-powered, controlled clinical trial to determine the cost-effectiveness of MOMENTUM.

The current study has several limitations. First, the uncontrolled design precluded any causal inferences about the efficacy of MOMENTUM. Second, given the small sample size, the findings should be interpreted with caution. Small sample sizes can inflate effect sizes and correlations (Schönbrodt and Perugini, 2013). To minimise this bias, all analyses were theory-driven and determined a priori. In addition, we estimated the RCI for each measure to determine reliable and significant change at the individual level. Third, multiple non-parametric correlations were estimated, which is likely to increase the likelihood of Type I error. Given the exploratory nature of these analyses and the small sample size, we did not adjust for multiple comparisons. Thus, these findings should be considered to be to be exploratory and interpreted with caution. Fourth, the current findings can only be generalised to UHR young people receiving treatment at a specialised UHR clinic who consent to trial interventions. Fifth, the short-term duration of the study precluded examination of the long-term outcomes. Sixth, the assessment was administered by an assessor non-blind to the study purpose, which may have over-estimated positive findings, and participant responses were subject to social desirability. However, efforts were made to minimise these biases. Specifically, i) 50% of the GF-Social assessments were also scored by an independent assessor blind to the study purpose based on clinical files; the intraclass correlation between the blind assessor and the study assessor was excellent (ICC = 0.95; CI 0.86–0.98); and ii) prior to each interview the interviewer emphasised that honest responses would be most beneficial for other young people and MOMENTUM's development.

5.1. Conclusions and future research

The results of this pilot investigation showed MOMENTUM to be a promising and relevant treatment approach for UHR young people as it yielded high and consistent usage, satisfaction and safety. The intervention appeared to engage the theoretical target mechanisms and the large and reliable improvement in social functioning observed during the study was correlated with indicators of system usage. These initial findings provide "proof of concept" for MOMENTUM and lend preliminary support to the theoretical basis of the intervention.

We will now investigate whether MOMENTUM is an effective strategy for improving social functioning in UHR young people via a large randomised controlled trial in which the current study limitations can be addressed. Meanwhile, our findings suggest that the integration between strengths-based and mindfulness approaches and online social media provides a promising new avenue to improve a key outcome for UHR young people which remains unchanged by current treatment approaches.

Contributors

M.A.-J., J.F.G. and N.B. led the overall design and conduct of the study. S.B. and S.R. contributed to the supervision of the moderation of the online intervention. M.A.-J wrote the first draft of the manuscript. D.P., A.R.Y., R.R., S.D., C.M., P.R., R.L., R.C., C.G.-B., M.L., E.K., and P.D.M. contributed to the design of the online intervention and critically revised the manuscript. All authors contributed to and have approved the final manuscript.

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Conflict of interest

The authors report no additional financial or other affiliation relevant to the subject of this article.

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Appendix A. Supplementary data

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