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Designing Guided Asynchronous Remote Communities to Support Teen Mental Health

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A dissertation

submitted in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy

University of Washington

2020

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Abstract

Designing Guided Asynchronous Remote Communities to Support Teen Mental Health

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The majority of teens experience challenges with stress and depression in the United States. However, they lack the resources to access traditional face-to-face mental health care and participate in Human Computer Interaction research. Researchers have successfully used Asynchronous Remote Communities (ARC) to study marginalized and geographically distributed adult participants by enrolling them in private online groups and conducting structured activities to understand their needs. To increase access and develop empirical understanding of teenagers' mental health needs, I led three studies that enrolled a total of 40 teens and 13 clinicians in ARCs to conduct 20-minute weekly activities in anonymous private online groups on Slack for ten weeks. In the first study, collaborators and I elicited current strategies, tools, and unmet needs of teenagers (n=23) for stress management. We found that coping strategies of teens were individual and based on their perception of control over stressors. Teens also wanted support from technologies to

support reflection, understand their mood, and navigate boundaries in sharing about mental health with adults and peers. In the second study, we used ARC for ten weeks to understand needs and obtain feedback from clinicians (n=10) and teens (n=8) on adapting the evidence-based practice of behavioral activation (BA) for depression management delivered through online platforms such as Slack. We designed low-fidelity prototypes of BA interventions to support teens in understanding the relationship between mood and activity and learning to practice goal-directed behaviors to improve mood. Based on our analysis, both teens and clinician participants wanted support asynchronous support as a supplement to in-person therapy and most teens preferred to preserve and enhance online peer support. Teens and clinicians also raised concerns about safety, privacy, and moderating the online group which need to be balanced with the potential benefits of learning coping strategies, increased access, and asynchronous human connection.

Informed by BA, teens' design needs, and clinicians' expertise, we adapted the ARC method in the third study to develop a high-fidelity prototype and evaluate the feasibility of a guided ARC intervention. We designed and developed an app called ActivaTeen on Slack which functioned as an interactive smart diary application that supported BA modules on activity logging, reflecting on upward and downward spiral of mood, and SMART goal planning. We enrolled nine teens and three clinicians on Slack to understand the feasibility of using the guided ARC intervention for eight weeks followed by interviews. We found that engagement varied at an individual level for teens with depression and designers need to account for avoidance, support reflection with possibilities of missing data, and navigate the burden of asynchronous clinical work in using guided ARC. Through my dissertation research, I aimed to understand how the design of remote technology can support teenagers to cope with stress and depression and empower their choice to act on healthy coping behaviors. The main contributions of my work include (1) an empirical

understanding of needs to design for teen stress and depression management, (2) design and development of a guided ARC intervention using BA, (3) reflection on lessons learned using the ARC method for engaging with teens and clinicians, and (4) design considerations for using the process of human centered design for teen mental health. This work is a step towards identifying opportunities and challenges in using guided ARC to integrate evidence-based practices in designing for mental health and supplement face-to-face or synchronous online therapy.

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ACKNOWLEDGEMENTS

I am extremely grateful to my advisors, Dr. Julie A. Kientz and Dr. Sean A Munson, for providing me the opportunity to work with them, guiding me with their expertise, creating a space where I could be honest, not giving up on me, and being patient with me through personal struggles during my PhD journey. I thank my committee members, Dr. Wanda Pratt and Dr. Helen Teresa (Trez) Buckland working with whom has immensely helped my learning. They have been amazing mentors to me even outside of my dissertation work. I am very thankful for my collaborators, Dr. Jessica Jenness, Ria Nagar, and our volunteer teen intern, Nithya Kemp. I am grateful to all our participants who shared their time and insights with us.

I am grateful to have done this work at UW, where my ideas are constantly evolving with constructive discussions with my colleagues. Dr. Katie O’Leary has been my role model and support system in working on mental health research in HCI. I am very grateful to Dr. Jin Ha Lee from UW iSchool who has been an incredible professional and personal support system, especially during the COVID-19 Pandemic. Students who have contributed to this work during different phases include Calvin Liang, Emily Y. Zeng, Kanishk Shukla, Miguel E.R. Wong, and Kim Tran. I thank HCDE for providing me opportunities to TA, teach, and mentor with amazing instructors and students with whom I could learn and explore different research methods.

I thank my mom and close friends who value my existence. I am thankful for my therapists and health care providers over the years, who taught me skills to navigate my own mental and physical health to be able to create boundaries and pursue my passion sustainably. I

found my solace in music, painting, and long walks amid the beautiful trees and clouds of the Pacific Northwest. When I look up at the sky, I feel immense gratitude towards mother nature for providing me a place to be safe and away from violence in the past 7 years.

This dissertation work has been funded by the University of Washington Innovation Award, National Science Foundation Award #IIS-1553167, and University of Washington ALACRITY Center under NIMH Award #1P50MH115837. This project was supported by the National Center for Advancing Translational Sciences of the National Institutes of Health under Award Number UL1 TR002319. The content is solely the responsibility of the author and does not necessarily represent the official views of funding agencies.

DEDICATION

I dedicate this work to children and youth with the hope that we keep striving towards creating physical, digital, and social spaces where they find the freedom and safety to learn and grow.

Chapter 1. INTRODUCTION

The mental health needs of teenagers, who are transitioning from childhood and seeking independence, are unique. Teens are under stress from multiple external sources such as school, family life, work, and peers [107]. At the same time, they do not have as many experiences or may not be as resourceful as adults in coping. Asynchronous Remote Communities (ARC) are helpful in increasing access for people who struggle with participating in on-site design research due to difficult health conditions, geographic distribution, or scheduling issues [59,62,78]. To involve teens in the design process and understand needs, design, and understand the feasibility of using digital tools to support teenagers with their mental health, I and my collaborators conducted three studies using the ARC method with 40 teens and 11 clinicians. We¹ used Slack² based on the preference of our teen participants to remain anonymous and Slack allows participants to use pseudonyms and hide emails in private online groups. In the first study (Chapter 3), we used the lens of transactional model of stress [53] to understand the role of technologies in supporting teens with their perception of control in stressful situations. In study 2 (Chapter 4), we worked with teens who have depression and mental health clinicians using ARC to obtain feedback on using the evidence-based clinical health practice of behavioral activation (BA). In study 3 (Chapter 5), we tailored the weekly ARC activities and designed and developed an app on Slack called ActivaTeen, to provide BA interventions. I use the term “guided ARC” to refer to this format of ARC in which we designed weekly activities based on modules from evidence-based therapy. I worked closely with our clinician collaborator and a teen volunteer,

¹ I use “we” to refer to me and my collaborators. I led the studies and am grateful for our amazing team.

² Slack: an online platform for group work with features for creating private and public group channels and supports functionalities for chatting, sharing media, and building and integrating apps slack.com

and used ARC, interviews, surveys, design methods such as storyboarding and low fidelity prototypes to elicit needs and facilitate teens' and clinicians' involvement in all stages of the human centered design process.

1.1 UNDERSTANDING NEEDS FOR TEEN STRESS MANAGEMENT USING ARC

Teens in the United States report higher stress than adults, and teens are more likely to develop unhealthy coping habits [5]. Teenagers' individual preferences also vary depending on their socio-cultural influences, which may lead to inter-generational differences with non-peers in their social circle. These differences can make it difficult for adults, such as parents or school staff, to relate to and support teens even though such support is necessary [107]. Technologies can support teens in developing more self-reliant coping strategies as well as connect them with other individuals for support in both online and collocated spaces, as well as scaffold that support. However, mental health technology has been designed and developed primarily for adults [41]. It is important to involve teenagers in formative research to design technologies for mental health. Researchers have conducted participatory design sessions with teens on physical health [11]. Fewer studies in HCI focus on designing for stress and mental health to understand their unique needs that can be supported using technologies (e.g., [84,106]). In addition, the sensitive nature of this area of design can require methods for participation where flexibility and anonymity are built into the approach. Both teenagers and researchers experience challenges in access and scheduling when involving teenagers in design studies [77]. The method of Asynchronous Remote Communication (ARC), in which participants are enrolled in private Facebook groups, has been used in HCI to understand needs of vulnerable and geographically distributed populations of adults. These populations include adults with rare diseases [59], people living with HIV [62], and pregnant women [78]. In this chapter, we describe our use of the ARC

method to engage teenagers— who have scheduling, financial, or logistical constraints—to participate in design-based research. To understand teenagers’ needs for stress management, we enrolled 23 teens in two private online groups on a social media platform popular in workplaces, Slack, which allowed them to participate anonymously [10]. The teens were asked to participate in weekly design activities for 10 weeks, entry and exit surveys, and exit interviews. Our results indicate that technology for stress management need to be designed based on teenagers' perception of control, sense of self, and different levels of social support. Teenagers found the flexibility of participation, anonymity, and choice to selectively disclose during activities in the ARC helpful. However, some teens also felt the reciprocity of interactions between participants on the Slack groups were limited. With this study, we contribute (1) empirical findings and design implications for technologies for stress management for teenagers and (2) reflections on use of Asynchronous Remote Communities with teenagers to involve them in designing for wellbeing.

1.2 UNDERSTANDING NEEDS FOR TEEN DEPRESSION MANAGEMENT USING ARC

Many teens in the United States experience challenges with symptoms of depression, but they lack adequate resources to access in-person mental health care [1,6]. Involving teens and clinicians in designing technologies using evidence-based practices that reduce barriers to accessing mental health care is crucial. Interventions based on behavioral activation (BA) help teens to understand the relationship between mood and activity, practice goal-directed behaviors to improve mood, and may be particularly well-suited to delivery via online platforms [65].

We aimed to understand the needs and challenges of teens and mental health clinicians with depression management and involved them in the design process using ARC. Our goal was

to understand the benefits and challenges of adapting BA to an online platform that supports an ARC approach as a delivery tool for teen depression management. We enrolled mental health clinicians (n=10) and teens (n=8) in separate private online groups on Slack. They participated in 20-minute design activities for 10 weeks and were then invited to do interviews about their experience in the study. Both teen and clinician participants wanted online support for BA as a supplement to in-person therapy. While participants perceived the asynchronous format as conducive to supporting accessible care, teens and clinicians raised concerns with safety, privacy, and moderating the online group. Design decisions to address these concerns need to be balanced with the potential benefits of learning coping skills, increased access, and asynchronous human connection to support teens. We discuss considerations for balancing tensions in privacy and safety while designing and selecting online platforms to support remote care and integrating evidence-based support for digital technologies for treating teens with depression.

1.3 FEASIBILITY STUDY OF USING GUIDED ARC FOR TEEN DEPRESSION MANAGEMENT

Based on the results of study 2, we designed and developed an application on Slack called ActivaTeen, which followed an interactive diary format. Teens could access this app individually and it guided them through the four BA modules of logging their mood and activities, upward and downward spiral, planning SMART goals, and overcoming barriers to SMART goals [66]. We also designed weekly activity prompts through which teens were asked to use ActivaTeen modules, reflect on the activity in the presence of peers, and reflect on their logging data and discuss barriers with clinicians using direct messaging. To understand the feasibility of using this guided ARC intervention, we conducted an 8-week study with nine teens with depression and three clinicians on Slack followed by interviews and surveys. We present

findings on how engagement with this intervention varied among teens and how it supported and challenged their mental health needs of reflection, reducing avoidance, and scaffolding social support from clinicians and peers. Based on this empirical understanding, we further the discussion on how to improve the functionality of guided ARC and online applications to support self-tracking and reflection for mental health while accounting for avoidance and data that may not match with the participants' real-world experiences. We did not have enough clinician participation to understand the feasibility from clinicians' perspective so we speculate how this type of asynchronous intervention can be integrated within the clinical workflow.

In Chapter 6, I reflect on and discuss my experience using the human centered design process and ARC method across the three studies to incorporate stakeholder needs and evidence-based practices to further the growing body of research on designing technologies for teen mental health. I also brainstorm ways to integrate guided ARC support in supporting clinicians in in-person or telehealth format. In all my work, I maintain the **stance** that human support is crucial for mental health and can be mediated and augmented with the use of technologies. It is important to create spaces for self-reflection and at the same time create safe spaces for validating, sharing, and learning strategies to cope with difficult experiences with support from peers, clinicians, and trusted adults.

The primary **contributions** of my work include developing an empirical understanding of design needs and challenges of teenagers in managing stress and depression, discussing considerations for using ARC with teens and clinicians, and understanding the feasibility of using guided ARC in conjunction with clinician support (Table 1).

Table 1: Summary of research questions, studies, and contributions of my dissertation

Research Questions	Studies	Contributions
<p>RQ1: What support and challenges do teenagers currently have for mental health management?</p>	<p><i>Study 1:</i> ARC with 23 teens on stress management (10 weeks) <i>Study 2:</i> ARC with 8 teens on depression management (week 1-5)</p>	<p>Empirical understanding of existing support and unmet mental health needs of teenagers from technologies</p>
<p>RQ2: What support do teenagers and clinicians envision from technologies for mental health management?</p>	<p><i>Study 1:</i> ARC with 23 teens on stress management (10 weeks) <i>Study 2:</i> ARC with 8 teens and 10 clinicians (in separate groups) on depression management (week 1-5)</p>	<p>Empirical understanding of needs of teens and clinicians for designing technologies for support with stress and depression</p>
<p>RQ3: What are the opportunities and challenges of using Asynchronous Remote Communities (ARCs) to engage with teens and clinicians in research?</p>	<p><i>Study 1:</i> ARC with 23 teens on stress management (10 weeks) <i>Study 2:</i> ARC with 8 teens and 10 clinicians (in separate groups) on depression management (10 weeks) <i>Study 3:</i> Feasibility study of adapting ARC with 9 teens and 3 clinicians using BA (8 weeks)</p>	<p>Lessons learned on using ARC as a method for working with teens and clinicians for Human Computer Interaction (HCI) research</p>
<p>RQ4: How do teens and clinicians engage with guided ARC intervention using BA?</p>	<p><i>Study 3:</i> Feasibility study of adapting ARC with 9 teens and 3 clinicians using BA (8 weeks)</p>	<p>Empirical understanding of usage patterns and barriers to engaging with weekly asynchronous online evidence-based interventions for coping with depression.</p>
<p>RQ5: What are the opportunities and challenges in designing guided ARC intervention using BA for teens coping with depression?</p>	<p><i>Study 2:</i> ARC with 8 teens and 10 clinicians (in separate groups) on depression management (10 weeks) <i>Study 3:</i> Feasibility study of adapting ARC with 9 teens and 3 clinicians using BA (8 weeks)</p>	<p>Design considerations for researchers and practitioners working with technologies to use evidence-based practices for supporting teens in reflecting on their behavior and mood, reducing avoidance, and integrating guided ARC support in clinical practice.</p>

1.4 THESIS STATEMENTS

My thesis statements are as follows:

S1. Teenagers can **feasibly engage** in Asynchronous Remote Communities to help researchers **understand needs** for designing technologies to cope with stress and depression.

S2. Online platforms can **integrate** peer-support, clinician support, and self-support to help teenagers use **behavioral activation therapy** to reflect on mood and behavior, reduce avoidance, and access social support.

Chapter 2. BACKGROUND AND RELATED WORK

In my dissertation work, I focus on stress and depression management of teenagers which are among the most common mental health issues among adolescents. Approximately 3.2 million teens are diagnosed with depression each year in the United States [1,5]. Depression in teens is a serious and debilitating disorder associated with lifelong negative outcomes, including heightened risk for recurrence into adulthood, social difficulties, physical illness, and suicidality [1,6,48,55,102]. Over 60% of teens with depression do not receive in-person mental health care, and, among those who do, treatment engagement is low [1,74]. Evidence-based psychosocial interventions (EBPIs) for individuals with depression typically require frequent interactions between patients and mental health providers over time, which can be a barrier for patients and costly to administer in-person [1]. There is potential for online technologies to help clinics reduce disparities and provide synchronous telemental health services, however adaptations are needed to understand and address unique needs of adolescents and sustain their engagement with mental health care [28]. In this chapter, I provide an overview of the transactional model of stress and behavioral activation model of depression as a lens to understand stress and depression. I then review design of mental health technologies for teenagers, specifically focusing on BA and mood tracking. Next, I review the need for social support from peers and clinicians, challenges in involving teenagers in HCI research, and how engagement and social support can be scaffolded using the ARC method. Finally, I review ethical considerations used in prior online mental health research that informed our ethical practices in all three studies.

2.1 THEORETICAL LENSES TO UNDERSTAND STRESS AND DEPRESSION

To understand stress (RQ1), we use Lazarus and Cohen's theoretical lens of viewing stress and stress response as transactions between an individual and their environment [53]. An individual develops coping responses after primary appraisal of the significance of the stressful stimuli and secondary appraisal of perceived control as well as the availability of resources to respond to the stressful stimuli such as social support and time. Depending on their appraisal and feedback (the outcome of their stress response), individuals may develop preferences for different coping styles such as emotional coping (e.g., venting) and/or logistical problem solving (Figure 1). During adolescence, teens usually start encountering unfamiliar stress responses and developing ways to cope. Technologies can support teens with appraisal (e.g., mediate social support, thought analysis (CBT [9])), support reflection on stress response and outcome, enhance feedback, and expose teens to different evidence-based options for coping.

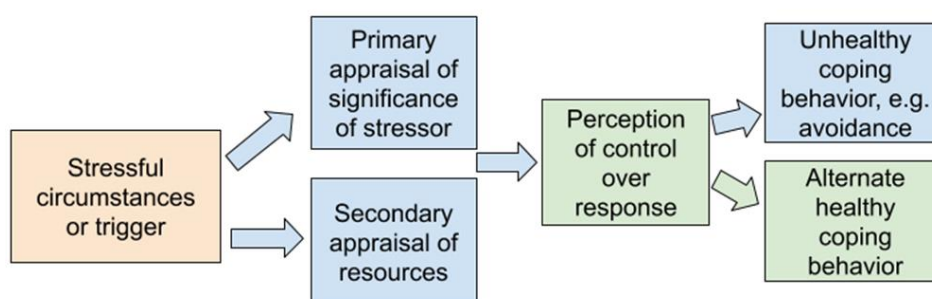


Figure 1: Transactional Model of Stress based on Lazarus et al. [53]

Behavioral activation (BA) is an EBPI for individuals with depression [26,65,66] and lends itself to a wide range of implementation and training methods [20,33]. BA is based on a functional analytic model of depression that highlights the transactional associations among

environmental stress, behavior, and mood (Figure 2) [66]. Specifically, BA approaches the treatment of depression through two primary targets: (1) increasing the experience of positive reinforcement (rewarding experiences) to help improve mood and (2) decreasing avoidance of reinforcing activities that may be negatively reinforcing depression symptoms. To address these treatment targets, BA emphasizes practicing goal-directed instead of mood-directed behavior. For example, if a teen is rejected by a friend and subsequently experiences low mood, a mood-directed behavior would be to isolate from all peers to avoid further rejection. Isolation from their broader group of peers would likely lead to negative consequences such as worsening friendships and lack of social contact. These negative consequences feed back into the teen's environmental stress, low mood, and avoidant behaviors ultimately resulting in a negative cycle of depression. Alternatively, goal-directed behavior refers to setting and following small steps towards a goal (instead of a mood) that aligns with the teen's core values and is likely to positively influence the teen's mood. For example, despite the mood-directed inclination to avoid potential rejection, the teen may set a goal to see a movie with a friend and follow small steps towards this goal such as calling the friend, setting a time and date, and selecting a movie to watch. While BA holds promise as an effective treatment for depression [65,105], there is an opportunity to improve the usability of and engagement with BA via online technologies, particularly among teens who are highly engaged with social and mobile technologies [12,60,75].

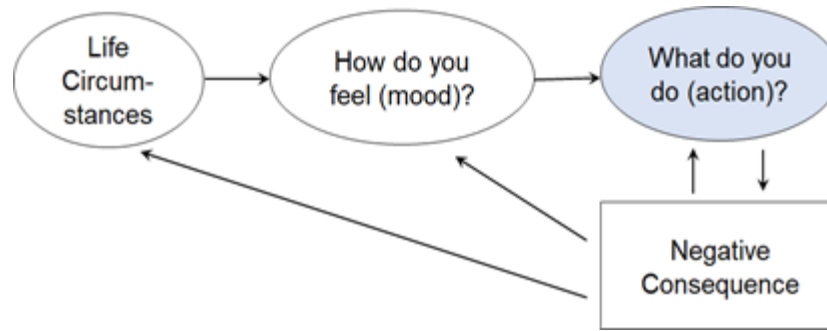


Figure 2: Behavioral Activation Model of Depression for Teens [66].

2.2 DESIGNING FOR TEEN MENTAL HEALTH

Although designing for teens is similar to designing for adults in many ways, there are still unique aspects of adolescent development that must be considered during the design process. According to Galvan [38], these aspects include: (1) Seeking new experiences or thrills, (2) the part of the brain responsible for understanding consequences is not fully developed, (3) sensitivity to social and emotional situations, and (4) stronger responses to rewards than adults or younger children. Basic design considerations for teenagers include low- or no-cost availability, a clutter-free interface, making the content easy to understand (5-8th grade reading level), and activities and interventions more tailored to teenage life (such as school, peer conflicts) [41].

Technologies can support **different modalities of engagement** to help teens develop their mental health. Engaging parents and pre-adolescents in digital storytelling with dialogic inquiry [96] and design of a toy that provides real time biofeedback [97] helped children understand and mediate negative emotional responses using Social and Emotional Learning (SEL) skills such as breathing techniques. Ecological Momentary Assessment Robot (EMAR), a social robot designed to ask teens about their stress, was designed in Participatory Design sessions with teenagers to support emotive, humanoid, and embodied interactions [84]. Adding

gaming elements of fun and metaphors in CBT based strategies during therapy sessions helped adolescents understand difficult concepts of CBT and increased engagement [19]. Designers of health applications that encourage teens to collaborate must consider teens' privacy preferences. For example, teens preferred to obscure personal health data (such as sleep data) when sharing self-tracking data with family members [76]. Mobile Mood Diary was an application developed for charting teenagers' moods and sharing them with therapists [64]. Adolescents and therapists in this study noted the app should be easy to conceal or be password protected due to the stigma associated with mental health. Additionally, they said such apps must be “engaging, interactive, provide concise information, be aesthetically attractive, allow for personalization, and provide reminders.” Therapists were concerned about increased responsibility, cost, need for training, and ambiguity of boundaries about when to monitor patients [64]. In study 1, we designed group activities such as mapping one’s social support network, imagining advice for parents, and providing feedback on storyboards, with a focus on examining the boundaries in sharing stress related data with adults.

In a pilot randomized control trial of a website delivering BA modules on planning activities to improve mood, Davidson et al. found that 96.2% of teen participants who had depression symptoms completed the module [20]. They suggested tracking activities and mood and sending reminders using mobile technology to improve engagement [20]. Rohani et al. [83] designed an app called MORIBUS that is based on BA for activity planning and rating and visualizing mood patterns for adults with depression. In their feasibility study, participants found the personal visual insights into the relationship between their mood and activity most useful with an overall compliance rate of 71%. Researchers identified opportunities to support the need for flexibility in logging activities instead of only in-the-moment logging, as participants had

individual usage patterns. For example, some participants logged their activities at the end of the day when they had privacy and time versus a few logged as they completed the activity.

Flexibility in how and when an individual engages with online mental health tools can be supported by an asynchronous format of logging and participating in activities.

Tracking everyday life for those navigating difficulties with mental health has included tracking mood (e.g., [50,83]) and behaviors such as daily routine, social and physical activities, and sleep (e.g., [63]). Benefits of tracking include increasing awareness of personal behavior and emotions, reflection to support development of insights and actions for behavior change, and also improve treatment outcomes for health conditions [45,83]). Self-tracking is also part of evidence based therapy and researchers have found increased engagement with in-situ phone based tracking such as for interpersonal and social therapy for adults with bipolar disorder [63] and BA for adults with depression [20,83]. The tracking data is often visualized and presented back to participants for reflection on their routines and mood patterns. Missing data and abandonment have been common issues in tracking everyday data [30,50]. In addition to text based logging, using MindTracker [54], researchers facilitated university students to practice mindfulness and record their emotions in a variety of forms, including abstract, symbol, and scene forms using tangible modalities of tracking. MindTracker had similar benefits in supporting emotional understanding but is less accessible than smartphone applications. In a codesign study with youth (18-25) with depression and clinicians, participants wanted to journal thoughts and identify factors influencing mood [45].

Explaining the role of technologies and social support in **supporting reflection**, Fleck et al. [34] discuss that technologies can be used to (1) record events (R0), (2) prompt users to

articulate their thinking with reflective questions for self-support and in presence of others (R1), (2) produce records that can be looked at again and enable “seeing more” from multiple perspectives which can also be facilitated from perspectives from others (R2), and (3) support with fundamental changes in understanding and assumptions which can lead to changes in practice (R3: transformative reflection). We build on these design concepts to design, develop, and iterate on our prototypes in study 2 and 3.

2.3 COMMUNICATION NEEDS FOR EMOTIONAL SUPPORT

Adolescents with depression tend to isolate because of their symptoms of avoidance, societal stigma, or due to being overwhelmed with the energy needed for social interactions. At the same time, social support from trusted family members, clinicians, and peers are crucial. According to Langford et al. four types of social support include *instrumental or logistical support* such as planning, monetary help, and driving to places, *emotional support* such as venting and companionship, *informational support* such as giving advice, sharing knowledge about experience with medication and treatment, and *appraisal support* such as validating an experience or support evaluating a situation [52]. Teens are not always transparent with their **parents** about their social media use and online risk experiences which can lead to negative experiences [109]. Rapidly changing technologies and use of personal devices make it difficult for parents to keep track of teens' online behaviors and to protect the teens' privacy online [11]. Latina teens wanted to use technologies for emotional support in advocating for their cultural needs against stereotypes, bridging acculturation gaps between them and their parents, and sharing relevant knowledge, such as college and dating, with parents [106]. During conflicts with parents, these teens wanted technologies to indicate that they want to be heard or given a chance

to explain and also suggested using technology as a shield to avoid communicating about emotional states in some contexts such as with their siblings and instead use non-verbal and visual cues [11]. We incorporated these aspects of technology mediated communication into our storyboards and diary activities in study 1 and discuss a design space for technologies for stress management.

2.3.1 Value of Peer Support for Mental Health

Hartzler and Pratt distinguish the expertise and learning that can be obtained from clinicians and peers [43]. Peer support focuses on the lived experiences of living with a health condition that fosters a sense of belonging, emotional support, and informational support while going through similar challenges. Technology mediated online interactions with people with mental health struggles and can be less burdensome with low barriers to access and increase accountability. In PeerTECH smartphone app, certified peer specialists supported elderly patients with severe mental illness and physical health conditions and found these older adults completed more than 70% of daily self-management tasks [35]. O’Leary [73] designed structured peer to peer chat in which peers could share difficulties, learn about Cognitive Distortions (CBT) [9] such as catastrophizing and over generalizing, and provide feedback during synchronous one on one conversations. The chats were pre-scheduled, and pairs were pre-matched by the researcher. This format required both peers to be online at the same time. Using the ARC method [59] lends itself to scaffolding asynchronous peer support from teen peers experiencing similar challenges and life circumstances.

2.3.2 *Clinician-Patient Interactions on Reviewing Self-Tracking Data*

Delivering evidence-based practices online in conjunction with other therapy formats has the potential for more engagement and psychoeducation among clients (e.g., [15]). Involving clinicians in reviewing everyday tracking data with clients is beneficial in leveraging clinical expertise of clinicians and contextual and experiential knowledge of clients. Chung et al. explain data collected by clients for self-tracking as boundary negotiating artifacts between providers and clients in clinical settings and can be crucial inclusion artifacts (to explain teens' context) and compilation artifact (such as reflecting on an issue together mediated by technologies and making sense of self-tracking data together) [17]. Health experts also found that MindTracker for tangibly tracking trends in emotion could be a helpful tool for gathering and tracking contextual data between clinical visits [54]. Though data tracked in-situ provides contextual information and aids recall, there are challenges in how this information is logged, presented, and integrated in practice to enable clinicians and clients to make use of the most valuable information in limited time [31]. These barriers include challenges in health literacy, time, data privacy and ownership, technology access and literacy, and level of engagement. It might not be equally helpful to every client and the design of these systems needs to find a balance between empowering clients and overwhelming them both while recording and interpreting health [91]. From the clinicians' perspective, large amounts of data to review could lead to other urgent information not being addressed in time and financial concerns about extra time reviewing, processing, and analyzing these data. Many clinics now have existing infrastructure for hybrid telehealth mechanisms with in-person treatment with clients such as providing secure messaging systems for purposes of allowing clients to ask questions, getting feedback, collecting health risks and history, tracking medications and dosage updates [22]. We used Slack (which was not

HIPAA compliant) to test the feasibility of using data tracking and communication while the clients and clinicians remained anonymous.

To support collaborative interpretation and trust building, reflection tools need to be flexible in presentation of client data, in simple and exploratory environments to provide common ground and awareness and support consensus, decision making, and development of actionable insights [44,87]. Schroeder et al. [87] conducted a study to support food journaling for IBS clients and observed them synchronously review visual charts of their food triggers and symptoms with their clinicians. The clinicians found value in these visualizations forming possible correlations between the client's diet and severity of symptoms enabling them to identify potential triggers and provide actionable information to include and remove ingredients from their diet. While some clinicians perceived it as challenging to review this before appointments, they wanted to review this together to understand clients' perception of their symptoms, opinion on their results, thoughts about their current diet, and willingness to change their diet. Tools like this can also be designed to support clients in long-term and form hypotheses or goals for future appointments. Mood and behavioral tracking data can be used similarly by clinicians to identify triggers and discuss next steps with clients [50]. In addition to automatically sensed contextual data such as location and time, understanding the context behind numbers was important for clinicians related to the behavioral issues that were symptomatic of mental health concerns such as meal timing and sleep timing and students found it helpful to share their data with clinicians as proof of progress and helpful in tailoring treatment [50].

Suicidal thoughts are also a symptom of depression which can lead teens to record crisis related logs that go unnoticed. Hetrick et al. found that in addition to mood monitoring, youth

with depression wanted to use a “one touch option” to escalate crisis situations to their clinician [45]. Clinicians, in turn, wanted to set expectations for clients on response time and the sort of response. They wanted to be notified about crisis situations using “traditional means such as notification from other clinicians” [45]. In study 2 and 3, we sought to engage teens and mental health clinicians in the design process to understand how to use an ARC platform to support an EBPI for depression.

2.4 ENGAGING TEENAGERS IN HCI RESEARCH & NEED FOR ARC METHOD

In a systematic review of papers in the Interaction Design and Children conference (IDC), researchers found that there was much less emphasis on teenagers than on other age groups [111]. Researchers have experienced challenges when working with adolescents using HCI methods (such as curt or not fully formed responses, power imbalance, and access constraints) and called for additional methods to engage teenagers [77]. Focus groups can help balance power dynamics between researchers and teens and scaffold peer support [77]. With the pervasiveness of online social networking tools among millennials, there is potential for using online methods to engage with youth in research and provide mental health interventions through online platforms. ARCs are private online groups in which researchers can deliver periodic research tasks to participants and gather information about their perceptions in a format that is lightweight, accessible, usable, and low burden. (e.g., [59,62,78]). Asynchronous methods have also been used in conjunction with online social networking tools to engage with youth in intervention research (e.g., [92,104]). For example, researchers enrolled 79 young adults in private Facebook groups to deliver Cognitive Behavioral Therapy (CBT) interventions for smoking cessation across 90 days [104] and SharpTalk was an online moderated peer support discussion forum designed for 16-25-year-old youth who engage in self-harm [92].

For teens, ARCs on social networking platforms offer more convenient and lightweight access than visiting offline research sites, as teens may encounter barriers to in-person appointments, such as the need for transportation and parental support. ARC also supports engaging with and following teens' activities over time and with teens who are geographically distributed. In study 1, we found that ARC was a promising approach for engaging teens in mental health design research that leverages technology's reach for understanding teens' mental health needs [10]. In study 2 and 3, we sought to expand the use of ARC to understand the benefits and challenges of delivering weekly BA interventions while scaffolding clinician and peer support.

2.5 ETHICS IN MENTAL HEALTH RESEARCH WITH TEENAGERS

Important considerations for using ARC with minors include maintaining privacy and confidentiality, ethical handling of adverse event disclosures online (such as suicidality, abuse, or harassment), and possibility of distress for others in a group setting. These challenges can be addressed through careful planning and moderation. Sharkey et al. [92] engaged youth who self-harm in online forums and balanced participant safety and their preference to remain anonymous while adapting and negotiating ethical practices with participants 'in-process' during their research. Adolescents under the age of 18 years usually require parental permission to participate in research. During the consent process, it is important to consider the autonomy of the adolescent in participating or not feeling coerced by their parent or guardian to participate. The need for parental consent can be waived for mental health in states like Washington [115] but this comes with additional responsibility on the research team to have protocols ready to handle issues with safety and confidentiality of minors. With internet and remote research providing

constant access to both participants' and researchers' information and time, boundaries need to be also established in the online space [67].

Before starting the ARC in study 1, we developed group guidelines and protocols for moderating the group and handling online disclosures of adverse events based on my trainings in Mental Health First Aid [116], Dr. Helen Teresa Buckland's protocols [13] for handling adverse events in-person, and Sharkey et al.'s [92] ethical considerations on balancing teens' safety, preference to remain anonymous, and potential distress in online communities (Appendix D and E). I closely worked with Dr. Jessica Jenness (clinician research on our team) and the Human Subjects Division at UW to finalize the protocols for reporting disclosures of minors in abuse (Appendix F).

In this study, we conducted weekly design activities in two online groups on Slack with 23 teenagers over the course of 3 months. Informed by our understanding of design needs envisioned by teenagers on stress management, we presented a design space on opportunities for technologies to support teenagers with stress management. We demonstrated the potential benefits and challenges in using the ARC method with teenagers, which we hope will enable researchers to invite and sustain participation from teenagers.

Chapter 3. UNDERSTANDING NEEDS FOR TEEN STRESS MANAGEMENT USING ARC

To engage teenagers who experience financial, or logistical constraints to participate in design-based research and access mental health care, we³ adapted the ARC to be used on Slack as most teen participants preferred to remain anonymous [59]. We designed weekly activities to understand their difficulties and strategies used by teens in managing stress, use of technologies for managing mental health, and design needs when envisioning future tools for improving mental health. In this study, we answered the following research questions specific to supporting teenagers with stress management:

RQ1: What support and challenges do teenagers currently have for stress management?

RQ2: What support do teenagers and clinicians envision from technologies for mental health management?

RQ3: What are the opportunities and challenges of using Asynchronous Remote Communities (ARCs) to engage with teens and clinicians in research?

We enrolled 23 teens in two private online groups on a social media platform popular in workplaces, Slack, which allowed them to participate anonymously. The teens were asked to participate in weekly design activities for 10 weeks, entry and exit surveys, and exit interviews. Our results indicate that technology for stress management need to be designed based on teenagers' perception of control, sense of self, and different levels of social support. Teenagers

³Study 1 collaborators: Calvin Liang, Emily Y. Zeng, Kanishk Shukla, Miguel E. R. Wong, Dr. Sean A. Munson, Dr. Julie A. Kientz

found the flexibility of participation, anonymity, and choice to selectively disclose during activities in the ARC helpful. However, some teens also felt the reciprocity of interactions between participants on the Slack groups were limited. With this study, I contribute to (1) empirical findings and design implications for technologies for stress management for teenagers and (2) reflections on use of Asynchronous Remote Communities with teenagers to involve them in designing for mental wellbeing.

3.1 METHODS

3.1.1 *Study Procedures*

We enrolled 23 teenagers in a private online group on Slack to participate in design activities for 3 months. This study was approved under minimal risk status by our university's Institutional Review Board (IRB). We invited teenagers (13-19 years age) to participate in an 8-10-week online study on designing for stress management. We posted our recruitment blurb on the Reddit group r/teenagers, our university's recruitment site, and researchers' social networks (which then spread via word-of-mouth), distributed flyers to students outside two high schools, and posted flyers around our university campus.

We first directed all interested participants to a screening survey asking gender, age, and preferred platform (Facebook or Slack). We then sent online assent forms along with online group guidelines to all interested teenagers. Due to the remote nature of the study, we obtained emergency contact information of an adult to whom we could reach out during disclosures of physical harm to self or another. Initially, we asked teens under the age of 17 to provide contact information of parents so we could obtain parental permission. We found that some interested teens were unable to participate as their parental contact was not responsive or teens were

unwilling to provide contact information of the parent. After consultation with our university's Human Subjects Division (HSD), we obtained a complete waiver of parental permission so that we would not have to exclude these participants. We recruited 9 adolescents before this waiver and 2 adolescents after. We compensated participants every two weeks with \$5 gift cards per week for 20 minutes of activity time.

Fifty-eight teens responded to the screening survey and 27 teens consented to participate. We gave each interested teen a choice of whether they wanted to join a Facebook group, a Slack group, and/or other platforms (participants could suggest alternatives). While previous ARC research has leveraged Facebook, we were concerned that its real name policy could create discomfort for participants, place them at risk, or cause them to choose not to participate. Of the teens who consented to participate, 15 teens selected only Slack, 3 teens selected only Facebook, and 9 teens selected both Slack and Facebook. We decided to run a Slack group after asking those who preferred Facebook if they were willing to join a Slack group and they agreed. Three participants did not respond after consent. One teen joined Group 2, but she did not complete any activities. We obtained and analyzed data from 23 teenagers (age 13-19 years) in two online asynchronous private groups on Slack for 3 months. We aimed to keep the group size to 10-15 participants so that participation and group moderation would not be overwhelming. Depending on timing of recruitment, we split the teens into two groups staggered by 3 weeks: 10 teens in Group 1 (labelled S1-S10) and 13 teens in Group 2 (labelled S11-S23). Participants could exit the study and/or the group at any time. Four participants dropped out from group 2 after week 5 (S21- S23), two participants (S9, S10) dropped out from group 1 after week 4. The first author moderated all groups: posted activities on Slack and sent it to participants on email, responded to participants, and sent reminders to teens who were late in completing activities.

Entry surveys: All participants individually filled out an online survey that included the Perceived Stress Scale (PSS) for the past month [18] to provide context for the initial levels of stress as the teens joined the group.

Activities on private online group: In each group, we asked participants to participate in an activity each week that we estimated took approximately 20 minutes to complete. We posted a total of 10 activities. These activities were related to (1) understanding stressors and stress responses, (2) existing coping styles, tools, and resources for stress management, (3) challenges in support for stress management, (4) feedback from teens on design of technologies for improving support stress-management, and (5) envisioning future tools and support for managing stress and mental health. These activities are detailed in Appendix A. In two design-focused activities, teens provided feedback on existing free mobile applications and storyboards illustrating speculated design ideas prepared by researchers (Appendix M). In week 10, teens envisioned their own designs and each teen posted three ideas for support with stress management with or without technologies.

Exit interviews or surveys: All participants (including those who dropped out) were invited to interview with us one-on-one to share their personal experiences in the study and with stress management (interviews lasted 30-60 minutes, compensation \$15). Participants who did not have time for an interview could alternatively respond to a survey (20 minutes, compensation \$10). The interviews were semi-structured, and topics included: use and feedback on Slack, experience in the study, stress management, technologies for health, and social support and involvement of family. We conducted 15 interviews and received 5 survey responses (3 participants did not respond). All interviews were transcribed. We then asked all participants to

fill out online questionnaires on PSS [18] (same as the entry survey), how helpful or unhelpful each activity was on a scale of 1-5, and demographic information.

3.1.2 Participants

As our study on stress is not specific to a diagnosis, we did not ask participants to report any physical or mental health diagnoses. During the course of the study, 3 teens mentioned challenges with anxiety. The majority of our participants were female (Table 2). Our study is biased towards frequent internet users and their identity as a teenager was based on self-disclosure [67]. We aimed to mitigate this challenge in our recruitment by distributing flyers outside high schools and posting on moderate group for teenagers. We also asked teens to provide school names in the intake survey and some teens used school affiliated emails.

Table 2: Demographic distribution of survey participants (N=23). NR indicates “No Response”

Gender	Female (19), Male (3), Non-binary (1) Age 13-17 years (11), 18-19 years (12)
Race	White: 11, Asian: 4, Mixed race: 4, NR: 4
Hispanic or not	Hispanic (3), Non- Hispanic (16), NR (4)
Region	Sub-urban (10), Urban (7), Rural (3), NR (3)
State	WA (14), CA (2), IA (1), NJ (2), PA (1), WI (1)
HH Income (USD)	<20k (3), 35k to 50k (1), 50k to 75k (1), 75k to 100k (1), 100k to 150k (1), 150k to 200k (3), 200k or more (4), NR (9)
School type	Public High School (8), Public University or College (6), Private High School (4), Public Online School (1), Private University or College (1), NR (3)

3.1.3 *Ethical Considerations*

We obtained emergency contact information of an adult from all teen participants and informed the teens that this person would be contacted if they disclose medical emergencies and/or concerns of harm to self or another. With the consent forms, we asked participants to review group guidelines and pinned it on the Slack group (Appendix D). We informed all teens that we are not counselors but are willing to listen to grievances and provided them with 24x7 helpline numbers to reach out to professionals. We had protocols for online disclosures of adverse events (Appendix E) and child abuse (Appendix F) in place for the research team. The first author monitored all posts within 24-48 hours for concerns of safety and emotional distress and reached out to teens via email or Slack private message. No immediate risks of physical harm or abuse were disclosed during the course of the study.

3.1.4 *Data Analysis*

We conducted the analysis in two parts, focusing first on teenagers' design needs for stress management and then on the use of the ARC method. The first dataset included participants' responses to design activities, focusing on diary entries, social support map, storyboard feedback, feedback on app activity, and codesign activity. The second dataset included exit interviews, exit survey feedback, and network analysis of interactions on Slack. For both datasets, we first analyzed the data inductively and then conducted affinity-modelling [46] based on our research questions. The first author read all posts on Slack and interview transcripts, coded a subset of the data, and prepared a code book (Appendix G) by defining codes for all research questions. Two coders inductively coded two interviews, discussed discrepancies in coding till consensus was reached, and iterated on codes. Four coders coded the remaining

interviews and design activities, independently, based on the code book, while writing memos. The first author reviewed and discussed all codes and memos with the research team to iterate on themes.

To visualize and better understand interactions between participants on the group, my collaborator Calvin Liang, conducted a network analysis after collecting the data using Slack API. We used Gephi [7] to create the network graph by defining participants as nodes and interactions between participants as edges. We assigned weights to participant replies (1 point) and reactions⁴ (0.5 points) on Slack, which mapped to the thickness of the edges (Appendix I). We also calculated the frequency of interactions between teens for each activity (excluding interactions with the researcher, Appendix I).

3.2 RESULTS: DESIGN NEEDS OF TEENAGERS

Three major themes emerged from our analysis of support that teenagers envision technologies providing for stress management: (1) meeting teens at their perception of control, (2) designing for the developing sense of self in teenagers, and (3) scaffolding varying levels of social support. These design needs reflected both a desire for self-management and seeking social support, with the former being more prominent. We explain each theme with the underlying needs expressed by teens, perceived opportunities for technologies, and designs envisioned by teens to support their needs.

⁴ Slack users can add reactions to Slack posts with one or more emojis, such as a thumbs up or a smile.

3.2.1 Meeting Teenagers at their Perception of Control

Participants scored an average of 21 on the Perceived Stress Scale (PSS, score range 0-40) (std dev.=5.8, n=23) and average of 20.2 on the exit PSS (std dev. =6.1, n=21). Scores of 20 and above are considered moderate to high stress [15]. Teens reported their sources of stress including school (n=20), thinking about the future (n=17), friends (n=13), family (n=12), and health (n=10). Participants perceived stress as overpowering, as depicted in the drawings they created to share what stress looks like to them (Figure 3).



Figure 3: Teenagers drew what stress looks like to them: a person drowning in a thunderstorm (S3), a girl physically being crushed under the weight of stress (S16), “good things in life that stress cuts you off from” (e.g., sleep, normal eating habits, laughter, and music) (S14)

Healthy coping was very individual for teenagers. Teens shared coping strategies that helped them regain a sense of control or reduce feeling overwhelmed by stress. These coping strategies included venting, meticulous planning and time management, and switching contexts before tackling stressful tasks. S2 explained that venting to others was helpful, “I have found myself using 7 Cups [online therapy tool] so often, and, having someone listen to me really helps me calm down.” S6 and S7 wanted a platform for venting in their codesign. S1 said she usually

uses an alternate or fake Instagram private account (“*finstagram*”) for venting. She explained that in these posts, she felt annoyed by suggestions or positive reframing of the situation from others.

For reminders, teens used both calendars and paper and digital planners. To increase their sense of control over the stressful task at hand, and not avoid it until when it is critical, teens suggested designs that help them reduce the perception of the magnitude of the task to an amount they would feel comfortable starting with and getting done. For example, S4 envisioned a planning tool that helped them break down their tasks and distribute it on their calendar automatically,

My third idea is a sort of add-on app to your calendar that gives you mini goals based on what it sees coming up in your calendar. For example, if I had a research paper due in a week's time, it would give me mini goals based on those parameters and on days where it shows that you don't have much activity. So, if it were to see that I didn't log anything for February the 8th in my calendar, it would send me a reminder that day to write my outline, and the next time there's a blank space before the due date, a note to write my intro/first body paragraph. I feel it would probably be helpful to students who have trouble with procrastination, since mini specific goals, always make it easier for you to know where to start. – S4

Teens valued support from technologies to help switch contexts and relax. While distraction may be considered a waste of time in their busy schedule, teens praised existing applications that helped them relieve their stress by taking a break. Some teens described taking a break and switching context to be helpful for gaining a different perspective when they come back to the activity from which they took a break.

Sometimes when I'm feeling rather stressed I just pop on over to Netflix and watch a couple of my favourite episodes from old telly dramas I've finished. They sometimes get me thinking about other aspects in my life besides the issue I'm skirting about, and by the end of it all, I might feel a bit more ready to tackle the issue at hand. – S4

Teens also valued doing activities they teens enjoyed or found relaxing, such as listening to music, alongside other stressful activities. S7 shared an image of a water bottle as a tool that helps her manage stress. She explained, *“My water bottle always makes me feel more relaxed. Maybe it's because I feel like I know I'm being healthier, or maybe it's because it's something to keep my body busy while I think.”* S1 used a color matching game app, I Love Hue [117], explaining, *“I often play it at school or while watching TV at home because it's so satisfying and calm; it has no time limit and it feels really good to put things back in order, especially because I like organization a lot.”* Teens who tried apps for mindfulness (e.g., Headspace [118]) and videos on YouTube that directly target relaxation skills during the app activity also found it helpful. S16 praised Headspace, stating, *“I really enjoyed the app because it gave me a mini escape from the real world and it did help me calm down.”*

I want to keep using this app [Headspace] because it really helped calm me down and reduce my stress. – S12

If the app were to expand, and offer its own stress management techniques, like meditation, it could definitely stand-alone (maybe with a connection to a Fitbit or something that could detect higher heart rates from stress.” Enjoying meaningful breaks or moments away from technologies but prompted by technologies was also sought for by

some teens. S14 stated that the app Happify [2] helped distract her, which provided her relief and got her “inspired to take a break and watch the sunset. – S3

3.2.2 Empowering Teenagers' Developing Sense of Self

All participants wanted to manage stress by themselves. They emphasized that each teenager has individual needs and preferences, thus, developing a distinct sense of self. To that end, they recommended personalized interventions that are based on these individual preferences and that support self-reflection. In the values activity, 15 teens prioritized autonomy as an important value. To cater to the values of seeking autonomy and wanting to take ownership of their teenager experience and health, we designed a low-fidelity storyboard for an app design called Teens Advice (Appendix I) which would be created by teens with advice for other teens and parents on mental health. We presented it to participants in Group 2, all of whom appreciated it. They also had ideas for further customizing the app. For instance, S14 and S17 said there is no general solution that will work for all teens. To address this, four teens (S13, S15, S16, S18) suggested categorizing the content presented in the app design (in the form of quizzes, activities, or advice) to account for differences, which can provide faster, more relevant information.

There could be categories too like: 'Dating & Romance', 'Hygiene & health', 'Family', 'LGBTQ', 'School', 'Social Life', 'Mental Disorders' etc. These topics can branch off, like, 'Hygiene & Health'– 'Sleep', 'Menstrual Periods', 'Birth Control' , and then 'Mental Disorders' – 'Learning Disorders', 'Self-Harm', 'Eating Disorders', 'Anxieties', 'Mood Disorder.' – S18

Their ideas also included systemic integration to support mental health in schools and at a societal level through popular media, such as promoting mental health awareness by creating

YouTube videos. S7 brainstormed a curriculum on emotional and mental wellbeing that she envisioned teaching in schools:

Starting from a younger age, discussing feelings, bodies, how to communicate, how to listen, how to problem-solve, as well as topics like racism, sexism, mental health, how to stay safe on the internet, and even harder topics like abuse, divorce, and other stuff I can't remember. That curriculum, as I've pictured in my dreams or something like that, would start as early as kindergarten, and continue through elementary school. – S7

Throughout the study, teens emphasized that every teen is different: what may work for some may not work for others. Several teens called for personalized experiences where teens can try out different activities as per their interests and rate how much each helped them.

I like apps that can 'get to know you' and suggest things following what you like. – S1

S16 envisioned personalizing objects that help relieve stress:

A website that creates a personalized 'stress box'. A stress box would be a box of things (or even a list of reminders) or really anything that may help you when you are stressed. Examples can include your favorite baby blanket, a chocolate bar, a letter to yourself, etc. A personalized stress box would require a couple of questions that outline common sources of your stress and suggest items to put in your stress box. – S16

Furthermore, S12 and S6 said some solutions are not suited for teens of all ages.

Critiquing the storyboard of an application to share schedules with parents, S12 said, *"this is probably better for freshmen and younger because it lets student be a little more independent but still rely on their parents' influence."*

Three teens (S1, S14, S19) envisioned technologies that prompt recall and reflection to see growth over time. They suggested that technologies could scaffold this growth by reminding them to reflect on positive aspects.

A simple app with prompts every day that you go through again each year and can get notifications to remind you to answer your print of the day. – S1

It can be nice to write down anything that made you happy – to remind you of those times when things aren't going quite as great. – S14

In these proposed solutions, teens hoped to use technology to reflect on their past to help them manage their current experiences. S10 found writing a letter to stress (a prompt on the diary activity) very helpful. She started her letter by venting and progressed towards positive reflection,

I keep forgetting it is in MY power to get rid of you [stress] and that any day I can start, but every day it is so easy to give up. So much EASIER to give up. But if it was easy everyone would do it. If it was easy, I would not feel good about doing it. So I will face the hard, I will face it head on until there is no bad habits of you. I cannot get better unless it's hard because that's not getting better that's just hiding my stress and pushing it away. So today will be the first day I will face you head on, and not give in to your words. This is so special to me. – S10

Teens explained that technologies may not only increase communication during stressful situations but also help communication by creating space between teens and their parents to work through issues.

Sometimes people need space. And I think this app [design idea that calls for time-out in communication] can help with that. – S8

S5 said that space is not always a good thing when it comes to communicating, stating,

If my mom keeps pushing off talking to me I'll just feel worse. – S5

3.2.3 Scaffolding Varying Levels of Social Support

Teens expressed that their social needs change based on their situation and characteristics of the individual(s) to whom they have access. Many teens supported collaborating with their parents but with certain concerns, seeking to establish boundaries. Teens perceived that parents may face issues in being able to reach out to the teen, effectively (“*break(ing) the shell their child may have created*” (S15)), not having all information about a situation, or not knowing their teen well enough. S13 added that parents might have to recognize that they themselves can sometimes be a source of stress for their teens.

Teens expressed the need to receive proactive support from parents. Seven teens (S11, S12-S14, S16-S18) expressed that it is parents' responsibility to learn about the issues and coping strategies relevant to teens. They suggested that technology can provide parents with crowd-sourced resources and tips for communicating with their teens.

It's important for parents to understand the many causes of teen stress other than school and work, such as relationships, the future, and even personal identity. They also need to understand what helps teens relax, like friends, enjoyable extracurriculars, or watching TV. Knowing that stress is existent in all areas of teen life will prevent parents from just focusing on how much their teen studies or sleeps. Similarly, knowing the ways teens

relax will hopefully stop parents from trying to control their kids and say “you should be studying, not watching TV” and “don’t hang out with friends;” saying these things pushes kids towards stress and away from activities that benefit their health. – S6

Several teens (S2, S8, S11, S13, S17, S18) expressed concern that their parents’ interventions tried to take control away from the teens, which teens did not find helpful. On the storyboard that suggested sharing their schedule with parents.

It would really frustrate me to feel this micromanaged by an adult, I really like having my space and this would feel like I was being controlled. – S13

Two teens also discussed how relying on technology to interface with families can lead to unhealthy dependence on families for teens (S11) and that an application might be unnecessary to mediate interactions with family (S16). Four teens (S14, S15, S17, S18) wished that parents would help teens with ways to relieve stress and support their teens without inquiry. S18 stated that it is important to do so without being “intrusive”,

Parents should ask ‘is there anything I can help you with?’ And do it in a way that isn’t intrusive. I find that when I ask for help and my parents don’t question me, I feel like they’re trusting me and just trying to help. Not seeing me reaching out to them as an opportunity for them [to] scope out my life. – S18

S3 and S8 also provided some insight into balancing the level of family involvement in which the family is aware of the situation but not driving the teen’s actions. S8 said, “I think it’s a good way for parents to be involved without being too heavily involved.” Teens supported technological solutions that helped them negotiate their priorities with their parents. S16 pointed

out that a solution that mediates arguments is helpful because “*when people are arguing they often interrupt each other.*” Having a third party stop any escalation might be helpful. S18, however, raised an important point that all parties must buy-into the idea of compromise and that parents and teens are not always as willing to come to a compromise as this type of solution would require.

Though five teens appreciated using memes with peers in the introduction activity as an ice-breaker, six teens rejected the idea of using memes or other trends as a way for parents to connect with their teens due to it being generationally inappropriate. S1 remarked, “*It's trying to relate to our generation but ends up being something we totally make fun of.*”

I never really share memes with my parents (my sense of humour does not line up with theirs). I figure finding a way to break the ice on a hard conversation is awesome, but memes aren't really the right way to do that. – S19

A few teens supported the idea of collaborative reflection with parents. S14 points out that communication highlighting positive aspects in a day can elicit appreciation for each other:

A parent and teen could keep a log of things that they really appreciate or didn't like too much that the other person did. At the end of each day, they should discuss what they have written down. – S14

Six teens wanted communication channels outside family to help manage their stress. S6, S7, S15 and S14 ideated on a venting channel or a “*messaging service where you get linked with a person who's also experiencing stress (or maybe to a professional who can help you manage stress).*” Their preferences for anonymity varied but they wanted to connect by sharing similar

experiences. S16 shared the idea of having a “*pen pal (someone in the same grade, age or region as you)*” with whom she could vent in writing. S8, however, emphasized that a system or other user must provide a fast response: “*I’ve had to wait an upward of half an hour for someone to reply to me, making me not want to try it again. But if you could get a speedy reply, I think that would be really useful.*” S11 suggested scaffolding support from loved ones, “*Stress management: an app that list some activities that could help manage stress. It would have a feature to link someone you love to remind you to do the things.*”

Teens appreciated seamless social support when other people helped them unexpectedly, as “*a nice surprise*” (S14) and that getting help without asking for it “*would be an ideal situation*” (S11). Participants said that reciprocating help can benefit both teens and their community. Technology can scaffold these interactions explicitly or implicitly. S14 explained her experience on an online community on Happify: “*I made a pledge to do something nice for someone and sent a compliment to one of the people that is most important to me. It felt good to take a minute to do something nice instead of always being so caught up in my own problems.*”

3.3 ARC METHOD FOR ENGAGING TEENAGERS

Using the ARC method supported: (1) Flexibility in participation due to the asynchronous nature of the study, (2) Technology mediated selective disclosure, and (3) Reciprocity and interactions among group members. In addition to the positives of the asynchronous method, we asked teens about potential difficulties and benefits of face-to-face alternate method. Their responses included: (1) logistical difficulties of scheduling face to face study sessions, (2) emotional difficulties in sharing in face to face settings, and (3) potential of a face-to-face setting to foster human connection, collaboration, and empathy compared to the online method. We

explain our findings on the advantages and disadvantages of the ARC method and comparisons with face-to-face methods as perceived by teens.

3.3.1 *Flexibility in Asynchronous Participation*

Most teens appreciated having short 20-minute activities each week. Nine teens stated that the study design allowed for flexibility in when they could do study tasks. Many of these teens had obligations such as schoolwork, jobs, and family commitments. Amidst these responsibilities, these teens did not perceive the addition of weekly study activities as an additional stressor. We designed 8 of the 10 activities so they could be completed any time within the week; teens valued being able to complete study activities during the time of the week that best fit their schedule. Most participants found the activities did not take too long to complete; they appreciated that this low time commitment did not hinder other activities during the day or week.

To me, that [completing activities] was just time management. I knew I had to get it done before Monday, for example. So, I'd plan it out in my week. Okay, maybe Wednesday night is when I'll get this done." S4 explained, "If I had a lot of stuff to do, I would either get it done early, or do it at the very end. So that wasn't a huge problem for me. – S8

In two other activities, teens were required to enter four diary entries on at least four separate days in a week. Though the teens found diary activities helpful for self-reflection, three teens (S3, S15, S16) mentioned that it was difficult to remember to complete and keep track of the diary every day. S16 found it hard to keep up with the diary activities because she said it was more commitment for them. For the teens who did not complete the diary activities regularly, we

sent them an additional link with multiple of these activities after the deadline allowing the teens to complete them in one go.

There were a couple activities that required us to submit a sheet four times in a week and that was a little hard for me because sometimes I would forget. At the end of the week I'd remember that 'oh, I forgot to turn it in' and I could only do one sheet per day. I liked that on the other activities that I was able to just do it all in one shot. That was just one problem I had – but other than that, the ones on Slack were really straightforward and easy to complete. – S15

S3 said he did not write much in the diaries because it felt he was saying the same thing every day. S3 was aware that the researcher was going to read them and he thought too much redundancy might bore the researcher.

Two teens (S4, S14) explained that the asynchronous study design gave them more time to think about their responses to more complex questions. They speculated that in a face-to-face study, they would need to come up with responses on the fly, which they said would likely have led to poorer quality responses.

Because sometimes you [researcher] ask a kind of complex question, or you ask someone to come up with a unique idea, it might take a little bit longer. I think that would feel a little bit rushed if you're doing it in-person. – S14

Participants S4, S8, S16, and S17 said that finding a time that works for everyone for a face-to-face group study and committing to that time over a long period would be particularly challenging.

It's definitely gonna be harder for someone to come over to the lab because [each activity] is not that long each time. It's like 20 minutes. I feel like most of the people wouldn't have that much time to just go to the lab every weekend and meet with your guys. – S17

As researchers, we found it advantageous to engage in activities with teens over the course of 10 weeks. Some questions from these activities could have been asked in a single interview, but not all (e.g., diary entry, app feedback). Particularly, the activity on introducing teens to an app in Week 7 and obtaining their feedback gave us the chance to follow up on the use of these apps after 2-3 weeks during the exit interview. We also gained an understanding of their challenges and time constraints as they worked through different stressful situations over time such as relationship issues, family commitments, mid-terms, and finals. The teens also appreciated having time to think about ideas before posting them.

3.3.2 Technology Mediated Disclosure

Eight interviewees mentioned that sharing their personal stories about stress with people in the group was comfortable for them. S4 and S1 perceived that sharing personal stories with ARC participants would not affect the readers emotionally as the readers could not put a face to the name on Slack. S8 mentioned that sharing was comfortable because she did not see these participants every day like she sees her friends. She explained that her friends reminded her of stressors and, in turn, stressed her out consistently (which she says is like a “stress loop”). All in all, lack of familiarity and the sense of “not knowing” the other person and staying anonymous helped the teens to feel more comfortable sharing stress-related information.

They don't know you yet, so what you say won't really, I don't know, [affect] them in any way. – S4

I don't wanna say with strangers, but with people who I just don't see every day because sometimes if you share things with your close friends for example, they might bring up your problems with you and you might not want to be re minded of that. – S8

It's very sensitive information that is better shared behind the screen names than face to face. – S16

In contrast, two teens (S13 and S16) felt reserved about sharing certain personal experiences in the online group format. S13 struggled with balancing her anonymity, group members' anonymity, and sharing personal and sensitive information. She explained, “*That's kind of a tricky balance between like being anonymous, but also you don't know who you're talking to and so it can be a little bit nerve-wracking to disclose stuff.*”

In two weeks of activities (Appendix A: weeks 5 and 8), we asked teens to complete diary entries redirecting them to a private online survey. Three teens (S1, S2, and S16) liked doing the diary activities because it allowed more privacy than in the group to write about personal thoughts. S1 and S2 thought that the open-ended prompts in the diary allowed more freedom for them to write what was on their mind without worrying about sounding professional, unlike in a post for the group activities. S16, however, reflected on difficulty with sharing on the private diary prompts as well,

I feel like personal experiences, I think it was the stress diary about times when I had conflicts with people, like relationships with my family or my friends, that was a little harder to share. Because I don't usually talk about that stuff. – S16

Seven participants stated that meeting people they do not know and sharing personal stories about stress in face-to-face setting adds a layer of discomfort. Some of these participants mentioned that talking about mental illness or stress would be difficult in a face-to-face setting due to stigma. These teens said that they felt more comfortable sharing personal anecdotes using a technology tool that supports anonymity, whereas a face-to-face environment diminishes anonymity.

I think, maybe it would be harder to talk about some of the things that make us stressed. I know, like when you post things online and you're anonymous under a different name, maybe you feel like it's easier to share things that you really wouldn't have shared before. – S8

I would probably be a bit more shy at first, because it's easier to type something into your computer, but it's a bit harder to talk to other people when you don't really know them yet. – S4

3.3.3 Reciprocity and Interactions Among Group Members

Our network analysis (Appendix A) showed 263 total interactions (replies and responses) including the researcher and 51 (19.4%) interactions between the teens in Group 1. In Group 2, interactions between the teens accounted for 47 (16.4%) of 286 total interactions. Activities that had the highest frequency of teen to teen interactions were the advice column and codesign. In

these two activities, we explicitly asked participants to interact with each other and allotted time for feedback in the study task (5 minutes). While some teens rarely interacted with other participants (e.g., S5, S16, S20), teens such as S1, S2, S6, S7, S18 and S19 were usually more proactive about responding and had more frequent interactions than others. S7 and S18 catalyzed feedback during the storyboard and codesign activities.

Collaborative sharing of ideas in a group setting can allow teens to develop their thoughts in the design ideation processes. Three interviewees (S4, S3, and S8) stated that sharing ideas in the online group was useful. S4 and S8 specifically mentioned that the ability to read other participant responses helped them come up with their own ideas. S3 also stated that the degree of openness from others in the group helped her feel more comfortable sharing, *“Other people were a little more open; and that helped me open up because I just wanted to know the degree of transparency that was being used in the study.”* Most teens said that reading others’ posts influenced their own posts. S1 read others’ posts to get a better idea of what the prompt was asking when she was confused. S14 and S16 read people’s responses when they were unsure how to respond to some activities.

When we were coming up with designs for stress tools toward the end, I wasn’t sure what ideas to come up with so I kind of read over some of the other people’s ideas and then it was able to inspire me to come up with my own ideas as well. – S4

S3 said reading others’ responses made him change some of his own responses. However, S2, purposefully avoided reading others’ posts before posting, so her post would not be influenced by what others said.

Most teens expressed that there were fewer interactions between teens in the group than they expected. When asked how to encourage more group conversations online, S6, who would have liked more interactions, suggested ideas to match buddies at the start of the study which might help increase reciprocity in the group.

In this group, nobody knew each other, so it was all strangers. There were no parent interactions. I would like to say, assign a buddy or someone to start volunteering then I would be willing to buddy somebody and then maybe match them up or something. – S6

S14 suggested compromising flexibility of participation for a few activities by having everyone on the study online and working on an activity at the same time. She provided an example, “Sundays from 1:00 to 2:00, you have to do your studies.” But ultimately, she was unsure if it would be worth it to have everyone go on at the same time, especially as different teens are in different time zones. A few teens also said they did not prefer more interactions than in this study.

Our codesign prompt was open-ended and the teens were not required to converge on design ideas. S1 speculated that having a face-to-face study and working together would facilitate coming up with more cohesive ideas and building off of peers’ ideas.

In an actual face-to-face discussion it would have been easier to build off each other. I feel like we would have come up with more cohesive ideas rather than all having an idea and maybe a couple of people respond. If you’re working on a group project in school, and you’re all working together at the same time instead of all coming up with these separate things kind of all at the same time. – S1

Three participants (S13, S8, and S1) mentioned that doing this study in-person could foster reciprocal interactions among group members. Even though these participants liked the flexibility of the ARC, they acknowledged that meeting other participants in-person would help foster empathy and people could put in more effort in the conversations and interactions.

No teen said they had any negative experiences in the online groups. S16 expressed that her experience was *“pretty neutral”* and S21 did not find the study useful to herself (she dropped out in week 4). All other participants described having positive experiences with the group. For example, S1 liked it when participants tagged her in their responses and agreed with her posts. S2 liked reading other people’s posts and seeing that they had gone through similar experiences. She said, *“I’ve been able to relate to other people in the study, reading their posts and seeing that they’ve gone through the same things and felt the same things. It’s been very therapeutic.”* S3 and S14 felt that everyone was supportive and nice. S4 reminisced that they received unexpected positive comments for some of their drawings which helped them feel supported.

3.4 DISCUSSION

3.4.1 *Design Needs for Teen Stress Management*

Technology has the potential to help teens learn and practice healthy responses to the experience of stress. Technologies could be designed to help tailor interventions depending on the perception of control of teens, to empower teens to learn, share, to teach teens to rely on themselves for managing stress, and to mediate social support. The teens' perceived locus of control of stressors on external factors confirms similar findings in physical health [11].

Providing logistical and emotional support, such as planning and a platform to through which to vent, can support them to shift this locus of control to them- self. Teens in our study recognized

that providing a platform and prompts for self-reflection through technologies can help with their individual growth. Similar to teens in this study, Vacca et al. found that Latina teens wanted a tool for venting and journaling – “tink tink”, in which they could post a rant anonymously or save it to support private self-reflection [106]. Evidence-based strategies in positive psychology, such as sharing 3 Good Things or gratitude, may be other ways to improve teens' optimistic perceptions of response to stressors [90].

In their real-life social networks, teens get different types of support from peers and adults [107]. How they prefer to interact with adults may differ based on age, cultural relevance, topic, perceived stigma, and levels of trust. For example, sharing memes with parents was not seen favorably in our study, whereas Latina teens ideated “MomChill” [106], wherein they could share memes with their mom to share about teen norms on relationships. Social support on stress in adolescence could also be provided solely through technologies such as venting to a robot, EMAR [84], which responded to them with social cues. Though robots can be difficult to access, similar experiences exist online using chatbots (Woebot [33,119], 7 cups of tea [120]) or virtual assistants.

Designers should balance perceptions of teens to support engagement and recommendations from evidence-based practices. Perceived approaches that teens think may help, may not line up with evidence-based methods for reducing stress. In Table 3, we summarize a design space on technologies for stress management for teenagers based on the three types of support identified in our findings – logistical (e.g., planning and organizing), emotional (e.g., venting and positive restructuring), and informational support.

Table 3: Design space for technology-based stress management for teenagers, including suggestions from participants (indicated with (T)), examples from prior research, and products/services on the market.

Design Needs	Logistical Support	Emotional Support	Informational Support
Tailoring support to perception of control	Mini Goals (T), Calendar or planner apps	Headspace[118], Screamer [106]	Pacifica (CBT) [121]
Empowering sense of self	Teens Advice (T): help teens organize content on mental health	3 Good Things [90], Happify [122]	Pacifica, Daylio [123]
Scaffolding social support	Sharing activities to manage stress with loved ones who can send reminders (T), Collaborative goal planning with trusted adults (T)	Peer matching for venting (T) EMAR [84], Woebot [119], Koko [124], 7 cups of Tea [120], tink tink [106], Galaxy Watch [11]	Teens Advice: helping parents with information to communicate with teens and vice versa (T), Videos for mental health awareness (T)

3.4.2 Reflection on ARC Method

We adapted the ARC method from Facebook to Slack as participants chose anonymity on Slack allowing for choice and comfort in disclosure online (similar to patterns of disclosures on mental health (e.g., [21,49])). While limited reciprocal interactions in the groups may reflect the teens' preferences, researchers can brainstorm ways to encourage interactions. Participants interacted in the activities in which we allocated time for and required feedback within the 20 minutes. As we were conducting such a study for the first time with teens, we were very cautious about potential confidentiality and privacy issues in the group guidelines. We did not encourage or discourage the teens to chat with each other outside the group activities (such as in private chat), which might be considered in future work. There were no off-topic conversations in the

groups other than the first week of ice-breaker activities. Researchers may try more elaborate ice-breaker activities in the beginning where teens can get to know each other.

Researchers may organize optional online social activities or maintain a separate channel, such as #random, where teens may get to know each other outside the study activities [114]. Assigning “buddies” (S6) each week to check in on one another or work on in pairs, while balancing the burden on their time and privacy, can also be explored. The teens in our study were from different time zones and had busy schedules. Most activity on the group was during evenings (after school hours). Participants felt that some degree of synchronous interaction would have facilitated collaboration, such as during brainstorming. Researchers could explore the potential to involve teens using audio or video conferencing tools such as Google Hangouts, though we note the potential trade-offs in flexible scheduling and anonymity. These interactions might be organized as “office hours” where the moderator might set a time and see who is able to show up. Moderators also can model active tagging, encouragement of reactions, and consider explicitly including interactions as a part of the activities.

When using a platform new to most participants, such as Slack, researchers might design early activities to encourage participants to explore different platform features. On Slack, this might include tasks such as reacting to a post, adding images (as in our week 1 activity), tagging others, and using threads (which some teens found confusing). Most participants preferred writing over drawing in the diary or co-design activities. Therefore, having the option of different modalities for presenting an idea or completing an activity was helpful. Teens appreciated that the activities could be completed within 20 minutes and that they had a full week to complete them. Similar to prior ARC studies [62], teens reported liking the structure in

which new activities were posted on each Tuesday. However, unlike on Facebook, it was difficult to maintain threads for each activity on Slack. The moderator waited on participants to complete earlier activities thus, delayed posting some activities. We used email and Slack to notify teens about a new activity and send reminders. Teens found it helpful to keep track of activities and sent us late or private responses to activities via email.

Most teens did not report having an issue with the 3-month duration of the study, and we found it helpful to learn about their challenges and development of ideas over time. We provided extensions in completing activities during finals week and vacations which were different for different schools. Researchers should plan on tailoring the study timeline around travel and hectic weeks beforehand, for example, setting activities relevant to exams or break. We encouraged teens to post 3 good things during breaks (optional) and had no activities during Thanksgiving and Christmas holiday weeks. We timed diary activities on the week after holidays, which prompted reflection on transitioning from break to school and/or spending time with family. Other ideas for increasing engagement might be to use videography which might be a more engaging and creative method to collect and share snap shots from teens' lives instead of text-based diaries [68,77]. More methods to engage teens may increase the number of teens who may participate in HCI research [111].

Chapter 4. UNDERSTANDING NEEDS FOR TEEN DEPRESSION MANAGEMENT USING ARC

Most commercially available digital mental applications do not incorporate evidence-based practices (EBPIs) for mental health tailored for adolescents which add to issues in accessing adequate care. After feasibly engaging teens in ARC for stress management, we⁵ aimed to further adapt the method to design and remotely deliver BA interventions that have been clinically proven to benefit teens with managing depression [65]. In this study, we involved teens and clinicians in the design process to understand challenges and strategies for managing depression and obtained their feedback on low-fidelity prototypes for adapting BA interventions using ARC. We answered RQ1 and RQ2 specifically for depression management:

- (1) What are the perceptions, needs, and challenges of clinicians and teens in designing technologies for the treatment of teen depression?
- (2) How do clinicians and teens envision the design and delivery of BA for the treatment of teen depression using guided ARC?

Using the ARC method, we enrolled 10 mental health clinicians and 8 teens in two separate private online groups. We posted 20-minute-long design activities each week for 10 weeks. In each activity, we introduced modules of BA related to psychoeducation on BA, reflecting on activity and mood, and planning SMART goals. We then prompted clinicians and teens to give feedback on adapting these modules to Slack. We sought to discover their needs and perceived facilitators and barriers to adapting BA for asynchronous delivery and analyzed

⁵Study 2 collaborators: Ria Nagar, Dr. Jessica Jenness, Dr. Sean A. Munson, Dr. Julie A. Kientz

their experience with ARC. Based on our analysis, both clinicians and teens highlighted (1) the need for technology to be a supplement to therapy and not a replacement, preserving the in-person interaction that therapy usually provides and (2) the importance of balancing human connection online while considering both privacy and safety. Based on this empirical work, we provide design recommendations for researchers and practitioners to use evidence-based practices and discuss considerations for platforms for delivering online mental health interventions for teenagers.

4.1 DESIGN OF LOW-FIDELITY PROTOTYPES OF BA ACTIVITIES

We created low-fidelity prototypes to show how some BA activities might be adapted to an interactive asynchronous remote platform and showed them to our clinician and teen participants to obtain feedback. Prototypes included low-fidelity paper-based or survey-based mock-ups and screenshots where the research team could easily incorporate feedback and iterate on the design before investing resources into building the tool (e.g., Figure 4-7). For each module in weeks 6-10, we posted worksheets from the BA handbook [66] for take-home activities and low-fidelity prototypes of technological adaptations of these take-home worksheets (Table 4). Based on feedback from clinicians, we presented each BA module in the teen group with examples through 2-3 slides (Figure 5) to briefly introduce and explain each activity along with the technology mock-ups of survey and/or chatbots. All participants were asked to try and review adaptations in the form of surveys, voting polls, group or direct messaging on Slack, upload photographs, and critique chatbot mockups. We asked participants to provide feedback on the content, engagement, format, and experience of doing these activities.

In Week 9, we posted a module on overcoming barriers to SMART goals (Specific, Measurable, Appealing, Realistic, and Time-Bound) they planned in Week 8. In the first part of this activity, participants were given examples of barriers and suggestions to overcome these barriers. These mock-ups also included survey prompts (Figure 6), a Chatbot mock-up (Figure 7), and Direct Messaging (DM) with peers. In Week 10, we presented mock-ups of possible teaching formats when delivering modules of Behavioral Activation. These remote teaching formats included animated videos to explain BA modules, teen peers explaining based on their lived experiences, and an interactive format using a chatbot where the respondent can use dialog and voting polls.

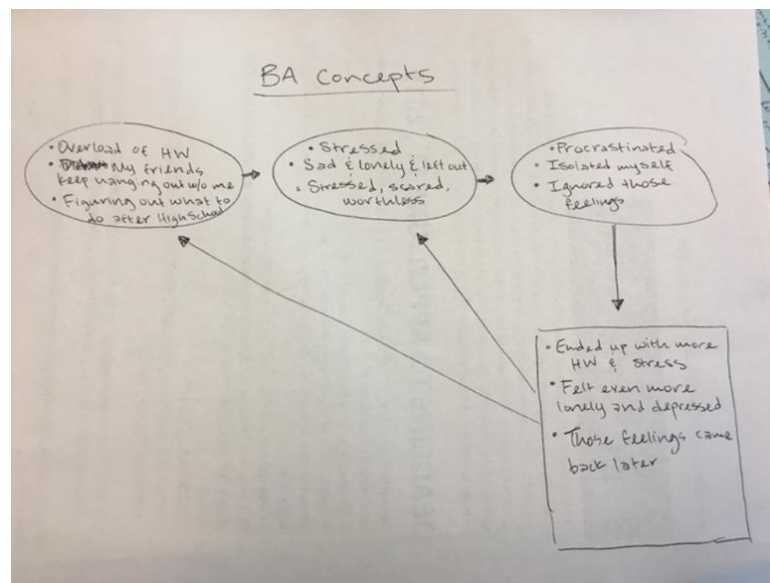


Figure 4: “How BA works for me?” Hand drawn picture from a teen participant explaining how BA would apply to their life circumstances.

Table 4: Summary of online activities in Study 2 on the private Slack groups for teens and clinicians

Week	Design Activity	Purpose & Activities	Clinician Completion rate (n=10)	Teen completion rate (n=8)
Week 1	Introductions	- Learning how to use features of Slack - Getting to know other participants	100%	88%
Week 2	Technology to manage mood	- Sharing current strategies and technologies that participants have found helpful for their clients (clinicians) and themselves (teens & clinicians)	100%	88%
Week 3	Online mental health support - Part 1	- Learning about more features of Slack such as polls with example poll - Ideating on benefits and challenges of using the online platform of Slack	100%	88%
Week 4	Online mental health support - Part 2	- Voting polls on preferred features of Slack for online support with mood - Voting polls for the format of the online support (e.g., group vs. individual) and the length of online support.	90%	100%
Week 5	Adapting BA online	Psychoeducational video that explains BA <i>Prototype:</i> Obtain feedback on a summary of BA activities for 6-week format (Appendix J)	90%	88%
Week 6	BA Model and Activity monitoring	Explaining BA model with a video and concepts through slides (Figure 3) and ask participants to give examples from their lives by uploading hand-drawings (Figure 5) <i>Prototype:</i> Mock-up of mood and activity monitoring in survey format	80%	75%

Week	Design Activity	Purpose & Activities	Clinician Completion rate (n=10)	Teen completion rate (n=8)
Week 7	- Upward and downward spiraling of mood - Introducing SMART goals	Providing feedback on upward and downward spiraling of mood and planning SMART goals Prototypes: - Survey format for reflecting on upward and downward spirals in mood and action (Figure 6) - Survey format for individually planning a SMART goal, mini steps, and setting reminders:	80%	75%
Week 8	SMART goal planning	Providing feedback on technological adaptations of planning a SMART goal, mini steps, and setting reminders. Prototypes: - Mock-up of chatbot format - Direct Messaging (DM) format in which participants pair up with a peer and a researcher moderator. Participants were asked to share SMART goals and provide feedback on each other's goals.	70%	75%
Week 9	Overcoming Barriers	Providing feedback on overcoming barriers to mini steps & SMART goals. Prototypes: - Survey format - Chatbot format with prompts to overcome barriers (Figure 7) - Direct Messaging (DM) format by pairing up with a peer from week 8, following up, and sharing barriers	70%	50%
Week 10	Teaching components	Identifying how to deliver teaching components of BA in online format such as videos and chatbots.	70%	50%
	Exit Interviews & Surveys	Providing feedback on the method and follow up questions on depression management.	90%	63%

Downward Spiral, Upward Spiral

HANDOUT 5

Downward Spiral, Upward Spiral

abap⁹

Keep track of one thing that happened over the week that brought your mood **DOWN**.

1. What happened?

2. How did you feel?

3. What did you do?

4. Did you feel better or worse?

Keep track of one thing that happened over the week that brought your mood **UP**.

1. What happened?

2. How did you feel?

3. What did you do?

4. Did you feel better or worse?

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Example of an Upward Spiral

- **What Happened:** I found out I failed my math test
- **How I felt:** Ashamed, sad, stupid
- **What I did:** I asked to have lunch with a friend and talked to them about how I felt
- **How I felt:** I felt better- we ended up making plans to see a movie that weekend

Seattle Children's/University of Washington

Figure 5: Example of a slide (PDF) of instruction presented to teens to explain Downward & Upward Spiral Worksheet in BA (Week 7)

1. What happened?

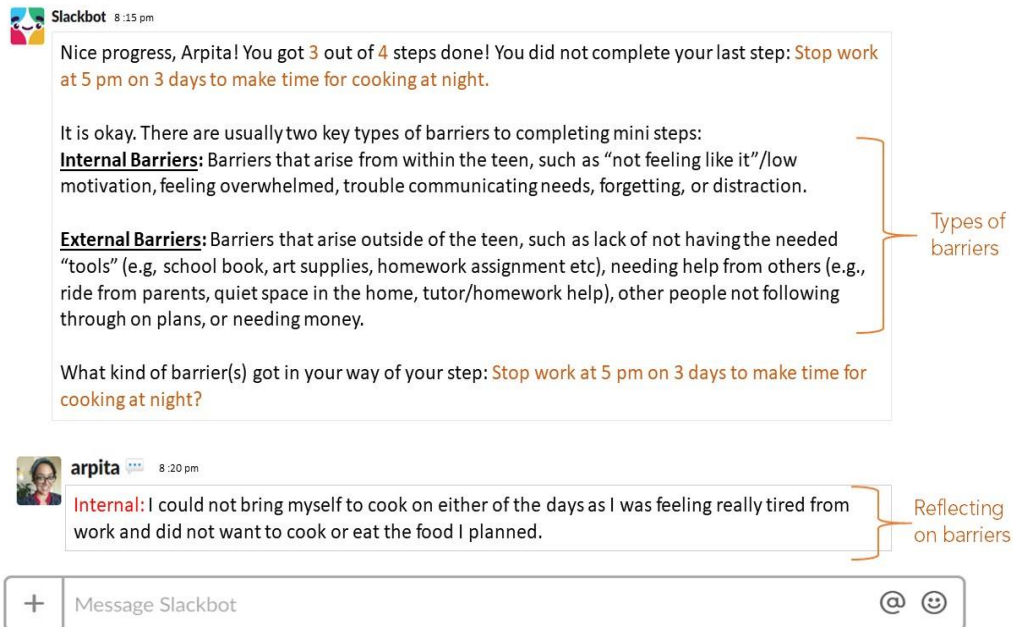
2. How did you feel?

3. What did you do?

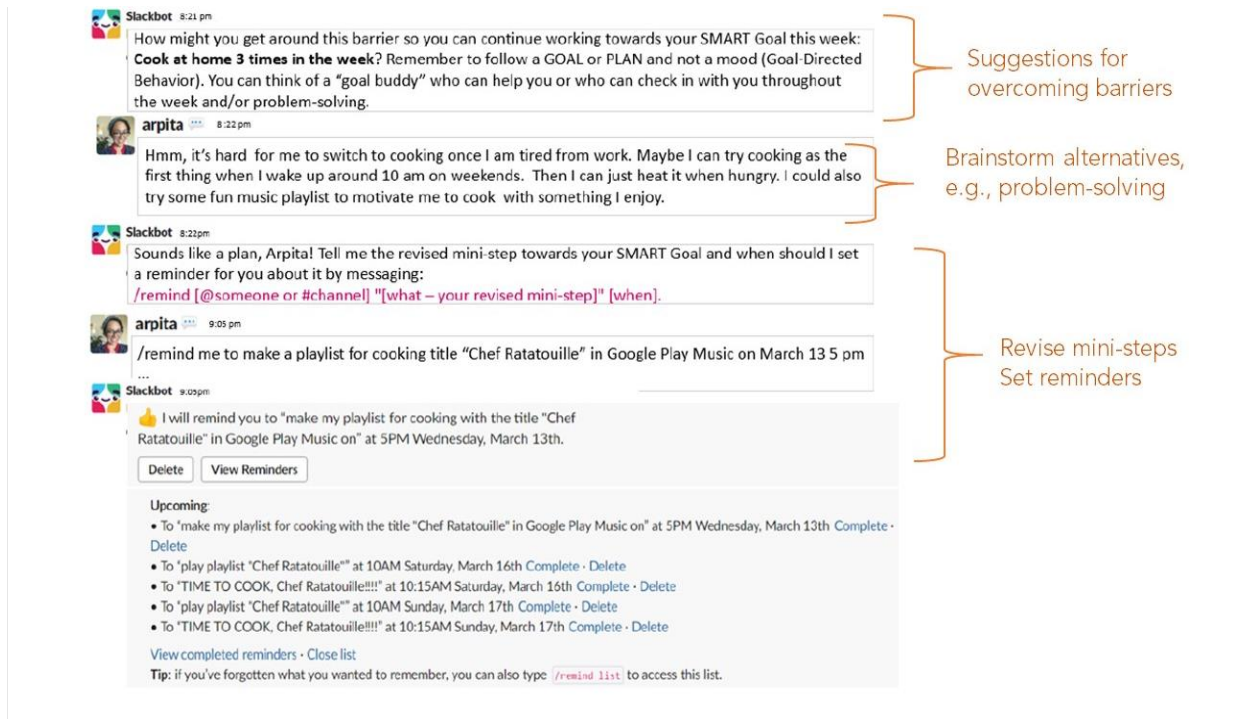
4. Did you feel better or worse?

Next

Figure 6: Mock-up for online survey-based adaptation of the Downward spiral module in BA



(a)



(b)

Figure 7 (a-b): Mock-up for interactive chat-based support for overcoming barriers to SMART goals (Week 9) (Slack username corresponds to author name used for testing purposes)

4.2 METHODS

We conducted two separate ARC studies on Slack with 10 mental health clinicians (labelled C21–C29, C210, including therapists, primary care, and school counselors), who work with depressed teens, and 8 teen participants (labelled T21–T28), between 15 and 19 years of age who experience mild-to-moderate symptoms of depression. Our aims were to understand (1) current perceptions, strategies, challenges, and technology use of teens and clinicians in managing depression and (2) their design ideas for adapting BA to online platforms that support an ARC approach to intervention. Clinicians were recruited through snowball sampling of the researchers' network. To recruit teens, we contacted participants from study 1 [10] who agreed to be re-contacted, posted flyers in clinician participants' clinics with their permission, and used snowball sampling.

4.2.1 *Participants*

Ten clinician participants started the study, with eight completing all online activities. All clinicians (n=10) were from urban or suburban areas in Seattle and Kent, WA (Table 5) and eight had prior experience using BA with teens. One clinician dropped out in Week 4 (due to a family emergency) and another dropped out in week 7 (due to difficulties with using the Slack platform) (Table 5). Eight teenage participants started the study and four teens had dropped out by Week 9 (without providing specific reasons). All teen participants identified as female (Table 6) and were from rural, sub-urban, and urban regions across the United States.

4.2.2 *Survey Measures*

At the start of the study, teens completed the Patient Health Questionnaire-8 Adolescent scale (PHQ-8 -A) [81]. While some teens did not identify with having experienced clinical levels of depression (n=1), all teen participants had mood ratings on the PHQ-8 in the 5 (mild depression) to 14 (moderate depression) range (mean = 8.87). In the post-study surveys, we asked all teen and clinician participants to complete the *Acceptability, Intervention Appropriateness, and Feasibility of Intervention Measure* [108] and *User Burden Scale* [101] surveys to determine participant approval of and burden of using BA delivered through ARC.

4.2.3 *Online Group Activities*

We conducted 10 weekly activities in the clinician group followed by 10 weekly activities in the teen group (Table 4), each designed to take 20 minutes to complete. The groups were moderated, and all clinician and teen participants selected a pseudonym to use as their username on Slack to protect their privacy.

4.2.4 *Post-Study Interviews*

To learn about clinician and teen participants' experience with depression treatment, the ARC method, and further explore ideas for implementing BA via an ARC platform, we conducted 30-40-minute exit interviews and surveys with 9 clinicians and 5 teens who were willing to be interviewed between June and August 2019. All interviews were audio-recorded and professionally transcribed. We provide our study protocol in Appendix B.

Table 5: Summary of demographic details of clinician participants in study 2 (n=10)

Age	31-50 years (Mean = 39 years)
Gender	Female: 7, Male: 3; Non-Binary: 0
Education level	Graduate education: 7, Professional degree:3
Race / Ethnicity	White: 8, Asian: 1, Hispanic: 1
Household Income	\$50k to \$75k: 4, \$100k to \$150k: 2, \$150k to \$200k: 1 \$200k or more: 3
Region	Urban: 8, Sub Urban: 2 WA: 10
Client base and setting	Teens and pre-teens with depression (11-18 years): including school counseling, community clinics, pediatrics, primary care, immigrants and refugees.
Experience with evidence-based practice	Cognitive Behavioral Therapy (CBT): 8 Behavioral Activation (BA): 8 Mindfulness Based Approaches: 6 Dialectical Behavior Therapy (DBT): 4 Interpersonal Psychotherapy (IPT): 3 Acceptance and Commitment Therapy (ACT): 2 Other: 3

Table 6: Summary of demographic details of teen participants in study 2 (n=8)

Age	15-19 years (Mean = 17.5 years)
Gender	Female: 8, Male: 0; Non-binary: 0
Education Level	College education with degree: 1, Some college education but no degree: 2, High School: 2, Less than High School: 3
Race / Ethnicity	White: 5, Asian: 1, More than one race: 1, Did not disclose: 1
Household Income	\$35k to \$49 k:1, \$75k - \$100k: 1, \$150k to \$199k:1 \$200k or more: 2, Did not disclose:3
Region	Rural: 1, Sub-urban: 2, Urban: 5 WA: 5, PA: 1, IW: 1, NY: 1
Therapy Experience	Received treatment for depression in the past: 6, In treatment during the study: 5

4.2.5 *Data Analysis*

We calculated average scores of PHQ-8 [81], each question of the Acceptability, Intervention Appropriateness, and Feasibility of Intervention Measure [108] for the clinician group and teen group, respectively. For the User Burden Scale [101], we computed average scores of teens and clinician groups separately across each of the 6 constructs – physical, mental & emotional, time & social, financial, difficulty of use, and privacy. Two researchers inductively analyzed all the qualitative data each week from the clinician and teen groups and the interview transcripts by developing codes. Both coders reviewed the codes, discussed any discrepancies in coding, prepared a code book (Appendix H), and wrote memos. We discussed the results with the entire team and used our research aims to guide an affinity diagramming process [46] through which our final two themes emerged.

4.2.6 *Ethical Considerations*

Important considerations for using ARC with minors include maintaining privacy and confidentiality, ethical handling of adverse event disclosures online (such as suicidality, abuse, or harassment), and possibility of distress for others in a group setting. We obtained emergency contact information of an adult from all teen participants and informed the teens that this person would be contacted if they disclose medical emergencies and/or concerns of harm to self or another. With the consent forms, we asked participants to review group guidelines and pinned it on the Slack group. We explicitly stated on the consent form, group guidelines (Appendix D), and on the first day of activities that we are not professional counselors but are willing to listen to grievances and provided them with 24x7 helpline numbers to reach out to professionals such as Teen Link and the National Suicide Prevention helpline. We had protocols for online

disclosures of adverse events (Appendix E) and child abuse (Appendix F) in place for the research team. Teens were informed that if they contacted the moderator with questions or concerns, they could expect a response within one business day. Both the clinician and teen groups were monitored by a moderator who had the ability to contact a licensed psychologist with doctoral-level training in child clinical psychology (Dr. Jessica Jenness) if any safety or emergency concerns arose. Moderators read all the posts, monitoring for concerns of safety and emotional distress, and reached via email or Slack private message in case of concern. No immediate risks of physical harm or abuse were disclosed during the study.

4.3 RESULTS

At the start of the study, teens and clinicians were asked their preference for a short (4-6 weeks) or long format (12 weeks) of BA. The majority of teens and clinicians voted for the short format, so we tailored our design activities to a short BA format. Though we focused on four modules of BA, we spread out the activities over ten weeks as we allocated time for feedback and reflection from participants on multiple versions of the prototypes as explained in Table 4. We observed that teen participants started dropping out around Week 5. The 5 teens who completed activities on 9-10 weeks and were interviewed at the end of the study said they wanted the long format to be able to familiarize with, learn, and practice BA strategies. The preferences of teens and clinicians for the format of the delivery of online BA interventions and specific features are summarized in Figures 8 and 9. Below, we explain two themes that emerged from our analysis of needs of teens and clinicians for online support in managing mood and depression: (1) balancing needs for augmenting human connection and asynchronous BA support and (2) need for boundaries around asynchronous online support.

4.3.1 Balancing Needs for Asynchronous BA Support and Augmenting Human Connection

When presented with the idea of including an automated chatbot application on the online platform, both teen and clinician participants perceived the role of the chatbot as an interactive platform for learning, self-reflection, supplementing resources when therapists are not available, and supporting treatment planning. Interactive asynchronous activities included engaging with psychoeducational videos, tracking mood and activity, self-reflection, planning, and check-ins.

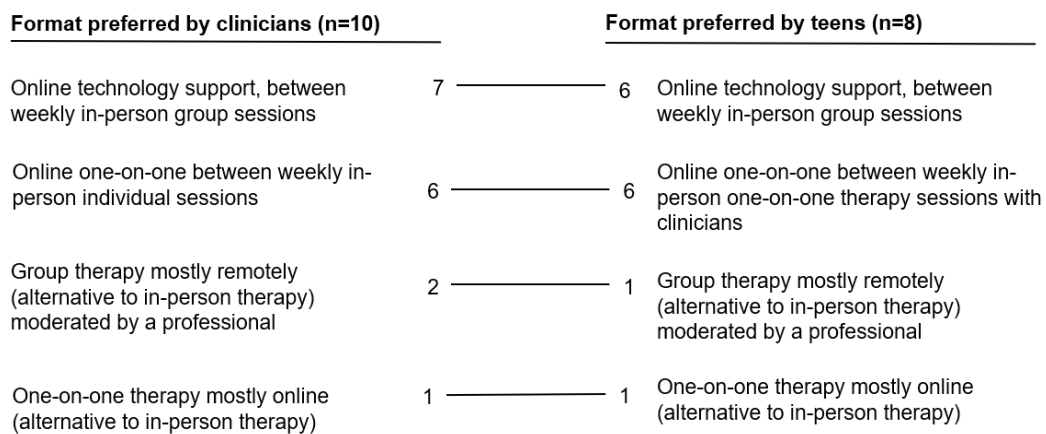


Figure 8: Preferences of teens and clinicians for format of online delivery of BA (individuals could select more than one). The values represent the number of teens and clinicians who voted for the respective formats. Trend lines connecting them illustrate the similarities in preferences of clinicians and teens

Interactive Learning: We presented mock-ups of online surveys and chatbots as self-help technological adaptations of homework activities for BA. Clinicians expressed the need for including interactive and culturally- and generationally relevant features (such as gifs and emoticons) to increase engagement with teens. Both teen and clinician participants appreciated the use of chatbots and their potential for responsiveness and interactivity, step-by-step guidance, availability always, ability to store and post lists of relevant information, and add explanations

and reinforce motivation. Clinicians also perceived that teens would find it engaging and “*be into it*” (C28, Clinician). Clinicians brainstormed how a chatbot could provide additional information to support teens that clinicians might miss or not have time to discuss during short appointments.

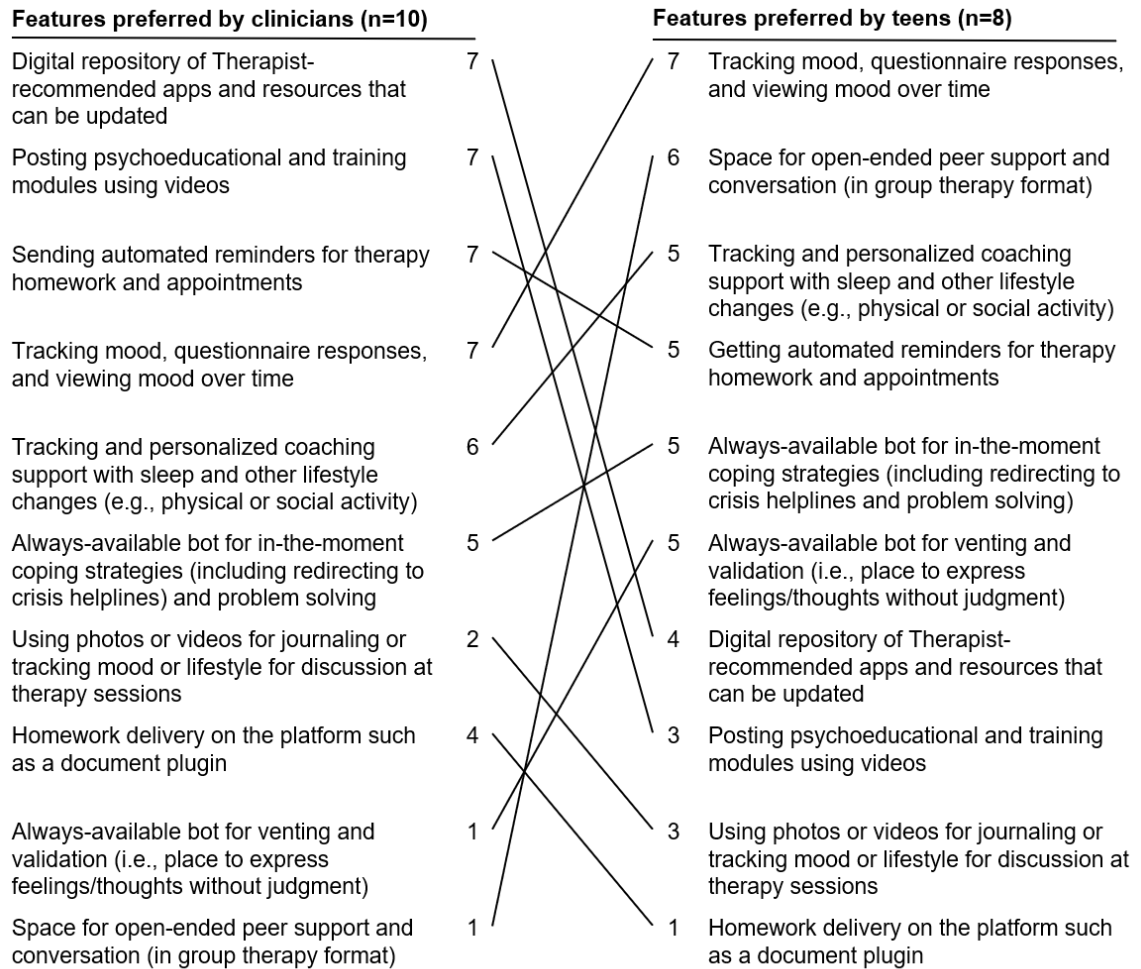


Figure 9: Preferences of teens and clinicians for features for online support. The values represent the number of teens and clinicians who voted for the respective features. Lines facilitate comparing ranking of preferences of clinicians and teens.

Support Self-Reflection: Teens found the private online survey format to be simple, clear, and helpful to illustrate BA concepts by applying written examples from their own context. They explained that the prompts in the activity on upward and downward spiraling of mood (*what*

happened, how did you feel, what did you do, how did that make you feel) helped structure their thoughts and helped them reflect. They also found it to be a good balance between journaling both positive and negative effects of action on mood. Two teens also found it helpful that the BA prompts forced them to write about and focus on a specific situation:

I think sometimes I can get overwhelmed with emotion in situations, and it really helps to take a breath and think, what triggered me? How did I feel? And how can I avoid feeling this way in the future? Writing out “I felt sad, mad and overwhelmed” really helps me process the emotions I felt! – T24

Clinicians highlighted there should be some way for teens to record how they are feeling or their mood at a specific time and then get prompted to do something that could possibly *help them in-the-moment* to alleviate symptoms.

Planning Support: Planning and executing SMART goals is a crucial aspect of BA. To learn about SMART goals and have an option where teens could interact with other teens, a moderator created four small chat groups with herself and two randomly paired teen peers on Direct Message (DM). We asked each teen in the pair to share a SMART goal, provide feedback on the other’s goal, share mini steps to attain that goal, and set reminders for mini steps on Slack or on their phones. Two teen-pairs completed this activity.

T22–Thanks! My smart goal is to write five thank you cards to teachers by the end of next week.

T24 - Hi @T22! My smart goal is to clean up my room over the weekend. I think your goal is Very smart! It’s specific (writing cards), measurable (5 cards), appealing, realistic and timebound (by the end of the week), good job <two_hearts> (edited)

T22–That sounds good! And thanks so much!! I like ur goal but my one question is how will you know when you are done/how can you measure your progress?

T24 - Ooo that's a good question actually... I'll know I'm done when the entryway is cleared and everything in that area is sorted and put back!

T22- "Sweet! Very smart :))

In the other two groups, one teen posted her SMART goal and the other teen did not respond. When asked to post about barriers to attaining that goal in the next week's activity on DM, only one pair of teens completed the activity. Though we sought to foster connection and accountability, such lack of interaction can be counterproductive for this vulnerable population. During interviews, teens speculated that this problem may be addressed if we could add more activities in the beginning for teens to get to know each other. When asked if they would prefer smaller groups, teens preferred having 4-5 peers in each group, so as not to be overwhelming and still enough social capital if some are not participating. During interviews, one teen explained that the SMART goals she and her partner selected were trivial and it would be more beneficial if they could select more appropriate goals that would benefit their mood. As they could not tell if the partner accomplished the goal other than through self-report, she said it did not help hold herself accountable. Another teen explained that they liked to work independently. Therefore, it is important to preserve a space where teens can practice and learn on their own. A clinician suggested adding digital rewards in the self-help mode if they indicate completing mini steps.

I like the chatbot mockup – I would have it programmed so that with each mini step completion they get some kind-of visual reward like fireworks or a gifhy if they complete

all of their steps. Even if they don't there could be some kind of visual message like you got this! – C25

Clinicians also thought that they might want to offload reminders to a chatbot, automating the process of reminding teens to complete assigned materials or activities.

Augmenting Human Connection: Most teen and clinician participants did not prefer an entirely remote-only format and wanted to increase access to human-human support for mental health. They critiqued the chatbot format, perceiving that it could be impersonal and increase isolation compared to formats that develop human connection. Three teens mentioned that chatbots can get repetitive, thus, it would be easy to ignore notifications.

Being in the States I often feel isolated since people value independence and not bothering others. Yet, the way to make relationships is actually through asking for help. If the robot [chatbot] or on-line discussions are made available, it seems to be reinforcing the isolation. – C26

Five clinicians and six teens wanted one-on-one online support in addition to in-person therapy (Figure 6-7). Teens explained they wanted to preserve the face-to-face format of therapy but felt the burden of time, transportation, cost, and frequency of weekly therapy visits. They said they would prefer online video chat or phone calls to connect with therapists over replacing in-person therapy entirely with asynchronous chat.

I think my challenges would be feeling lonely with a lack of human connection (especially in talking to a chat bot). I would be willing to try it, but I believe I might begin to feel isolated if the only thing that I can talk to/will listen is a programmed robot. – T25

Six teens preferred a group support format online in addition to one-on-one therapy. At the end of the study, teens mentioned that learning strategies from each other and building off each other's ideas was helpful on the Slack group. When asked what they were looking for in peer support, they elaborated: empathy, a platform to share struggles and be "heard" by a human, benefits in the ability to express themselves in writing or talking out loud, and relating to shared experiences of a peer who is going through similar difficulties.

Social media shows the highlights and the best moments and it's hard to remember that nobody's life is perfect. Having a platform where you can discuss your problems and give advice is refreshing. – T26

Clinicians also highlighted the need for an online platform where their teen clients can interact with peers (who have similar struggles and cultural backgrounds) who may be difficult to access in their offline circles. A school counselor, who worked with teens that were primarily immigrants and not fluent in English, requested different languages for delivering the treatment and connecting the minority population with similar peers online.

For example, if I'm seeing an Arabic speaking kid, if there is an Arabic speaking group online, I think it would be really helpful to have an additional group where he can connect with other people in their own native language. There's psychoeducation, there's a little learning, there's encouragement from his peers. I think it's great, because I think in a way it probably will help connect with people, he's not able to connect with in our school because there is not enough people in counseling, or open to counseling who also speak Arabic. – C26

Thus, participants emphasized the need for augmenting human interactions by increasing therapist-teen interactions and peer interactions using an online platform.

4.3.2 *Need for Boundaries around Asynchronous Online Support*

The concerns of clinicians and teens in using Slack during our study centered on the need for boundaries around privacy, safety during crisis, and time burden on clinicians due to asynchronous access. They anticipated these concerns for using any online platform for delivering mental health therapy.

Privacy: In our study, teens wanted to remain anonymous in the group and did not want to share identifying information such as real names, email, or phone number. We had asked all participants at the start of the study to de-identify (such as remove names, blur pictures) or not share any identifiable information about themselves and not share information about others outside the group even if they knew the participant in-person. During interviews, all teens expressed that these guidelines helped reduce their concerns with sharing in the group. However, two teens expressed concerns about their data being shared with people who were not a part of the group. These invisible audiences included a parent potentially finding and reading information on the group and the online company's policy around sharing data with a third party.

Some parents might be more intrusive— or I feel like that could be a problem for some people who might be concerned that their parents would go and— if it was text-based go see what they've been saying and stuff like that. – T21

Oh my God, yes, a thousand [privacy] concerns. I think that is really hard to trust online services to not sell your data. And I'm with therapy, sometimes it's super confidential. So

I think that it's different from person to person—my concerns would be about tech companies sharing my data. – T22

In contrast to this preference for *external* privacy, some teens felt there was a lack of reciprocal interactions between peers *within* the group. Teens attributed this to the inability to know other teens in the group on a “*personal level*”, i.e., sharing their interests and values, while remaining anonymous. Although it was attributed to the lack of personal connection, Slack not being a part of the teens’ regular social media use could have also contributed to this less frequent interaction.

Although participants took measures to remain anonymous, Slack does not offer end-to-end encryption or HIPAA protection for personal health data that is shared on the platform. Clinicians brought this up as a major issue. They explained that if such a platform were to be adopted by their clinical institution in the future, it had to be HIPAA compliant.

Safety: The second major concern discussed by both teen and clinician participants was on the physical and emotional safety of teens on the online platform. As the format of discussion is asynchronous, the current online group is “available” or accessible by teens at all times. Clinician participants were concerned about unnoticed posts at non-working hours that need urgent attention such as suicidality or self-harm. They were also concerned about secondary exposure to distress and sharing and learning unhealthy or maladaptive coping behaviors in a peer group format.

Issues around teens messaging a therapist when a therapist isn't available to respond—like if the teen posts at 2am that they are feeling suicidal and nobody sees it until the next day. – C23

I would be concerned about how teens' interactions would be monitored/shaped in an anonymous group... I would want to think more about safety concerns (e.g., suicidality) and how to communicate about this in a timely, safe, and not overly reactive manner. – C24

Some clinicians wanted the chatbot to be programmed to identify words related to crises such as suicidality and alert a human who can help or provide a list of resources to the teen.

Teens brought up similar concerns of being triggered by others' difficult experiences and not being able to share or minimizing their struggles if they felt their experience was not as difficult as someone else's in the group.

The problems may be that hearing about others problems more regularly thanks to the openness and limitless-ness of a chat format could have an effect on one's own mental health, especially if the chat ends up just being a place to rant and only has negative thoughts filling it up, instead of any productive or supportive conversation. – T21

One challenge/problem is that people who have mood disorders/depression might exacerbate someone else's hardships if they're having a bad time. For instance, if John is really depressed and talks about his problems at home, Joe might not feel like he can talk about his own problems because they aren't as "bad" as John's. – T23

Clinicians felt a need to always be available online for safety reasons, which would be prohibitive for their workload. They explained concerns and needs for setting boundaries and expectations around receiving and responding to crisis messages and reviewing homework submitted online.

I would also be concerned that clients would be reliant on immediate responses from me. As they do with most social media. Would have to coach them on their expectations. – C22

Clinicians expressed concerns on how they would be compensated for time spent online and reviewing homework. Some clinicians believed they would have difficulty teaching the content on an online platform in an effective manner. They also mentioned it might take more time with more monitoring or moderating the group and possibly have an extra cost involved. Clinicians acknowledged the potential benefits of the online platform for delivering treatment via an ARC format and they wanted the treatment to be as effective with less added burden on them.

A challenge that hasn't been discussed here is billing. I know it's a little unsavory to bring up, but if there are features of this system that require monitoring by a professional, then this seems like non-billable time, which in our current healthcare system is difficult to find. – C21

Overall, participants indicated low burden and high adaptability of the online intervention. The post-study survey was completed by 9 clinicians and 5 teens. On the User Burden Scale (1: not at all burdensome, 4: very burdensome) [101], participants scored an average of 1.36 (clinicians) and 0.7 (teens) on *difficulty of using Slack*, 0.4 (clinicians) and 0.5 (teens) on *mental and emotional burden*, 0.4 (both) on *privacy burden*, and 0-0.1 on all other types of burden. The interview data also reflected that the teens found no or less difficulty in using Slack compared to clinicians. One teen expressed privacy concerns about how Slack shares her data. Other teens had no concerns about privacy, and all felt comfortable sharing in the group when anonymous. The clinicians talked about issues with privacy related to HIPAA but

their score on the privacy burden was low. The average scores on the Acceptability, Intervention Appropriateness, and Feasibility of Intervention Measure of intervention (1: Not at all, 5: Very much) [108] averaged between 3.5 and 4.8, indicating high perceptions of adaptability.

4.4 DISCUSSION

Teens and clinicians both preferred the use of an online platform for psychoeducation, homework activities, check-ins, reminders, and self-reflection in between one on one therapy sessions. Both groups preferred that it not be a technology-only intervention and wanted the platform to connect teens with a therapist or peers. Clinicians recommended increasing the “human-like” conversation style of the chatbot to connect with and engage teens. However, **teens did not want a chatbot to replace or emulate a human** but envisioned its function as an interactive tool for self-reflection. Researchers have found higher preference, engagement, and reliability and quality of responses obtained through a conversational chatbot approach than a traditional approach to administering mobile banking questionnaires [14]. Prior work also highlights difficulties in using a chatbot approach that influence engagement such as the inability to handle or escalate errors in-the-wild, difficulties with scaling, perceptions of human-like responses from the bot as irrelevant or eerie by participants (also known as “the uncanny valley”), and individual preferences over the chatbot emulating human-like conversations [42,47,93]. We should consider nuances in the expectations we set for the chatbot functionalities to offload or augment human labor. As personal safety of disclosure of suicidal content was a major concern of clinicians, they considered a task-focused bot [42] would be appropriate to flag crisis posts 24x7 and escalate it to a human clinical expert. However, algorithms may not be reliable in identifying complex human language related to crisis and the posts need to be double-checked by human moderators. Both teens and clinicians preferred chatbots in the role of

intelligent assistants [42] to send and receive reminders and check-ins. Some teens expressed concerns over potential exposure to their peers' distress but neither teens nor clinicians wanted a chatbot to fulfil the roles of a virtual companion [42].

Previous research has identified the feasibility of using online platforms to support BA treatment with teens [20] alongside the need for mobile platforms to support varying usage times and patterns of tracking BA activity [83]. We addressed these needs by obtaining formative feedback from teens and clinicians on the design of an asynchronous, modular, and weekly approach to delivering multiple BA intervention components while enabling access and flexibility for teens in tracking, planning, and reflecting on their activities and mood in-situ. Based on the lessons from this study, we reflect on the aspects of the online platform, procedures used by researchers, and the format of integrating online intervention(s) with traditional therapy that need to be considered for designing future online mental health interventions.

Reflecting on our study procedures and use of an online platform that supports ARC, changes to the structure and facilitation of the online group may help to balance the need for human connection with safety in a peer group format. These changes include limiting the time of access to the group, an always-visible and easy to reach helpline button, distributed moderation, good moderation policies and communication of those policies, and/or automated in-the-moment crisis support. When deciding on a platform for ARC to deliver mental health interventions, we list the requirements for consideration by administrators or moderators (Table 7). Though Slack was a helpful tool, researchers might consider alternatives such as Microsoft Teams (HIPAA compliant but not anonymous), Discord (supports anonymity) [56], Group Me, or a custom-built

online platform, which can still allow the option to be anonymous on the group while being intuitive, familiar to teens, and able to organize and present content.

The online asynchronous group format introduces *moderation burden* both in terms of time and effort related to monitoring for crisis support and adverse events. This was a concern for the majority of clinicians and also is prevalent in volunteer-moderated online groups [89]. To support participants in reaching moderators efficiently, platform must have clear, discoverable methods for teens to connect with individuals moderating a group. Chatbots can also be designed to assist moderators by flagging content that needs to be reviewed by moderators and responded to in an urgent manner.

In our study, both teens and clinicians wanted to leverage advantages of increased access to mental health care through an online platform that supports an ARC approach to intervention delivery. Different care models that may lend themselves particularly well to the integration of the ARC format for treatment delivery with traditional therapy, including stepped care [100], supplemented traditional care, and after-treatment care. For example, supplemented traditional care could include weekly online modules on a platform like Slack during traditional therapy to decrease the amount of in-person treatment sessions and support teens in their therapy goals, help with homework completion, and answer questions between in-person sessions. Through our work, we highlight the need to integrate and support human infrastructure and digital technologies for teen mental health. By involving teens and clinicians early in the design process and presenting an empirical understanding of their needs, we hope to reduce the gap in navigating design tensions in online and accessible mental health care.

Table 7: Important requirements from online platforms and moderators or admins for asynchronous remote mental health interventions

	Support & Limitations of Online Platforms
Access	<ul style="list-style-type: none"> • Users should be able to access the platform on both computers and mobile phones to be able to use it in their context (e.g., at school, at home, between work). Having both a browser option and an app option helped participants who did not want to install anything. • There is no additional cost for installation
Privacy: Anonymity	<ul style="list-style-type: none"> • Users should be able to use pseudonyms when signing up. • Administrators should have the option to hide emails and other personal identifiers on the online platform.
Privacy: Healthcare	<ul style="list-style-type: none"> • Trying to attain HIPAA compliance would be the gold standard. • If HIPAA compliance is not possible, make sure that teens are anonymous, are not interacting with clinicians, and/or are in separate groups in a study. • Consider the scalability of using the platform in the real world with clinics.
Safety	<ul style="list-style-type: none"> • Online platform should allow pinned posts with 24-hour helpline numbers for crisis support accessible at all times • Participants should be able to access moderators via direct messaging. Need clear affordances for group participants to contact moderators and helplines. • Set expectations about moderator hours and response times (e.g., expect a response within 24 hours on weekdays). • Have access to clinician researcher(s) or clinical support (e.g., partnering with local clinic) on group and have an adverse events protocols in place for crisis response • Moderators can be supported with Chatbots to help them filter adverse events and alert them on urgent issues
Group norms	<ul style="list-style-type: none"> • The online platform should have affordances such as pinned posts or side bars with “always accessible” group expectations, guidelines, and norms
Creating apps and bots	<ul style="list-style-type: none"> • Online platform should have a public API to create and add bots and apps
Exporting data	<ul style="list-style-type: none"> • API of the online platform should allow exporting data
Content organization and navigation	<ul style="list-style-type: none"> • For unfamiliar platforms, moderators need to add tutorial videos and organize content so that people who join in late or miss certain weeks can trace it back and respond. Potential workarounds include: • Each week’s activity can be on a separate channel or group • Screen record tutorial videos and talk through functionalities such as threads, channels, formatting.

Chapter 5. FEASIBILITY STUDY OF USING GUIDED ARC FOR TEEN DEPRESSION MANAGEMENT

To support teens with managing depression using technology, we need to account for avoidance and lack of motivation which are two characteristic symptoms of depression and interfere with engagement [66]. I developed an application on Slack – called ActivaTeen – based on participants’ feedback in study 2 to test the feasibility of using ARC to deliver guided weekly BA interventions. With concepts of BA, we used design recommendations of Fleck et al. [34] to support the four levels of reflection by using technology to record data, prompt questions, make data visible to “see more”, and scaffold co-reflection to intentionally design ActivaTeen for supporting reflection and to form our codebook to analyze the data. We used the interactive style of chatbot to explicitly support inquiry and facilitated social reflection through human support of clinicians and peers to encourage goal planning and transformation [8,95].

To understand the feasibility of reviewing mood and activity tracking data asynchronously and identify therapeutically relevant information, we⁶ added clinicians and clients in direct messages to discuss the summary of teens’ data after two and four weeks of tracking. All teen participants were enrolled in a private group with teen peers so they could share personal interests, relate to experiences of depression, share reflection on weekly activities, share SMART goals, and provide each other feedback on their SMART goals and barriers. In this study, we aimed to answer the following research questions:

⁶ Study 3 collaborators: Ria Nagar, Dr. Jessica Jenness, Dr. Sean A. Munson, Dr. Julie A. Kientz

(RQ4) How do teens and clinicians engage with the guided ARC intervention using BA for coping with depression?

(RQ5) What are the opportunities and challenges in designing guided ARC intervention using BA for teens coping with depression?

(RQ 5.1) What were the benefits and challenges of teens and clinicians in using the guided ARC intervention using BA for coping with depression?

(RQ 5.2) What changes did participants envision in the design of guided ARC intervention using BA for coping with depression?

We found that engagement of teens varied at the individual level and we present a case-by-case account of how each of the nine teens engaged with the BA modules followed by usability metrics and qualitative feedback on participants' overall experience with guided ARC. Next, we present the results from analysis of the design needs of reflection, reducing avoidance by providing structure and adjusting teens' perception of control, and scaffolding social support from clinicians and peers. I discuss the considerations for designing teen mental health by accounting for avoidance in teens with depression, accounting for mismatches in logging data and actual behavior, and integrating guided ARC in clinical practice. In this study, our main contributions are developing an empirical understanding of the feasibility of using an asynchronous system that might support teens with depression in conjunction with therapy and understanding the potential for combining the EBPI of BA with the ARC method to integrate peer support and clinician support.

5.1 DESIGN OF ACTIVA TEEN MODULES

Video for Psychoeducation on BA: To introduce BA to teens, we created an animated video [125] that follows the style of showing real time whiteboard drawings. The content for this video was prepared by storyboarding iteratively and was led by our teen volunteer. We obtained feedback from two clinicians who are experts in BA and the visual design and video-making was outsourced to a freelance Undergraduate designer.

ActivaTeen: Based on feedback from teens in study 2, we designed an application on Slack called ActivaTeen in the format of an interactive smart diary. We did not aim to simulate human conversation through ActivaTeen but intended for teens to reflect through interactive prompts sent by the bot. This expectation was set for the teens at the start of the study. We incorporated four main modules of the short format for BA into ActivaTeen: (1) logging prompts for activity and mood tracking and interactive modules for (2) a conversational module to prompt teens to reflect on upward and downward spiral, (3) an interactive module for planning SMART goal and mini-stems, and (3) a conversational module to reflect on barriers to SMART goal.

I built the **backend** of the app using the Slack API, Javascript, and Node js building the modular functions for each BA module (Figure 10) on the open source botkit library⁷. The Node js application was hosted on Heroku⁸ and data was stored in Amazon AWS server S3 buckets⁹ in

⁷Botkit: <https://botkit.ai/>, Github code: <https://github.com/howdyai/botkit>

⁸Heroku: <https://id.heroku.com/login>

⁹AWS: <https://aws.amazon.com/>

JSON format. I parsed and cleaned the data using Python scripts and prepared the visualizations summarizing teens' logging data using Tableau¹⁰.

Preliminary Testing with Expert Designers: In February 2020, we invited four Masters' students in HCDE as expert designers to conduct preliminary user testing and cognitive walkthroughs of the Slack app for 7 weeks. Each week, we conducted an in-person meeting and asked designers to try out the respective activity on Slack for 20 minutes while two researchers observed them. We then conducted a focus group for 40 minutes to discuss the designers' experience, challenges, and changes they want in the design. Designers were also asked to log their mood and activity for 3 weeks while obtaining intermediate feedback on design changes each week. Key changes were made to the interface to support adding context for logging activities and mood, understanding psychoeducational content, and visual representations of mood logging data. We also asked our volunteer teen and two teens and a clinician from prior studies to remotely test and provide feedback on the four ActivaTeen modules via a survey or email. The final design and functionality of the modules are explained below.

In the logging activity (Figure 11 a), we asked teens to log one *activity* they did in the past 3-6 hours, the *type of activity*, how they were *feeling* during the activity, and *intensity* of the feeling (Figure 1). The nine types of activities included everyday activities, hobby, physical activity, relaxation, school, socializing, work, and other. After week 6 when they planned a SMART goal, a category of goal was added. Options for feelings were based on the circumplex model of affect [85] which included positive (content, relaxed, focused, happy, excited), neutral, and negative (angry, overwhelmed, depressed, anxious, tired, sad, bored) valence. Teens could

¹⁰Tableau: <https://www.tableau.com/>

log the intensity of their feeling ranging from 1: least intense to 10: most intense. After feedback from expert designers, we added a text box for teens to freely journal any additional context that may be relevant to the activity or how they were feeling.

1. In the activity reflecting on **upward and downward spiral**, teens were prompted to think about an activity in the week that brought their mood down and up. In a conversational style, they were asked by the app to respond to: what happened, how they felt about it, what did they do as a result of feeling that way.
2. In the module for planning **SMART goals**, to support teens with generating ideas for goals, we showed teens examples of SMART goals and mini steps and added suggestion cards for 6 types of activities: hobby, everyday activities or chores, socializing, relaxation, do less of something, and physical activity (Figure 11 b, 12).
3. In the activity for **overcoming barriers**, the conversational design of the app guided them by asking them what barrier(s) they encountered in completing their mini steps (Figure 13), educating them about the internal and external types of barriers with examples (Figure 14), and asking them to plan how they would overcome these barriers. I designed suggestion cards for both internal and external barriers with an intent to help teens brainstorm ideas and adapt it to what was feasible in their context. The teens could then plan their SMART goal by being directed to module 3 with revised mini steps for overcoming barriers.
4. **Crisis response:** In the text boxes and Slack messages where teens could enter free text (such as entering activity or context when tracking, upward/downward spiral), I programmed the app to detect 23 keywords and phrases related to suicide, abuse,

violence, and self-harm. The app would immediately send the teen helpline numbers as a follow up response and send all the moderators a direct message with who typed crisis text and the text that was typed. These keywords and phrases were chosen after discussions with our expert clinician collaborators and teen volunteer. This allowed us moderators to pay attention to what was imminent and address any concerns (Figure 15). This functionality provided a base level of monitoring for teens in crisis and it can be improved with natural language processing techniques. We primarily relied on human moderators reading through all posts within 24 hours on business days.

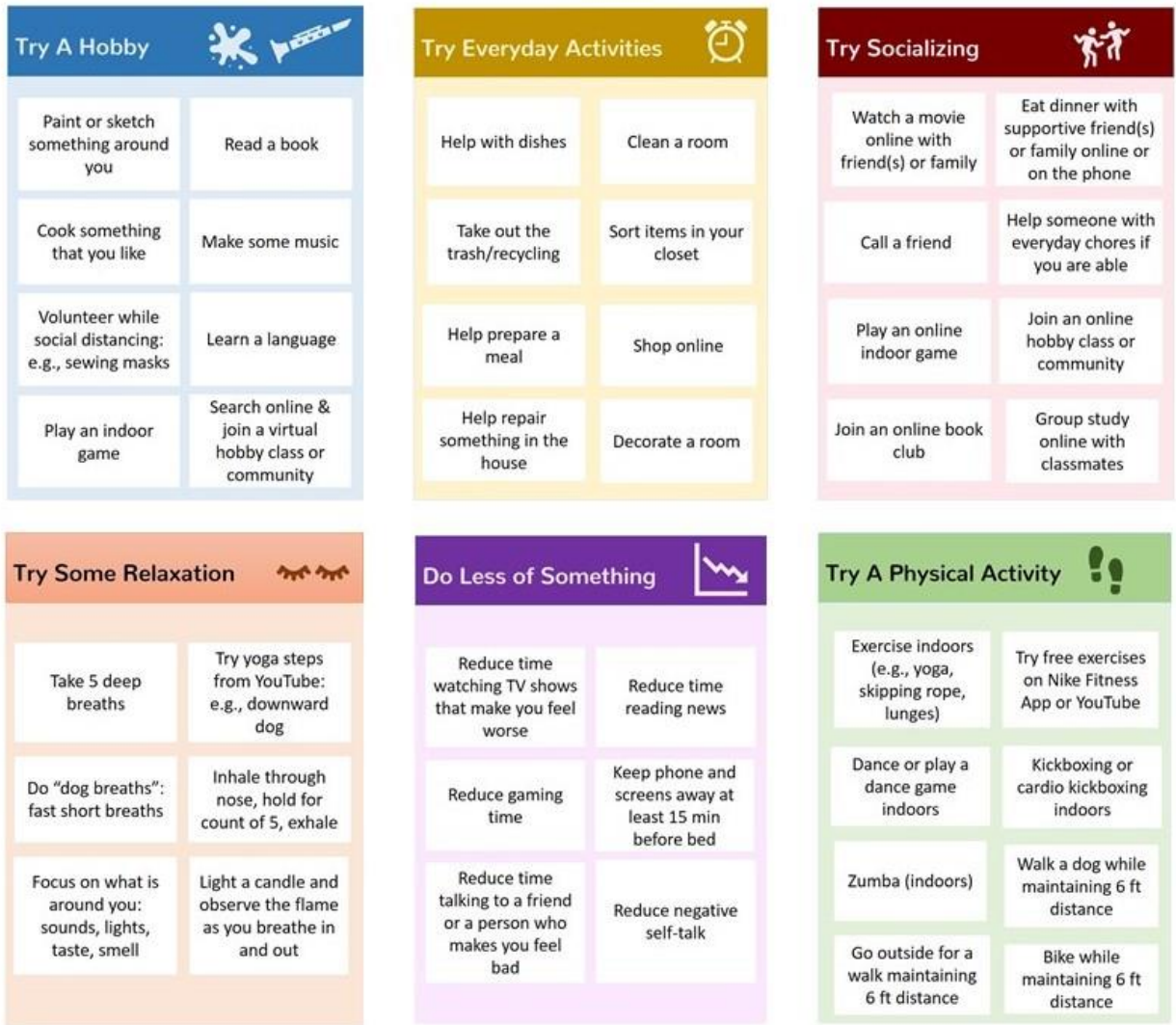


Figure 10: Four modules of BA supported by ActivaTeen

(a)

(b)

Figure 11: ActivaTeen UI for (a) logging activity, feeling, intensity, and journaling context, (b) planning SMART goals and mini steps



(a)



(b)

Figure 12: (a) Suggestion cards for SMART goal activity and (b) annotated example of a SMART goal

Hi! What was the barrier in completing your SMART goal?

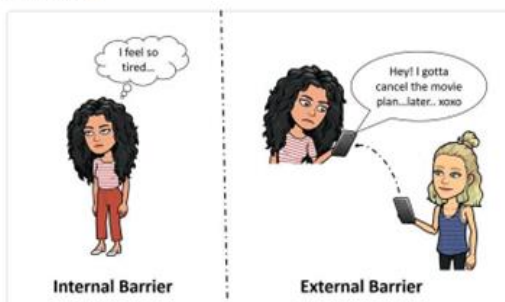
arpita 3:10 PM
i felt so tired

ActivaTeen APP 3:10 PM
Thank you for sharing! There are usually two key types of barriers to completing mini-steps: **Internal** & **External** barriers.

Internal Barriers: Barriers that arise from within yourself such as not feeling like it or low motivation, feeling overwhelmed, trouble communicating needs, forgetting, or distraction

External barriers: Barriers that arise outside you, such as not having the needed tools, needing help from others, other people not following through plans, or needing money.

(171 kB) ▾



What type of barrier got in your way: internal or external?

arpita 3:10 PM
internal

ActivaTeen APP 3:10 PM
Examples to reduce

- **internal barriers:** set a goal with a buddy
- **external barriers:** ask parents or friends for help (264 kB) ▾



Figure 13: ActivaTeen module for overcoming barriers activity (Slack username corresponds to author name to respect anonymity of participants)

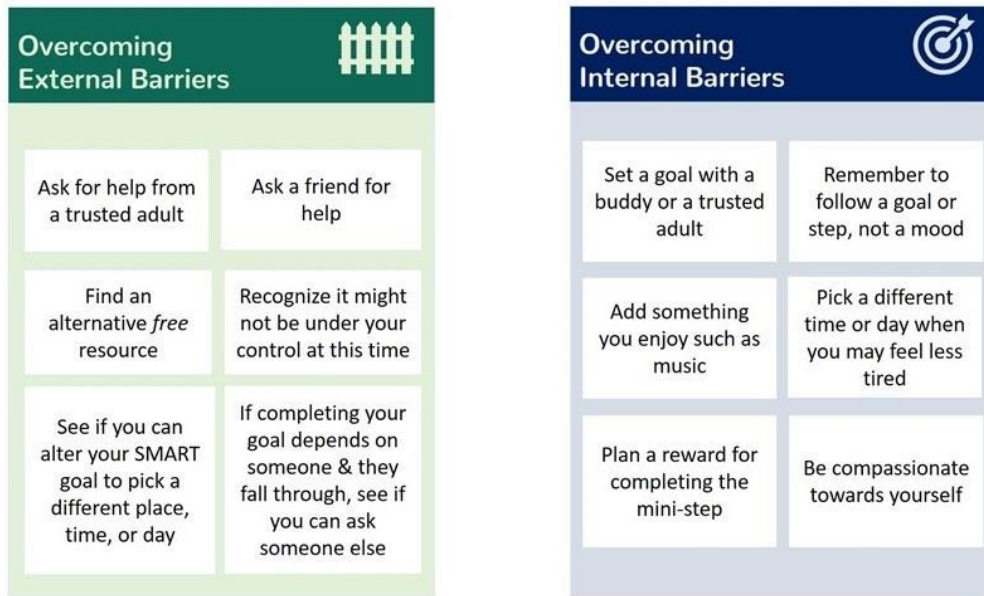
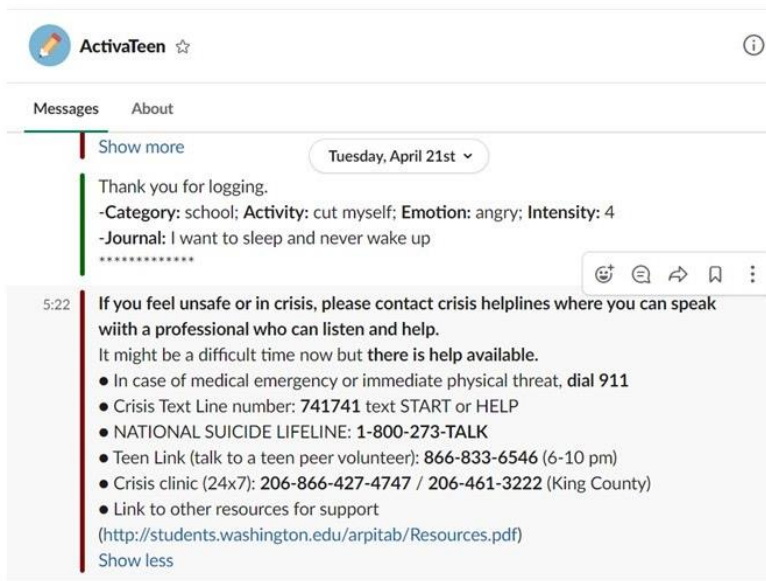
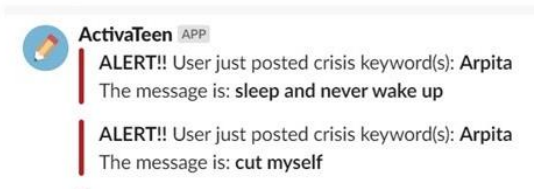


Figure 14: Suggestion cards for overcoming barriers to SMART goals

Trigger warning



Automatic direct message sent from ActivaTeen to moderators



Automatically generated text with list of crisis helplines

Figure 15: Crisis response in ActivaTeen (Slack username corresponds to author name used for testing purposes)

5.2 METHODS

5.2.1 *Recruitment*

We started this study during the on-set of the COVID-19 Pandemic in the US. Between February and March 2020, we reached out to an in-person BA depression management group for adolescents at a hospital. Later in May 2020, the BA group transitioned to an online synchronous format due to the Pandemic. We advertised our study in the online group, sent messages and flyers to clinicians, and snowball sampled through researchers' network of parents with teenagers. We directed interested teen participants to fill out a screener survey with contact information, PHQ-8 A questionnaire [81], and if they are currently seeing a therapist or have seen a therapist in the past. Clinicians were recruited through researchers' contacts. Participants were compensated with \$10 on completing each week's activity and \$20 for completing the exit interviews. All study activities were conducted between May 26 and August 17, 2020.

5.2.2 *Participants*

Eleven teens consented and joined Slack but one of them did not complete any activities (labelled T31–T41), two others dropped out after week 1 and week 4, respectively. Nine teens completed the online activities (Table 8), seven teens completed the exit interviews, and five teens completed the exit surveys. We obtained logging data from 9 teens. One teen dropped out after week 4 and another participated selectively from time to time as she was struggling with her mental health which is important to consider in this type of study. The pre-study PHQ-8 scores of teens were between 6 and 19. Five teens were seeing a therapist at the start of the study and two had a therapist and/or depression treatment in the past. Three clinicians (labelled C31–C33, Table 9) were recruited at the start of the study and two of them dropped out from the study in

week 3 and week 5, respectively. Clinicians and teens dropped out of the study due to personal life challenges, transitions, and difficulties with keeping up (which may have also been aggravated due to the pandemic). Two teens (T36 and T39) explained depressive episodes and lack of motivation as reasons for not being able to do the study activities. C32 struggled with using Slack and left in week 2 and C33 quit the study in week 4 without further communication.

Table 8: Summary of teen participants’ demographic information in study 3 (n=9)

Age	13-19 years (mean= 16 years)
Gender	Female (n=4), Male (n=4), Non-binary (n=1),
Education level	Some high school (n=5), Some college (n=1), No response (n=3)
Race	White (n=5), Mixed (unspecified) (n=1), no response (n=3)

Table 9: Summary of clinician participants’ demographic information in study 3 (n=2)

Age	29-41 years
Gender	Female (n=3)
Number of years of clinical experience treating teens	5-12 years

5.2.3 Study Design

We started with an outline for 6 weeks and discussed progress and preliminary data each week to finalize the activity for next week for clinicians and teens. The content for each module is explained in Table 10 and protocols are in Appendix C. We then conducted online group activities on Slack with clinician and teens for 8 weeks.

Online group activities: In weeks 1 and 2, clinicians and teens were enrolled in the same Slack group. They were provided a short tutorial on how to use Slack features, asked to introduce themselves with ice-breaker questions, and asked for feedback on the BA video. The clinician

and teen groups were separated in week 3 as we wanted them to be able to reflect on their own accord without the influence of clinicians.

Both teens and clinicians were asked to track their mood and activities in week 3 and reflect on their experience in week 4 in their respective groups. The teens continued tracking activities for 5 weeks (weeks 3, 4, 6,7, and 8). We asked teens to log mood and activity on ActivaTeen with 112 reminders over 5 weeks (35 days) of the study. In week 3 (June 17-24) reminders were sent 4 times a day at 9 am, 12 pm, 6 pm, and 9 pm. In week 4 (June 25 to July 2), reminders were sent 3 times a day at 12 pm, 6 pm, and 9 pm. In weeks 6-8 (July 22- Aug 13), reminders were sent 3 times a day at 9 am, 12 pm, and 6 pm. We changed the timing and frequency of the reminders based on the preliminary analysis of the times at which the participants logged and the feedback from participants. Participants were asked to let us know any time if they wanted us to change the frequency of or stop the reminders.

Each ActivaTeen module was interleaved with one week of reflection and feedback on the module. Teens completed the ActivaTeen modules on upward /downward spiral in week 3, SMART goal planning module in week 6, and the overcoming barriers module in week 8. They reflected on them in the teen group in weeks 5 and 7, respectively. We obtained feedback on the module for overcoming barriers during the interview. In week 4 and 8, we created a *direct message* (DM) group with a teen, clinician, and one researcher present as a moderator. The clinicians were asked to initiate the conversation and provided example prompts to help teens reflect on their tracking data in week 4 and review SMART goals, brainstorm how to overcome barriers, and review data in week 6.

Exit Interviews and Surveys: Eight interviews were conducted on Zoom and participants were given the choice to turn off the video. One teen (T31) chose to respond via text chat only with her audio and video turned off as the interviewer asked questions verbally while being available on video. The ninth interview was conducted over the phone. Interviews lasted between 30-60 minutes. All interviews were transcribed automatically via Zoom and I read through and edited the transcript for errors while watching each video.

For each interview, I prepared a slide deck with screenshots of the four main modules of ActivaTeen, 6 summarized graphs and link to the data for each teen participant, and SMART goals from week 6 and 8 (as available). The graphs included representations of valence of emotions across categories of activities, time, frequency of logging, and a summary table of specific activities across time and valence (Appendix L). For the clinician interviews, I used graphs from 2 teens as examples (Appendix L). In the first part of the interview, I shared my screen with a deck of slides with the participants with screenshots of ActivaTeen user interface (UI) (section 5.1) to ask them for feedback on the design. I then presented 6 graphs prepared from each participant's 5 weeks of logging data to understand what information was useful for teens and clinicians, why, and what levels of reflective inferences [34] they were drawing from these graphs. I shared back their SMART goals to inquire about their progress. If the participant had missed certain modules, I explained the activity using screenshots, showed them a demo on Slack, and asked participants to respond to the prompts verbally as I entered the information (e.g., planning mini steps or responding to the prompts on overcoming barriers) before asking for feedback. On completing the interview, I sent each participant's slide deck to them via email.

In the post-study surveys, we asked all teen and clinician participants to complete the Acceptability, Intervention Appropriateness, and Feasibility of Intervention Measure [108], Intervention Usability Scale (IUS) [58], and User Burden Scale (UBS) [101] surveys to determine participant approval of and burden using BA delivered on an online platform. Teens also completed the PHQ 8-A Questionnaire [81].

5.2.4 *Data Analysis*

I calculated average scores of PHQ-8 and each question of the Acceptability, Intervention Appropriateness, and Feasibility of Intervention Measure for the clinician group and teen group, respectively. For the User Burden Scale [101], I computed average scores of teens and clinician groups separately across each of the 6 constructs – physical, mental & emotional, time & social, financial, difficulty of use, and privacy. In the IUS, items are rated on a Likert scale from 0 (strongly disagree) to 4 (strongly agree), with half of the items reverse-scored [58]. A total score is normally calculated by multiplying the sum of these scores by 2.78 (range: 0-100). Drawing parallels from scoring the system usability scale (SUS), above a 68 would be considered above average and anything below 68 is below average [126].

I distributed the weekly data and interview transcripts between three coders. The coders first read and inductively coded the data line by line and wrote their codes in a cumulative document. The coders then met for weekly discussions to prepare a codebook. The remainder of the data was coded using the final codebook (Appendix K) and all coders read and shared memos with each other and met for discussions to resolve and discrepancies in coding. I conducted affinity modelling and four main themes emerged from our analysis. Themes were iterated upon through discussions with the research team and writing.

Table 10: Summary of guided ARC activities using BA in Study 3 (*whether the channel was merged or separated)

Wk	Teen activity	Clinician activity	Channel*
1	1.1. Getting to know Slack 1.2. Getting to know each other Introduction	1.1. Getting to know Slack 1.2. Getting to know each other Introduction	Merged
2	2.1. Getting to know each other more 2.2. Introduction to BA: reflect on the BA video https://youtu.be/Le10_EyamDw 2.3. Track activity and mood on ActivaTeen	2.1. Getting to know each other more 2.2. Introduction to BA: reflect on the BA video https://youtu.be/Le10_EyamDw 2.3. Track activity and mood on ActivaTeen (clinicians were also asked to try out tracking)	Merged
3	3.1. Reflect on Activity and Mood Tracking (post in group) 3.2. Upward and downward spiral on ActivaTeen	3.1. Reflect on Activity and Mood Tracking 3.2. Feedback on tracking data: clinicians were shown 3 teens' data sheets for one week and asked to reflect how they would use this in their sessions.	Separate channels for clinicians and teens
4	4.1. Reflection on upward/downward spiral 4.2. Discuss and share data and summary on direct message channel with one teen and one clinician	Share data and summary on direct message channel with one teen and one clinician	Direct Message
5	Reflection on week 4 direct message discussion	Reflection on week 4 direct message discussion	Separate channels
6	6.1. Tracking activity and mood (resumes on July 22) 6.2. Learn about and plan SMART goal on Activateen	NA	
7	7.1. Reflection on SMART goal tool 7.2. Peer sharing on the group	Clinicians were given the list of SMART goals planned by teens and asked how they would use and discuss this data	
8	8.1. Barriers activity on ActivaTeen and plan or revise SMART goal 8.2. Discuss SMART goal and barriers with clinician 6.1. Tracking activity and mood	Direct Messaging about SMART goals and barriers	

5.2.5 *Ethical considerations*

We obtained emergency contact information from all participants. Parental permission was not obtained formally although majority of the teens were recruited through parents. All participants chose anonymous pseudonyms, and no identifiable information was shared on the groups or direct messages. Teens were informed during the consent process that clinicians will be on the Slack group and will be able to see their tracking data (with their pseudonym). Adversity mitigation protocols were still relevant and used from prior studies and emergency contact information was obtained for all participants. Three researchers moderated the group and responded to participants within 24 hours. This study was approved as minimal risk by the Human Subject Division at UW.

5.2.6 *Limitations*

Data collection was delayed during COVID-19 pandemic and data collection phase corresponded to Summer when there was no school. This skewed the type of activities logged by teens and we expected more indoor relaxation related activities. Two of three clinicians dropped out over time. We initially aimed to recruit participants from an ongoing in-person depression group at a hospital. It might have been useful to pair up clinicians with their actual patients in the DMs. However, no teen from the group participated. The number of participants was low due to difficulties with recruitment during the Pandemic and people dropped out over time. We could follow the journey of nine teens in-depth while engaging with the guided ARC intervention over eight weeks. In sections 5.3 and 5.4., I explain our results to answer RQ4 and RQ5, respectively.

5.3 RESULTS ON USER ENGAGEMENT

5.3.1 Case by Case Engagement Patterns of Teen Participants

In this section, I answer RQ4 on “how do teens and clinicians engage with the guided ARC intervention using BA for coping with depression?” As the engagement patterns varied across the teens both in engaging with the online group activities and activity tracking, it was difficult to fit them into categories and I present them case by case.

Table 11: Number of activities completed by teens in each week in Study 3 (total number of teens who joined the Slack group n=11, number of teens who continued after week 1 n=9)

Activity type	Number of teens who completed
Week 1: introduction	10
Week 2: BA video	5
Week 3: Upward/downward Spiral	6
Week 4: Clinical DM logging review	9
Week 5: Reflection on Clinician DM	6
Week 6: SMART Goal Planning	7
Week 7: Sharing on group about SMART goal	5
Week 7: Peer feedback on SMART goals	0
Week 8: Clinician DM SMART goal barriers	7
Week 8: Barriers to SMART goals	6
Tracking activity and mood (Table 1)	9
Interviews	7
End of study survey	5

To understand the differences in teens’ engagement with this study, I summarized each teen’s routine and activities, patterns in mood, goals planned and progress/barriers, and study

experience. But low engagement did not always mean that the teen did not benefit from the study. For example, we have a teen who had sporadic engagement with both online activities and logging, but she changed her routine based on the SMART goal planning and barrier activity in the last week (she perceived that she benefited a lot from it). Their outcome or perceived benefits – those who took action on goals and those who planned goals but didn't take any action/faced barriers did not necessarily depend on the level of engagement.

Table 12: Summary of the number of logs by teen participants in 5 weeks of Study 3 (weeks 2, 3, 6-8). T39 quit after week 4. (*week 3,4, and 8 had 2 activities, **these teens continued to access the prompts and log activities 1-2 days after the reminders stopped)

Activity type	Pre-study PHQ-8 score	Post-study PHQ-8 score	Number of activity logs (out of 112 total reminders)	Number of distinct days logged (35 days of reminders)	Number of online group activities participated in (out of 11*)
T38	14	NA	111	37**	11
T31	19	11	125	36**	11
T37	13	NA	40	17	11
T33	6	5	73	33	9
T34	15	2	14	12	9
T32	19	18	16	13	7
T35	13	NA	9	8	6
T36	17	12	29	3	3
T39	14	NA	3	3	2

Teens were asked to participate in 11 online group activities for eight weeks and in addition, logged their activities and mood in five of those weeks (35 days). Engagement of the teens in the study varied for the weekly group activities and logging (Table 11, 12). The

frequency of logging was not always correlated with the number of group activities they completed. For example, even though T37 logged activities on 17 days he completed all group activities (consistently engaged). On the other hand, T33 logged on 33 days, but he did not complete 2 activities (moderately engaged). Teens logged across all categories of activities with the most activities being related to relaxation and least being related to school or work as it was Summer during the COVID-19 Pandemic. Physical activity and socializing were difficult during the stay-at-home order, but some teens planned these activities as their SMART goals.

(1) Case study of T31: T31 is a 19-year-old and identified as non-binary (PHQ-8 =19). They had been seeing a therapist at the time of the interview. Their favorite activity was seeing gifs from their peers in week 1. They rated their comfort level in participating in the study as 8 and found the study helpful in providing structure and planning goals both from logging and SMART goal related activities.

Mapping Routine and Activities to Logging: They used Slack on their phone and logged 125 times in 5 weeks. They logged consistently across all time blocks but would prefer to not have the 9 am reminder and log 3 times per day. Their logs were distributed across all categories of activities and time blocks. Their negative logs were related to relaxation such as watching a movie or listening to podcasts or audiobooks. These activities were also associated with positive or neutral emotions at other times (which can be inferred was due to the content of the media that they were consuming).

Reflection on intensity and valence: They said they mostly experienced and logged positive emotions and their range of intensity was between 4 and 8 for all valences (Figure 16). They found all graphs helpful to reflect upon.

Goal: T31 would read the summary of logged activities to reflect and plan activities ahead. T31’s goal in week 6 was to “*watch less online streaming movies*” and in week 8 was to “*go out and do more yoga somewhere*”. They set mini steps and said she could complete their goals without barriers.

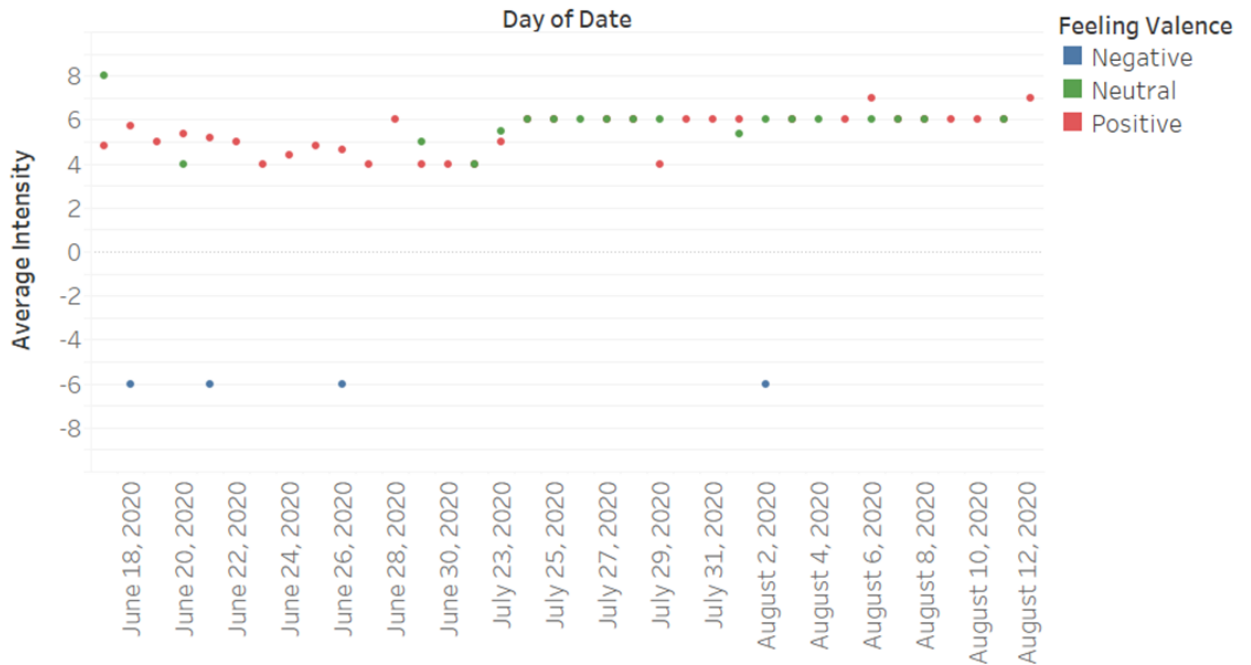


Figure 16 a. Average intensity of feeling per day: T31 (note: X axis intervals are for 2 days and T31 logged for 36 days)

(2) Case study of T38: T38 is a female (PHQ-8=14). She did not participate in the interview or survey.

Mapping Routine and Activities to Logging: She completed all group activities and logged 111 times across 37 days. Based on her graphs, her valence was distributed evenly across all activities with only work-related activities not being associated with negative emotions. The valence was distributed across all time blocks.

Reflection on Intensity and Valence: She logged positive emotions with the most frequency. Her positive logs were within the range of 2 and 7 whereas negative emotions were wider range between 2 and 8.

Goal: In week 6, her SMART goal was to “read a history book for at least 30 minutes every day”. She did not plan any other specific mini steps. While reflecting on the activity in week 7, she said she experienced difficulties setting reminders on Slack and during her conversation with a clinician, she planned to set reminders on her phone. She experienced internal barriers – “feeling unfocussed and anxious about perfecting the goal”. After completing the barriers activity, in week 8, she revised her goal to be more specific, measurable, and timebound: “read at least 3 chapters of a history book this week” and added mini steps to choose a book and set reminders on the phone to read.

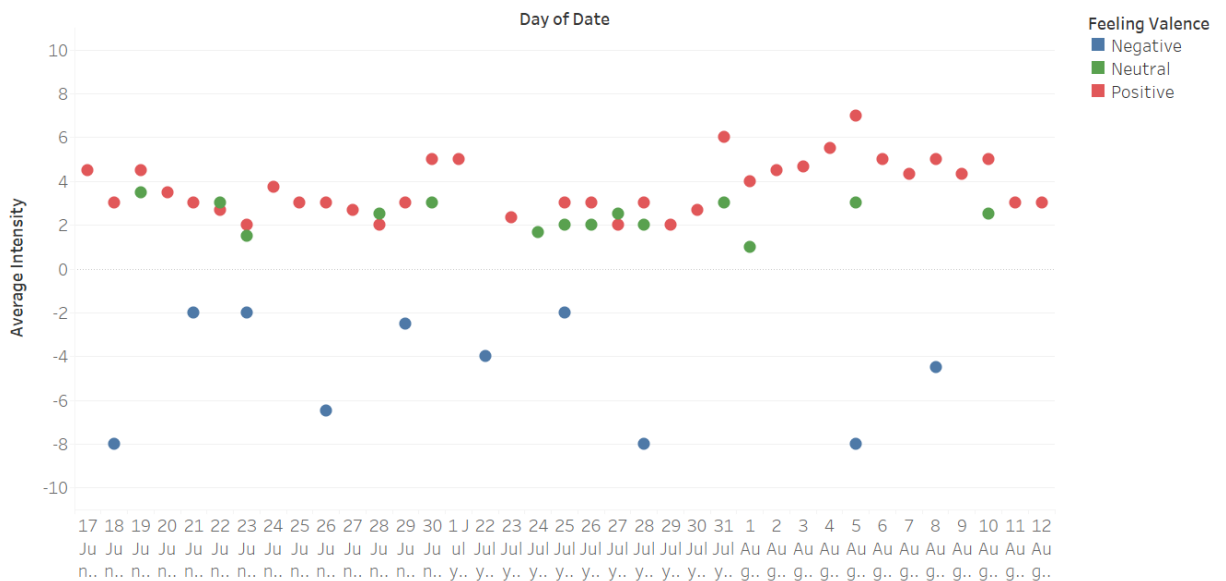


Figure 16 b. Average intensity of feeling per day: T38 (X axis labels—Jun: June, July, Aug: August)

(3) Case study of T37: T37 is a male (PHQ-8 = 13) who had a psychiatrist but had never seen a therapist. He did not have any favorite feature but found value in learning strategies to cope through the study. He rated his comfort level as 8 in participating in the study. He did not find the study helpful for himself but appreciated being able to learn coping skills.

Mapping Routine and Activities to Logging: He used Slack on his phone, completed all online group activities, and logged activities 40 times in 17 days. He did not mention any specific routines but found it tedious to log and said that the reminders were annoying. We stopped sending him reminders in the last week as he requested it. T37 explained that his activities and feelings would not change much over time or he was not doing activities that he considered out of the ordinary for him. He wanted a button that said “same as before” for each logging field. His activities ranged across all categories and only negative log was “sat in my car”, which he did not remember why he logged negatively.

Reflection on Intensity and Valence: He most frequently logged neutral emotions and his range of intensity was less than 3 for all valences. His favorite graph was average intensity versus days.

Goal: His goal was to “do more cooking/baking” in week 6 and “getting outside for 30 minutes a day” in week 8. He did not identify any mini steps for his goals in either weeks and did not complete his goals as he perceived his goal to be a single step that needs to be done. He could plan minis-steps with additional explanation from the researcher during the interview.

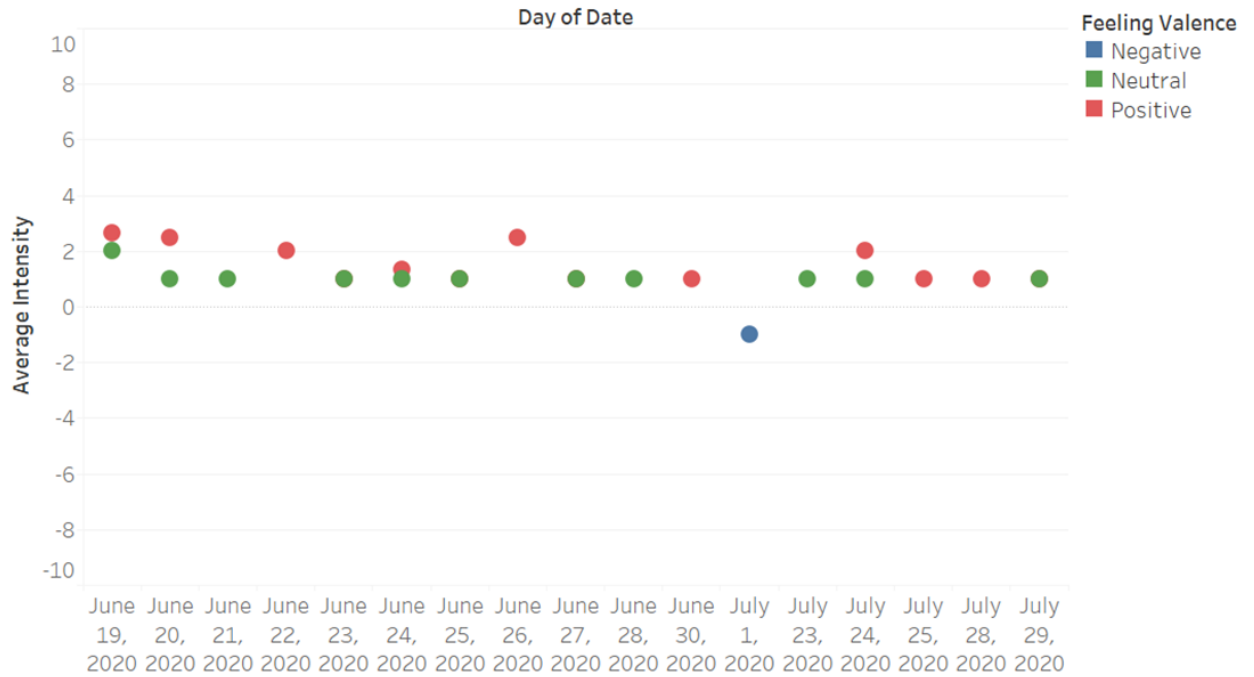


Figure 16 c. Average intensity of feeling per day: T37

(4) Case study of T33: T33 is a 14-year-old male (PHQ-8=6) who was seeing a therapist during the study. He completed 9 online group activities and logged 125 times in 36 days. He rated his comfort level as 6-7 in participating in the study. Hi favorite aspect of the study was logging which he found to be fun and helped him organize.

Mapping routine and activities to logging: His mom logged him on to Slack at the time of the reminders so he could log his activities on the computer. He planned out each day on a physical sheet of paper and did not use any digital reminders. Reflecting on the graphs, he said he felt negatively in the morning however the valence was distributed across all time blocks and categories of activities (except for school activities which were rated as positive and neutral). He associated video gaming with positive behavior but had a rule from his mother that he had to do a certain amount of physical activity before gaming. due to which he frequently got into conflict

with his mother that led to negative emotions. He perceived socializing and doing household chores for helping his mother positively and negatively other times. He logged most frequently in the evenings and did not like tracking before getting ready in the mornings. He would prefer to log two-three times a day at 12 pm, 6 pm, and 9 pm (before bed).

Reflection on Intensity and Valence: His favorite graph was frequency of feelings versus category of activities and he found the numbers helpful. He logged positive and neutral emotions between 4-10 and a wider range of intensity for negative emotions (2-9).

Goal: In week 6, he planned two SMART goals to “do less arguing with mom” and “3-5 times a week run 2 miles before I play Fortnite, 25 pushups and 10 burpies” (which followed the screen time rule in his household). He planned mini steps but did not set any reminders. He discussed barriers with his goal on the group in week 6 but did not complete the barriers or SMART goal activity in week 8.

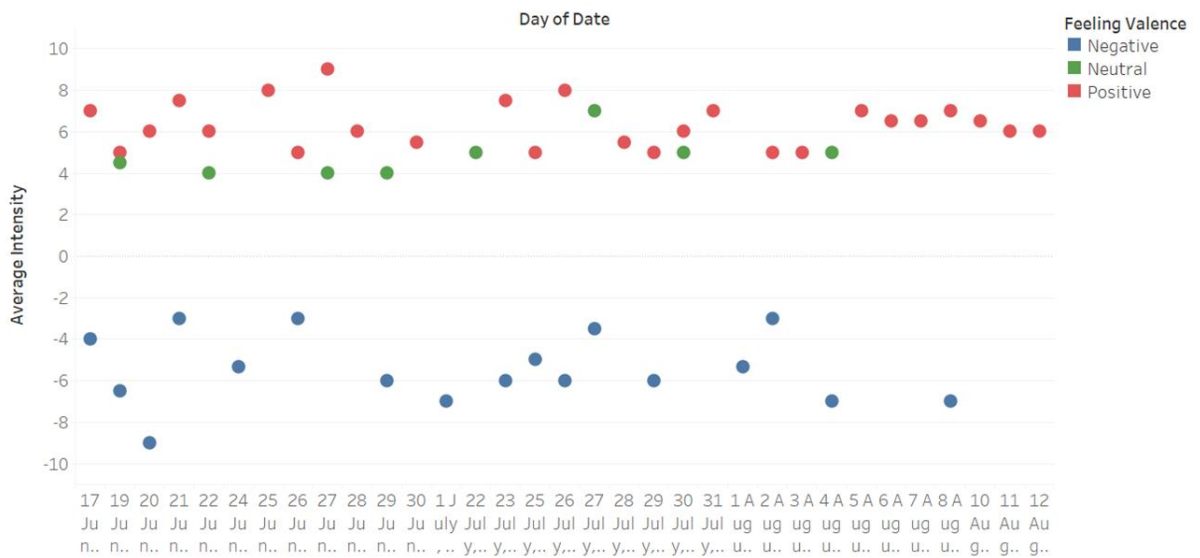


Figure 16 d. Average intensity of feeling per day: T33

(5) Case study of T34: T34 is a 16-year-old Female (PHQ-8=15). She was seeing a therapist monthly at the time of the study and explained that the frequency of her appointments varied depending on her stress levels and ability to cope (for example, she saw a therapist every two weeks during school time). She rated her comfort level as 8. Her favorite aspect of the tools was that it was responsive, and she could go in different directions using the same app. She did not like the personified nature of the app.

Mapping routine and activities to logging: She used Slack on her phone, completed 9 online group activities, and logged 14 times in 12 days. She completed all online activities. She started working 8-hour shifts during the Summer and adjusting to it was difficult for her in the beginning of Summer which made the evenings hard for her. She was mostly at work during morning and afternoons. Her evenings were mostly neutral or tired. She only logged once in the morning when she did not have anything on her schedule and slept in and did not have to rush to do anything on a Saturday. If she scrolled through Tiktok for a long time and took a nap in the afternoons, she would feel exhausted and groggy after. Getting things done like going to the dentist also had a positive impact on her. She explained that she does not “*ever associate positives with chores*” such as doing the dishes. She logged more in the evenings usually before going to bed. She would prefer to log once in the afternoon and once in the evening with enough intervals to have changed the activity.

Reflection on Intensity and Valence: The most helpful graph to her was on intensity versus days. She said she would usually log when she was feeling strong emotions and she could pinpoint how she was feeling, and her logs were in the range of 4-10. Her positive and negative logs were evenly distributed across the days.

Goal: Her SMART goal was to “exercise 3 times a week for 30 minutes” which was influenced by her sedentary lifestyle as the Pandemic began. She planned mini steps and followed through with her SMART goal. The logging activity also prompted her to plan her school schedule by printing it out in calendar format using sticky notes.

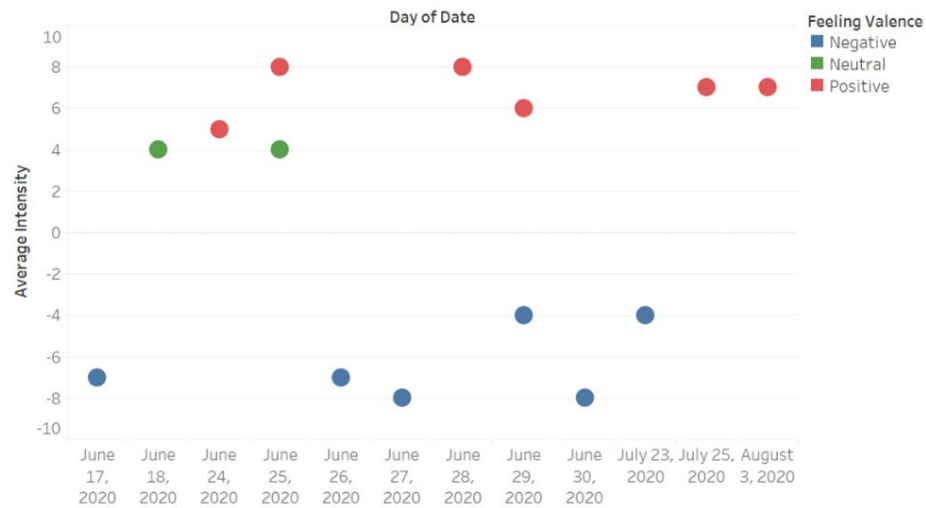


Figure 16 e. Average intensity of feeling per day: T34

(6) Case study T32: T32 was a 16-year-old male (PHQ-8= 19). He was taking therapy at the time of the study and had done group therapy in-person. His comfort level for participating in the study was 6-7 as he wanted some more details on what to expect in the study at the start of the study. He did not have a favorite aspect of the study.

Mapping Routine and Activities to Logging: He used Slack on his phone and logged his activities 16 times in 5 weeks and completed 7 online group activities. He most frequently logged negative emotions and the range of intensity was between 4 and 10 for all valances. Upon reflecting on his summary graphs, he explained that he woke up late and did not log any positive emotions in the mornings. His afternoons were variable, and evenings were not too stressful with all positive logs. He associated socializing with positive emotions, relaxation

with both neutral and positive emotions, and everyday chores such as shopping or cleaning with negative emotions. He would prefer to log 4 times a day at 12 pm, 3 pm, 6 pm, and 9 pm.

Reflection on Intensity and Valence: He had difficulties identifying emotions to log when he was experiencing negative emotions and has been working on it through therapy over the years. He found the most helpful graph to be the summary of activities distributed across time and valence.

Goal: His SMART goal was influenced by the decrease in socializing during the stay-at-home order during the COVID-19 Pandemic. His goal in week 6 and 8 was to socialize with friends at least once per week. He perceived that the ActivaTeen app helped him set his goal intentionally and the barriers activity supported his perception to keep trying to contact different people if the plan did not work out. He experienced challenges in logging his goal and setting reminders as his goal was dependent on someone external and he needed to be flexible about it (as it was not a consistent weekly activity).

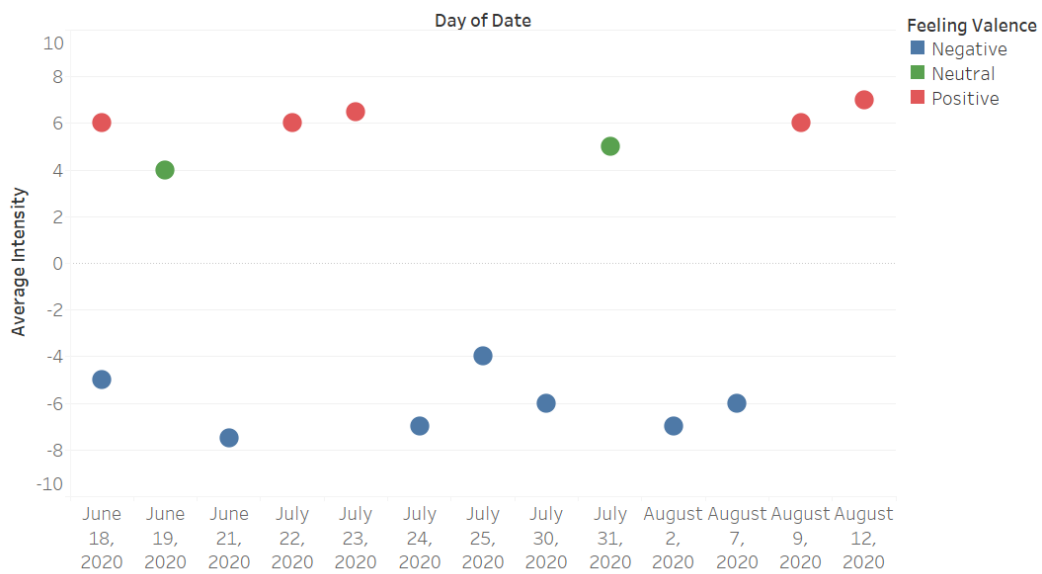


Figure 16 f. Average intensity of feeling per day: T32

(7) Case study of T35: T35 is a 13-year-old Female (PHQ-8=13). She used to see a therapist but stopped. Her comfort level in the study was 9 and her favorite feature was planning the SMART goal.

Mapping routine and activities to logging: She used Slack on her computer and often missed notifications when she was away from it. She completed 6 online group activities and logged 9 times in 8 days. Her negative emotions corresponded to activities related to travel and positive emotions were related to relaxation. She experienced negative and positive emotions during physical activity depending on what else was going on such as the dog was not behaving well. Before planning her SMART goal, she struggled during the morning and logged negative emotions during mornings and evenings. She explained that afternoons between 12 pm and 4 pm and nights were the best time of her day. She usually logged after breakfast and around nighttime but missed the midday window. She would like the reminders to be sent twice a day at 3 pm and 9 pm.

Reflection on Intensity and Valence: She explained that she experienced “*pretty strong emotions*” which was also reflected in her intensity logs which varied within the range of 1-10. She had no neutral logs, and her negative and positive logs were balanced. She found the most useful graphs to be on days versus intensity and intensity versus category of activities.

Goal: T35 did the barriers activity and spoke with a clinician before planning her SMART goal in week 8 (she missed her activity in week 6). Informed by ideas from brainstorming with the clinician, her SMART goal was to “*do a morning routine to get me up and excited about the day*”. She wrote her mini steps to “*wake up, shower, listen to relaxing music and go for a run*” on a sticky note and put it beside her table. At the time of the interview,

she had been following the routine for about 2 weeks with some off days and perceived this change as beneficial.

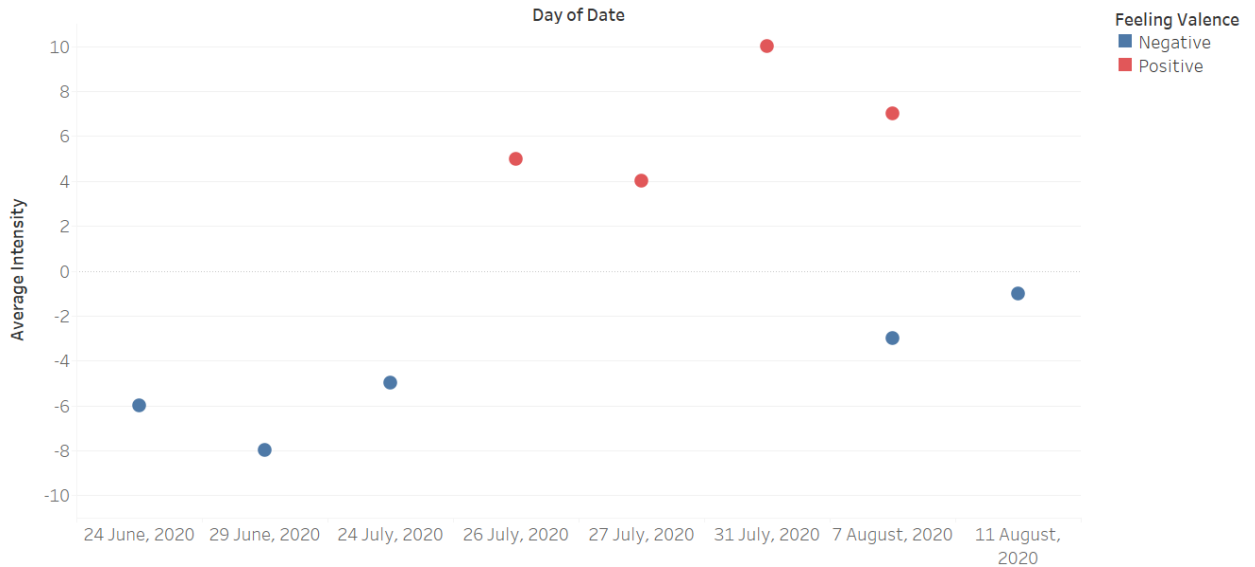


Figure 16 g. Average intensity of feeling per day: T35

(8) Case study of T36: T36 is a 17-year-old Female (PHQ-8=17) who previously had a therapist but had paused and was looking for another therapist at the time of the interview. She rated her comfort in participating in the study as 8. Her favorite aspect of the study was to get the data back about what she had logged.

Mapping routines and activities to logging: She used Slack on her computer and struggled with logging and participating in online activities, especially during her depressive episodes. She completed 3 online group activities and logged 29 times in 3 days. This high number was because she would go back and log a lot of her activities with the misunderstanding that the data tracked would correspond to the time the reminder was sent. She would be sleeping in the mornings and would not log. In the afternoons, when her ADHD medication would kick in her system, she would feel more positively. She found socializing with friends to be always

positive. She logged negative emotions on everyday activities and found cello practice and homework stressful. Hobbies, relaxation, and school related activities were both positive or negative. She never logged in the evenings. She said sending reminders to log via text message 3 times per day would be more accessible and manageable.

Reflection on Intensity and Valence: Her favorite graph was intensity of valence versus category of activities. Her positive and neutral valence intensity was between 4 and 6 while negative emotions ranged between 4 and 10.

Goal: Her goal was to “practice cello for 30-45 minutes per day five days in a row this week”. Her mini steps were to use a timer to break practicing into 15-minute chunks and plan breaks to get snacks and water in between. During the interview, she said she did not consciously do this by setting reminders, but she would subconsciously practice for 15 minute- intervals when she went downstairs close to the music room. She said she would eventually want to increase her practice time, but this was still an improvement compared to not getting any practice.

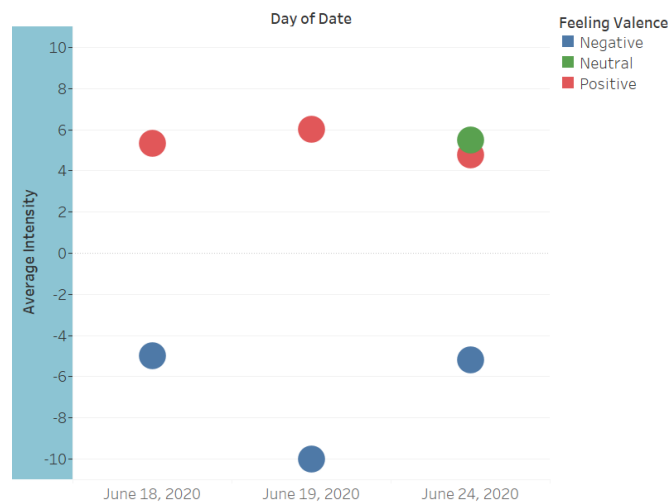


Figure 16 h. Average intensity of feeling per day: T36

(9) Case study of T39: T39 is a male (PHQ-8=14) who struggled with experiences of being bullied and was seeing a therapist during the study. He did not plan goals or participate in the exit interview and survey. T39 logged 3 times in 3 days and completed 2 online group activities (introduction and DM with clinician on week 4) He quit the study after week 4 stating that he got lazy and had gotten busy with Summer school.

Mapping routine and activities to logging: His logs were negative twice (related to video games and an argument) and neutral once (playing video games). His negative logs were in the afternoon and neutral in the evening.

Reflection on Intensity and Valence: He logged negative and neutral emotions with intensities within the range of 6 and 8.

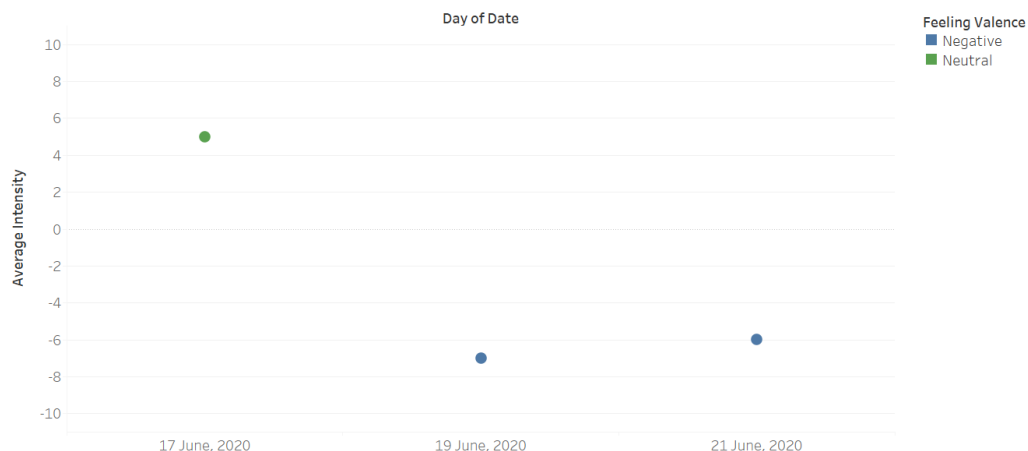


Figure 16 i. Average intensity of feeling per day: T39

5.3.2 Usability Metrics

Five teens and two clinicians responded to the end of study survey with the usability metrics. Overall, participants indicated low burden and high adaptability for the online intervention. On the User Burden Scale (1: not at all burdensome, 4: very burdensome) [101],

participants scored an average of 0.6 (clinicians) and 0.6 (teens) on difficulty of using Slack and 0-0.2 on all other types of burden. T36 rated 3 (very much) for demands on her mental effort which corresponds with her difficulty with participating during depressive episodes. C32 also struggled with difficulty of use as she quit the study in week 2 due to issues with Slack. The average scores on the Acceptability, Intervention Appropriateness, and Feasibility of Intervention Measure of intervention (1:Strongly Disagree, 5: Strongly agree) [108] was between 3.4 and 3.5 for teens and 3.6 and 4 for clinicians, indicating high perceptions of adaptability. The IUS score was above the average usability score of 68 [58,126] for 3 participants (range 69.5-89). T36 (IUS=47) and C32 (IUS=61) provided the lowest ratings as they did not participate often and struggled with the study structure. T31 (IUS=58) rated 3 (neither agree nor disagree) for 9 out of 10 items.

5.3.3 *Experience with Study Structure*

Overall, teens who were interviewed found that the study structure was easy to follow. No teen mentioned experiencing anything negative in the study except the frustration of forgetting to log or feeling overwhelmed by reminders (T33, T37, T35, T36).

It felt very supportive and like I said. Because there hasn't been any like anything negative about it and like. Anything that anyone had said basically was just positive stuff – My experience – it was positive and a little bit. It was mostly positive because nothing really bad happened. I would love my activities. It helps– it helped me become more active and things like that. And it helped me with like internal and external barriers. -T35

Most teens except T36 and T32 could participate when they were experiencing negative emotions. T36, however, struggled with the logging and setting reminders on Slack but overall, Slack was an easy tool for her to use.

Yeah, and I already have experienced with slack because like my debate team uses slack as its main thing. I know how to use Slack, it wasn't. Yeah. – I tried to set it. Okay. And like a click through all of it. Like did all the settings and stuff. And then it just didn't -- I tried to because I thought that'd be helpful, but it didn't work. – T36

The timing of the weekly activities and asynchronous participation worked well for all 7 teens who were interviewed. T34 and T37 explained that they would either do the activities right away when it was posted or wait till the last minute. T35 and T32 found the asynchronous format comforting. T34 highlighted that having the weekly deadlines on Wednesdays was also helpful so they could get breaks on weekends. T35 frequently jumped in and out of the study and was unable to participate when she went camping one week.

I liked that there were updates every week and stuff – Usually I would wind up doing them closer to the end of before the next activity came out – probably taking less time than that [20 minutes] – I think it was helpful to do it on Wednesday, because then we have the weekend to do them if we so choose. And it also meant that if you had something on Monday. You could do it Tuesday, and it would still be ready for Wednesday, or you could even do it. Tuesday, right. So, yeah. – T34

Clinician C32 also found it manageable to fit chatting with three teens in her schedule.

I'm fairly certain I spent probably 20 minutes with three teens assigned to me sending me three messages to each a week and like spending the time probably most of that time was because I've includes the feedback portion where you asked me to reflect on how it went. Is that right, there will be messaging and giving you a summary of my feedback. Yeah, I'm thinking, I probably spent you know, five minutes total for each team chatting and then five minutes –C31

Teens who were interviewed rated their comfort in participating in the study between 6 and 10 (average 8, 1 being least most comfortable and 10 being most comfortable). T32 (comfort = 6-7) wanted some more guidance on what to expect towards the beginning of the study and T34 (comfort =8) experienced some “*social anxiety because it was just a little bit of an unknown*”.

I think maybe the main reason I wasn't as comfortable is just because I didn't know what to expect. I just wasn't sure exactly what to expect. And I'm not really sure, you did make it pretty clear what we were doing – I think that would be helpful – just a brief summary for those activities. I think that might have made me a little more comfortable. –T32

T34 and C32 wanted a more “*finished app*” where the graphs can be generated automatically instead of the current Slack app as Slack can get “*messy*” in organizing content and it limits visual design and is heavily text based. Clinician C31 was comfortable using Slack but found it cumbersome to respond to the weekly prompts on her phone.

I'm young enough that I feel comfortable using like a tech space communication platform like I thought that was nice. This is a very small thing, but – it's not intuitive on my phone to respond to a bunch of questions in a list on Slack, because I couldn't copy and paste it

was just kind of tough to answer every question and be able to look at the question because it was such a big block. So I had to spend a lot of time like figuring out how to copy on my phone, and then paste into the chat and then delete but not hit 'Enter' like to answer each question. I think for chatting a teens like phone was totally fine. But I probably should have gone to a computer when I was actually giving you guys the big prompted feedbacks. – C31

Depressive episodes and lack of motivation were reported by T36 and T39 as reasons for not being able to do the study activities. T36 participated sporadically and expressed her guilt in not being able to keep up:

I realize that I've basically abandoned this study, and I'd like to personally apologize for causing any holes in your data. For the past two months or so, I've been having on and off depressive episodes in which I've been unable to find the motivation to do basically anything, which I quickly discovered included doing the daily logging. – T36 (week 3)

Among clinicians, C33 left the study after week 4 without further communication. C32 felt overwhelmed with the text-heavy platform and notifications of Slack, unable to find the mental space to catch up. She quit using Slack in week 2 and did not communicate with teens directly but provided her feedback on the graphs and activities (that we combined for multiple weeks) over email and interview.

I had a lot of trouble. First of all, the all the slack reminders were going to my clutter and so I wouldn't get them and then I reset the filters and then I wasn't sure what like what to complete – what was for me was for the teen. I also get a lot of emails and so that was like an easy way for me to be like, 'Oh, I'm confused. I'll figure that out later.' And then I

would never figure it out — I think me being kind of an older person. Functioning and new platform so – Slack is very text based and I think the graphics that you included were much more appealing and like intuitive to me so – I'm reading lots of texts all day – And not really difficult like on its own, just like in the context of my own life and all the things that I need to digest [and the Pandemic]. – C32

5.4 RESULTS ON OPPORTUNITIES AND CHALLENGES OF GUIDED ARC USING BA

In this section, I answer research questions 5.1. and 5.2. on: “what were the benefits and challenges of teens and clinicians in using the guided ARC intervention using BA?” and “what changes did participants envision in the design of guided ARC intervention using BA?” Four major themes emerged from my analysis: (1) supporting understanding of behavior and mood, (2) from avoidance to action, (3) scaffolding clinician support using ARC, and (4) scaffolding peer support using ARC (Figure 17). I explain each theme explaining the benefits, challenges, and envisioned design changes.

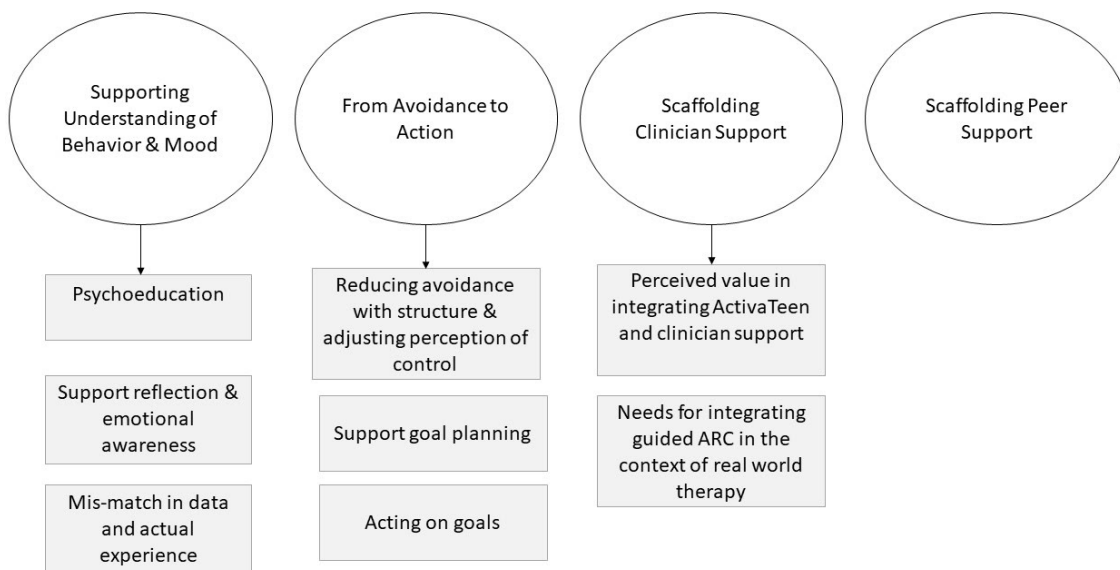


Figure 17: Final themes from analysis of design needs for using guided ARC with BA for depression management

5.4.1 Theme 1: Facilitating Understanding of Behavior and Mood

The BA modules helped teens understand BA through psychoeducation and helped them learn about their own mood and behavioral patterns through logging and reflection.

5.4.1.1 Providing Psychoeducation

Research participants had a positive experience with watching the BA video. Both clinicians and teens appreciated the visual presentation and content of the video and understood the key takeaways of BA. T31 suggested adding more specific behavioral examples in the video.

Main takeaway is that setting small goals can eventually add up for the better. – T37

Thought the videos shared in week two were too generalized. Would have liked to see more specific directions of what to do in case scenarios like overeating/oversleeping. The video was good in the aspect of sharing how we can set goals to have structure and motivation –T31

During the interview, however, most teens expressed confusion around what is behavioral activation. For example, T37 could not relate to the experience of actions influencing his emotions.

Teens found it helpful to learn about internal and external barriers to SMART goals and specific examples to overcome these barriers.

I liked it because I hadn't really thought about Internal or external barriers – the examples are also really helpful. The overcoming and stuff like that so [interviewer

shows suggestion cards on slide] – These ones – I went through, just one of them. The internal barrier. –T35

I think it makes sense the way that you described it, the way versus internal and external barriers. And for me, for my goal, it was mostly external barriers, but I think it's helpful to know the different types of things that can prevent you from reaching your goal. –T32

Clinician C31 explained that the barriers module on ActivaTeen was helpful for education and similar to what she would do in session, all information in one place is helpful. Overall, teens found the information and data presented to them in the study helpful to learn about their personal behavior and mood management. T34 also appreciated the progression in the study per week.

All the information that was provided was helpful to see. So, like doing the study and walking through everything that happened. I would say I had a positive experience with the entire thing because it just kind of helped– you learned more about what you were doing as you went through it, if that makes sense. It wasn't just the same thing. The entire time – you learned more about what you were doing as you went through it. –T34

Like all of the information like the questions, the assignments were useful. Learning a lot of stuff from that and how to like deal with stuff better. –T37

5.4.1.2 Supporting Reflection and Emotional Awareness

Teens attributed a range of reasons that influenced their mood which included time of day, type of activity, medication, type of day (weekday or weekend, work or school day) structure (or lack of structure due to Summer and Pandemic) in their day, and expectations from

self. In addition, teens also reflected on their emotional awareness and struggles with logging it pertaining to the system design. The level of reflection ranged from simple description based on what they see on the graphs, explaining or expressing surprise on why they logged a certain valence, confirming or understanding personal routine, and planning future actions based on previous logs of mood and activity [34].

I think I was already kind of aware of this pattern internally, but seeing the data laid out like that made it a lot more concrete. - T34

Teens explained differences in how intensely they experienced emotions and had varied awareness of how they are feeling and how it correlated with the activities in the moment and in the long term. Teens found it valuable to compare the frequency and intensity of negative and positive logs over different days. Understanding their **range of intensity of emotion over different days** was the most helpful visualization for a few teens.

Looking at the graph, I mean, it seems like it is sort of equal parts, positive and negative. One thing I noticed when I'm looking at it is there's no really low intensity feelings on there. It's all mostly around five or higher and there's nothing that's really one or two or three. -T32

I think that's because I have pretty strong emotions. So I'm never really having like a neutral feeling. - I think there were more negative ones and positive, but some of the positive ones are pretty high. - [To determine the intensity] it would just be like, how angry I really was like, was it just a small thing that I was just irritated about or was it something that I was really mad about. -T35

Clinicians also found it helpful to understand the range of emotional intensity of teens.

Definitely like a preponderance of neutral and positive mood. So I would comment on that. It seems like when there was negative mood there. They were like fairly strong intensity. So with this is kind of a person who feels things strongly. A lot of you know average intensity going on there. So those are probably the themes that I would pull out of that. –C32

Interestingly, all participants explained experiencing **neutral emotion differently** from depressed emotion and even logged neutral at different intensities.

Sometimes I had a more negative outlook and I was just numb going through the motions – but no feelings of anything [same activity but feel differently and neutral varies] yes...I just saw it as not being interested... kind of doing what was available...maybe when it was intense I was more depressed [difference in neutral 4 and 8].. yes...neutral isn't depressed...there's no sadness in neutral – T31

Interviewer: How would you distinguish feeling neutral from feeling depressed?

T37: [Neutral] is a feeling neutral, kind of, for me, like, not necessarily being like, really happy. But I'm not definitely not feeling like negative

Clinician C32 appreciated the neutral emotion and the balance she saw across different valence.

I think that's good because you don't have to. We're not like going for, like, happy happy joy joy, all the time. We were like want a range of emotions and great to distinguish you know across different emotions and different intensities. I like having the options. –C32

Clinician C31 was confused with representation of neutral on the graph song with the positive emotions as they were on the same axes but the negative emotions were plotted on the negative y-axis.

It's probably different for everybody but I probably prefer to have them all consistent like have the blue [negative] dots up at the top and just distinguished by color or figure out how to make neutral fall somewhere in the middle despite that, they're also rated on template. –C31

Logging helped T34 **think more consciously about how she was feeling**. She initially perceived her mindset to be more negatively inclined. However, on seeing her logs she was surprised that her positive and negative logs were evenly distributed.

It [logging] helps trigger me to think more forward about what I was actually feeling because sometimes you don't think about it. You just feel it. – The negative stand out in my mental frame more than the positives do. It [graph] looks actually pretty even which is surprising – I was thinking that it would skew more to the negative feelings based on how I think of the past few weeks overall, So I don't know, it's interesting to see that there's positives hmm! –T34

Emotional awareness was **difficult** for T32, who said he had been working on it for a long time as he found it tough to identify emotions when he was feeling negatively and was not sure what to log. T32 suggested adding an option under emotions that says, “*unable to explain*”.

T32: I've gotten a lot better at trying to understand how I feel and looking at my emotions but when it comes to in that moment, it can be hard for me to identify my emotions. And

that's something I've been working on for years is trying to identify my emotions. And it's not always easy.

Interviewer: That makes me think that we could probably add an option, which is not any specific emotion – maybe unable to explain or something like that in addition to the [current] options?

T32: Yeah, probably because activity isn't something that you have to think about. With emotions, you actually think about what you're feeling, with activity you just do it and what it is.

On the contrary, it was helpful for T34 to have the emotions listed as sometimes it is difficult to think of one and name it.

Well, in terms of like the system, it was helpful to have all of those listed emotions out because sometimes it's hard to think of one and name it so it was helpful to see those because I would be like, Okay, this is, this is what I'm feeling I'm going to log this one. Or sometimes I do like I know that I'm feeling. I don't know. I know that I'm feeling excited. Right. Or I feel like I can't name my bad feelings, but it's a bad feeling so it's one of these so yes, that was helpful. –T34

T32 and T33 also pointed out the **differences in short term emotion and long-term emotion** about an activity. T32 talked about watching YouTube and feeling good in the moment versus feeling differently about the day overall.

When I have a day where I don't have any responsibilities and I'm just doing a relaxation activities like watching YouTube, things like that, I feel positive in the moment, but at the

same time I know that in the back of my head I didn't do anything productive. So I think that's one thing with logging, is it tells you how you're feeling right then. – When you're talking about how I feel in a normal day, I think that these activities do show how these activities generally make me feel. But it doesn't really show how I would feel about that day. – Maybe even a journal entry where you could say how did you feel at any given time during the day and how do you feel now [at the end of the day] about what you accomplished or something like that –T32

T33 had a rule in his household where he had to do a certain amount of physical activity before playing video games. He associated negative emotions in the logs with physical activity. When asked about it in the interview, he explained his understanding that it was good for him in the long run.

I think it's good and bad at same time 'cuz it starts to get old after a while, but like, at the same time. it's like, I know it's good for me in like the long run. –T33

Clinicians valued the summary graphs and data to identify points of discussion, query, and future goal planning during therapy session.

This [graph showing intensity versus activity categories] is pointing you in the directions to query and then you need to like follow up and really understand the antecedents that prompted the negative mode— and then this you needing to connect it to this to get those like idiographic patterns for the individual. –C32

I liked the simplified excel sheet that had things and that is easy for me to see patterns in and make goals around like upward spiral activities. –C31

Information relevant to clinicians for helping teens in therapy included visualizing how the teen's valence and activities distributed across time to understand behavioral patterns. In an example of how she would use and interpret the activities summary table and intensity versus time graph, C32 explains:

Relaxation is not working for this person. So, I would want to dive into that and see is that scrolling through social media like passively and comparing themselves to others, like what's going on there. I would be drawn to that pretty quickly. And then it looks like they're doing like a lot of things really well. I would just highlighting to them that they're, they're all these other activities that are helping them to maintain positive mood – might look at the morning and like, see what – is it waking up that's really hard, or is it that there's a chore before going to school or, you know, really using this as a clue for what to look at in more detailed mood tracking log this how I would use that –C32

Intensity information was more valuable than frequency which helped identify any noticeable shifts

I think it is good to remember the number of times that they're logging, but I prefer the capturing of the intensity, just as more meaningful to me. – I think, 'cuz then you're kind of pulled to the most dramatic just kind of shifts.–C32

C32 envisioned being able to obtain more information about the activities for that day by clicking on the valence dots per day to capitalize on the positive days and identify triggers.

Maybe can you, like, click on the dots and get more information about that day – it would be very cool if you could click on the dot and then be brought to the log for that day

because I like to try to understand for that person what the patterns are that may be contributed to negative mood and then I would also want to do that with positive mood. So we could get a better idea of what's happening in those spaces that might be contributing and could be opportunities to change their mood – Capitalizing on the experiences from the positive days and then like looking at the patterns for negative to see if there were triggers that could be avoided or cope ahead with or if we would need to add in some additional skills in those negative days. - C32

5.4.1.3 Mismatch in Data and Actual Experience

It is important to understand the context of collecting and logging data to support reflection which can influence real life experiences and sense making. The Pandemic and Summer influenced how the teens' schedules changed, when and what they logged, and how they reflected on the logging data.

Interviewee: So, the Summertime is also very different compared to like school time when you have lot of flexibility.

T34: I have a feeling, it would have. I have a feeling all of this data would have looked very different had it not been COVID. This is all data from when everyone was inside their house. All the time.

The motivation to log ranged from intrinsic motivation of novelty or learning about how they feel to extrinsic motivation in supporting the study, being told by parents to log, or getting paid. For example, T37 did not have any expectations from logging and would log when he got the reminders. s

The tracking, I guess was kind of helpful. Like, the process of it. – I log when my mom tells me too. Usually after a meal or before playing video games or after exercising. No problems logging in. I notice a thank you each time I hit return so good manners. –It was kind of like It was like a task to do for their reward. – T33 (Week 3)

I log my activities when my mom reminds me to log them. Maybe three times a day like after every meal that would help me remember to log them – T35 (Week 3)

Clinicians perceived tracking data from teens to be helpful and more intuitive than paper tracking

I think the idea of activity tracking and mood logging, I would assume that it would be helpful. It was, it's what I would ask as a BA clinician anyway. And so to have it in a format that's slightly more intuitive than like a piece of paper. I think it works for teens, um, Yeah, this looks good to me. –C31

T31 who logged the most among all participants said she was consistent in logging and some teens said they would log when their phone notification reminded them to.

That I was consistent – I tried to log all. [I logged] after I got reminders and as soon as possible. –T31 (Week 3)

T37 and T31 said they were not selective about what they logged. T35 on the other hand said she would consciously decide what to log (or not) such as when she did a big activity or balancing the frequency of logs when she felt positive and negative (her logging was sparse as she logged 9 times in 8 days).

Well, the reason was usually are either do like a big activity like go to the river or something like that, or I would just wake up and it would be on my mind – I would definitely sometimes feel the need like not to share it [activity]. But then I tried to share all of my feelings and sometimes, though I felt I would be sharing more negative than positive, so I try to share a positive experience or if I was sharing a lot of positive I tried to share a negative experience. –T35

I've gone to therapy for a while. So, I know that I tend to think not more negatively, but I don't think extremely positively, so I don't focus on the positive and I also think forward in like the future – which is not a great thing sometimes. So, I think I logged back and forth between positive and negative. If I did was overly positive and like I recognize that that I would log that. –T34

Barriers to logging included structural, internal, and technical issues. Structural issues occurred when the timing of the reminders did not match their personal routine such as sleep or work or not having done much that they wanted to log in that time period. Internal issues included forgetting to log, feeling unmotivated to log on a phone or computer during depressive episodes (T36), and difficulty in identifying what they were feeling in the moment especially, when experiencing negative emotions. Technically, teens were missing notifications as either they were using Slack only on the computer and missed notifications while they were away or notifications got buried with other notifications on their phones. While T36 and T32 struggled to log during experiencing negative emotions, T35 and others said they did not experience that difficulty. Another struggle brought up by T36 was feeling overwhelmed by seeing the number of logs she had missed already and perceiving that she could not catch up.

Some teens (T35 and T36) also experienced guilt and negative emotions when they **forgot to log** or felt that it was tedious to log when they did not have anything that changed between the reminders. Some (e.g., T32) expressed this guilt specifically while seeing their graphs and wished that they would have logged more to get an accurate representation without the missing data. This guilt might have been due to the teens' perceptions of not meeting their own expectations and/or researchers' expectations or missing out on what the clinician or they themselves could have learned from the data if they logged more.

Um, negative with sometimes it would be frustrating when I forgot personally, so that I would be frustrated at myself for forgetting [to log]. So that wasn't the best, but that was the only negative thing in my experience. –T35

I do wish I was able to log a lot more so that we had more to look at this [graph]. –T34

It's hard when there's missing information that I feel when I think about the times I logged. I think that in my daily activities, I think that there is a lot of information that isn't here – I think it would be nice if I had logged more to get a more accurate representation. The problem was I think it was two weeks there, I didn't really log it all. And so, I felt like if I had logged more than it would have been more helpful— the talk with the clinician. –T32

T36 often logged multiple activities done on different days at once and her recollection of multiple activities and emotions may not be as accurate as when they were happening in the moment.

Like I would log like 20 at a time to catch up for the past like five days or whatever. And then I wouldn't do it again for a few weeks, or whatever. –T36

She expressed that frequently struggling with depression and anxiousness impeded her motivation to log.

It was just because like I wasn't feeling good. Well, I mean, like, I'm just going through it for going through my head like what mine would be for this definitely internal like all of my issues are internal here just like not being motivated. – How many things that I was supposed to log it just started piling up because I would forget to do it or login and that made me really anxious. –T36

T37 found it tedious to repeat the same information multiple times a day with some underlying expectation around logging only when you experience something that is out of the ordinary. He therefore asked for an option that would simply help indicate each of the options were similar to last time.

Mood tracking was easy but I didn't like getting notifications for it 4 times a day it really started to annoy me – I did a couple of times a day, and I wasn't, I didn't really feel like a lot of experiencing a lot other than just normal stuff. So, it was a little tedious writing the same thing down a couple of times a day. Maybe like a thing which is like feeling a button which is like feeling similar to the last time – maybe like you choose “same as last time” under a checkbox for each of them [activity, category, feeling, intensity]. –T37

Depending on where they used Slack (phone or computer) the reminders were or were not helpful for the teens. T35 had it on her computer so it would not be helpful if she wasn't

already on her computer. Whereas for T32, even though he used it on his phone, the notifications would get lost among other apps. T37 used it on his phone but did not feel like logging the same thing multiple times and it was getting tedious. T36 asked for an option to send the logging reminder as a text message as she only used Slack on her computer, and it was difficult to access and motivate herself to use when she was (frequently) feeling depressed.

I don't often log every time I get a reminder because I'm not close to my phone, however I do log it for the evening reminder at 9. - T34 (Week 3)

Um, they [reminders] were sort of useful sometimes they would help me and but most of the time, they didn't help me. Because sometimes when I was on my computer, there would be a little notification saying like you need to log Slack. But sometimes when I wasn't on my computer. It wouldn't give a little sound or anything like that. –T35

Teens suggested that **relevant timing and reduced frequency of logging reminders** would support them in logging more consistently. The times at which teens logged varied and depended on the teens' personal routine. T31 and T35 preferred to log in mornings and evenings. On the other hand, T34 said she would prefer afternoon during lunch and then one in the evening – two halves of the day so there is a considerable amount of time that had passed, and her activities had changed. T35 mentioned that sometimes she would forget or not have much to track but usually missed the midday window. For T32, evenings provided more flexibility, but afternoons and mornings depended on his schedule for the weekday or weekend. Most teens and clinician C31 asked to remove the 9 am reminder.

I'm noticing in the morning it's more negative, but that's not always the case. I think a lot of the time it's just, I'm not logging in the morning because I'm not awake. And if I am awake that early, I'm probably in a bad mood, which is why it is probably negative. –T32

It looks like I'm really sad in the morning for some reason. – After like I wake up and like I get food and everything and like kind of get ready – I shouldn't do morning because like I'm kind of like not really done anything I think about it like in the morning. I don't do that much. –T33

Most teens asked that the **frequency of reminders** be reduced to 2-3 times per day. T37 found logging tedious, in general and asked to stop reminders after week 4.

I liked to get reminders about logging and think that if we had just two a day it would help establish a bit more of a pattern of logging in order to show a more accurate data set. It is difficult to be motivated to come into the app and reach out to the bot to record data without prompting. –T34

I think that if I only had to log moods three times a day that would make me remember better. :) –T35

The time for logging did not correspond to the time for having done the activity for all. T36 was confused that the system would log the time the reminder was sent as the time the activity was being recorded. She tried to back-track and log activities from multiple days at once which was not how the system worked as it only logged the current timestamp of logging. T36 suggested having a clearer interface for understanding what time of logging was completed versus not.

So, it would give you all these notifications, but then it wouldn't like say when you had completed one notification. Like a different color or something when you had completed it. So, I had no way of knowing which ones I'd done in which ones I hadn't done which kind of made it harder. –T36

5.4.2 Theme 2: Scaffolding Steps from Avoidance to Action

5.4.2.1 Reducing Avoidance with Structure & Adjusting Perception of Control

A characteristic symptom of depression is avoidance. In addition, the Pandemic drastically changed teens' routines, life-circumstances, and activities they had control over. Over the Summer, online or offline school was not in session although some teens still had part time work. BA activities supported structure and helped them manage their perception of control. Logging helped teens ***add structure and maintain a routine***, especially, in an otherwise unstructured and uncertain time during the COVID -19 Pandemic.

I think it [logging] changed my behaviors I guess because instead – well COVID is the whole thing. Which is crazy. And I think when COVID started my behavior shifted a lot because I just was like depressed. I guess is the best way to say that. So I would dwell in my room a lot and just kind of soak and like I would do whatever schoolwork I had to do but the bare minimum. –T34

Like the logging was like it was like fun to like organize and yeah, just it just made me feel like a lot more organized And I like that. –T33

Interestingly, the logging activity would not only trigger T34, T35, and T31 to log but also to do something related to self-care or help them prepare for the next activity to feel how they expected.

Doing the study was a way to kind of get back into doing like little bits of something [during the Pandemic], even if it was, it's not really work, but it's something that I had to do. Right, so the reminders would trigger me to do something right. [...] But it would definitely trigger me to think more about it. Right. And maybe to do – I don't know at one point we talked about self-care to do something with selfcare - T34

I started doing like more activities because like looking at what I logged. It looked like I was just like logging like watching TV and stuff like that. So, I rode my bike more hung out with friends and stuff like that. And also my morning routine has helped me become less cranky in the morning. –T35

I would use it to maintain a regimen. Yes, it was useful – because I didn't feel [as] expected sometimes – so, I was able to prepare [for the next activity]. –T31

T35 also said she would go back and see the summary of activities on Slack when she felt like she didn't do anything that week, which made her feel positively and plan future activities.

Interviewer: Did you, did you ever see yourself going back and looking at the activities that you logged

T35: Yeah. When I would be looking like sometimes when I would be frustrated. Like I feel like I haven't done anything this week, or actually go back and like look through slack and I look at what I did.

Interviewer: And how did that make you feel?

T35: Made me feel pretty good.

Some teens showed evidence of behavioral activation by acting on small controllable and helpful things against avoidance when feeling overwhelmed due to internal emotions and external issues. In the upward downward spiral activity in week 3, we received 17 reflections from 6 teens. In the majority of reflections, teens explained how negative circumstances led to negative or neutral mood and consequent actions and positive circumstances led to positive mood and positive actions. However, four teens showed evidence of changing their actions by bringing their focus to positive or helpful actions that were under their control even when they were struggling with negative or overwhelming emotions and negative circumstances.

What happened: There is still unrest because of authority figures in our country.

How did that make you feel?: Sad

What did you do as a result of feeling this way?: Meditate –T31

What happened?: my room was messy

How did it make you feel?: uncomfortable, unmotivated

What did you do?: I cleaned my room –T38

T34 found it valuable to understand SMART goals explaining her experience with avoidance and the value of breaking down her goal into small steps.

To me, SMART goals were a new thing. So that was interesting to think about how instead of having one big goal you have little steps to get to the big goal – which makes a lot of sense when it comes to like having some mental illness part that makes you want to

not do said big thing, but you could do little things right. It's like if you're depressed and you're sitting in your room and everything's failing, and you don't want to like clean it or something just putting cups away would make you feel a lot better. Right. If you put one little thing away. It helps. So the mini step were helpful in that it would show you like what you can do. So I think I got up to stretch and then I got to. I haven't gotten to bike rides yet, but we're close. –T34

Similarly, T35 found value in using mini steps to think through her goal.

My SMART goal was to like be excited to wake up, but I like didn't know how to do that. But the mini steps really helps do that. –T35

5.4.2.2 Support SMART Goal Planning

Teen participants found value in planning SMART goals and most of them planned activities for socializing, exercising, and practicing hobbies (Table 13).

But after doing that [SMART goal], I definitely like made a lot more plans like go outside and hang out with people and stuff – I mean yeah me realizing that I should talk to my friends more and try to get outside more – And then you had me realizing that I should try to do things like practicing at a time of day when I'm the least anxious or bored. With the smart goal like breaking it up into chunks. –T36

Table 13: SMART goals planned by teen participants using ActivaTeen only in week 6.

Participant	Goal	Mini Step 1	Mini Step 2	Mini Step 3	Mini Step 4
T33	3-5 times a week run 2 miles before I play Fortnite. 25 pushups and 10 burpees	have clothes out and shoes by door	have glass of water on table	have AirPods and computer charged and ready to watch	None
T35	Do a morning routine to get me up and excited about the day.	Wake up and shower with relaxing music	eat a good and healthy breakfast	go on a walk or run	None
T38	Read history book	read for at least 30 minutes everyday	None	None	None
T32	Start hanging out with one of my friends in person at least once a week	Text some of my friends to figure out who's available	Make a plan for when/where	None	None
T37	Umm do more cooking/baking	Idk	None	None	None
T31	Watch less online streaming movies	Cancel subscriptions to paid streaming services	Don't watch free streaming services	Don't watch movies on YouTube	Try not to watch more than one movie a day
T33	Do less arguing with my mom	breathe	walk away	ignore	try not insulting her
T36	Practice cello for 30-45 minutes per day five days in a row this week.	Use a timer to break practicing into 15-minute chunks.	Begin with doing two or three separate 15 minute chunks. Get a snack or water in between.	After a few days of this try doing two chunks in a row without a break. Or at least reduce the length of the break.	None

T37 struggled to come up with an idea for SMART goal and did not use the suggestion cards either. On the other hand, T34 and T32 already had a goal in mind (pertaining to circumstances due to COVID-19) so did not need to use the suggestion cards. Their goals were driven by being sedentary during the stay-at-home order and wanting to do something physically and socially active. Activities on the suggestion cards that were similar to what they had in mind resonated with them.

So I don't actually believe I went through this [suggestion cards] because I had a goal of like I wanted to do something physical. And I just went to log it and it was like exercise or something. And I was like, yep, sounds right. Because that's something that's like I think about a lot now that I'm just kind of stuck at home is like, get yourself outside. –T34

My goal activity fell under socializing and socializing is something, especially with Coronavirus that I don't get to do as much anymore because I'm staying at home a lot of the time, so it's nice to socialize. – I think I already knew generally that this goal would make me happy and I think it did. So, I don't think I need any more support in planning it. – I looked at some of them [activities in the suggestion cards] and I think those can definitely be helpful for some people who don't know exactly what they want their goal to be. That can help provide some inspiration. –T32

Some teens also started planning and generating ideas for goals as they were co-reflecting on the tracking data together with the clinicians on DMs in week 4 and particularly, week 7 (which according to Fleck is R3 transformative reflection) moving towards action.

I would like to start my morning with a morning routine that will hopefully make my mornings more exciting –T35 (Week 4, DM with clinician)

The book I want to go with is a history book. I think setting reminders on my phone will work well. – [when asked by the clinician about which book they would like to read] A people's history of the united states –T38 (week 7, DM with clinician)

The process of goal planning did not work for T37 as he did not find any mini steps and perceived the goal to be a single step as he was confused by the expected granularity of each step. He was able to come up with mini steps for his goal on walking when I explained the examples during the interview.

My goal was to do more baking and cooking and I couldn't think of any mini steps. (week 5) – I didn't really know a mini step for stuff like this (week 7, DM with clinician) – I am usually not thinking about the mini steps. I am mostly thinking about the goal in general. – going outside for 30 minutes or like cleaning my room. Okay, stuff like that – you can't really think of a mini goal because it's like so straightforward that it would just be to do that. –T37

Clinicians found the teens' SMART goals to not fit all the criteria of being SMART, especially some goals were less specific. They explained that in their clinician practice, the process of planning started with similar vagueness and then the clinician prompted and guided teens through the process. They wanted to be involved early on in the process of planning so they could improve the quality of teens' SMART goals.

Would have been nice to have therapy time with the teens to help make sure that the goals they made were SMART because I felt like some of them were less SMART than others. And that just kind of some waste of time. If they're doing it, but they're not actually doing a SMART goal. So that wasn't helpful because I think by the time that I got

to them, they had already made their SMART goals and I was just checking in.– But without me. I don't know if there's a way to like put quality controls on those that they're coming up with – C31

T35, who completed the SMART goal activity after speaking with a clinician, found it helpful to speak to the clinicians to figure out ideas for her SMART goal and mini steps in this study for her morning routine.

I think it [talking with the clinician] was very helpful -they [clinician] had helped me know that I had been really cranky in the mornings lately. So, then the morning routine, it actually made me really excited to wake up because I can look forward to taking a nice shower going on a walk and eating a nice breakfast – Well, the clinician was talking about how there were ways that I could boost my mood in the morning like listening to a podcast or on like waking up to some nice music that I really liked in that kind of like inspired this SMART goal to have an exciting morning routine that would make me more excited and happy for the start of the day. - T35

C32 **envisioned** having a checklist reminder on the app after the teens write out their goal so teens can review on their own if their goal is SMART. She also suggested using annotated icons to determine if the components of SMART goals are present.

After the SMART goal, I might want a little reminder like check your goal and go through each one – is it specific, is it measurable, is it actionable, is it realistic, is it time bound. Or if there was a way that I don't know if the computer is smart enough to know those things and like, tell you, 'You're more likely to meet your goal if you set it time bound' – something to just cue them about what the SMART thing means and if their goal aligns

with that – And they could check it off if they like – you know– ‘Yes.’ ‘Yes.’ – I liked that infographic where it has the pieces of the smart goal [the image with annotated goal (Figure 12 b). I wonder if you could like, you know, have a way for the user to use these little icons and label their goal. And then they would, you know, be able to see that it was it had that or not. –C32

5.4.2.3 Support with Acting on Goals

At the time of interview, T35 was following her routine and T31 completed her goals. While a few teens such as T31 used digital reminders on Slack, T35, T34, and T33 used paper to map out their respective SMART goals.

When I wake up, I have a little sticky note above my bed and has the mini steps on I would say [I have been following the morning routine] for about a week because sometimes I have off days where I don't do it. –T35

I don't mind using Activateen to record – the reminders tho[though] I didn't find helpful or needed – the only thing helpful for me was the use of sticky notes all over my bathroom mirror to remind me to exhale when I get mad – my goal was to not fight with my mom when she doesn't let me play video games— I would suggest others use these reminders too cuz it gives you something physical to look at which I guess triggers you brain wiring to find a pattern. Writng stuff down really works. –T33

T36 whose goal was to practice Cello, said she acted on her goal subconsciously without setting any reminders. Her timing for practice was also not predetermined as she would have to gauge when her medications allowed her to focus the most during the day.

I'm definitely giving myself breaks or saying, 'I'm just going to do it for 15 minutes at a time. I'm just going to do it for another 15 minutes and I'll come back.' That's a lot easier for me than trying to just sit down and do an hour in a row. And I'm actually, I'm supposed to practice a lot more than 30 to 45 minutes a day so this is like a really low goal, but it was like, I'm just gonna start out with this and it definitely did work.— No [I did not set reminders], I just made a conscious effort to do it in the morning. Like when my meds kicked in and I could feel myself like this is the most focused I'm going to be all day. I'm just going to go do it now. Like, I'm going to set a schedule where I have 15 minutes each, and this is my scales and this is my Dvořák and this is my Popper – You know, like it's just like, I know what I need to do. –T36

T32 also did not set reminders and said reminders could be helpful for consistent activities but were not helpful as they could not do their goal on socializing at a specific time.

I didn't use the reminders. It didn't help me too much, I feel like I could've set a goal without the bot. Wait, no, I did the first week, but personally I didn't find it too helpful because for my goal, I felt like I wasn't always able to do it at a specific time. I think if it was a goal that I could do at a very specific time each week, I think it would have been more helpful.–T32

The structure and instructions for the activity on AactivaTeen for **overcoming barriers** were easy to follow for most teens. When conversing with clinicians in week 7, some teens reported on their progress or barriers.

[Following the barriers activities] it was easy. [Suggestion cards for internal and external barriers were] mostly helpful – Quarantine lockdown etc. can't do anything active. –T31

I have to admit I kind of cheated on the steps before exercising. Yes, the atmosphere is different because she's [mother is] being more easy. Not as strict. –T33

It was difficult for T34 to identify what barrier she was trying to figure out. She tried to log about forgetting to do the mini step but it did not help immensely as her issue was in identifying the barrier to SMART goal. Seeing the suggestions to overcome barriers also did not help. Similarly, T37 did not do the activity as he could not think of any barriers (and did not do his goal).

It's sometimes hard to pinpoint what barrier you're trying to figure out, right. If you knew you were having a barrier. And I think I did log something around – Maybe it was forgetting. So I think it it did help, but it didn't help immensely for me. –T34

A challenge with working around barriers to set another SMART goal was that if a goal relied on other people or unpredictable aspects, the mini step could not be completed on a schedule. T36's barrier was with creative work of practicing music which she said was also difficult to do on a schedule.

In order to get my homework done like I have to sit in my six period and be like, Okay, from 4:00 to 4:15 I'm going to do my math homework from 4:15 to 4:30 I'm going to do my la blah, blah, blah, blah, blah. But with music. I just can't do it that way. –T36

T32 explained that it was helpful for him to brainstorm with help from the suggestion card which encouraged him to find alternative resources and keep trying.

I think for me it was mainly when I look at find an alternative free resource, that's mainly what happened with me is because my goal relied on friends, sometimes my friends weren't free. And so when it's talking about free resource, yeah sometimes I need to just talk to someone else and not give up. –T32

T34 and T31 suggested **improving the reminder function** to be able to set reminders for all days and not just one day at a time. She also wanted a functionality to have reminders where one could check off their completed steps and the app reminded them accordingly.

I tried to set reminders through Slack which did work, but you had to set every reminder for every day. I couldn't somehow switch it to like all days — So maybe if there was a way like at the end of all of this, it could remind you for each of those [mini]steps. And then you just you just like click remind me, and then you click something else, like, 'remind me this step or all these steps' and then it just sends you reminders for those – that would be a whole another thing to add to it– but like you could be like 'I've done mini step one.' So it's like, 'Okay, I'm going to remind you of mini step two then' – you're like, 'okay cool', and you go in and change that. That could also track progress. –T34

It [reminders] could've been clearer on how to add little details so you stay on track like maybe added reminders. I didn't really need it but it could be useful. –T31

5.4.3 Theme 3: Scaffolding Clinician Support using ARC

5.4.3.1 Perceived Value in Integrating ActivaTeen and Clinician support

All teens appreciated DM conversations with the clinicians for informational, logistic, and emotional support. Teens felt validated and heard by the clinician and valued getting quick responses (within a week) and feedback from someone more knowledgeable than them who supported them with goal planning. Most teens did not perceive the need for any additional help from the clinicians.

I felt comfortable communicating with the clinician – Like quick responses and being able to get good information and get good responses. They like we're like saying the right stuff to me. Yeah, like responding to my questions well - T37

Well, I think that they basically were well okay I like the questions that they asked to kind of get me to open up more about it. That was definitely helpful. - T36

T34 had a week's delay due to issues with one of the clinicians dropping out of the study unexpectedly. On being reassigned a clinician, she felt positively about the clinician reaching out first.

Well, I did wait for one clinician to get back to me and then you switched it – I think it was helpful to talk to someone who had more knowledge about things in me. I was able to show me like this is what your graph is. And this is what it says. I did wait because of just anxiety reasons and just like eh...I did wait for the clinician to reach out to me which makes sense. - T34

Clinicians wanted to interleave human support to review tracking data and plan SMART goals. This could support accountability in increasing compliance as someone gives them personalized and actionable feedback motivating them to log.

In session, we would be doing what I just said like problem solving the smart goal, trying to figure out a positive reframing of a SMART goal and then I'd be you know tweaking things and asking them to do. I just help them brainstorm, like other ways that they could be tackling barriers to their smart. I guess we kind of asking them to do something differently. I remember asking, so about barriers and then asking them, like what they might do to overcome barriers. – C31

Most teens appreciated that the clinician could help understand the data and identify potential strategies to lessen negative moods or plan future goals.

I thought the clinician was going to ask supportive questions and give helpful advice and that's what happened. It was helpful being able to talk with someone. The suggestions that the clinician gave were very helpful and boosted my mood in the mornings. –T35

The clinician I talked to was really nice and easy to talk to. It would definitely be helpful if I logged more, but the clinician could help me with analyzing the data and identifying potential strategies to lessen negative moods, and I can definitely see the benefit of doing so. – I think she was really nice and she helped interpret the data from the logging and she helped understand, yeah I mean, it makes sense why you feel this way. –T32

Teens envisioned it to be valuable to be able to review their data both by themselves with their current therapists once a week or once a month depending on the need.

I think that [reviewing the logging data] would be helpful, seeing like how productive I've been that week and because sometimes when I'm feeling down, I don't do a lot of activities so seeing that might help me try and boost my mood to do more things. –T35

Because like an app like this would make sense if it were able to show you your data and like maybe that would be a really good tool for therapists to use, right. So, I wish I had more data to see just overall because maybe that would make me look at the past few months differently if I knew that I had logged more positives. –T34

Would like feedback on just kind of like how am I like routines are going [once a month] and like if there's like a behavior difference or like any difference –T33

Clinicians perceived the value of using ActivaTeen modules to support psychoeducation by replacing printed handouts and tracking both in individual and group therapy context.

And then educational elements. I guess we could, like, as a group, refer to them instead of handouts – Okay, this is an electronic version of a manual that we can all look out when we're doing teaching, for example in group versus like having it up on the board. We can all pull out our app and go through it, versus having a handout. –C31

Reviewing the tracking visualizations, clinicians were able to identify teens' patterns of positive activities, problem solve issues with negative triggers, and support the planning process for future changes. In the direct messages, clinicians prompted the teens to first explain what they noticed in the data and if anything was unexpected or surprising for them. While one clinician summarized her insights first, the other waited for the teen to explain first. They then validated the teen's experience and offered their personal insights on the behavioral patterns

highlighting activities and routines that negatively and positively influence the teen, followed by asking if the teen has any future goals based on these observations. Clinician C31 said the summary table of activities helped her identify and support the teen in planning upward spiral activity.

I liked the simplified table [of activities distributed by valence and time of day] that had things and that is easy for me to see patterns in and make goals around like upward spiral activities. – And it's also this count stuff [for how many logs per valence in per time window] seems to be represented on the Excel file that I like. –C31

T35 talked about potentially using the SMART goals module in her therapy sessions.

When I had a problem I wanted to fix, like having a friend problem, or a family problem or something like that – I think this would be similar. Because if I had a problem or something that was bothering me, I think using a SMART goal could be helpful to fixing it. –T35

Both clinicians expressed that it would be helpful that they can guide the teens before they planned their SMART goals on ActivaTeen app instead of after.

5.4.3.2 Needs for Integrating Guided ARC in the Context of Real-World Therapy

The shift to telehealth during the Pandemic seems to be already catalyzing use of apps in therapy. Therapy for all interviewed teens was virtual and T31 experienced issues with therapists being overbooked. T37 said that he and his current therapist were not working with activities so tracking would not be needed for him at that time.

I don't think right now that we're focusing – me and my therapist – I don't think we're quite focusing as much on how the daily activities make me feel, but I think sometimes that does happen. And in those cases when we're focusing, especially during the school year, I think that this could be helpful. –T32

T34 was the only teen who used an app with her clinician but struggled with sticking to one app.

Usually, we try and use an app [for mood tracking]. I've had difficulty finding one. So I've used many different ones. So I've skipped between some...So for me I for me, I can't keep track of paper. – Usually I find them [tracking apps] by literally just searching mood trackers in the app store. –We've tried many times with my therapist and me to log things hasn't really worked very well if you can tell. It gets very inconsistent because I don't make it a habit easily. –T34

Clinician C31 had experience using apps with her clients which she said was more supporting compliance than sharing PDFs during the shift to telehealth during the Pandemic. She did not require permission from the clinic as there was no data sharing or communication on the application but the teen showed their data on the screen for her to review. These apps included Cognitive Processing Therapy (CPT) coach by the Veterans Affairs Hospital (VA) for trauma processing, Cognitive Behavioral Therapy (CBT I) by Stanford for Insomnia, and Dialectical Behavioral Therapy (DBT) coach.

I use actually apps to guide my therapy with patients that I see like I'm doing CPT right now the VA has made several free apps for more adult therapies. So like I have a kid who's doing CPT (cognitive processing therapy) and we use the free CPT coach app. And

it's just a replacement for what I would usually use the handouts from the manuals. But it works much better now that we're Telehealth to have it all electronic and I can just pull up my version of the app. Actually, it's the same version for both of us. And he can pull up his version of the app. And I'll be like, 'Okay, we're gonna fill out this worksheet today like navigate here, click on this worksheet'. I think having that same experience with a BA version would be super helpful. I think it'd be helpful, even if you weren't doing the in between sessions, just to have everything held in one virtual place to be able to refer to together – still homework in between sessions is spotty but certainly it's more likely that it will happen now than when it was like a random PDF and his email somewhere. - C31

Teens advocated for the option to choose between using ActivaTeen either synchronously during therapy and/or asynchronously. They did not want to get rid of synchronous therapy with clinicians and use ActivaTeen as a standalone application.

Good to have options like hybrid Telehealth and in-person. Meet the therapist once a week and then talk to the therapist online once a week at least. –T31

T34 also emphasized maintaining privacy boundaries in viewing patient-data so that therapists can view the data based on permission from the teen without and use the data to check up on the teen once a week or if a crisis situation needs to be addressed or spikes their interest and they would need to schedule an appointment.

I think it would definitely be helpful for a patient therapist resource as if specially if you have a way that the therapists can view that [patient's graphs] without having to see the app of the patients, if that makes sense. – You can have it so that a therapist can look at someone's thing with permission. So, you could turn on and off for someone to view it. So

if something happened, it could be like, 'Oh, you logged something really negative. Do you need to talk?' – I would think maybe she would reach out like once a week or something –she would reach out if something spikes her interest. - T34

T32 and T35 would have preferred to chat with clinicians **synchronously** due to difficulty in articulating how they feel over writing.

[Asynchronous format] It can be harder than talking in person or over the phone because you don't have as much of a connection as usual, and sometimes I can't really describe what I want to say over writing. – T32

It could be challenging not being face to face and only using messages. –T35

On using direct messaging in this study, Clinician C31 said that the time burden was not high for chatting with three teens but she did not stay on track with following up as it was not her real client. Similarly, C32 explained the commitment would have been higher for her own patients as she would have more motivation and context for her own patients.

I wasn't really asking them, like, okay, like how are we going to change it next week like and follow up with that with me. You know, I didn't really get into – With the amount of time that I had. –C31

You have more context if it's your own patient and You know, more motivated to like really dive in and get in there and be helpful. –C32

Though **clinicians** were keen on using such a system with their real clients, they explained that with their current caseload of back to back hourly sessions, asynchronous check-

ins will add time burden and it would not be possible to scale up to review each client's data and provide feedback outside therapy time without administrative support. They currently only followed up with clients asynchronously for scheduling appointments and during crisis. C31 explained that structural support in other therapy techniques like DBT might yield themselves to more asynchronous client time than BA. Both clinicians strongly preferred working on the app data together during the session.

Right now, I don't communicate with my patients outside of session pretty much unless they have a crisis or they leave me a voicemail scheduling, like I just don't, so it's hard for me to imagine – If you're doing full time clinical work you're assigned to see, you know, 20 or 30 patients a week – I don't know how realistic it would be that I would add, and between sessions check-in to my practice unless there were some support for it administratively like had some time set aside to do it. – I mean, in like a DBT you're available more frequently in between sessions and generally, you see fewer patients in DBT – you're available in between sessions in your time is generally thought of as greater per patient – but depression and BA generally isn't in that category. –C31

And then we could review it and session together. And then it doesn't take any out of session work for the clinician who is, you know, probably scheduled our to our back to back. And would be eliminate some of the barriers like I didn't know what to do. Or I lost my work or, you know, all of those things. So, I could see it working really well as the work in between sessions. –C32

Envisioning **how it would fit in their clinical workflow**, clinicians explained that the weekly modular approach would be a fit for EBPIs they use that follow a manual with in between session homework.

Yeah, I mostly do evidence-based therapies that rely on between session homework and so I mean not mostly that's not true, because now I work with people with cancer and medical diagnosis, it's not I don't do that 100% of the time. But when I do know that there's a manual as treatment that fits the diagnosis that they have, then yes, I would love to do that with them. By the book and it's like I said ways you to do that without now that there's COVID. –C31

They wanted review the app data and activities completed by teens either during session or in 5 or 10 minutes before the session.

Yeah, I think I would assign it at the end of session and talk about what the assignment was and push out the notification. Have the teen fill it out during the week and I probably wouldn't look at it until they came back into Session and I would review it. – I think it would make it really easy for homework completion, you know, all these tasks are what we ask teens to do in between sessions. –C32

Based on her experience using different apps for different kinds of problems, C31 explained that onus was also on the clinician to manage different apps. To make it accessible in the clinicians' workflow, clinicals wanted systems for messaging patients and sharing tracking data and summaries integrated into the EHR.

It's going to take a long time. I think for all of this to come together, but probably eventually well where the educational materials are electronic the apps are able to track things like this and integrate with the health care records and communication with the provider is also like somehow integrated with that. –C31

I think the best way to ensure that the clinicians will know where the information is and know how to find it is to have it integrated within the medical record and so the like health information technology people would need to be included. Like having kind of standalone external stuff is really hard to get clinician uptake and sustains us because it's out of the workflow that they really typically have so if they can, like, be an add on within the medical records system, then that makes it a lot easier to be accessible to people in the hospital. –C32

Clinicians initially had concerns on safety but said that it was handled well in this study.

Everyone's always worried about what if someone tells me that they're going to kill themselves. But no one did, and it seemed like you guys really clearly told them like this is kind of a separate thing like not a crisis way, not a way of getting in touch and crisis. I'm sure you gave them like an alternative if they were in crisis. –C31

5.4.4 Theme 4: Scaffolding Peer Support using ARC

The presence of peers on the online group primarily provided emotional and informational support to the teens. No teen reported experiencing any negative interactions and both clinicians were satisfied with the moderation practices and online safety maintained in this study and did not raise any safety concerns. Preferences for peer interactions ranged from

wanting no additional social burden, optional interactions (if others wanted), and increasing guided or assigned interactions about personal interests.

I don't think there were any barriers. I think the only thing was I just didn't feel the need to interact with them, but there was nothing that was preventing me from doing so. –T32

Honestly, there was never really, like interaction between all of us, so it didn't really bother me like nothing really happened. –T35

Social interactions among peers in week 1 and 2 included talking about their hobbies (e.g., instruments, puzzles, painting, playing games, learning future pursued interests such as economics or programming), pets, personal/quarantine routine, difficult life circumstances (e.g. bullying), and health conditions they are experiencing (e.g., ADHD). Peers did not comment on other posts but some teens added reactions.

I would really like to learn how to do those two things. I have been doing a lot of painting, playing basketball with my brother, and redecorating my room. –T35

I've been studying rocks, playing video games, reading books. All kinds of things. –T31

I love learning new languages however my brain doesn't retain everything, so I often forget. I've stayed busy by playing my instruments, playing animal crossing and talking to friends as well [as] sleeping and school. –T40

Most teens appreciated these interactions and wanted to keep learning about each other's interests and hobbies that were not directly related to depression. Except T37 and T33, teen

participants suggested that these ice breaker activities continue for longer and it was a positive part of the study for some teens.

Like it was one of the fun things that we did was the questions when we introduced ourselves. Those were fun. So maybe if you had done one or two of those, like, with each activity that would have been more interaction, just so that you could like learn something about who else is studying with you – doing a study I guess because it's not studying. Just you kind of get [to know] personalities, a little bit. –T34

Seeing gifs [was my favorite feature]... people were really fun there. –T31

That felt nice [when everyone was sharing in the beginning] because it was kind of like everyone was relating and stuff like that. So that was nice. Yeah, I think that was, um, a nice like supportive feeling for everyone. I think that would have been nice. Yeah. just more activities like the first one that we did, yeah. –T35

T35, T32, and T31 said they read other teens' posts and/or SMART goals for informational support to confirm how to respond to the activities or get some ideas for their own goals. T34 would read the posts sometimes but focused on “*being done with*” the activities.

I did read other people's posts and it was nice to see what they felt about a certain week or how they felt about the goals or things like that. But in terms of talking to them directly about it, I didn't really feel a need to do so. So I think it was fine – the level of interaction. –T32

Sometimes I didn't like didn't know exactly what to say [to respond to the activities] and stuff like that. So sometimes that was hard. [Reading others' posts was] really helpful

because I kind of got a sense of like what exactly the questions were asking. – Some of the other people's goals like... are the example goals because I know at the time what my goal was, and then reading some of them, I realized what would be like it would be best for me. –T35

Both clinician participants valued and advocated for the peer support and emphasized the importance of pushing teens with depression to participate in social interactions even though the natural tendency might be to not participate due to the characteristic symptom of avoidance.

I think it's good to push them [to interact]. Yeah, I mean like you don't want to be too bossy. But part of the work is getting out there and being more active and more social and so I think it's reasonable in the context of the treatment to ask for that. –C32

I feel like a lot of apps recently have like built in social media type platforms and gotten engagement. I just suspect based on what you're telling me that the teens benefit from the social pressure of being face to face back and forth conversation and actually giving feedback because they're depressed teens right like you have to, you need all the pressure, you can get for them to communicate with each other. –C31

C32 added that suggestions from peers resonate more with teens than adults' advice when brainstorming goals.

Yeah, I think that's [sharing barriers to SMART goals in the online peer group] great. A lot of the like problem solving in our groups comes from other teens' suggestions and it always resonates a little bit more than coming from a group leader. –C32

Clinicians also acknowledged that the online nature of the study presented challenges such as prior difficult experiences and ambiguity in what to expect from the online interaction that were different from their experiences in in-person groups. C31 drew parallels to how she paired up teens for discussions in her in-person group while explaining that the pressure is greater to interact in face-to-face interactions.

We pair them up [in-person] and so two people over here are talking – that kind of puts pressure. – I haven't been on the video groups when we were in-person. I think it just social pressure is greater to say something back to when someone tells you – it varied across teens, obviously, to what extent they were going to jump in with feedback for somebody else. But I think there definitely were teens who would do that. And say like, 'oh yeah, I've been wanting to do that. The problem is, blah, blah. Like, how do you get around.' Yeah, definitely. I remember teens having conversations like that in group that they probably are less likely to do online. –C31

Balancing privacy with social interactions was important for teens. Not all teens preferred knowing their peers in-person. T37 and T32 perceived that they might have had more interactions if they knew the peers in-person. On the other hand, T35 said that she would have felt more nervous than she felt in this study if she knew the peers in the group.

I have done group therapy before and you do get to know them and interact with them a lot more versus online when you don't know their names, which is understandable because you want it to be all confidential. But I think I probably would have interacted with them more if this was a therapy setting and I actually knew them. –T32

Maybe it was kind of nice almost not knowing them because then it was a little less nerve wracking to share your answers. So maybe if I had known them before that would have made me a little more nervous. –T35

Design ideas for improving peer support included technological changes such as adding a bio section in peers' profiles or digital rewards for socializing as well as structural changes such as pairing up teens to interact and requiring more prompts to know peers' interests. T31 explained that it was helpful to be anonymous and able to use the app when no one was around. They considered themselves as introverted and suggested adding a "bio section" to know about peers' interests and hobbies.

[It was] nice to be private [because they didn't know my real name] yes or when I was on the app [no one was around me]. – Yes [have more interactions] if they [peers] want to. [For more interactions have a] a bio section... people who do a bio tend to be more outgoing... they can do a short hobby/interest paragraph. –T31

C32 suggested having digital rewards on the app to acknowledge peer contributions:

I don't know, does Slack have like [digital] rewards or any sort of like way to motivate participation and maybe that would be a way to encourage. Yeah, I think it would have to be like part of the expectation going in and then like some sort of way to, you know, reward or recognize the contribution for it to happen because otherwise, I think they feel they get a lot of unsolicited advice as being teenagers, so don't want to contribute to that. Oh, I think just from adults. –C32

Some teens did not expect more peer interactions but may have participated if it was a required in the activity to share personal interests and hobbies. T34 suggested requiring prompts for socializing and balancing anonymity with a buddy system where teens could pair up. Both T34 and T31 emphasized that these interactions should be optional.

I don't think there were many barriers, other than the fact that, like we weren't prompted to do so I don't think many of us thought to do it right – whereas had we've been prompted with maybe questions of, like, 'tell each other your favorite blah blah blah', – or respond to one person with something right – I know that sometimes people responding to comments is just interesting because then you can go read them so maybe that would have made more interaction. – Maybe if you paired them – just so they could even if it was just for like one activity like, 'hey, talk to this person about' like I don't know something – If it was some of your friends or something – however, you didn't know who is who – or maybe you do it in a buddy system. Maybe two people knew each other. You had like six people in a study and there were three pairs, right, just so that just so maybe you converse with that person every now and then. And it would be like completely optional so someone could reach out right. – T34

5.5 DISCUSSION

The primary contributions of this study are (1) the design and development of guided ARC activities based on BA and (2) the empirical understanding of opportunities and issues with the feasibility of asynchronously participating in self-support using ActivaTeen, participating in the presence of peers, and communicating with clinicians. Three core mental needs that were supported by this guided ARC included reflection for inquiry and transformation [8], reducing

avoidance by providing structure and adjusting perception of control, and providing social support from clinicians and peers. Below, I discuss these needs can be further supported in the context of personal informatics and telehealth for teens with depression by (1) designing by accounting for avoidance, (2) designing for reflection while accounting for data mismatch, and (3) supporting the therapeutic relationship using ARC.

5.5.1 *Designing by Accounting for Avoidance*

Teens with depression struggle with avoidance and overcoming avoidance is supported through BA with emphasis on acting on a goal instead of following what one feels like doing due to a certain mood. [66]. Design of ActivaTeen supported teens in reducing avoidance **by providing structure through logging and adjusting their perception of control by planning SMART goals** and breaking down goals into smaller tasks. Using reminders and planning tools, technology can intervene the avoidant thought process in-situ with psychoeducation and reminders for action and support teens in breaking down activities into manageable steps preferably with help from clinicians. Further, technologies can be used to help teens keep track of progress with their mini steps and provide intermediate rewards for small achievements.

To account for avoidance in logging behavior, there is a need to reduce teens' perceived and experienced time burden and make logging less emotionally overwhelming. Design changes to meet temporal and structural expectations of teens involve **personalizing the timing and frequency of logging** reminders based on the participants' routines and the times they feel most comfortable to log. For example, notifications were missed because participants had not woken up yet, were at work, or their medications had not kicked in yet. However, piling on notifications still emotionally overwhelmed the teens and added to their guilt. Some participants also logged

multiple activities done throughout the day at one specific time. Rohani et al. [83] also recommended providing options for not only in-the-moment logging but designing to support participants in retroactively logging multiple activities. To enable accurate interpretations and account for recall bias, these logs need to be differentiated by providing visual indicators for what data was logged in-the-moment versus data that was logged later.

Lack of **motivation** is also a symptom of depression that adds to avoidance [65]. Teens' motivation to log can be improved by providing human support and accountability with opportunities to discuss their logs with clinicians. Providing summarized and meaningful visualizations of their own data during the logging process is a good motivation to help teens understand the importance of logging. Many of the participants wished they had logged more *after* they saw the value in these summaries during the interviews. Asking participants early on to reflect on why they are logging, providing intermediate summaries to support potential outcomes and benefits, and intervening if the logging behavior should change would be helpful to revisit intermittently during the logging process.

5.5.2 Designing for Reflection while Accounting for Data Mismatch

Understanding of one's behavior and mood patterns through psychoeducation and reflection is crucial for teens who are undergoing psychosocial transitions and developing routines and habits that may last a lifetime [38,65]. Reflection was primarily supported in our study through logging, prompting teens to review data by themselves and with clinicians, and through explicit interactive prompts such as in the upward or downward spiral activity. As per Fleck et al. [34], technologies can support different levels of reflection by providing additional data (or making the implicit explicit) and also scaffold co-reflection with others – which in our

study was supported by peers and clinicians. The levels of reflections demonstrated by teens in this study ranged from teens merely describing what they notice in the data (R1), supporting inquiry to elaborate more on why they observe certain patterns in their routines and making connections (R2), and ultimately taking transformative action to change their activities and plan goals (R3) [8,34].

Teens did not want to change any graphical representations. However, as recalled by some teens during their interview, the logging data was different in some cases from their behavior and mood due to mismatches in what the teens logged and what they did throughout the day. Design changes to navigate emotional expectations of teens involve the need **to normalize expectations in logging mundane everyday activities**. Designers and researchers should reduce expectations of selectively logging positive emotions and activities and instead, set expectations of balancing different valences of emotions. Intentional or unintentional feedback mechanisms in the vocabulary or design of a system can lead teens to internalize expectations of increased positive emotions and socially desirable behavior instead of supporting the teens in learning about themselves and have a balanced expectation of positive, negative, and neutral emotions. For example, wanting to see the green colored feedback to be below calorie limit on MyFitnessPal encouraged disordered eating behavior [29]. These negative emotions may also prevent participants from logging negative activities such as when they relapse (e.g., urges for smoking [104], or slips in diet [2]). However, lapses, relapses, and understanding negative triggers are valuable information for clinicians to work on with their clients during session and this may be missed due to selective logging. Lee et al. [50] also found similar issues when “responses were the disconnect between the data itself and individual reactions to that data; students seemed to give more meaning to the data than it deserved, and often found that the

representation of the data did not match their experiences” and the participants also felt “guilt over not meeting the expectations they set from themselves”. Thus, Lee et al. [50] suggested having mechanisms in place to support participants emotionally when the data is reflecting something negative about them.

Lapsing and missing data are a common issue in personal informatics [72] and feeling negatively due to lapsing can also add to avoidance as discussed in 5.5.1. We need “designs that better support people who have lapsed, whether or not they want to return to tracking” [72]. When people miss their goals, they are also less likely to log [50]. During reflection, we need to support interpretation by accounting for missing data. In this study, we used neutral language in the summary without encouraging any positive logs. We emphasized that the summary showed logged behavior and not their actual behavior (e.g., “you logged positive emotions 28 times” instead of saying, “you felt positively 28 times”). Additionally, we also saw that teens who did not log regularly still benefited from aspects of the intervention and used non digital tools such as sticky notes or retained the information subconsciously and reminded themselves in-situ. It is important to identify and be inclusive of what meaningful engagement means for the teen even if it does not always involve interacting with the technology.

As teens are in a developmental stage of learning **emotional awareness**, different emotions might mean different for different teens and as we saw in our study, some teens might even struggle with recognizing how they are feeling. Interpretation of intensity of an emotion and their range of intensity also varied for teens in our study. Participants in Hetrick et al.’s study preferred a “color system for mood that each young person equated with their own customized ratings and, with involvement of their clinicians” [45]. They also explained similar variations in

intensity – for some youth 9 might be really high intensity of emotion whereas for others 6 might be the highest intensity [45]. They preferred adding “trigger points” for high distress, and possible onset of suicide-related behaviors.” The challenge with customized input though is when reflecting collaboratively with clinicians, these interpretations of the clients’ side need to be made explicit to the clinicians. These patterns become clearer over time with logging but may not be evident early on. Teens who need additional support with identifying and logging emotions should still be encouraged to elaborate on the context of the situation and flag the emotion as “unsure” for discussing with their clinicians. Emotions should not be just thought of on a linear scale of positive, neutral, or negative. Processing complex emotions can be supported by including support for media for creative expression such as visual art. For example, reflective practices were supported by using activities for illustrating experiences using visual lines, icons, and photo elicitation for people with bipolar disorder [98] or visual prompts similar to asking teens in study 1 to “draw what stress looks like to you” (Figure 3). Tangible technologies also support reflection on emotions in practices for mindfulness (e.g., MindArt for students [54], Spheres of Wellbeing for borderline personality disorder [103]). Teens can then reflect on these visual and tangible artifacts together with their clinician.

5.5.3 Supporting the Therapeutic Relationship using ARC

Similar to study 2, both teens and clinicians wanted to preserve the human connection with a clinician online or in-person. Though teens preferred to have options between asynchronous direct messaging and reviewing the data during therapy, clinicians spoke about the burden of their caseload which did not warrant them time to chat with 20-30 patients that they have to see each week. This opens up opportunities for involving other stakeholders in a clinic to understand how the workload can be distributed to support patients’ needs and possibly reduce

the frequency of synchronous online or in-person session or adapt to other formats that feasibly fit into the clinician workflow.

Both teens and clinicians found value in reflecting on the data summaries and graphs and discussing it together. Clinicians wanted to use the data summary and visualizations to identify activities and contexts that triggered negative emotions and the intensity of the emotion, identify positively influencing activities, and plan future goals and recommendations with teen clients during synchronous online or in-person therapy sessions. This would require supporting the teens in understanding the value of logging, reducing technical and barriers to logging, and reducing mismatches in the data with their daily activities. An overwhelming amount of information about the patient's context such as location can be collected automatically. In addition, it is also a challenge to make sense of long-term data on small display devices such as a phone when "patients may bring weeks or months of self-tracked data to a clinical visit" [72]. **To help clinicians and patients in sense-making**, it is important to display data in a shared context and facilitate communication about the data while using their clinical time efficiently. Researchers have suggested strategies for supporting meaningful reflection such as visualizing "cuts" that summarize the logged data based on empirically derived criteria of interest such as abnormal days or physical activities during commutes [31]. For supporting clinical discussions on problem solving and goal planning using BA, preparing similar cuts or summaries by flagging and selectively displaying negative triggers and consistently positive activities while also providing teens the agency to select what they want to share with their clinicians may be valuable.

Clinicians also wanted to support the teens synchronously in early stages of SMART goal planning so they could explicitly scope and verify their goals to be specific, measurable,

achievable, realistic, and timebound. Using the app as a central repository of psychoeducational information for teens and clinicians, tools can support further reflection in reviewing SMART goals in addition to supporting generation of ideas through examples and suggestion cards. Including functionalities for reaching out about any red flags or crisis related information was also perceived to be helpful.

The **COVID-19 Pandemic** was as a catalyst for mental health care systems to migrate to online telehealth using HIPAA compliant teleconferencing tools (e.g., [61,80]). Due to the widespread impact of the Pandemic on mental health due to uncertainty, isolation, and grief, communication and awareness about mental health difficulties became mainstream in schools and workplaces. Increased number of people have been seeking mental health support and clinics have been struggling to meet demands [110]. During study 3, the onset of the Pandemic impacted and delayed recruitment as we could no longer reach teens through in-person measures, participants' schedule and activities changed (e.g., no school, lack of or no access to peers, migration to online activities, and cancellation of camps or part time work), and the coping strategies that teens could feasibly use were limited due to social distancing. As the social distancing requirements due to the Pandemic continued for over nine months in the United States at the time of writing, we speculate that compared to our data from study 2 (Figure 9-10), mental health clinicians may have increased acceptance over the potential use of online technologies for therapy and may have devised creative strategies for compartmentalizing their online time, incorporating contextual information from clients' homes, and using available mental health apps and digital tools to support teenagers (similar to C31 in study 3). Clinicians might want to continue using these digital tools when they return to in-person therapy creating more opportunities for hybrid in-person and ARC formats of therapy. Future research should take

these potential shifts in the clinical workflow into account. For example, integrating ARC based support in group format for clients who may be experiencing mild to moderate symptoms but may not require weekly one on one therapy might help increase scalability of mental health care.

5.5.4 Limitations & Future Work

Teens with depression are a difficult population to reach for participation in research. The number of participants that were recruited and then eventually dropped out in this study was also impacted by the COVID-19 Pandemic and personal difficulties of participants. We initially aimed to involve clinicians with teen patients whom they were already treating but the patients did not agree to participate. Though we could focus on each participants' engagement at an individual level, we could only ask participants to speculate how this type of guided ARC system would work with their real-life therapists or patients. Recruiting real world client-therapist pairs would provide more helpful insights into understanding how a system like this would be feasibly fit into the clinicians' workflow and influence the therapeutic relationship. This would require more intensive recruitment efforts, using HIPAA compliant system such as Microsoft Teams, and connecting with administrative and technological stakeholders at clinics. To evaluate clinical mental health outcomes and usability outcomes on a larger scale, future research can involve experimental studies such as RCTs with and without the guided ARC in conjunction with in-person and telehealth BA therapy.

Chapter 6. DISCUSSION

Based on the three studies, I (1) discuss how the human centered design process can be used in collaboration with interdisciplinary experts and stakeholders for incorporating evidence-based practices of mental health, (2) reflect on the advantages and limitations of using the ARC method with teens and clinicians, and (3) envision how to integrate guided ARC interventions in clinical practice.

6.1 HUMAN CENTERED DESIGN PROCESS FOR INCORPORATING EVIDENCE BASED MENTAL HEALTH PRACTICES

Human Centered Design (HCD) methods are increasingly being used in designing patient centered technologies for physical health and mental health. Over the years, HCI researchers have provided guidance on how to include clinical stakeholders when designing for mental health [27]. More recently, the University of Washington's ALACRITY (Advanced Laboratories for Accelerating the Reach and Impact of Treatments for Youth and Adults with Mental Illness) Center (UWAC) has been working closely with interdisciplinary research teams to work using the Discover, Design/Build, and Test (DDBT) framework to implement evidence based practices (EBPIs) for mental health treatment [57]. In this section, I discuss considerations in using HCD processes of understanding stakeholders, designing and prototyping, and evaluating designs of mental health technologies for teenagers by reflecting on my experience in the three studies (Figure 18).

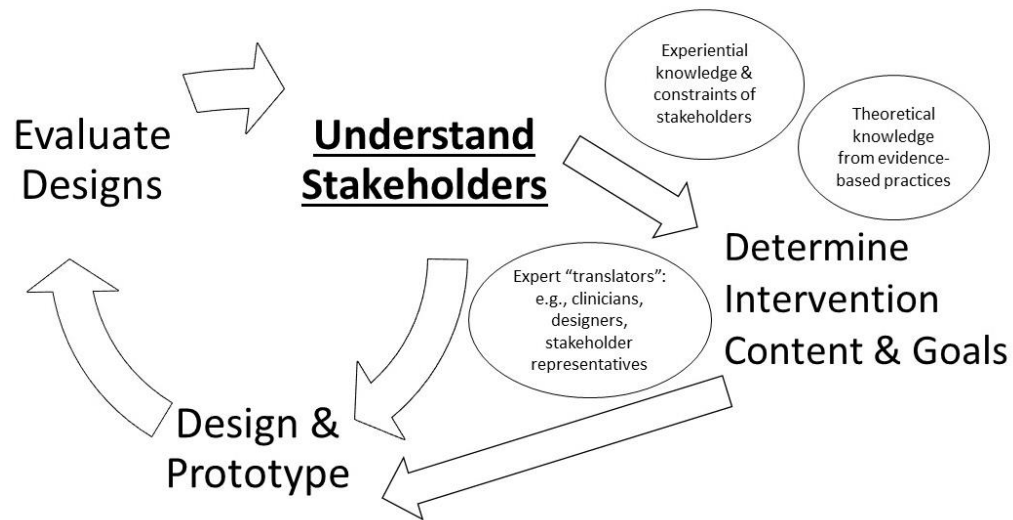


Figure 18: Human centered design process for evidence based digital mental health interventions

6.1.1 *Understand Stakeholders: Experiential Knowledge & Constraints*

Developing empathy and understanding needs of stakeholders is a key strength of using human centered design methods. In interdisciplinary work, this understanding is influenced by the experiential knowledge of the researcher, collaborators from other disciplines, volunteers from target stakeholder groups, and study participants. Often, it difficult to acquire a breadth of new knowledge from different disciplines, translate knowledge from one stakeholder group to another, and reconcile needs with constraints and conflicting values that can be incorporated into the design of a system. It is important to include and acknowledge diverse perspectives and experiences which may take time. Researchers can use methodological approaches such as Value Sensitive Design (VSD) [36] to systematically incorporate the needs of direct and indirect stakeholders. Though I did not use VSD in our work, I describe the process of involving direct and indirect stakeholders and experts followed by a discussion on ethical considerations and boundaries when designing for mental health.

6.1.1.1 Involve Direct Stakeholders

Recently, HCI researchers have involved teenagers in participatory design which is very helpful in understanding requirements, perspectives, and vision of stakeholders who directly use the technology and are impacted by its use [36]. Although there are methodological and ethical difficulties in working with teenagers [67], it is possible to involve them in early design process. If a technology is to be used with family members or clinicians, it is logical to involve them in the design process as well. There are differences in power dynamics where a teen may not be as comfortable in participating in the presence of a parent or a clinician. It is valuable to gather feedback separately from these stakeholder groups as well as observe these social dynamics together if the technology is to be used by both stakeholders. We used and adapted multiple methods including ARC, interviews, surveys, and codesign to create a space where teens could feasibly and comfortably participate. For example, we maintained a flexible timeline which enabled teens to drop in and out of the study asynchronously and interviewed teens using text chat. It is also important for researchers to include and respect teens as informed participants and equal partners in the design process [112,113], negotiate decisions (e.g., ethics [92], privacy, research timeline) with participants during different stages of research, and share the results with them. Teen and clinician participants expressed interest in learning what we find, and we summarized and emailed our publications and poster to the teen participants inviting any feedback. After Study 3, we sent the logged data and the summary of visualizations back to each teen, which most of them appreciated.

6.1.1.2 Involve Indirect Stakeholders

Indirect stakeholders are people who may not use the technology but can be affected by its use [36]. It is also helpful to interview indirect stakeholders to triangulate if the intervention

skills have been used by direct stakeholders and/or if there are any positive or negative effects of an intervention. For example, Slovak et al. also interviewed teachers who did not use the system but observed how the students and parents reacted to it or how the students' may have adopted some of the behaviors they learned in their system that used social emotional learning (SEL) skills over time [96]. In our studies, parents or guardians were secondary stakeholders who did not directly use the system but played crucial roles as gatekeepers by either restricting access (such as not letting teens participate) or providing access (such as forwarding emails, encouraging teens to participate, and logging them on to the system). Some parents also encouraged or reminded teens to log activities which improved their engagement. In some households, parents monitor and/or restrict teenagers' online social activities. Teens explained that their relationship with their parents or guardians was important in how comfortable they felt with the privacy of using Slack in their own environment (e.g., privacy considerations for parents reading the posts). A few teens were restricted from using social media such as Facebook or Snapchat. These are important considerations when choosing platforms that are accessible for teenagers. If data sharing and communication functionalities are to be integrated with the existing clinical infrastructure, indirect stakeholders would include hospital or clinical administrative and IT staff. Though we did not involve these secondary stakeholders in our studies, it is important to consider their role and perspectives in future work.

6.1.1.3 Involve Experts

The most common strategy in designing for mental health is to involve a mental health clinician or researcher from psychology or psychiatry who is an expert in evidence-based strategies early in the design process. Their expertise usually helps in close collaboration with designers. They can be a part of the research team or be consulted with through initial expert

interviews, contextual inquiry, or focus groups. Clinicians have real world field-expertise working with multiple clients and offer helpful perspectives on the implementation of EBPIs. Designers have also been external consultants in teams that are led by psychiatrists (such as involving IDEO designers in design of PRIME [86]). Translating evidence-based strategies into design is complex and such interdisciplinary collaborations are helpful to study what visual and functional aspects of the design are helpful in delivering the intervention content (which I elaborate on more in section 6.1.2). HCI researchers should strive to understand how strategies used in practice might differ from theoretical knowledge either through observations in clinics or participating in clinical trainings. For example, to understand how BA is used in clinical practice, before the start of study 2, I attended a one-day clinician training workshop on BA meant as a crash-course for practitioners. This experience helped me connect with clinicians, ask questions, and understand the clinical workflow when using BA.

6.1.1.4 Ethical Considerations, Reflexivity, and Boundaries

Balancing needs and values, autonomy, safety and moderation, privacy and confidentiality are crucial when working in the mental health space. To be able to create and maintain a safe space for participants, HCI researchers should strive to obtain mental health trainings such as Mental Health First Aid for youth and adults [116]. Volunteering and field experiences outside of research to engage with patients and mental health communities before starting research is also very helpful. Experiences on the field primed me to anticipate challenges that we might face during the study and develop protocols for moderating and planning for the safety of participants with support from collaborators and HSD (Appendix D, E, F).

Emotional labor is intensive in qualitative research work in sensitive settings. It is important to recognize how our personal experiences support and sometimes interfere with the intents, goals, and processes in our design practice. Practicing **reflexivity** is also crucial when working with multiple stakeholders and collaborators from different disciplines. Researchers should strive to work closely with team members to validate their interpretations, journal regularly, and leverage therapy or other forms of reflective spaces for support.

While it is important to be empathetic to carry out mental health research, maintaining **personal boundaries** is necessary for researchers to prevent harm to both participants and researchers. It is essential to be aware of and maintain physical, financial, emotional, and social boundaries with adult and adolescent research participants. These boundaries may often be blurred in qualitative research on sensitive topics where researcher(s) inquire about personal and intimate details about participants' lives, such as illness, death, loss, or abuse [24]. By training, researchers' goals in qualitative research are to develop rapport, listen to participants, gain in-depth data and insights about the lives of participants, and communicate their stories. However, if researchers do not consciously balance personal boundaries, evidence from multiple accounts of qualitative researchers supports that occupational stress and secondary exposure to trauma may ultimately lead to development of unhealthy attachments, visceral emotional reactions during the interview, transcription, or analysis, emotional desensitization, burnout, feelings of guilt, clinical depression, and/or even physical symptoms of exhaustion and pain [23–25,51,70]. Considerations for maintaining boundaries in qualitative research for mental health include:

1. **Balancing expectations of participants versus goal of the research:** Research opportunities to share about health conditions may be interpreted as a therapy session. In

some cases, researchers may also be asked questions about sharing tips or information about an illness. Inquiry in qualitative research involves similar skills as therapy [24] such as active listening and supporting reflection. Participants may perceive researcher as a friend, a confidant willing to listen, or even a therapist whereas a researcher may not be equipped to take on these roles. If a researcher is aware of certain strategies and resources, they can discuss them with participants at the end of the interview or study.

2. **Selecting safe physical locations:** Intimate environments such as people's homes may allow researchers to learn about private lives of the participants but may further blur personal boundaries between researchers and participants.
3. **Navigating self-disclosure:** Researchers may be motivated to do studies in sensitive settings by their personal experiences [51]. Self-disclosure can help in building rapport and making the participant feel validated speaking to someone who has shared experiences. Self-disclosure can also make the researcher feel vulnerable and shift the floor for sharing from the participant to the researcher [25]. In such cases, it is important for the researcher to judge and understand how much they prefer to disclose and is reasonable for the research.
4. **Whose voice is communicated?:** Researchers who are motivated to work in a domain of research due to personal experiences may overshadow participants' voice with their own. Thus, they may highlight quotes and examples that resonate with their own experience and values and ignore voices that oppose their personal views. Maintaining a reflexive journal can help separate experiences in the data from researcher's personal experiences.

5. **Navigating ethical hangover:** Researchers report feelings of guilt and responsibility towards participants who may be struggling emotionally or financially, experience adverse events, or recount adverse events. This is termed as ethical hangover [23]. Researchers must understand where their responsibility ends, view the participants as resilient and autonomous individuals, and be able to leave the participants with other resources to reach out to for support. This emotional distancing may not be possible in-the-moment for the researcher and seeking counseling can help to handle such emotions.
6. **Navigating secondary exposure to trauma and re-traumatization:** A challenge with active listening is that researchers can be triggered and/or be re-traumatized by participants' experiences which are similar to one's own difficult experiences. Researchers should make efforts to recognize the impact on their own mental health and seek avenues for therapy and social support to process their own healing.

Types of trainings and support for researchers to maintain effective boundaries involves both preparedness at the start of the study and on-going dynamic support during the study. Moncur [70] talks about three levels of support: personal experience, institutional support (supervisor, counselor, ethical review board), and informal coping mechanisms. The following measures can help researchers be aware of and maintain personal boundaries:

1. **Planning interviews with breaks:** Researchers are encouraged to leave time between interviews to process any information that may be harmful, adverse events, or work that may be emotionally taxing for them. For instance, researchers can schedule one interview every 2-3 days and interleave it with other tasks in non-sensitive settings.

2. **Preparedness:** Researchers should be prepared to do risk assessment and have protocols ready for adverse events, distress, and physical and emotional safety for both the participant and the researchers. Such a protocol can also include self-care recommendations and plans for researcher(s).
3. **Team debriefing:** Researchers should debrief with peers, teammates, and/or supervisors in the study about the data as well as their reactions to the sensitive nature of the study. Peers in workplace outside the study team are also a helpful resource (e.g., for venting and getting perspectives). Researchers should prepare to conclude the study physically and emotionally after the study by being aware of their limitations and role in the life of a participant. Researchers should be careful when sharing data outside the team and should respect confidentiality of participants.
4. Researchers should **practice self-care** both proactively and reactively. These measures may involve interleaving work with other non-sensitive studies, dedicating structured time and environment for work (e.g., office or desk space at home), taking care of personal health (e.g., physical exercise, diet), or taking time off. McKeller [67] explains that as per British Psychological Guidelines (2009),

“if a researcher becomes aware of any health-related or personal problems which may seriously impair their own professional competence when working with participants then they should refrain from practice and seek professional consultation or assistance.” [[67], p 35]

5. **Bracketing, reflection, and reflexive journaling:** Dempsey [23] suggests practicing “bracketing”, reflecting on oneself, and being reflexive about one’s thoughts about the

research process and events. Researchers may do this by journaling their thoughts after study sessions. Bracketing helps researchers “set aside their own understanding and allow the phenomenon under investigation to speak” [[23], p488]. Maintaining a journal is a helpful avenue for venting and helps maintain a reflexive account of the research process. Reflection can also support researchers in making meaning out of the experiences. Moncur found that meaning making from experiences in sensitive research also helped researchers cope [70].

6. **Seek informal support:** Researchers may also seek support by venting and discussing with informal support networks such as friends or family. This strategy may however lead to issue of confidentiality and researchers must be careful of disclosing sensitive issues and/or identifiable information outside the team.
7. **Systemic support:** Support from research team, institution, and ethical boards to encourage or mandate researchers to plan and review self-care measures at the start of the study can also help. Recognizing distress need not be sole responsibilities of the field worker but can be encouraged by supervisors, IRBs, and/or departmental levels.
8. **Distribute moderator roles in online research:** Sharkey et al.’s team had structured moderation and distributed moderator responsibilities among six team members during high activity periods in the evenings [92]. It may not be possible to have a large number of team members, however, distributing the role of monitoring asynchronous online posts can help researchers engage in self-care practices and support one another with debriefing and planning.

9. **Reinforce boundaries:** Making our roles as researcher and our limits clear to the participant at the start of the study is helpful (e.g., stating and reminding that “we are not counselors” and explaining the benefits clearly during the consent process).

6.1.2 *Determine Intervention Content & Goals*

Mental health technologies have been designed to facilitate tracking, deliver interventions/intervention reminders, and/or connect people for peer support. Underlying skills for coping with stress and depression include psychoeducation, reflection, problem solving, accessing social support. Technologies can be designed to support adolescents to technologies using strategies such as journaling to promote reflection, self-tracking and helping teens develop insights about how their mood is related to their daily activities, psychoeducation about mental health challenges, stress, coping strategies, and evidence based strategies.

Technologies that are designed and developed for adults have been primarily used for personal self-tracking and monitoring (e.g., MONARCA [37], MoodRhythm [63]). When designing technologies for people who have mental illness diagnoses, researchers have used evidence based strategies such as Cognitive Behavioral Therapy (CBT) in designing Chatback [73], Dialectic Behavior Therapy (DBT) in designing Pocket Skills [88], and Mindfulness meditation [54].

The format of delivery can vary such as text messages, sequential prompts on an app, interactive chatbots, storytelling (e.g., [96]), games (e.g., [19]), or tangible objects (e.g., [54,97,103]). To design for mental health and maximize benefits to participants, it is important that the content is based on strategies that have already been proven to work. Designers and HCI

researchers should work closely with clinicians during the design process to be able to preserve the goal of the evidence-based practice in the design.

6.1.3 *Design & Prototype*

In this section, I discuss how we brought together experiential understanding, theoretical knowledge, and design practices to iteratively ideate and design the system. Michie et al. [69] created a taxonomy of specific interventions across multiple behavioral change theories to inform key components that can be translated into the design of behavior change technologies. Similar work can be done in reviewing evidence based mental health practices to identify core mental health needs that are supported by EBPIs.

In our studies, the work in translating from stakeholder needs and theoretical concepts to design was done by closely collaborating with designers, clinicians, and representatives from stakeholder groups, thus ensuring that the therapeutic aspect of the intervention is preserved in the design of the system. Our immediate team members comprised of HCI researchers, clinical experts, an undergraduate trained in psychology, and a teen volunteer. We reconciled of design concepts with stakeholder needs, intervention content, and technical functionalities by constantly ideating low-fidelity prototypes, iterating, and obtaining regular feedback from all team members. In addition, we also reached out to BA experts and design students outside our team to obtain feedback on high fidelity prototypes during the development stage (Figure 19).

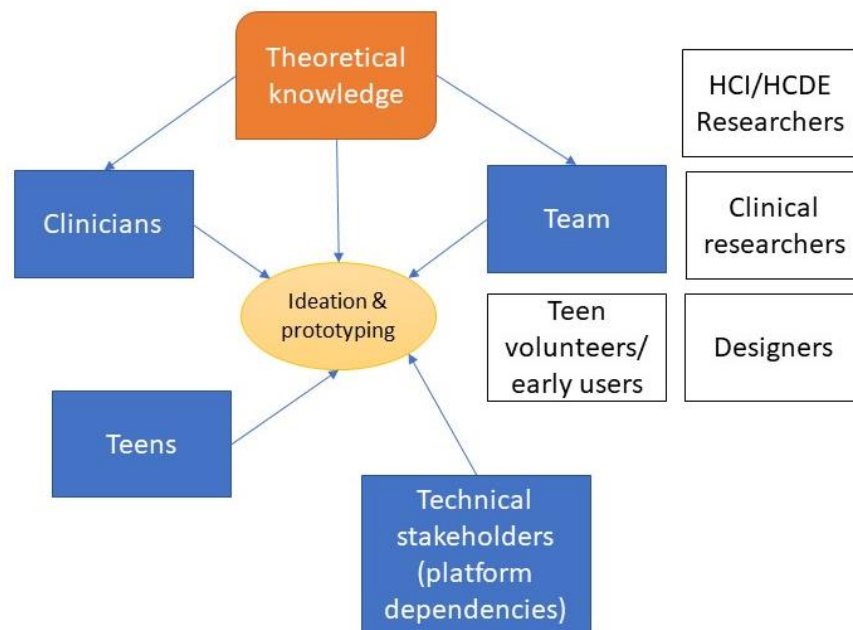


Figure 19: Stakeholders involved in the ideation and prototyping phases

Creating a design space to map the empirical needs with theoretical concepts was incredibly helpful in thinking through how the design of functionalities of the app and BA modules supported these needs. The three core needs for supporting teen mental health and the types of support discussed in study 1 (Table 3) helped me to intentionally design technical functionalities for depression management in Study 2 and 3. I revised the design space to separate informal support from peers or parents from formal support from clinicians and added the need for integrating crisis support (Table 14). In Study 3, the BA strategies that addressed reduction in avoidance—such as planning mini steps— supported the need for tailoring perception of control for healthy coping. BA strategies that scaffolded reflection – such as upward and downward spiral – supported teens in developing or validating a sense of self with data focused on mood and behavioral patterns. Peer support was limited in study 3 to participating in the presence of peers and reading their posts which according to teens provided emotional and informational support. Clinicians supported planning SMART goals and mini

steps (logistical support), validation and reflection on logging data (emotional support), and provided suggestions during brainstorming (informational support). We added the crisis support functionality for alerting moderators (logistical) and automatically sending helpline numbers (informational) but it was not used during study 3. Design spaces like this may not be exhaustive but are helpful in intentionally incorporating technical functionalities and analyzing the data.

While building the prototype, it is important to consider the **constraints of technologies** and working within those constraints to maximize and prioritize the stakeholder needs that can be addressed. There were functionalities that would have been good to incorporate but were not feasible to implement on the Slack platform. For example, we thought about automatically deleting logging reminders before sending the next reminder to make it less overwhelming if they missed logging, integrating the reminder function more accessible than using a Slack command, or adding progress tracking functionalities but these could not be implemented due to our technical limitations.

Another technically constraining factor for researchers and designers when designing and prototyping for sharing data in the clinical context is **determining HIPAA** compliance of a system. Current systems that abide by HIPAA guidelines are limited in the technical functionalities they can support which may not map with the complex designs we would want to innovate as researchers and designers. Obtaining HIPAA compliance for non-compliant systems and/or navigating administrative hoops for data privacy takes time and effort in figuring out which technical and clinical stakeholders to involve. The research team needs to negotiate if that effort necessary is for the current goals of the project.

Table 14: Revised design space based on mental health needs of teens that were supported using BA modules in the feasibility study 3

Design Needs	Logistical Support	Emotional Support	Informational Support
Tailoring support to perception of control	Logging mood and activities SMART goal planning, mini steps, overcoming barriers	Logging mood Upward and downward spiral	BA video Suggestion cards, example SMART goals and mini steps, example strategies for internal and external barriers
Empowering sense of self	Reflection through logging summary, visualization, upward/downward spiral, DM with clinicians	Logging emotions	
Scaffolding social support – Informal	Peer responses and presence, Parental support with logging	Peer responses and presence	Peer responses to SMART goals
Scaffolding clinician support	Clinician DM for discussing logging data and barriers to SMART goals	Clinician DM	Clinician insights in DMs for discussing logging data and barriers to SMART goals
Safety and crisis support	System identifies certain crisis keywords and flags it by sending a direct message to the moderator	Active listening and open communication support through moderators	Providing helpline numbers

Following the iterative approach of HCD and value of novelty in research and funding goals, it is helpful to have flexibility for innovation in types of solutions that can be designed. In the early stages of design and development, there is value in being able to rapidly iterate with feedback which is easier on a modular level with more control for making changes from within

the research team than integration with robust state of the art clinical infrastructure. It also depends on whether there is an immediate need for sharing identifiable patient information attached to the shared patient data (in our case, this would be after study 3 if the teen and clinician participants know each other and are no longer anonymous). Thus, I recommend judging the need for HIPAA compliance after it is established that an intervention can be feasibly used in the context of clinical care. However, lack of HIPAA compliance of a system might lead to the participants' feedback being overly focused on privacy issues as we saw in concerns of clinicians in Study 2. We can acknowledge to the participants that privacy is an issue we are aware of and will assume that it will be taken care of in future large-scale deployment stages after understanding feasibility issues. The decision to choose a HIPAA compliant system will also depend on the timeline of a project for moving from the feasibility testing phase to the deployment or RCT phase. If these phases are temporally close to each other and the goal is to make incremental changes over the course of the project, starting from a system that is already HIPAA compliant will be efficient. In Study 3, we considered using MS Teams which is HIPAA compliant as opposed to Slack but ended up deciding against it because we wanted to respect the participants' choice to remain anonymous and the clinicians did not know the teens in real life.

As access to working with people with mental health difficulties is challenging, Doherty et al. recommended working with **proxy users** who can play the role of primary stakeholders before evaluating the system with vulnerable users, thus reducing their time burden and potential frustrations [27]. Towards the end of the design phase, I found it incredibly valuable to conduct the initial usability testing of the system and weekly prompts used for the BA modules over seven weeks with four students who were trained in HCD and acted as proxy users of the Slack intervention. Iterating on AactivaTeen based on their expertise and feedback each week helped me

rapidly debug functional issues, iterate on conceptual and user interface changes, and test the changes I made with them in the following week. I also obtained feedback by sending a survey with the tasks for remotely user testing the four modules in ActivaTeen to our teen volunteer and two teens and a clinician participant from study 2.

6.1.4 *Evaluation*

The next step in the HCD process is to understand the feasibility and usability of the prototype and determining psychological and/or behavioral outcomes for evaluating the effectiveness of the intervention. In Study 3, we focused heavily on the qualitative feedback of participants. The goal of this feasibility study was not to understand if there were pre- and post-improvements in mental health but to understand how and why the functions and interface design of ActivaTeen and guided ARC interventions were influencing participants and how the technology fit or caused challenges within their context. Due to the low number of responses in the end survey, we could not draw any conclusive evidence from the quantitative metrics of usability (User Burden Scale [101], Intervention Usability Scale [58], Acceptability of Intervention [108]) and mental health (Perception of Stress (PSS) [18], PHQ-8 [81]). Engagement patterns of teens were individual and in addition to the comfort with using Slack and the study structure, it also depended on personal factors such as commitment towards the study, schedules, and struggles with depression. In future studies, researchers can choose intermediate variables to evaluate behavioral and psychological processes that support improvement in health (e.g., measuring behavioral activation or perception of control). Lyon et al. also provide recommendations for other potential usability clinical measures that can be used in the test phase [57]. While quantitative measures help in determining app usage and benefit the businesses model of commercial apps, **meaningful engagement** may not always be captured by

these metrics. It is important to understand the qualitative experience of teens which may include learning outcomes when not using the technology. For example, T35 sporadically engaged with Slack or ActivaTeen but was benefited by her sustained change of morning routine after planning her SMART goal with the clinician and ActivaTeen in week 8. She did not engage with the app again but had been using a sticky note to remind herself to continue working on her goal. This type of engagement is beneficial but is not captured by current usability metrics.

6.2 REFLECTION ON USING THE ARC METHOD FOR RESEARCH WITH TEENS

Reflecting on our experiences and participants' feedback using ARC with teens and clinicians in the three studies, I discuss considerations for balancing access needs with safety and anonymity with sense of belonging. I also speculate how using ARC might compare to designing with teens in face-to-face context.

Our project started with the motivation to **increase access** for teens to participate in research and mental health, but we needed to **balance it with safety** measures in an online environment. Increased asynchronous access to the system 24x7 introduced potential safety concerns if a disclosure that needed immediate attention went unnoticed. Therefore, it was important to maintain a manageable participant to moderator ratio in each group and set adequate expectations for response times (e.g., within 24 hours on business days). In Study 3, we created alerts for crisis keywords that would send messages for moderators and planned specific time-windows among moderators to check in on all messages, discuss messages that needed attention, and respond to participants. Mediated participation through technology also provided teens the emotional accessibility to think through and type responses in their own time and control what they wanted to share in the online space. Different styles of engagement were facilitated with the

modular approach of weekly activities so teens could participate and leave at any time, benefiting from what they could feasibly complete. This type of engagement might not have been possible for teens who live far from the research site, have transportation difficulties, struggle with symptoms of avoidance, lack of motivation, and physical difficulties, and are generally constrained for time.

Our **strategies for recruitment** included posting flyers around UW campus (as teens visit for camps and events), reaching out in-person to teens at a BA depression management group at a hospital, handing out flyers to teens after school, posting on social media platforms such as Reddit, and emailing researchers' contact list of families who are willing to participate in research. In study 2, we also requested clinician participants to post our study flyers in their clinics. In study 3, we hoped to recruit teens who were familiar with BA but did not get any interest from the teens in the BA depression management group at SCH when the group was held was in-person and when it transitioned to the online format due to COVID-19. We hoped to recruit teens who were real life patients of the clinicians who would participate and obtained permission from the HSD so that the clinicians could handout flyers to their clients to participate (clearly stating that their decision to participate or not would not have any implications on their treatment). Their teen clients were not willing to participate. Our final group of participants in study 3 did not know each other and thus, it does not reflect the therapeutic relationship between a clinician and patient. Overall, our recruitment was limited to teens who were familiar with and were willing to use Slack and majority of our teen participants were female. To balance safety online and recruit teens who are familiar with therapy, we included teens who were seeing a therapist at the time of the study or had seen a therapist in the past. This bias in our recruitment may have skewed our results towards teens who did not have issues with using Slack and found

it comfortable to engage with clinicians via direct messaging, which may not be true for all teenagers. Though access might have improved online compared to face-to-face research settings, recruitment was difficult for all studies and sustaining engagement was also an issue for 8-10 weeks. We saw that some teens dropped out usually by week 4. There were still teens who struggled to keep up due to school exam schedules and familial responsibilities. We needed to send regular reminders and constantly make adaptation to the protocols so the teens who got back to us after intermittent hiatus could participate either in parts or respond to a batch of activities together. They could also respond over email, complete interviews only after dropping out of the study, or only participate through surveys if they did not want to interview. In the future, researchers can consider involving teens who may not have online access by using other remote asynchronous modalities such as text messaging or mailing a research packet with modular activities to be opened each week and mailed back to the researchers (e.g., cultural probes [39]).

The next key consideration is to **balance anonymity with sense of belonging** through peer support. Sense of belonging supports with accountability and helps reduce depressive symptoms of isolation and lack of motivation. In all three studies, peer engagement with each other was minimal. Though some teens felt okay about it, others wanted more peer support. Clinicians suggested pushing for social engagement for better coping even when teens may not feel like it. Most teens wanted to remain anonymous and at the same time some of them expressed interest in sharing and learning more about their personal interests and wanted to buddy up with other teens. When we tried using DMs with teens for discussing SMART goals in Study 2, not all teen pairs responded which can increase feelings of isolation and do more harm. Strategies to enhance peer support in future work might include combination of synchronous and

asynchronous socializing, combination of in-person and online interactions (e.g., [56]), or narrowing the scope of the study or creating groups based on teenagers' shared interests (e.g., gaming). Based on Preece et al.'s recommendations for sustaining engagement in online communities and participants' ideas, I brainstorm ways for allowing for more opportunities for teenagers to move from roles of readers to contributors and collaborators on the ARC [79]:

1. **Increase affordance to group participants about readers:** Features such as “seen” or “viewed” offer affordances to users if their post was read even though readers may not actively engage with the post. It would have been good to let participants know that others were reading posts during the study thus, providing visibility of readership and passive engagement.
2. **Having a reward system within the group:** Clinicians suggested adding social rewards in the system that would encourage socializing. Preece et al. suggested that social rewards are helpful for engagement in online groups [79]. We did not have social rewards such as “karma” points (other than the study compensation) but the teens could react with emoticons if they wanted to. Perhaps, having a social reward system such as asking people to explicitly to use thumbs up if they read a post would have helped but this could also lead participants to modify their posts for social desirability or feel discouraged if they do not get enough reactions.
3. **Providing a more collaborative platform to work on design ideas:** The linear nature of posting on Slack did not provide a platform for discussing ideas collaboratively as would have been possible in a face-to-face setting. Only a few teens extended on others' ideas in their feedback when we allocated time for it in the 20-minute weekly activity.

Probably asking members to team up, select buddies to discuss ideas on DMs, or provide an online space outside of the group chat with affordances for synchronous and asynchronous collaboration (e.g., Miro boards or Google Docs) may have been helpful.

4. **Freedom of conversation among members:** Most conversations in our studies were only relevant to study activities except for the initial weeks of introductions). Working with vulnerable population and minors, we were concerned about harassment, bullying, sharing disclosures of self-harm, suicidality, or malpractices, or confidentiality breaches. While we were glad that no teen had any negative experience during our study, opening up the “random” channel on Slack where teens could chat about anything they wanted or channels specific to hobbies (not related to the prompts or the study) might be interesting to try in future studies.
5. **Peer mentorship:** Based on participants’ ideas, we can assign buddies to each teen on the group. Additionally, to maintain a safe space for participation researchers could include peers who have some prior mental health training, have experience with practicing the BA modules, or are further along in treatment. This provides opportunities for teens to have at least one companion they get to know better on the group, provide mentorship, and sets realistic expectations to socialize on the group. Teens are more likely to seek emotional support and disclose to their teen peers than to adults [109]. However, teens may not know healthy coping strategies to support each other. In that case, training peer teens on helpful strategies (such as in Panoply for adults [71]) or professional moderated group interventions such as in HORYZON for adults [3] may be helpful.

6.3 INTEGRATING DIGITAL INTERVENTIONS IN CLINICAL PRACTICE

Clinicians in our feasibility study favored the use of a AactivaTeen to review the summary and visualizations collaboratively with their teen clients **synchronously** during the therapy session. This approach would be helpful for reducing time burden in the existing financial and temporal structure of clinical work. Clinicians preferred using technology as visual and interactive mediator for sharing psychoeducational information and personal data to guide conversations with clients during the session.

Though C31 did not find it burdensome to **asynchronously** use direct messaging with three teens during one week of the study, having to chat asynchronously outside therapy sessions was perceived as added work and time burden by both clinicians in study 3. The teens however, favored a hybrid synchronous and asynchronous approach both with in-person sessions and telehealth. The asynchronous format supported in-situ reflection, provides teens times to think before sharing, was perceived as low burden, and fit into the teens' schedule. In future research, we need perspectives of more clinicians to determine how to incorporate the asynchronous format with clinicians' existing case load and this will require administrative and structural changes to reduce technical, temporal, and financial burden. It is also crucial to provide safety monitoring and set appropriate expectations for clients for response time and type of content they can expect to get help on asynchronously. Alternatively, additional clinical staff can be employed to support asynchronous communication. An example of this is SilverCloud, an online platform where clients with depression can engage with the online CBT through modules such as audio, video, and quizzes at their own pace [16]. Instead of a clinician, graduate psychologists with low intensity CBT training — called supporters— spent 10-15 minutes to write weekly reviews for the clients “to encourage engagement and continued use” and their supportive

messages were strongly associated with better engagement outcomes [16]. This type of intermediate support can also assist clinicians who may not want to or be unable to spend time and effort in learning and using unfamiliar technologies.

Lastly, in all my studies, most clinicians used multiple evidence-based interventions to support their client based on the context of the problem and the symptom(s) that need to be prioritized and addressed. However, in most HCI research studies, researchers typically follow one school of EBPI such as BA, CBT, DBT, or Problem-Solving Therapy (PST). The **modular approach to our design space** (6.1.2) can help break down the key needs that are supported by different techniques in EBPIs and identify what is unique in each of these practices. For example, problem-solving skills in the module of overcoming barriers to SMART goals are used in multiple EBPIs such as BA and Problem Solving Therapy (PST) [82]. Activities to support distress tolerance skills from DBT [88] such as grounding can be used for creating and teaching a safety plan for a client who is undergoing crisis at the moment and may not be in the mental space to be able to log activities, identify emotions, and/or reflect on current activities. With a modular approach, clinicians can create their own set of modules and set their own pace for individual clients or weekly group interventions. We also saw that not all teens engaged with the modules at the same pace or completed the activities in the same order. The need for therapy also varied for teens at different times. The weekly asynchronous approach allowed them to use and engage with what was feasible and helpful for them.

6.4 INTEGRATING GUIDED ARC IN EVERYDAY LIFE

Steve Down challenged the traditional approach to designing technology for health and provoked designers to rethink integration of healthy practices within the existing lifestyle of an

individual so that health is not considered an additional aspect to take care of [99]. A similar approach can be used for mental health by focusing on improving quality of everyday life. Evidence based mental health support can be intentionally designed into everyday tools that people use for work and /or leisure so they may not have to download an additional application or visit a different location for finding support. With the modular approach of using weekly activities in ARC, there is potential for integrating helpful coping practices in daily lives of adolescents and adults who may not be showing prolonged symptoms of mental health difficulties but might be at risk. As teenagers encounter stressors in everyday life situations, guided ARC interventions provided through everyday access points (such as schools, social media, and youth centers) can help teens take preventative actions and minimize worsening of symptoms. Slovak et al. discuss the potential for teaching skills for social and emotional learning (SEL) [94,96] which may be adapted for asynchronous delivery by school counselors through MS Teams or email and can be practiced by teens between classes. As smartphone use has been causing increased stress due to screen time and attending to notifications, digital wellness tools have been designed by Google (Digital Wellbeing [40]) and Apple (Screen Time [4]) to help an individual be aware of their screen time, limit app use, and focus on mindfulness practices. During the Pandemic, teens and adults have been spending an increasing amount of time on digital devices and social media with negative news. In addition to redirecting users to crisis support helplines (e.g., [32]), practices for self-compassion and mindfulness can be integrated into the design of social media for emotional regulation. Examples of such guided ARC interventions include (1) a reminder or animated visual to practice a breathing technique to regulate flight or fight response or (2) prompting the user to track the intensity and emotion after their session on social media to support emotional awareness based on the activity tracking

module in BA. Integrating such strategies may eventually decrease the amount of time for which an individual uses an application but can increase meaningful engagement and sustainable use of the application, over time.

6.5 CONTRIBUTIONS

The empirical contributions of my dissertation include an understanding of the (1) existing support and unmet needs of teenagers from technologies for stress and depression management and (2) feasibility and barriers to engagement of teenagers with depression when delivering the evidence-based practice of BA using ARC. Through design and development of ActivaTeen and weekly BA modules in study 3, I discuss design considerations for researchers and practitioners working with technologies to use human centered methods and evidence-based practices for scaffolding teens in reflecting on their behavior and mood, reducing avoidance, and integrating guided ARC support in clinical practice. Based on our experience in all three studies, I reflect on lessons learned on using ARC as a method for working with teens and clinicians for HCI research.

6.6 FUTURE WORK

When we work with teens who are aware of their diagnosis and/or have a therapist, we are already limiting access for adolescents who cannot access any form of mental health care. There are many teenagers and youth who do not have this privilege and go undiagnosed or misdiagnosed for a long time before they find any accessible help [1]. Mental health clinics can increase the scalability of treatment by sharing synchronous and asynchronous tasks among clinical staff and volunteers (e.g., supporters [16]) with different levels of training. To reach and sustain participation from teens, we need to involve in-person community volunteers in

grassroots youth organizations and schools who are often the first point of contact for adolescents. The ongoing impact of COVID-19 Pandemic, climate change, and political unrests have increased isolation and worsened mental health difficulties for youth. Teens are spending increasing amounts of time in online and offline environments under uncertainty and are being exposed to direct and secondary trauma and grief. As expressed by our clinician participants, teachers and school counselors may not have specialized training in evidence-based practices. Educational modules such as in the guided ARC can be helpful to empower them with effective and engaging strategies in their toolkit and community members can be trained to be active first responders for mental health crises to recognize warning signs and connect teenagers with adequate professional support (e.g., Mental Health First Aid [116]). The current online social media environment has also been toxic for teens' emotional wellbeing [109]. Eventually, micro-modules of interventions such as the ones used in study 3 can be integrated with social media platforms to not just guide users to crisis helplines but offer helpful therapeutic support in navigating struggles with mood, access help, and support planning positive coping strategies. Reimagining online interactions can also be supported by understanding how evidence-based support on mental health can be provided to teenagers' close informal social ties such as family members, peers, and school personnel through social media.

6.7 CONCLUSION

We conducted weekly design activities in asynchronous online groups on Slack with 40 teenagers and 13 clinicians across the human centered design cycle of understanding needs, designing prototypes, and understanding the opportunities and challenges with the feasibility of using guided ARC for mental health management. Informed by our understanding of design needs envisioned by teenagers and clinicians on stress and depression management (RQ1), I

presented a revised design space on how technologies might support mental health needs of teenagers (RQ2) and integrate evidence-based practice of BA (RQ5). I demonstrated the challenges and opportunities with feasibility and engagement of nine teenagers in using the guided ARC interventions for depression management (RQ4). Our participants are skewed towards a majority of female and online users and future researchers should consider broadening recruitment measures to include schools and community centers. I hope that our reflection on the ARC method (RQ3) will enable researchers and practitioners to invite and sustain participation from direct and indirect stakeholders of mental health technologies and help teenagers practice coping strategies and thrive.

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APPENDIX A: STUDY PROTOCOL FOR STRESS

MANAGEMENT STUDY 1

Online group design activities

————WEEK 1————

[ACTIVITY: INTRODUCTIONS]: @channel Let's begin by introducing ourselves! Send a message on this group with:

- (1) your name (some of us chose an alias so use that),
- (2) something you like to do for fun or hobbies,
- (3) an animal that you think is your spirit animal or favorite animal, and
- (4) share a meme or a quote on how stressful your week has been (you can search online/just add an image and write a quote in the message/just a quote)!

Click on the "+" sign on the left of the message box to add an image from "your computer". You can also always feel free to comment and/or react on each other's posts on Slack (Slack allows us to react with so many emojis!).

————WEEK 2————

[ACTIVITY, RECOGNIZING STRESS]: Hi all @channel! This week's activities are to help notice your physical and emotional reactions when you are stressed. It has the following 4 parts:

- (1) Watch this video from Ted-Ed on "_How stress affects the body_"(approximately 5 minutes): <https://www.youtube.com/watch?v=v-t1Z5-oPtU>
- (2) After watching the video, message and discuss your reaction to the video on the group: for example, what is a new thing you learned from it/something you could relate to from your experience with stress or something you disliked.
- (3) Message on group: what are some physical and emotional reactions that you have which make you recognize that you are stressed?
- (4) Draw what stress looks like to you and post a photo of your drawing on the group. It can look something like the monster on the video or something totally different (it does not have to be elaborate, you can also use text to describe what stress looks like to you).

These should take about 20 minutes in total. You don't have to do it all at once (e.g.; you see the video and message your reactions one day, observe your physical and emotional signs for some days then message that, and you can draw and post by the end of the week). I look forward to reading your responses!! Also feel free to discuss, react, and respond to other's messages. :)

—————WEEK 3—————

[ACTIVITY, VALUES]: What you find meaningful can also be stressful. @channel there are 3 parts to activity for this week:

(1) **Value sorting**: From the list of values below, select **15 values** and sort them into 3 categories based on how important you think they are to you (add maximum of 5 values per category). The 3 categories are:

1. Very important to me (5 values)
2. Important to me (5 values)
3. Less important to me (5 values)

Share your sorted list as a message on this group. You can add your own values and define what it means to you but stick to the upper limit of 5 values per category.

—*List of Values:*—

A value is what you believe is meaningful to you. Values can include but are not limited to:

- `1. DISCIPLINED – being restrained and self controlled`
- `2. HEALTHY AND FIT – soundness of body and mind.`
- `3. IN CONTROL`
- `4. ON TOP OF THINGS`
- `5. RESPONSIBLE`
- `6. ATHLETIC`
- `7. COMPETENT – being productive, efficient and skillful`
- `8. CONFIDENT`
- `9. SPIRITUAL – with God, self, religious beliefs.`
- `10. ENERGETIC`
- `11. ADVENTUROUS – pursuing excitement and taking risks.`

- `12. SUCCESSFUL – attainment of goals and aspirations.`
- `13. AUTONOMY – being self-directing, self-reliant, and freedom in thought and lifestyle`
- `14. POPULARITY/FAME – recognized and known for your contributions.`
- `15. CREATIVE – being inventive, original and innovative`
- `16. ATTRACTIVE`
- `17. RELATIONSHIP WITH FAMILY—close relations and support of loved ones.`
- `18. FELLOWSHIP—having important relationships with friends.`
- `19. HUMOROUS – being light-hearted, witty and funny`
- `20. KIND – being helpful to others`
- `21. LEISURE – entertainment, pleasure, relaxation and fun.`
- `22. FLEXIBILITY—being adaptable and able to change`
- `23. FORGIVENESS—being able to excuse and let go`
- `24. TOLERANCE—being open, accepting and patient`
- `25. OTHER? (add your own)`

(2) Next, list **5 or more activities that you do or want to do in your daily life that align with the values you chose in your list** (list the activity and corresponding values). Do these activities also stress you out? How? One activity can align with multiple values. _E.g., going to the gym aligns with my value of wanting to be healthy (it stresses me out when I don't feel like I have the time or feel low on energy)

(3) Conflicting values: Message on the group if there are values in your list that you think are in conflict. What are these conflicting values? Do any of these conflicts lead to your stress? How? _E.g., I value being healthy and being regular and I have to leave some tasks incomplete if I want to go to sleep on time. Leaving work incomplete is a difficult stressor for me. _

The activity should take about 20 minutes. Values can change over time and you can have many more values but the task is to sort, prioritize, and share them for now. Please feel free to comment, react, and discuss in group. Hoping you can complete this activity by next week (1/9). Thank you! :slightly_smiling_face:

—————WEEK 4—————

[ACTIVITY, ADVICE COLUMN]: Hi all! @channel Following are 7 scenarios for _fictional_ personas of teens who are in stressful situations. The activity is to **pick 5 scenarios**, post ideas or advice for the persona on how you think tools (e.g., digital technologies/apps, physical tools,

paper-based tools) can be used to help them manage stress in each scenario. These tools can be something that you know of, have used yourself, or something you imagine but doesn't exist. The tools can be used by the main persona or anyone else in the scenario (e.g., a friend).

In your advice message, for each scenario, *add the number/name of the persona, describe the tool, who is using the tool, and how can the tool be used to manage stress in that situation.* One tool can be used in different scenarios. You can also draw and post a picture, but drawing is not mandatory. Also feel free to build off of each other's ideas and discuss.

—-*Scenarios*—-

(1) Rosaline had a break up with her significant other with whom she had been together for a year.

(2) Broc applied to 7 colleges and is waiting on hearing college decisions. So far, he has had 3 rejects in a row. He has 4 decisions remaining, but he is feeling anxious and stressed out, unable to concentrate much on his current work.

(3) Sofia returned home late one night after shopping with friends and got into a conflict with her parents about who she should be hanging out with.

(4) Francis was involved in a car accident but her family does not know, yet. No one was hurt but the car suffered significant damage. Her insurance is under her dad's name but she is afraid to inform her dad about this situation. She does not have finances to pay for the damage herself.

(5) Gary is passionate about playing drums in the school band and they have a crucial live performance in 2 weeks. He has been doing good academically, but now he needs to put in extra hours for band practice and gym regularly to increase his physical stamina to play drums. He is trying to study late nights to finish weekly school assignments. He feels stressed about how he is going to make it through the two weeks.

(6) Johanna wants to join the swimming team but feels conscious about her body image. She starts to skip food which also makes her feel tired most of the time, she is not attentive in school, and missing social activities with her friends.

(7) Ian posted about his hobby on social media. He gets bullied and called names online by other students in school who are in his network. He does not feel like going to school and does not feel like he fits in.

Hope you can complete it by 1/17. It should take 20 minutes. Thank you! :slightly_smiling_face:

—————WEEK 5—————

[STRESS DIARY]: This week's activity is called **Stress Diary**. It is a personal daily diary entry online where each day you will have a different prompt for journaling about stress (3-5 minutes/day).

You need to go on the following link to complete one entry per day on **at least 4 days**:

<http://www.surveygizmo.com/s3/4042055/Stress-Diary>

The diary will be open from tonight, 12/4/2017 to 12/12/2017 night. Tonight and tomorrow will be the same prompt. We hope you can complete 4 entries at least on any 4 days of the week (including weekends).

It should take around **20 minutes**. It is optional to do the journal entry on more than 4 days if you think it is helpful and we are thankful for your time, but there won't be additional monetary compensation for the extra time.

The data from these diary entries will not be shared outside the research team. Let me know if you have questions. Thank you!

—————WEEK 6—————

[ACTIVITY: SUPPORT NETWORK MAP (15 min)]: There may be different people who can support us in different ways through stressful times. In this activity, map the type of support that you find helpful when you are stressed to who can you approach to receive that support.

There are 3 parts:

First, from the following, pick the types of support you expect from others when you are stressed:

- (1) Informational support: practical advice or suggestions, providing resources and information, sharing their own experience
- (2) Logistical support: Helping me with chores or school work, driving me places, help me with planning or saving time
- (3) Companionship: holding me accountable, distraction, doing activities together
- (4) Emotional support: listens to me or I can vent to them, positivity/encouragement, validates/acknowledges how I feel, comforting.

You can modify these or add your own categories or subcategories.

Second, under each type of support you expect, list the people in your social network who you can approach for that support (if any). You can also include whom not to approach when you need one type of support (e.g. someone can be good at giving advice but bad at listening to you). One person can offer multiple types of support too.

Message your support network map on the group or email it to me if you don't want to post on group (you can draw it or type it out)

Third, if you feel like you need more support in a given area, message on the group: what are some things you might try to do to find more support there? What difficulties do you see in being able to grow your support network?

You can complete it by 2/5! Thank you! 😊

————WEEK 7————

[ACTIVITY, CUSTOM STRESS DIARY]: @channel This week's activity is to design and customize your own stress diary that you think is helpful.

The online custom diary is a blank text box and you can also upload images or other files as well. The only constraint is that your entry should be related to stress or stress management

Link to add your diary entries: <http://www.surveygizmo.com/s3/4097424/Custom-Stress-Diary>

Please complete entries on at least **4 days (3-5 minutes per day)**. Responses will not be shared outside research team without anonymizing.

I am attaching the document with 8 online stress diary prompts we used in week 5, if you want to refer or use it.

Some ideas: you can write about stress (current, past, future), write to stress, plan how you could manage it, vent/complaint, use prompts from last time, or design your own. You can write the entry when you feel stressed or when you find time. You can use the same prompt every day, use different prompts, or just free write, whatever is helpful to you! Thank you! 😊

————WEEK 8————

[ACTIVITY: There's an app for that!]: Hi all @channel! In this activity, use one mobile app or web based app related to stress management, mood, or mental health. Install and try out **one** free app (preferably, one that you have not used before) for 4-7 days and let us know your feedback on the app, after. Below, are suggested prompts for your feedback and a list of apps based on tools you shared and some others we know. You can pick one from the list or find one of your own choice.

We recommend spending 20 minutes to complete the activity. Message your feedback on Slack after 4-7 days.

—Prompts for feedback—

- (1) Which app did you choose and why?
- (2) When did you use this app? (e.g., set reminders, when stressed, while working)

- (3) What do you like in this app (if anything)? Why?
- (4) What do you not like in this app (if anything)? Why?
- (5) Do you want to continue using this app in the longer term? Why or why not?
- (6) What would you want to change in this app (if anything)?

—List of apps—

The app should be free of cost, but it may require you to send data. We will not have access to any data you send through the app and we want to know your feedback on your experience.

(1) Mindfulness/meditation:

HeadSpace– <https://www.headspace.com/headspace-meditation-app>

(2) Time management/task management:

– Wunderlist

(android):

<https://play.google.com/store/apps/details?id=com.wunderkinder.wunderlistandroid&hl=en>

(iphone) <https://itunes.apple.com/in/app/wunderlist-to-do-list-tasks/id406644151?mt=8>

– SplenDO

(android): <https://play.google.com/store/apps/details?id=com.splendapps.splendo&hl=en>

(3) Connecting with listeners/professionals:

7CupsOfTea – <https://www.7cups.com/> (note that you have to register and login for this by providing email and date of birth which they say is secure, we won't have access to that information or what you chat about)

(4) Calming/relaxing/distraction from stress:

– Quiet space – thequietplaceproject.com

– I Love Hue: <http://i-love-hue.com/>

(5) Mood and mental health related apps:

– Happify: for Stress & Worry

(iphone) <https://itunes.apple.com/us/app/happify-activities-games-for-stress-anxiety/id730601963?mt=8>

(android) <https://play.google.com/store/apps/details?id=com.happify.happifyinc&hl=en>

– Pacifica: For Stress & Anxiety

(android): <https://play.google.com/store/apps/details?id=com.pacificalabs.pacifica>

(iphone) <https://itunes.apple.com/us/app/pacifica-for-stress-anxiety/id922968861?mt=8>

– Moods: Tracking for better mental health (iphone only) –

<https://itunes.apple.com/us/app/moods-tracking-for-better-mental-health/id1023271188?mt=8>

– MindShift (anxiety)

(iphone) <https://itunes.apple.com/us/app/mindshift/id634684825?mt=8>

(android) <https://play.google.com/store/apps/details?id=com.bstro.MindShift&hl=en>

– What's up: A mental health app

(android) <https://play.google.com/store/apps/details?id=com.jacksontempra.apps.whatsup>

(iphone) <https://itunes.apple.com/us/app/whats-up-a-mental-health-app/id968251160?mt=8>

(8) App ideas for in-the-moment support from a community or adult during distress: (these apps are not functional now, I think. So, you can watch the video/read the article and give feedback on the idea)

– CodeBlue (https://www.youtube.com/watch?time_continue=4&v=1-8I5mtwvyE)

– XPlan (<https://bertfulks.com/2017/02/23/x-plan-giving-your-kids-a-way-out-xplan/>)

—————WEEK 9—————

[ACTIVITY: Design Ideas]: Hi all @channel! In this activity, we seek your feedback on 4 design ideas for technologies that can be used with family for stress management. The ideas are at very early stage, presented as a story and some diagrams on how the technology might look like. Please feel free to critique them, provide us feedback and suggest ideas for what you think can be helpful for teens.

Below, there are 4 threads for each design idea and one discussion question. We encourage discussions so **please maintain one thread for each design idea**. (Please respond by clicking on "reply" under each thread). Spend about 3-4 minutes for feedback/discussion on each.

Click on "reply" or "replies" under each design idea, my first reply has link to 2 images under each thread (page 1 of 2 and page 2 of 2), please see both pages, then add your feedback as a reply. You can read all replies. It should take **20 minutes** for all and you can complete by next week (3/5). Thanks!

—Suggested prompts for feedback on each design—

- (1) What do you think can be helpful or what do you like about it (if anything)? Why?
- (2) What do you think can be unhelpful or what do you not like about it (if anything)? Why?
- (3) It does not have to be used with parent(s). Who would you rather use it with (if you would)?
- (4) What would you change about it (if anything)?

[Followed by links to four design ideas (Appendix C) hosted on Dropbox]

————WEEK 10————

[ACTIVITY: Codesign week]: Codesign means we design together and we consider you all to be experts of the teenager experience. Two parts to this codesign activity:

1. Post 3 design ideas: We ask you to post 3 design ideas for tools or means of support that you consider can be helpful for challenges that you or other teens have with stress management and/or accessing social support when stressed (from a parent, trusted adult, counselor, peer, or family).

You can modify ideas from past weeks or make completely new ones. You can also answer the following prompts to write about challenges and what you expect for support on stress management,

"Current challenges with stress and/or social support...."

followed by,

"In my ideal world...." (what you expect)

It doesn't have to be technology: I learned that some of you do not favor the use of technology or app during communication and challenges still exist. In your ideas, you can brainstorm other ways to help the other person support you or find the support you need, e.g., who can be a conversation mediator if it is a person?

Spend about **5 minutes on each of the three ideas**. Your ideas can be simple drawings.

2. SWAP an idea: Finally, swap at least one idea that another person on the group posts, and provide feedback, discuss, and/or build on the idea(s). Spend about 5 minutes on this.

Total 20 min, and hope you can complete by 3/15. I look forward to your responses! Thank you!

Exit Interview Protocol

40-60 minutes, \$15 compensation

Hi, is this [name]? I am [researcher name] from [University name] regarding the interview on teen stress study. Thank you for taking the time out! Is this still a good time to chat?

First, I will go over some information regarding the interview.

Interview will take 40-60 min. I would like to learn about your experience in the study and stress management.

Please share only what you are comfortable with. If you feel like you don't want to answer a question, you can feel free to let me know and we can move on. You can also let me know if you want to end the interview at any time or ask me questions anytime.

Is it okay if I audio record this interview? I will delete all identifying information (name, location) and recording will be transcribed anonymously.

Do you have any preference for an alias when you are quoted?

Reflection on Method

1. Have you used Slack before you joined the study? How was your experience using Slack? (probe: Compared to Facebook or other social network tools you use, notifications)
2. Overall, how was your experience in this study during the last 3 months? (probes: activity timing – asynchronous nature, **activities**, exam/midterm time, flexibility)
 - a. When did you usually do the activities?
 - b. What do you think about the 20-minute time frame for each activity?
3. What would have made it an easier or better experience for you (if anything)? (timing, break)
4. Who would you recommend to participate in the study? Why? (your friends, other teens?)
5. Did you maintain any records of your responses for yourself and/or reflect on any responses, later? (e.g., paste or write in a diary or notes)

6. Imagine we had done this study face to face. What would change if anything?
(probes: schedule, anonymity)

Dynamics of social interaction on group

7. On a scale of 1-5, how comfortable did you feel disclosing personal issues in the group?
Why do give it that rating? What were your challenges in sharing? (probe: diary activities vs group sharing)
8. Did you read other's responses on the group (for activities in which feedback was not mandated)?
 - a. Did others' responses influence your thinking or your response? If so, how?
9. Did you feel like others responded to you on the group as much as you expected?
 - a. How can we make it so people on the group talk to each other more if you would like that?
10. Did you have any negative interactions you did not expect on the group? Please elaborate.
11. Did you have any positive interactions on the group that you did not expect? Please elaborate.
12. Do you think the study influenced your mental health in any way?
13. What does a "safe space" mean to you and how can one help create it? Do you think this space exists in your daily life?

On technology use:

14. What are some apps that you already use for health? (probe based on their responses in the online the study, e.g., planner app, 7 cups of tea).
15. What Social media tools do you use? Do you think they are source of stress or help you to manage stress? How so?
16. Which app did you pick and use in week 7 during the study? Did you use it over time after week 8?
17. When you are really stressed out whom or what do you turn to? What are your current challenges with stress?

Family and stress:

18. How do you primarily communicate with your parents related to stress?
 - a. During conflict or when stressed is there anything you wish that would be different?

(Note: If time permits, ask 19-21, else wrap up)

19. Do you think your parents' mental health care or stress impacts you in anyway?
20. What is your advice to parents on helping teens in managing their stress?
21. Do you want to use journals or letters to communicate with your parents asynchronously or do you want to communicate face to face?
22. Anything else you would like to share with me regarding the study, stress and accessing social support for stress and mental health. (probe: other ideas, trailing thoughts)

Wrap up:

Do you have any questions for me or regarding the study?

Would you like to be contacted in future to provide feedback on iterations of the designs or their ideas?

Finally—please fill out a survey similar to what you answered upon entry on stress response scale and feedback on how helpful you found each of the activities. 5-10 min

Explain compensation.

Thank you!

APPENDIX B: STUDY PROTOCOL FOR DEPRESSION

MANAGEMENT STUDY 2

Weekly Online Activities¹¹

Week 1

[**ACTIVITY: INTRODUCTIONS**]: Hi everyone @channel ! Thank you for your patience over the past week or so, we will now get started with the introductions! Keep in mind that each weekly activity will look similar to this one.

[**Introductions**]: Please introduce yourself to other members in the group. You can share using images or giphys as well.

1. Your **Slack name**
2. What is **one thing that helps bring your mood up**? This can be a hobby or something you like doing or watching!
3. What is **one coping strategy** that you have tried using when things are hard? Has this coping strategy been helpful?
4. [**Demographic Survey**]: Please fill out this demographic survey (~5 min):
<https://www.surveygizmo.com/s3/4896680/Teen-Demographic-survey-Teen-Depression-ARC>

Week 2

[**ACTIVITY: TECHNOLOGY TO MANAGE MOOD**]: Hi @channel! This week's activity is on sharing and discussing tools and resources that you currently use to manage mood and depression. Please post a single message on this channel with your responses to the following questions:

(1) Examples of **digital technologies** that you have ever used in **therapy** or on **your own** (if any). You may post links, photos, or videos of what you use.

¹¹ Formatting note: On Slack, '*' is used to format bold *text* which is retained in most parts of the protocol for online activities.

– These tools may include but are not limited to apps (e.g., mood tracking apps, mindfulness apps, calendar apps), Fitbit or other tracking devices, websites, online videos, games, virtual reality, social media, and text messaging

(2) Examples of **non-digital tools or resources** you have ever used in **therapy** or on **your own**(if any). You may post links, photos, or videos of what you use.

– These tools may include paper worksheets, book recommendations, in-person social or support groups, paper handouts or informational pamphlets

(3) If applicable, what are some ways you have **benefited** from using technology to manage mood and depression?

(4) If applicable, what are some ways that technology has been **unhelpful** or **challenging**?

(5) If you have not used any technological tools to manage mood and depression, or have stopped using any tools, please explain why

Please share what you are comfortable with. This activity should take about 20 minutes to complete. Hope you can complete it by **4/12 (Friday)**.

Week 3

Poll:

Question: What has been the easiest way for you to ask for help when you are struggling with symptoms of depression or sadness?

- *Face-to-face help from a friend or trusted person*
- *Phone call to anonymous hotline*
- *Phone call to a friend or trusted person*
- *Texting friends or trusted person*
- *Texting with strangers such as a helpline anonymously (e.g., Teenlink)*
- *One-on-one online chat (anonymous)*
- *Posting anonymously for peer support on social media groups (e.g., Reddit groups)*
- *Contacting a mental health professional or trained volunteer via phone*
- *Contacting a mental health professional or trained volunteer via text/email*
- *Other*

Week 4

[ACTIVITY: Online Mental Health Support Part 2]: Hi @channel! Based on your feedback from last week on how a platform like Slack might be used for the delivery of depression treatment, we have put together ideas. There are **three parts** to this activity (A, B, and C).

1. * Reactions to other ideas (~10 min)* -: One strength of this platform is that you might be able to interact with other teens who are dealing with similar experiences.

- When posting about struggles with mood/depression, what kind of feedback or support would you like best from others on an online platform (e.g., advice, understanding/validation, encouragement)?
- Provide feedback and/or ask a follow-up question on another group members' post as a thread from last week or previous weeks. Please feel free to discuss and build on each others' ideas. As usual, you can express your thoughts in text, drawings, and/or images.

B. *Reflecting on receiving feedback (~10 min)*: Either based on experiences you've had so far or what you imagine ...

- What might be the benefits of being a part of an online group with other teens when receiving help for mood/depression?
- What might be the challenges or problems of being a part of an online group with other teens when receiving help for mood/depression?

C. Polls: We synthesized your ideas from the previous activity and have created a poll to understand what will be helpful features for online platforms to support mental health. Please vote on the the following polls. Please provide any additional explanation for your responses and/or add other options or comments in threads for each poll.

1: Question: Thinking about individual vs group formats of therapy sessions, how do you think technology platforms such as Slack can play a role (you can select multiple options)?

- Online one on one support through technology between weekly in-person one on one therapy sessions with clinicians

- Support through one-on-one therapy but mostly online (alternative to in-person therapy)
- Support through online technology, between weekly in-person group sessions
- Support through online group therapy but mostly remotely (alternative to in-person therapy) moderated by a professional

2: Question: Which of the following options do you consider useful when thinking about how to best utilize an online platform such as Slack for treatment. Please select all that apply (setting aside privacy concerns and technological limitations of Slack)?

- Tracking mood, questionnaire responses, and viewing mood over time
- Tracking and personalized coaching support with sleep and other lifestyle changes (e.g., physical or social activity.)
- Using photos or videos for journaling or tracking mood or lifestyle for discussion at therapy sessions
- Getting automated reminders for therapy homework and appointments
- Homework delivery on the platform such as a document plugin
- Always-available bot for in-the-moment coping strategies (including redirecting to crisis helplines and problem solving)
- Always-available bot for venting and validation (i.e., place to express feelings/thoughts without judgment)
- Space for open-ended peer support and conversation (in group therapy format)
- Digital repository of Therapist-recommended apps and resources that can be updated
- Posting psychoeducational and training modules using videos

Week 5

[ACTIVITY: Behavioral Activation]: Hi @channel! Thank you for all the valuable feedback so far on how technology can be used for depression treatment! Our project goal is to adapt a specific treatment, Behavioral Activation (BA), to an online platform. Research has shown that BA is an effective strategy for treating depression in both adults and teens.

BA comes from the idea that what you **do** affects how you **feel**. Because of this, BA focuses mostly how we can help people to **find** and **engage with** the activities and people in their lives that help improve mood!

There are 3 parts to this week's activity.

Part 1 (<7 min): Watch a video on BA You all have already given us lots of examples of how you use activities and people in your life to help you cope with feeling down. We'd like to make sure that we are all on the same page about what BA involves. **Please watch this ~7 minute video on the idea of Behavioral Activation (explanation starts at 0:47):**

<https://www.youtube.com/watch?v=1R6-gLZZhYc&feature=youtu.be&t=47>

(**Note, this video is only meant as an introduction to how BA works, we are not using the worksheets or website mentioned in this video)

Part 2 (5 mins): Summary of the concepts of BA In the attached PDF, is a table of the concepts and skills taught during specific sessions of BA. For each concept and skill, we have also provided examples of what we mean. You will be learning more and trying out activities from each session in the coming weeks. We are aiming to create a 4-6 session treatment. Please review the table below: (Appendix A)

***Part 3: Post discussion comment (5-10 mins)*:** After watching the video and reviewing the summary table, please discuss the following by posting a comment on this thread:

(1) What are your reactions to using BA strategies to support improvement in mood and depression symptoms for teens? What aspects of these strategies make sense to you for help with mood and depression? (You can also write about what was confusing or unclear to you)

(2) What BA strategies or similar strategies have you tried either on your own or with the help of a therapist?

We hope you can complete this by Monday, May 6th.

Week 6

***[ACTIVITY: Adapting BA]*:** Hi @channel! Thank you for all of your feedback so far. We now plan on getting your feedback on some ways we can adapt Behavioral Activation on an online platform such as Slack! There will be two parts to this activity, *please provide feedback on the following technology adaptations*:
***Part 1*:** Introducing the BA model and how it works for you
***1a. Worksheet*:** The first step is to explain the BA model and how it works. We typically do this in-person by talking through the model and asking you to fill out this worksheet: (edited)

***1b. Technology adaptation*:** You can then fill this out yourself and upload a photo which can be reviewed by a clinician like this one.

***Part 2*:** ***Activity and Mood* tracking** to better understand how your actions might impact mood in your daily life. ***Please provide feedback on the following technology adaptations, including ways we could improve delivery via an online platform (5 minutes).**
****2a. Worksheet*:**

***2b. Technology adaptation*:** A chatbot on Slack/ text messaging that regularly asks you to enter activity, feeling, and intensity of the feeling. Here is a prototype of how that might look:

***2C. Technology adaptation*:** We were thinking of sending reminders 3-4x/day from 9am-9pm - this would be on one weekday and one weekend day where you could fill out a survey like this one. <https://www.surveygizmo.com/s3/4866621/Clinician-ARC-Behavioral-Activation-Session-1-4>

Week 7

[ACTIVITY: Introducing SMART Goals]*:** Hi @channel! Thank you for your feedback last week. We are now going to introduce more of the BA treatment for you to explore and provide feedback on. There are ***two parts for this activity!
Part 1: Upward and Downward Spiral*:** An important part of BA is understanding connections among situations, feelings, and actions in order to identify what contributes to ***upward (improvements) and ***downward*** (worsening) spirals in mood. Please see below for how we currently teach “Upward and Downward Spirals” in mood and a potential technology adaptation:
***B1. Worksheet*:** Here is an explanation of what an upward and downward spiral means and the current paper worksheet used to explain the concept. ***Please read over and let us know in comments if you have questions and/or need any additional details to help understand upward and downward spirals.*:**

B2. Technology adaptation*:** We think of delivering it as a diary in survey format that you could fill out 2-3 days of the week. Please try it out by filling out this survey, and ***provide feedback on your experience in understanding and filling out the survey in comments. Also add any difficulties in understanding the content or additional details you may need to help with this part of the activity: <https://www.surveygizmo.com/s3/4861333/Behavioral-Activation>

Part 2: Setting SMART goals: A key component of BA is helping teens to set *SMART goals and mini steps related to making a behavioral change to create upward spirals and prevent downward spirals in mood.* SMART stands for Specific, Measurable, Appealing, Realistic, and Time-bound goals. Please see our explanation on how to set SMART goals in the PDF, B1. In part B2, try out an interactive way of using peer to peer direct message to help each other set SMART goals (15 min)

B1. Worksheet for guidance: <PDF>

B2. Technology Adaptation: We will pair you up in a direct message channel where we'd like you to help each other set a SMART goal and reminders within Slack to work through your mini steps. Please guide each other through the following prompts:

(*a*) What's one SMART goal that you can work towards in the next week? Bonus points if it's mood boosting! (each share your SMART goal over direct message)

(*b*) Respond to your partner with your thoughts on how "SMART" you think their goal is:- Is it Specific? Yes/No (any explanation)- Is it Measurable? Yes/No (any explanation)- Is it Appealing? Yes/No (any explanation)- Is it Realistic? Yes/No (any explanation)- Is it Time-bound? Yes/No (any explanation)- Walk through the mini steps of how you are going to attain your SMART goal- as few or as many as you need.

Help each other determine whether you are truly breaking things down into small, manageable steps.

- Set a date/time that you'd like to accomplish each step, share it with your partner, and set reminders on your calendar, phone, or Slack (by messaging the "/remind" command on Slack message box e.g. /remind me to drink Kombucha at 5 pm on March 12)

(*c*) Once you have had the chance to try direct messaging, please *give us feedback* on the Group Channel for what went well and what was challenging with this format. Feel free to share progress on your SMART goal mini steps so we can cheer you on! There might be challenges in coordinating with each other, let us know if you encounter any difficulties. (edited)Please let me know if you have any questions, thank you so much!

Week 8

[ACTIVITY: OVERCOMING BARRIERS TO SMART GOALS]: Hi @channel! Now that you all have had a chance to practice setting SMART Goals by direct message (and maybe

completing a few mini steps yourself!), the next take-home activity in BA involves overcoming barriers to mini steps and SMART Goal completion.

There are two key types of barriers: *Internal Barriers:* Barriers that arise from within, such as “not feeling like it”/low motivation, feeling overwhelmed, trouble communicating needs, forgetting, or distraction. *External Barriers:* Barriers that arise outside of yourself, such as not having the needed "tools" (e.g, school book, art supplies, homework assignment etc), needing help from others (e.g., ride from parents, quiet space in the home, tutor/homework help), other people not following through on plans, or needing money.

We have several ideas for how we can build in a “barriers assessment” into our SMART goal setting and planning and would like your feedback on.

A1. Worksheet on overcoming barriers to SMART Goals: Please *read through it for reference and post feedback and ideas* on how you would like it to be implemented on technology platforms.

A2. Get to know your SMART Goal buddy: We thought it would be helpful to get to know your SMART Goal partner a bit more, please share what one thing on your bucket list is and why in your direct messages!

A3. Technology Adaptation 1: Peer support in Direct Message (message each other): In the paired groups @rianagar created last week, check-in with your SMART Goal buddy on progress and barriers with their mini steps. Please guide each other through the following prompts:

1. How did it go completing your mini steps to your SMART Goal? For any mini step *not completed*, what kind of barriers got in the way (Internal or External)? If you completed all your mini steps, you can think of a barrier that might come up in the future that you would want to overcome and brainstorm.

2. How might you get around this barrier so you can continue working towards your SMART Goal this week?

- Recommended suggestions: remember to follow a GOAL or PLAN and not a mood (Goal-Directed Behavior); think of a “goal buddy” who can help you or who can check in with you throughout the week

3. Re-set a date/time that you’d like to accomplish each step, share it with your partner, and set reminders on your calendar, phone, or Slack (by messaging the “/remind” command on Slack message box e.g. /remind me to drink Kambucha at 5 pm on March 16)

4. Post your feedback on this group Channel for what went well and what was challenging with this format. Feel free to share progress on your SMART goal mini steps and overcoming barriers!

Week 9

[ACTIVITY: OVERCOMING BARRIERS TO SMART GOALS Part 2]: Hi @channel!

The following two technology adaptations are a continuation from last week's activity on barriers to SMART Goals. Please *try them out* and *provide us feedback*.

A3. Technology Adaptation 2: Survey (Fill out the survey) Link to a survey on which you can reflect on the barriers to your mini steps in your own time and send an email to yourself with your responses. If you completed all your mini steps to your SMART Goal, think of any barriers you may have in the future mini steps while trying out the survey. – >

<https://www.surveygizmo.com/s3/4891392/week8>

A4. Technology Adaptation 2: (Provide us feedback on the mock-up) A continued mock-up of the SMART Goal chat-bot from two weeks ago (attached PDF with 3 pages) that follows up on (1) whether you completed each mini-step to your SMART Goal, (2) what were the barriers, and (3) scaffold revision of mini steps for next week. *Please provide us feedback* on the chatbot mock-up.

Let us know your feedback: what can make this more helpful (if anything) and what might be difficult.

We hope you can complete this by June 3rd. Let me know if you have any questions, thank you so much!

Week 10

***[ACTIVITY: HOW TO TEACH THERAPY CONTENT ON AN ONLINE**

PLATFORM]:* We are now going to start exploring how we can teach therapy material through Slack. In order to do this, we must explore many possible options to find the best way to deliver this material in an engaging and understandable way.

Please provide as much feedback as possible!

Teaching content format: We came up with *five* possible ways to teach therapeutic content via Slack (or another online platform). *Please review* and then *complete the tasks outlined in 1 - 3 below*:

-***Powerpoint slides with voiceover***: This approach would use powerpoint slides of the worksheets, like the ones you all reviewed throughout this study (see example below as a

reminder). We would add a voiceover of an expert like a school psychologist, licensed mental health provider, psychiatrist, or clinical psychologist to walk teens through the powerpoint slide concepts each week.

- ***Animated video with voice over:** * We have a great example of what this teaching process could look like. Please note this is an example only, and not related to BA. Watch the video for at **last 1-2 minutes** to understand the general idea:

https://www.youtube.com/watch?v=C_3phB93rvI.

- ***Video of a mental health professional:** * This would involve an expert like a school psychologist, licensed mental health provider, psychiatrist, or clinical psychologist explaining the concept in-person through a video format.

- ***Video of a teen or adult with lived experience:** * This would be a video of a teen or young adult explaining a concept through the lens of having experienced depression in the past. Here is an example, not specific to BA (please note this video is long, so no need to watch the entire clip): <https://www.youtube.com/watch?v=njESlZa2b10>.

- ***Chatbot:*** A chatbot would interactively walk through a new concept with the teen and have the ability to ask the teen questions that could later be used when coaching through a homework assignment. Please read through the mock chatbot example attached.

1: Please fill out the poll to check which options you would think would be best for teaching a teen therapy content:

/poll “Please click on all teaching methods you prefer” “Animated Video with Voiceover”
“Video of a mental health professional” “Video of a teen or adult with lived experience”
“Chabot”

2: What other ideas do you have for teaching therapy content?

3: Please tell us why you selected the options in the poll.

Please try and have this done by **Monday, June 10th**, thank you so much!

Interview Protocol for Teenagers

Time: 30- 40 min

Hi, is this [Participant_name](#)?

This is [<researcher_name>](#) from the University of Washington regarding the interview on technology and teen depression management study. Thank you for taking the time out! Is this still a good time to chat?

Information regarding the interview.

The interview will take 30-40 min. I would like to learn about treating depression and your experience in the study.

I will be asking you questions on your experience in the study and on adapting behavioral activation for online platforms, and reflection on the method of using Slack.

Share only what you are comfortable with. If you feel like you don't want to answer a question, you can feel free to let me know and we can move on. You can also let me know if you want to end the interview at any time or ask me questions anytime.

Is it okay if I audio record this interview? I will delete all identifying information (name, location) and recording will be transcribed anonymously.

Experience with depression and/or low mood

Current or past experience with depression and treatment:

- Did you seek any kind of counseling, therapy, or treatment for difficulties with mood or depression? -
 - what kind of clinic/therapist?
 - how long,
 - frequency of sessions
- If you had wanted to get treatment for mood or depression and didn't, what were your barriers to getting help?

Adapting BA to online platforms like Slack

1. BA can be delivered in a long **format** (full ~12 session treatment protocol) or a short (4-6 session protocol) format.
 - What do you think are the **benefits** of long vs the short format?
 - What do you think are the **challenges** of long (full ~12 session treatment protocol) vs short (4-6 session protocol) format?
2. If we think about in-person therapy to online only therapy as a spectrum, which type of care do you think would be appropriate for **you**?
3. **Typical therapy for depression** involves weekly in-person sessions. Through this project, we are hoping to use an online platform like Slack to decrease the amount of in-person treatment sessions needed and support teens in their therapy goals between sessions. This could be especially helpful for teens that live far away from mental health care and have trouble making it in every week.

For example, a therapist would see a teen in-person once every 2-4 weeks and then use the online platform to deliver treatment, help with homework completion, and answer questions until they are able to see them next.

What do you think about using Slack in this way to help deliver depression treatment to teens?

4. In terms of time, how burdensome do you think the prototypes for homework activities will be for you?
 - If they have therapy experience ask how is this online format different?
5. Do you have any **concerns about privacy** when using remote technologies for treatment?
 - What steps might help mitigate these privacy concerns?
 - Are there any privacy concerns that you see as insurmountable?
6. If you were to be involved in **online group support** that supplements your face-to-face care, what privacy concerns would you have regarding the group format?

Take home activities between sessions

1. Now that you've experienced the Slack format, how do you think it could best support teens between sessions?

What do you think Slack can be used for to best support teens in between therapy sessions?

2. How was your experience with **the direct messaging** (DM) activity for SMART goals (if not already covered) [probe: what worked, what did not work]?

Teaching components

1. In our next phase of the study, we hope to propose design ideas for how to teach concepts via an online platform. Based on your responses, many of you indicated that an animated video with voiceover, video of teen with lived experience, or chatbot would be the best ways to teach this content online.
 - a. What are your thoughts about the benefits/challenges of these approaches in teaching BA concepts?
 - b. Are their other ideas you'd like to share with us?
2. Many of you indicated chatbot was not a preference, what are other ways do you think we can support the online homework format?
 - a. [in person was important, supplement the treatment]
 - b. Peer teaching/mentoring with a more advanced "buddy"?
3. We are thinking of a **peer learning format** for learning and practicing skills of BA. Thinking about an online platform like Slack, how would you modify the format or the interface it to support:
 - a. Peer interactions among teens
 - i. How many teens per group?
 - ii. Synchronous elements such as a time window or video/audio chat?
 - iii. Duration of the group? We are thinking 6 weeks.
 - b. Safety & Moderation: who should be moderating? Safety concerns? Any suggestions for moderation practices?

Reflect on ARC Method

1. Have you used Slack before you joined the study?
 - a. How was your experience using Slack during the study?
 - b. Did you have notifications on or off?
 - c. Activity timing – asynchronous nature, flexibility
 - d. When did you usually do the activities once it was posted?

- e. Was 20 minutes okay for each activity?
 - f. Did you read others' activities?
 - g. How did you feel about your interactions with others on the group? - reciprocity/acknowledgements
2. What was **helpful**?
 3. What was **challenging**? Any negative experiences?
 4. What would have made it an easier or better experience for you (if anything)? (**probe: timing: 20 minutes per activity, 1 week, any breaks?**)

Wrap up:

Do you have any questions for me or regarding the study?

Researcher: Would you like to be contacted in future to provide feedback on iterations of the designs or their ideas?

Finally– survey on for 10-15 min.

Is it okay if we send you the compensation gift card (\$15) at the end of next week after all interviews?

Thank you!

Interview Protocol for Clinicians of Teenagers

Time: 30- 40 min

Hi, is this [Participant_name](#)?

This is [<researcher_name>](#) from the University of Washington regarding the interview on technology and teen depression management study. Thank you for taking the time out! Is this still a good time to chat?

Information regarding the interview.

The interview will take 30-40 min. I would like to learn about treating depression and your experience in the study.

I will be asking you questions on your experience treating teens, adapting behavioral activation for online platforms, and reflection on the method of using Slack.

Share only what you are comfortable with. If you feel like you don't want to answer a question, you can feel free to let me know and we can move on. You can also let me know if you want to end the interview at any time or ask me questions anytime.

Is it okay if I audio record this interview? I will delete all identifying information (name, location) and recording will be transcribed anonymously.

Experience with Depression Treatment for teens

You may have already answered these questions. I am asking in case there are any updates.

- Where (what kind of setting) do you currently work? (i.e., school, hospital, community clinic)
- How many years have you been licensed as a mental health professional?
- How many years have you been treating children and adolescents?
- Of the clients you have seen, what is the % teens you've treated for depression (based on your best estimate)
- % teen depression cases where you used Behavioral Activation (based on your best estimate) → how many years have you been using it?
- How many times per week do you see (or try to see) a teen with depression for a therapy session?

Adapting BA to online platforms like Slack

- BA can be delivered in a long **format** (full ~12 session treatment protocol) or a short (4-6 session protocol) format.
 - What do you think are the **benefits** of long vs the short format?
 - What do you think are the **challenges** of long (full ~12 session treatment protocol) vs short (4-6 session protocol) format?
- **Stepped care models** typically involve first delivering a low burden intervention and monitoring response for 4-8 weeks to see whether a higher level of care, like weekly individual therapy, is necessary.

For example, a clinician would see a patient in-person once every 2-4 weeks and primarily use the technology platform to deliver initial care before moving to a higher level care (i.e., weekly in-person, referring to specialty care).

What do you think about using a technology platform like Slack as a low burden, first step in the context of a stepped care model?

- **Clinicians overall indicated that in-person face to face sessions are preferred over only remote therapy over an online platform.**
 - If we think about in-person therapy to online only therapy as a spectrum, which type of care do you think would be appropriate for **which type of teen patient**?
- We want to make sure a technology platform is feasible for clinicians in regards to time burden. Do you need to meet certain billing requirements as part of your work for the online work you do?
 - Do you use texting, phone calls, or other remote methods to communicate with clients during therapy?
 - **If so**, does your clinic currently have a mechanism for billing for online or telehealth?
 - Has your clinic ever attempted to find a way to bill for technology-based contact with clients, like texting, email coaching etc.?
 - **If not**, how burdensome would you see monitoring your patient's/client's activity on a technology platform compared to weekly in-person visits?

- Through the study we learned that many of you were **concerned about privacy** when using remote technologies for treatment.
 - What steps might help mitigate these privacy concerns?
 - Are there any privacy concerns that you see as insurmountable?

Take home activities between sessions

1. Now that you've experienced the Slack format, how do you think it could best support teens between sessions?

What do you think Slack can be used for to best support teens in between therapy sessions?

2. How was your experience with **the direct messaging** (DM) activity for SMART goals (if not already covered) [probe: what worked, what did not work]?

Teaching components

1. In our next phase of the study, we hope to propose design ideas for how to teach concepts via an online platform. Based on your responses, many of you indicated that an animated video with voiceover, video of teen with lived experience, or chatbot would be the best ways to teach this content online.
 - a. What are your thoughts about the benefits/challenges of these approaches in teaching BA concepts?
 - b. [Are there other ideas you'd like to share with us?](#)

Reflect on ARC Method

1. Have you used Slack before you joined the study?
 - a. How was your experience using Slack during the study?
 - b. Did you have notifications on or off?
 - c. Activity timing – asynchronous nature, flexibility
 - d. When did you usually do the activities once it was posted?
 - e. Was 20 minutes okay for each activity?
 - f. Did you read others' activities?
 - g. How did you feel about your interactions with others on the group? - reciprocity/acknowledgements
2. What was **helpful**?

3. What was **challenging**? Any negative experiences?

4. What would have made it an easier or better experience for you (if anything)? (**probe:**
timing: 20 minutes per activity, 1 week, any breaks?)

Wrap up:

Do you have any questions for me or regarding the study?

Researcher: Would you like to be contacted in future to provide feedback on iterations of the designs or their ideas?

Finally– survey on for 10-15 min.

Is it okay if we send you the compensation gift card (\$15) at the end of next week after all interviews?

Thank you!

APPENDIX C: STUDY PROTOCOL FOR DEPRESSION MANAGEMENT FEASIBILITY STUDY

WEEK 1:

Goal of the research study: Hey everyone! I hope you are doing well. We are very excited to have all of you participate. In this study, we have both teens as well as mental health clinicians in this group so that we can get different perspectives on how using these online therapy tools work.

We also want to remind everyone that this is ***not a treatment study*** but a study focused on using tools that are meant to help with a specific type of depression treatment, Behavioral Activation. You will be testing these tools on your own and with the clinicians and then providing feedback about how they work.

We will be posting an activity ***every Wednesday evening*** and you can respond to it in your own time by the following ***Wednesday at 5 pm***. It should take you about ***20 minutes*** to complete each week's activity.

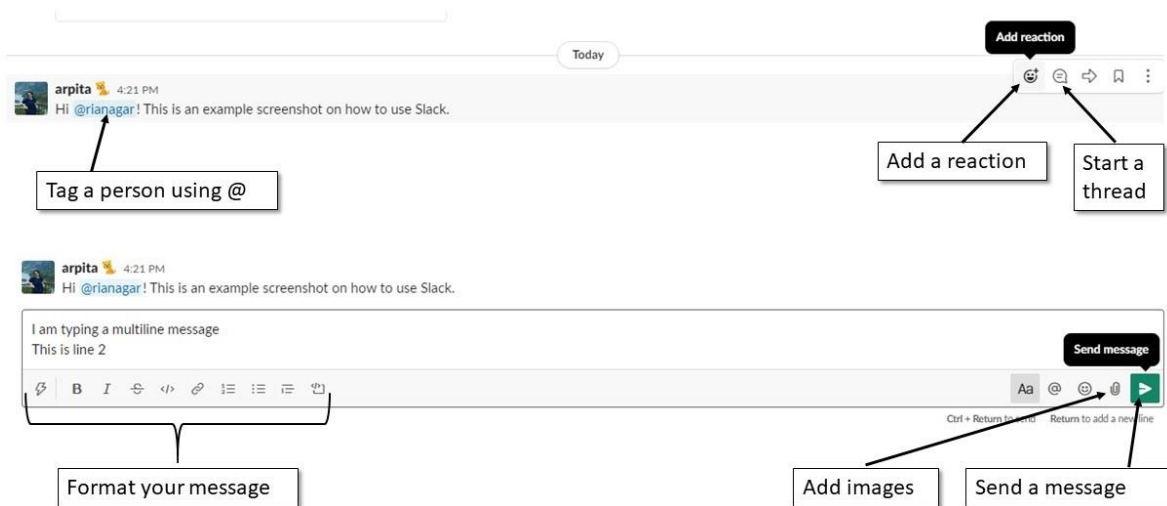
***[Week 1]*:** We are very excited to begin our study with all of you. We have 9 teens and 3 clinicians in this group. The moderators on this group are @arpita, @jess jenness, and myself (@rianagar). Please feel free to ask any questions by tagging any one of us and we can get back to you within 24 hours on business days. Please make sure to review the group guidelines at the top of this channel.

There are two activities this week. The first is to get familiar with Slack features and second is to post introductions to the group.

[ACTIVITY 1.1: Getting to know Slack]:

As Slack can be a bit confusing, we have provided an instructional video below. Please take a look at the video as it will be very helpful in the coming weeks.

For the first part of the activity, **read** over the following information pretending that you are using Slack for the first time. For those who are unfamiliar with Slack, here are some interactions on Slack that we hope to use. When you *hover* your cursor over a post such as this post, you can see some small icons on the top right of the post.



1. ***Reactions:*** The smiley face icon lets you add reactions to a post. You can react with any emoji.
2. ***Threads:*** The chat bubble icon next to the smiley face allows you to start a thread so that all responses related to one post can be together. Please use threads when you respond by clicking on the chat bubble icon or click on “reply” if there is already an existing conversation thread going on. The thread is visible to everyone on the channel. Here’s a video on how to use threads: <https://www.youtube.com/watch?v=gT4MIMmQN5A>
3. ***Tagging:*** You can tag group members by using “@” and their slack name.

4. ***Adding images:*** You can add images (such as memes or design ideas) on Slack by clicking on the paperclip (attachment button) in the message bar.

5. Feel free to set up notifications, this might be helpful in the coming weeks as we will be posting weekly activities.

6. Option to download Slack on your phone, tablet, or computer, this will increase accessibility and make it easier for you to participate!

7. You can edit your posts even after you post them, just click the edit option on the right side of your post.

[ACTIVITY 1.2: Getting to know each other]:

Now that you've gotten a basic overview on how to use Slack, it's time to get to know teens and clinicians in this group. We have a few questions for you all to answer as an ice-breaker. Pick **two** of the following prompts to answer and ***share your responses in the group as a message***. You may answer more or all of them if you like.

1. If you could choose one place to go on vacation, where would it be and why?
2. If you were an ice cream flavor, which would you be and why?
3. If you could pick up a certain skill instantly, what would it be?
4. Share a gif or meme that expresses how you're feeling at the moment.
5. What are some creative ways you've found to stay busy or active (if any)?

In addition, ***clinicians*** @Margot @Simba Lion @Cherry Blossom ***please let the group know how you have been involved in treating teens?***

Please complete posting your response for activity 1.2 on Slack by next Wednesday *5 pm on June 17*. The activity should take ~20 minutes. Thanks all! :)

WEEK 2:

Hi @channel! This week's activity has 3 parts primarily focused on introducing Behavioral activation and logging your activities and mood.

[ACTIVITY 2.1: Getting to know each other more]

Continuing from last week, we have a couple more questions as an ice-breaker. Pick **one** of the following questions to answer and share it on the group with your peers. You may answer all of them if you like.

1. If you could instantly be an expert on a topic subject, what would it be?
2. What superpower would you like to have?

[ACTIVITY 2.2: Introduction to BA]:

Our project goal is to adapt a specific treatment, Behavioral Activation (BA), to an online platform. Research has shown that BA is an effective strategy for treating depression in both adults and teens. BA comes from the idea that what you **do** affects how you **feel**. Because of this, BA focuses mostly on how we can help people to **find** and **engage with** the activities and people in their lives that help improve mood!

Please watch this video on Behavioral Activation. We'd like to make sure that we are all on the same page about what BA involves.

https://youtu.be/Le10_EyamDw

After watching, please write responses to the following questions :

1. What were your key takeaways from the video?
2. What were your thoughts about how the information on BA was presented?
3. Any other feedback about the video (content, animations etc...)?

[ACTIVITY 2.3: Track your activity and mood]

Add the ActivaTeen app on Slack: please see instructions on this PDF to install the Slack app

Every day, you will receive a notification on the Slack @ActivaTeen app to log your mood and activities at **12 pm, 6 pm, and 9 pm**

- Once you get the prompt, when you are ready, click on **“Log Now”**.
- It will ask you to log an activity you did in the past 3-6 hours and how you felt while doing this activity.
- If you want to add multiple activities, you click again on “Log Now” and make multiple entries
- If you miss logging sometimes, don’t worry! The prompt will be there on the app and you can come back to it when you feel like logging.

Why are you asked to do this activity?

- After 2 weeks of logging, we will process your logged data and send you a chart of what activities you did, how you said they influenced your mood, and at what times of the day
- As part of BA, it helps to be able to reflect and make inferences about the relationship between your mood and activities.
- We will share these charts anonymously with the clinician members on our group and they will provide their feedback and insights, which we will share back with you

- We will ask you for feedback on what you would like to see and learn from this type of logging

Please complete these activities by **Wednesday, June 24th 5 pm**. Let us know if you have any questions. Thank you! :)

WEEK 3 Clinicians

Hi Clinicians @channel! We have created a separate channel for you all as the activities will be different for teens and clinicians starting this week. This week's activity has 2 parts.

[ACTIVITY 3.1: Reflection on Activity and Mood Tracking, 10 minutes]:

Thank you so much for logging your activities in the past week. You are no longer required to track activities or mood. Teens will continue to log in the next 4 weeks.

Please reflect on your experience with mood and activity tracking on @ActivaTeen in the past 7 days and share it as a message on this Slack group.

Reflection Questions:

- How would you use this kind of mood-activity tracking when treating patients with depression?
- What challenges do you imagine encountering when using this mood-activity tracking?
- What do you imagine your patients would like about the mood-activity tracking?
- How would you improve the mood-activity tracking for your patients?

[ACTIVITY 3.2: Feedback on Tracking Data 10 minutes]:

In the Google spreadsheet linked below, you will see logged activities from three different teens who have various levels of engagement in their logging. Each teen's data is on a separate sheet in that file (see tabs for different sheets on the bottom). <link>

Please review the data and let us know:

- How useful do you find this spreadsheet? How would you want to use these data, or data like these?
- What are some ways you would like to see this information visualized? What would you like to learn from this data?

Please complete this by Wednesday, July 1st 5 pm. Let us know if and when you have questions. Thank you :)

WEEK 3 Teens

Hi all @channel! Thank you so much for logging your activities in the past week. We ask you to continue tracking your activities this week and we will remove the 9 am reminder. This week's activity has 2 parts.

[ACTIVITY 3.1: Reflection on Activity and Mood Tracking, 5-10 minutes]:

Please reflect on your experience with mood and activity tracking on @ActivaTeen in the past 7 days and share it as a message on this Slack group.

Reflection Questions:

- How often did you log your activities and when (e.g., during lunch, after you got a reminder, before bedtime)?
- Did you encounter any challenges while logging your activities and/or mood? If so, what were they?
- How often do you want to be notified to log your activities and mood?
- What do you think about the summary message of activities after logging each time?

[ACTIVITY 3.2: Upward and Downward Spiral, 10-15 minutes]:

An important part of BA is understanding connections between situations, feelings, and actions in order to identify what contributes to **upward** (improvements) and **downward** (worsening) spirals in mood.

This week’s feature is designed for you to log downward and upward spirals during the week. Try it at least once during this week. You can also do this multiple times if you want to.

- Please open the @Activateen app.
- Type “hi” or “hello”. You will see a prompt with buttons.
- Click on the button that says “**Share Upward Downward Spiral**” (ignore the other buttons for this week).
- Follow the prompts that appear and respond to them by typing your response and then clicking on the green send arrow on the bottom right (similar to how you send messages on Slack).
- First, @ActivaTeen prompts will guide you to reflect on something that brought your mood down. Then, it will prompt you to reflect on something that brought your mood up.

Please complete these activities by Wednesday, July 1st 5 pm. Let us know if and when you have questions. Thank you :)

WEEK 4 Clinicians

Post on the clinician channel first. – Monday

Hi Clinicians @channel! We are going to add you into 3 separate direct message groups with 3 teens each to discuss their summary of logging data, **tomorrow**. We have compiled a summary PowerPoint for each teen and added a link to the raw data for each of your assigned 3 teens. We will post this PowerPoint in your direct message chat with the respective teen. On the direct message chat, I will be there to help if needed. You can tag me @arpita if you need to get my

attention. As a reminder, I check my messages once per day during normal business hours (10am-4pm Monday-Friday).

The goal of this task is for us to learn 1) whether asynchronous direct messaging could be a useful therapy tool and 2) how you would discuss the data with your patients.

You can use the suggested questions below to structure your conversation, but please feel free add your own questions.

We are expecting that you will start and guide the conversation with the teen. Importantly, we will remind the teen that this messaging is not meant to be considered a form of therapy. Rather, it is meant to help us learn whether these tools, like data logging and direct messaging, could be useful to clinicians and teens when we are creating online therapies in the future. Please let us know if you have any questions or concerns.

Suggested questions to pose to teens for discussion on logging summary and data:

- What patterns did you notice from the data and the summary?
- What did you learn from the data and the summary?
- How might this help you form therapy goals?

Post on teen channel – Monday

WEEK 4 Teens

Hi Teens @channel! Hope you had a restful weekend. This week's activity has 2 parts.

[Activity 4.1 Reflection on the upward/downward spiral]: please post and discuss on this channel about your experience using the upward/downward spiral feature on Activateen.

What went well when responding to prompts on the upward/downward spiral on @ActivaTeen?

What did not go well?

What would you like to change about the interaction (if anything)?

[Activity 4.2 Discussing your logging data and summary with a clinician]: Tomorrow, we are going to add you into a direct message with a clinician to discuss the summary of the data you logged between June 16th and July 1st. We have compiled a summary PowerPoint for each one of you and added a link to the raw data so you and the clinician can review it and refer to it during discussions. We will post this PowerPoint in your direct message chat with the clinician. No other teen participant can see this PowerPoint or your data.

On the direct message chat, I will be there to help if needed. You can tag me @arpita if you need anything. Please note that I check my messages once per day during normal business hours (10am-4pm Monday-Friday).

As a reminder: The interaction with the clinician is not meant to be considered therapy. The goal is to learn whether these online tools, like data logging and direct messaging, could be useful to clinicians and teens when we are creating online therapies in the future.

We are expecting the clinicians to start the conversation, but you can jump in at any time. The timing of this conversation is meant to be flexible, which means you and the clinician can chat any time that's convenient for you and does not need to happen when you're both online.

After seeing your summary and data, you can think about what you learn or want to learn about your patterns in mood and activities.

Please let us know if you have any questions or concerns. Thank you!

Post on direct message channel – Tuesday

Hi @[insert clinician] and @[insertteen]!

This is the direct message group that we'd like you both to use when discussing the mood-activity logging data.

I'm attaching a PowerPoint slide that includes a summary of the data @[insertteen] logged between June 16th and July 1st.

- Slide 1 shows the summary of logs and also includes a link to the raw data so you can review it and refer to it during discussions.
- Slide 2 shows a graph of the valence of feelings logged over the time of day (morning, afternoon, or evening)
- Slide 3 shows a graph of the valence of feelings logged (negative, positive, or neutral) over the type of activity.

Please note that no other teen participant can see this PowerPoint or your logged data.

@[insertclinician] has been asked to start the conversation; however, @[insert teen] please feel free to chime in with reflections or questions at any time. Messages are meant to be sent at whatever time is convenient for each of you, so you do not need to be online at the same time!

The expectation is that the messaging should take no more than 10-15 minutes of your time across the week.

Please tag @arpita if you have questions! I will aim to respond within 24 hours on business days.

WEEK 5: Clinicians

[Activity: Reflection on last week's discussion]: Hi @Cherry Blossom! This week we would like to get your feedback on how your experience was with the activity in week 4 on the following two aspects:

Data Logging and Visualization:

1. What was useful about the data logging visualization and summaries?

2. How could the visualization and summaries be improved?
3. What else do you want to learn from these logs about a teen client's patterns in mood and activities that weren't included?

Direct Messaging to Teen:

4. What was it like sharing your thoughts about the data logging via direct message to the teen?
5. What were or could be the benefits of giving feedback remotely and/or asynchronously with a patient?
6. What were or could be the challenges of giving feedback remotely and/or asynchronously?

Week 5: TEEN CHANNEL

[Activity: Reflection on last week's discussion]: Hi @channel! This week we would like to get your feedback on how your experience was with the activity in week 4 on the following three aspects if you had a chance to read the summary:

Data Logging and Figures:

1. What was useful about the mood and activity tracking figures and summaries?
2. How could the figures and summaries be improved?
3. What else do you want to learn from tracking your patterns in mood and activities that wasn't included?

Direct Messaging to Clinician:

1. What were your expectations while communicating with the clinician?
2. What was it like communicating or not communicating with the clinician about the data logging via direct message?
3. What was or could be helpful about getting online feedback from a clinician?
4. What were or could be the challenges of getting online feedback through asynchronous direct messages?

Goal Setting:

A key piece of behavioral activation is helping teens to set **goals and mini steps related to making a behavioral change to create upward spirals and prevent or stop downward spirals in mood**. Next week, we will have you test out an online tool for how to create and set goals related to improving mood:

- Based on what you learned from your mood-activity tracking, what are 1 to 2 goals you'd like to focus on related to your mood?

WEEK 6 Teens

Hi all @channel! Last week, some of you thought about what goals you want to set based on your data. This week, we will move on to planning and scheduling SMART goals for mood. This week's activity has 3 parts.

[Activity 6.1: Log activity and mood]: We will start tracking mood and activity again and you will get reminders **3 times** per day 9 am, 12 pm, and 6 pm. Log when you are able and willing. We have added a new activity category called "goal" to help you track your SMART goal activity.

***[ACTIVITY 6.2: Learn about SMART Goals, 10 minutes]*:**

We are now going to introduce more of the BA treatment for you to explore and provide feedback on. You can do this activity in parts or together.

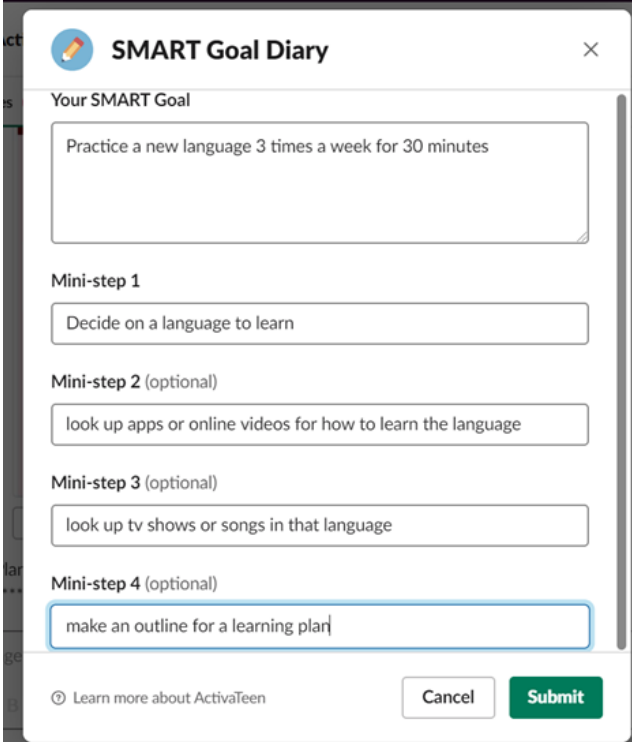
Setting SMART goals:** A key component of BA is helping teens to set ***SMART goals and mini steps related to making a behavioral change to create upward spirals and prevent downward spirals in mood.

Please read this PDF to learn about SMART goals.

[Activity 6.3: Plan and schedule your SMART goal]

Now, plan your SMART goal using the app @Activateen.

- Please open the @Activateen app.
- Type “hi” or “hello”. You will see a prompt with buttons.
- Click on the button that says “Plan SMART goal” (ignore the other buttons for this week).
- Follow the prompts that appear and respond to them by clicking on the button options you want to choose.
- First, @ActivaTeen prompts will guide you with some examples and categories of SMART goals.
- Then, You will see this dialog box to write your SMART goals and mini steps. Write at least one mini-step. This is an image of what it will look like.



The screenshot shows a mobile app interface titled "SMART Goal Diary". It features a close button (X) in the top right corner. Below the title, there is a section for "Your SMART Goal" with a text input field containing the text "Practice a new language 3 times a week for 30 minutes". Below this, there are four sections for "Mini-step" entries, each with a text input field:

- Mini-step 1: "Decide on a language to learn"
- Mini-step 2 (optional): "look up apps or online videos for how to learn the language"
- Mini-step 3 (optional): "look up tv shows or songs in that language"
- Mini-step 4 (optional): "make an outline for a learning plan"

At the bottom of the form, there is a link "Learn more about ActivaTeen" and two buttons: "Cancel" and "Submit".

- After you Submit, you can edit the goal or add another goal.

- Schedule reminders either on Slack or on your phone to do the mini steps.
 - Set a **date/time** that you'd like to accomplish each step, share it with your peer, and **set reminders** on your calendar, phone, or Slack (by messaging the ***"/remind"** command on Slack message box e.g. /remind me to drink Kombucha at 5 pm on July 25).
- The activity is complete once you have set the reminders for yourself.

After you schedule your mini steps:

- You can log the SMART goal ministep activity on ActivaTeen under category “goal”
- Feel free to share progress on your SMART goal(s) or mini-step(s) here on this group so we can cheer you on!

Also, please take note that **it is okay to encounter difficulties or barriers** when completing the tasks. Try your best!

Please complete these activities by Wednesday, July 28th 5 pm. It should take about 20 minutes. Let us know if and when you have questions. Thank you :)

WEEK 7 Clinicians

Hi all @channel! The teens used the ActivaTeen app to plan their SMART goal last week. We would love your feedback on the data and the app itself. This week’s activity has 2 parts.

[Activity 7.1: Try out the SMART goal tool on @ActivaTeen]

The teens used this tool to plan their goal. We are requesting you to try the tool and give us any feedback on your experience. You don’t have to plan a “real” goal (though feel free to do so!), but you’ll need to fill out some text boxes to fully experience the app.

To plan your SMART goal using the app @Activateen.

- Please open the @ActivaTeen app.
- Type “hi” or “hello”. You will see a prompt with buttons.
- Click on the button that says, “Plan SMART goal” (ignore the other buttons for this week).
- Follow the prompts that appear and respond to them by clicking on the button options you want to choose.
- First, @ActivaTeen prompts will guide you with some examples and categories of SMART goals- take a few minutes to explore around and review the examples.
- Then, You will see this dialog box to write your SMART goals and mini steps. No need to think of a “real” goal and mini steps but enter in text within the SMART goal section and at least one mini-step in order to submit. This is an image of what it will look like.

- After you Submit, you can edit the goal or add another goal.
- Test out the “schedule reminders” feature on Slack
 - Set a **date/time** that you’d like to accomplish each step and **set reminders** on Slack by messaging the **“/remind”** command on Slack message box (e.g. /remind me to drink Kombucha at 5 pm on July 25).

- The activity is complete once teens have set the reminders.

Action item: After you try this, respond to the group with

1. How was your experience using the SMART goal tool on @ActivaTeen? What worked and what didn't?
2. What did you think of the examples and categories provided?
3. What would you like to change about this tool to support teens in planning SMART goals (if anything)?

[Activity 7.2 Reviewing the outcome]: Here are the planned goals from the teens after they planned it using @ActivaTeen

User	SMART goal	Mini Step 1	Mini Step 2	Mini Step 3	Mini Step 4
4leafclover	3-5 times a week run 2 miles before I play fortnite. 25 pushups and 10 burpees	have clothes out and shoes by door	have glass of water on table	have AirPods and computer charged and ready to watch	None
yoshimi 00	Read history book	read for at least 30 minutes everyday	None	None	None
Parzival	Start hanging out with one of my friends in person at least once a week	Text some of my friends to figure out whos available	Make a plan for when/where	None	None
llad	Umm do more cooking/baking	ldk	None	None	None
twilight	Watch less online streaming movies	Cancel subscriptions to paid streaming services	Don't watch free streaming services	Don't watch movies on YouTube	Try not to watch more than one movie a day

Action item: Please respond to the group with:

- How might you use this information with a teen patient on Slack chat asynchronously or in a session?

- Is there anything you would change about the type of data logged or presentation of the data?

Please complete these activities by Wednesday, August 5th, 5 pm. Let us know if and when you have questions. Thank you :)

WEEK 7 Teens

Hi all @channel! Now that you tried planning and scheduling your goals, let's move on to reflecting on how your experience of planning your SMART goal was. This week's activity has 2 parts.

[ACTIVITY 7.1: Reflection on SMART goal tool]:

Please respond to the following questions on this group based on the SMART goal activity you completed on @Activateen:

1. What did you see as the reason behind setting the SMART goal?
2. How was your experience using the @ActivaTeen tool to record your SMART goals?
What worked and what didn't?
3. What would you like to change in the SMART goal tool (if anything)?
4. How and where did you set up reminder(s) (if any)?
5. In what ways did using this tool support you in accomplishing your goal (if it did)?

[Activity 7.2: Peer sharing on the group]

1. Share your smart goal and/or mini step here in the teen group
2. Share with the group one problem you ran into while setting the goal or planning mini steps that you are willing to get the group's thoughts on
3. Give feedback to at least one other teen peer on the group and/or cheer someone on

[Activity 6.1 contd.]: Continue to track your activities as and when you are able. You will get reminders on @ActivaTeen at 9 am, 12 pm, and 6pm. Please reach out to me or comment on the group if you want to stop logging or change the frequency of the reminders.

Please complete these activities by Wednesday, August 5th, 5 pm. Let us know if and when you have questions. Thank you and take care.

WEEK 8 Clinicians

Hi @Cherry Blossom! This week's activity is on direct message with teens similar to week 5 but discussing about their SMART goals and barriers. Like last time, we are going to add you into 3 separate direct message groups with 3 teens and share their goal and summary of their logging data from the last two weeks. We will post a PowerPoint in your direct message chat with the respective teen's SMART goal and activity log summary.

In this week's activity, teens are learning about internal and external barriers to SMART goals and planning how to overcome these barriers with some examples on ActivaTeen app.

I will be there to help if needed. You can tag me @arpita if you need to get my attention.

The goal of this task is for us to learn (1) whether asynchronous direct messaging could be a useful therapy tool and 2) how you would discuss SMART goals and barriers with your patients.

You can direct the conversation and feel free to use the suggested questions below to structure your conversation

We are expecting that you will start and guide the conversation with the teen. Please let me know if you have any questions or concerns.

Suggested prompts for discussion:

- What were barriers to your SMART goal? What have you tried or would like to try to overcome barriers with your SMART goal?

- You can also discuss teens' activity logs similar to the earlier week and discuss if anything has changed compared to last time.
- You can plan/discuss future goals with the teens

Hope you can complete it by Wednesday, August 13th. Please let us know if and when you have questions. Thank you and looking forward. :)

WEEK 8 Teens

Hi all @channel! This is the last week of the online group. This week, we will be planning how to work around barriers to your SMART goal. This week's activity has 2 parts.

[ACTIVITY 8.1: OVERCOMING BARRIERS TO SMART GOALS, 10 minutes]:

Now that you all have had a chance to practice setting SMART Goals (and maybe completing a few mini steps yourself!), the next activity in BA involves overcoming barriers to mini steps and completing SMART Goal.

There are two key types of barriers:

***Internal Barriers*:** Barriers that arise from within, such as “not feeling like it”/low motivation, feeling overwhelmed, trouble communicating needs, forgetting, or distraction.

***External Barriers*:** Barriers that arise outside of yourself, such as not having the needed "tools" (e.g, school book, art supplies, homework assignment etc), needing help from others (e.g., ride from parents, quiet space in the home, tutor/homework help), other people not following through on plans, or needing money.

—How can we overcome these barriers? —

This week's @ActivaTeen feature is designed for you to work through your barriers to completing your SMART goal. Try it at least once during this week. You can also do this multiple times if you want to.

- Please open the @Activateen app.
- Type “hi” or “hello”. You will see a prompt with buttons.
- Click on the button that says “**Barriers**” (ignore the other buttons for this week).
- Follow the prompts that appear and respond to them by typing your response and then clicking on the green send arrow on the bottom right (similar to how you send messages on Slack).
- First, @ActivaTeen prompts will guide you to reflect on the type of barriers you experienced and examples of strategies to overcome the internal and external barriers (figure below).

.....

Hi! What was the barrier in completing your SMART goal?

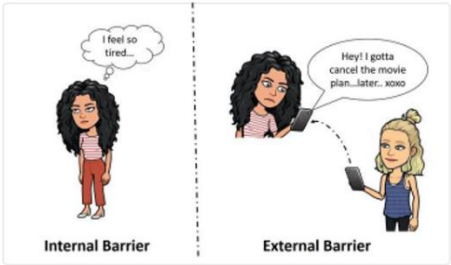
arpita 3:10 PM
i felt so tired

ActivaTeen APP 3:10 PM
Thank you for sharing! There are usually two key types of barriers to completing mini-steps: **Internal & External** barriers.

Internal Barriers: Barriers that arise from within yourself such as not feeling like it or low motivation, feeling overwhelmed, trouble communicating needs, forgetting, or distraction

External barriers: Barriers that arise outside you, such as not having the needed tools, needing help from others, other people not following through plans, or needing money.

(171 kB) ▾



What type of barrier got in your way: internal or external?

arpita 3:10 PM
internal

ActivaTeen APP 3:10 PM
Examples to reduce

- **internal barriers:** set a goal with a buddy
- **external barriers:** ask parents or friends for help (264 kB) ▾

Overcoming Internal Barriers Overcoming External Barriers

- After you type how you will overcome the barrier, @ActivaTeen will prompt you to plan a SMART goal with steps similar to week 6.

This time, when you plan the SMART goal, include mini steps on how you might overcome the barrier you experienced last time or might experience. The activity is complete once you have set reminders.

[Activity 8.2: Discussing with Clinician in direct message, 10 minutes]

This week, we are asking you to discuss your SMART goals and barriers with the clinician in a direct message group (similar to the earlier week in which you spoke with clinicians). In the direct message group:

- I will share your SMART goal and activity tracking summary PowerPoint and tracked data with you and the clinician. Please review this.
- Clinicians are asked to initiate the conversation but feel free to jump in at any time. Please discuss barriers and overcoming barriers with the clinicians
- You can also discuss your activity logs with the clinician similar to the earlier week. (e.g., if you have noticed any changes compared to last time)
- You can also plan/discuss your future goals

[Activity 6.1 contd.]: Continue to track your activities as and when you are able. You will get reminders on @ActivaTeen at 9 am, 12 pm, and 6pm. Please reach out to me or comment on the group if you want to stop logging or change the frequency of the reminders. We will share this data and summary with you at the end.

Please complete these activities by Wednesday, August 13th. Please let us know if and when you have questions. Thank you and looking forward. :)

Post on the direct message group with teen and clinician

Hi @[insert clinician] and @[insertteen]!

This week, we would like you to discuss SMART goals and barriers faced during SMART goals.

Like last time, I'm attaching a PowerPoint slide that includes a summary of the data

@[insertteen] logged between July 22 and August 4th, 2020.

- Slide 1 shows the SMART goal and barriers shared by @teen
- Slide 2 shows the summary of activity logs and also includes a link to the raw data so you can review it and refer to it during discussions.
- Slide 3 shows a graph of the valence of feelings logged over the time of day (morning, afternoon, or evening)
- Slide 4 shows a graph of the valence of feelings logged (negative, positive, or neutral) over the type of activity.
- Slide 5 is a table of logged activities across valence of feeling and time

Please note that no other teen participant can see this PowerPoint or your logged data.

Similar to last time, @[insertclinician] has been asked to start the conversation; however, @[insert teen] please feel free to chime in with reflections or questions at any time. Messages are meant to be sent at whatever time is convenient for each of you, so you do not need to be online at the same time!

The expectation is that the messaging should take no more than 10-15 minutes of your time across the week.

Please tag @arpita if you have questions! I will aim to respond within 24 hours on business days.

Interview Protocol for Teens

Time: 30- 40 min

Hi, is this [Participant_name](#)?

This is [researcher_name](#) from the University of Washington regarding the interview on technology and teen depression management study. Thank you for taking the time out! Is this still a good time to chat?

Information regarding the interview.

The interview will take 30-40 min. I would like to learn about your experience in the study, so I will be asking you questions on your experience with the activities in this study and how we might use these activities/tools to help teens manage depression.

Share only what you are comfortable with. If you feel like you don't want to answer a question, you can feel free to let me know and we can move on. You can also let me know if you want to end the interview at any time or ask me questions anytime.

Is it okay if I audio record this interview? I will delete all identifying information (name, location) and recording will be transcribed anonymously.

<start recording>

Do you have any questions before we begin?

1. Feedback on the weekly activities (Conceptual questions about understanding depression, BA, and self)

So in our study we used behavioral activation for 4 main activities

1. Tracking mood and activity for 5 weeks
2. Reflecting on upward and downward spiral
3. Planning SMART goal
4. Planning how to overcome barriers to SMART goals

1. Psychoeducation about BA

How do you think BA applies to your experience with mood? (if it does)

1. Learning about self through tracking

1. How was your tracking experience?
2. When and why did you log your activity?
3. What was helpful (if anything)?
4. What would you change about the design of the logging screen and prompts (if not covered already)?
5. What was unhelpful (if anything)?

b. Reflection through the summary data - self and with the clinician

<Start screen sharing>

Show the summary during the interview

1. I noticed that you have rated intensity for neutral differently on different days. Can you elaborate on why?
2. What is helpful in each representation?
3. What would you change in each one?

c. Goal Planning

<Show their SMART goals>

1. What additional support would you need to support this type of planning?

d. Changes in Action and/or mood (if any)

0. Were there any actionable outcomes from the tracking and planning process? If so, what were they?

e. Barrier activity specific:

- What was it like following the directions and learning about barriers using the ActivaTeen App?
- What would you want changed or added to the “barrier” feature?
 1. Activity suggestion cards
 2. Overcoming barrier suggestion cards

- Did you use the “remind” function during this activity or previously? (just to get a count of who used it) What were the challenges of using the “remind” function? How could it be improved? Any other feedback?

3. Method and format of ARC

- How was your experience with the pace of the study and activities? (timing, activity burden, asynchronous format)
 - How do you feel about interactions with and the presence of peers in the teen group?
 - What were your barriers in engaging with the peer teens in the group?
 - **How was your experience interacting with the clinician?** (probe: week 6, later in week 8, in terms of feedback content (support with any additional insights?))
 - What could have we done to make it an easier experience for you, if anything?
- If you are in therapy or have been in therapy how could you see this being useful? What would make it more useful? (How do you imagine something like this being integrated with existing therapy (group or individual)? Would it be different as an in-person telemedicine group versus people you don’t know?)
 - **Overall, how comfortable were you participating in the study?** (probe: did you have any negative experiences; what was your favorite aspect of the study/tools)

Do you have any questions for me regarding the study? Thank you for participating!

There is one last survey to do. I will send you the data and the summary graphs.

& we will send you the gift card next week.

Additional questions for clinicians on experience

1. Where (what kind of setting) do you currently work? (i.e., school, hospital, community clinic)
2. How many years have you been licensed as a mental health professional?
3. How many years have you been treating children and adolescents?

4. Of the clients you have seen, what is the % teens you've treated for depression (based on your best estimate)
5. % teen depression cases where you used Behavioral Activation (based on your best estimate) → how many years have you been using it?

APPENDIX D: ONLINE GROUP GUIDELINES

—These guidelines will be pinned to our Slack group —

Hi! This is a private Slack group for a research study on designing tools for health management for adolescents. This group is mainly for research on understanding stressful factors in adolescent life and strategies for coping with stress. Everything you share on this group will be used for research purposes and is accessible to other members in the group. Please only share what you are comfortable with.

Please remember the following guidelines for the group:

- We honor **confidentiality**. Please do NOT share any information about members in the group outside the group.
- If you have questions or want to post something **anonymously**, you can message or email one of the moderators and we will post it without identifying you.
- Please respect other people's **privacy and personal space**. If someone does not want to add another person to their personal Facebook page as a “friend”, please respect their decision.

Privacy guidelines:

- Please **do NOT share any personal health information or medical records** here (e.g.; pictures of prescriptions or medical reports) . Please be aware at all times that your information can be seen, downloaded, and/or saved as a screenshot by other participants in the group.
- Please **do NOT post any identifiable information** such as account number, full name, address, photographs of individuals in settings which are not public. You may blur the identifiable features before sharing or ask us to do so on your behalf. Please be aware that all images and videos are downloadable and/or people can take screenshots. Even though our research team will be careful to not share this information outside the study team, we

do not have control over what other participants can share outside of this group.

- You may “block” individuals if you do not wish to see their posts and/or do not want them to see their posts. But do notify the research team if you decide to do so.

If you have any questions on privacy settings, feel uncomfortable, distressed, harassed, please contact the moderator(s).

Here is the privacy policy for Slack: <https://slack.com/privacy-policy>

To ensure that this group is a safe space for discussion on sensitive topics:

The purpose of discussions is not to come to any consensus, there are no wrong answers, and we may have disagreements. We encourage group members to listen to differing perspectives with an open mind.

- We honor diversity of opinions. **Respectful disagreement** is welcome. However, personal insults, biases and abusive language are not welcome. Use of such language may result in you being eliminated from the group and the study.
- Please be respectful of another individual’s culture, beliefs, customs, and spirituality.
- If you sense that a person may be in crisis or posts something on the group that concerns you, notify the moderators immediately. We will follow up with necessary measures for support for you and the person of concern.

If you feel unsafe or in crisis, please contact for professional help:

- Crisis Text Line number: 741741 text START or HELP
- NATIONAL SUICIDE LIFELINE **1-800-273-TALK**
- Crisis clinic (24x7): 866-427-4747 / **206-461-3222 (King County)**
- Teen Link: **866-833-6546 (6-10 pm)**
- [Link to other resources for support](#) (See resource sheet)

We are all peers and want to be supportive of each other. We are NOT professionals. Peer advice and sharing from experiences is welcome, but please always check with your physician/psychiatrist/therapist, especially for medication and emergency situations.

Moderators are here to help:

- If there is a post that is disrespectful or violates above guidelines, please report it to the moderators, and they may delete it after discussion with the concerned individuals and research team.
- If someone feels they have been treated unfairly on the group or in private messaging with group members or receiving unwanted messages, you can bring it to our attention.
- Please **do not spam** the group page with offensive or inappropriate content or commercial advertising. Such content will be removed.

We encourage participation from all. However, failure to abide by our shared guidelines will result in a warning from the moderators. Your first warning will come from one of us, second warning will come after discussing with the research team. After the second warning, if further concerns arise, the person will be removed from the online group (while we do not hope that should happen).

Let the moderators know if you have questions or want to discontinue the study at any time.

APPENDIX E: ADVERSE EVENTS PROTOCOL FOR RESEARCH TEAM

Emergency contact: All participants (including adolescents enrolled without parental permission) are required to provide emergency contact information for an adult in their network. The PI will reach out to this emergency contact under following circumstances:

- (1) Disclosure of physical harm to self (including medical emergencies)
- (2) Disclosure of physical harm to another individual.
- (3) Disclosure of a minor in abuse.

All participants are and will be informed about exceptions to confidentiality in their respective consent and assent forms. Protocol for disclosures of emergency situations are explained below.

Involving parents: An emergency contact is an adult in the minor's network (e.g., parent, sibling, aunt, uncle, significant other). In the following scenarios, if the emergency contact is a parent, we will be able to reach them directly. If the emergency contact is not a parent, we will only work with the emergency contact s explained, encourage them to inform the parent, and we will not contact the parent directly.

Protocol: While we do not directly ask participants about situations of minor in abuse or intent for suicide, this protocol ensures that the research personnels will be prepared for any unexpected events at all times.

Management of Emergency Situations

During the conduct of research with human participants, there is always the potential that an emergency situation will arise. The general categories of emergency situations that might arise include:

- (1) medical emergencies,
- (2) disclosure of suicidal ideations
- (3) disclosure of minor in abuse
- (4) emotional distress: grievances of online harassment, bullying, hate speech, violating group guidelines,

(5) privacy or confidentiality breach in online group setting

Constraints and workarounds due to online and asynchronous nature of the study:

1. In this study, all procedures are conducted over phone, email, or online Facebook/Slack groups. We will not be in physical proximity of participants or aware of their physical location to be able to assist them on the spot. Therefore, in addition to contact information of the participants, we are obtaining contact information of an adult emergency contact person for each participant on their consent forms, so we can reach out to them in case of emergency.
2. **For issues posted on the online group, private messages, emails,** we are not staffed to be able to monitor situations 24x7. We have provided contact information for appropriate resources for adverse events to participants in all consent/assent forms and in Appendix F (Group Guidelines). Appendix F will be available as a pinned post on every Facebook/Slack online group.
3. We will monitor online group activities at least once every business day and will be able to reach out to the participant as soon as we learn of the emergency within that business day.
4. PI will provide hours when participants can call in with issues directly on business days, depending on her schedule for the quarter. This will be also posted on the pinned guidelines.
5. Study personnels will attempt to involve the participant in decision making as much as possible.

Our maximum turn-around-time to make first contact with the participant regarding an issue will be within 24 hours on business days.

The following guidelines are designed to support project personnel in the management of emergency situations. **We are not providing any counselling and/or medical service.** Specifically, these policies and procedures are designed to assist project personnel with identifying and directing participants to resources that are the most appropriate for providing crisis or emergency services in specific instances.

As soon as study personnel is aware of emergency situations, they should contact Principal Investigator (PI) (arpitab@uw.edu/ 323-686-1624) and faculty advisors as soon as possible, so that they can assist in the management of the emergency situation.

In cases where we break confidentiality resulting from these emergencies, PI will inform the HSD.

(1) MEDICAL EMERGENCIES

As the study is online, we do not expect physical injuries or emergencies due to the study. In case the participant describes or discloses a current event leading to medical emergency to the study personnel or on the online group (e.g. cardiac arrest, sudden loss of consciousness):

1. First, try to **reach the participant**. If already in contact with the participant or able to make contact with the participant, the project personnel should ask the participant to immediately dial **911** on the nearest phone.
2. The study personnel should also **call the participant's emergency contact** provided on the consent form as soon as possible and inform the contact person about the disclosure and context of emergency. Ask them to dial 911 if the participant is not able to do so.
3. **If neither the participant nor their emergency contact is reachable, study personnel should dial 911** themselves and inform the police about the emergency and contact information of the participant and their emergency contact with details that is available with the research team.
4. PI will inform the IRB about the emergency and the reason for breaking confidentiality.

(2) DISCLOSURE OF SUICIDAL IDEATIONS

For this study, research personnels will not explicitly ask participants if they are experiencing suicidal ideations. However, if participants express current thoughts of suicide or death or in response to any study tasks on the online group or private correspondence: as soon as the study

team is made aware of this, contact the PI (arpitab@uw.edu/ 323-686-1624) so she can contact the participant.

Protocol for PI/trained staff:

1. First, try to **reach the participant**. If already in contact with the participant or able to make contact with the participant, inquire about the situation by asking, “Are you thinking about suicide?” Listen to the participant’s response.
2. If participant says yes to the above, the study personnel will **first ask the participant if they have a mental health therapist or counselor they can reach out to within the next 24 hours**. If yes, encourage them to reach out to that professional for support within the next 24 hours.
3. Regardless of whether they have a therapist or not, **also provide the participant with the following resources (verbally and either email or text)** during the conversation, by emphasizing that, “these are resources where professionals can help”, and encourage them to reach out to these resources for support:

National Suicide Prevention Lifeline (24x7): 1-800-273-8255

Crisis Line (24x7): 1- 866-427-4747

Teen peer support: TeenLink: <https://866teenlink.org/> 1-866-TEENLINK

Crisis text line: 741741 – text HOME/HELP

4. Next, ask the participant **if there is an adult in their social circle who they want to reach out who can help them feel safe** (if it is a minor, emphasize that they pick an adult contact person). If so, ask the participant if they want help reaching out to that person and provide that help if requested (e.g.; dialing the number and staying on call/chat with them). As indicated and with permission from the participant, study personnel should facilitate the contact between the subject and the emergency contact or between the subject and the Crisis Line.

5. **If the participant declines that help, nonetheless, contact the participant's emergency contact** (provided on the consent/assent form) to let the contact person know that the participant is experiencing thoughts of suicide and explain to them the context of disclosure. All participants are explained in the consent form that we will break confidentiality in situations of threat to self/others.
6. Provide the emergency contact person with the helpline numbers in step 3, and let them know that they can themselves call the helpline numbers where crisis helpline professionals can help them prepare a safety plan over the phone.
7. **In cases where PI is unable to reach the participant after disclosure**, she will directly contact the subject's emergency contact (provided on the consent/assent form) to let the contact person know about the disclosure and context of disclosure and repeat step 5 and 6.
8. **If neither the participant nor their emergency contact is reachable, and the last post or message from the participant is directly indicative of imminent threat to self/others: study personnel should contact the clinical staff**, and consult with them if it is required to dial 911 to inform the police about the emergency and contact information of the participant and their emergency contact with details that is available with the research team.
9. PI will inform the IRB about the emergency and the reason for breaking confidentiality.

Facebook has also provided links for Suicidality and Self-Injury resources, which the study personnel can provide to the participant or use as reference:

https://www.facebook.com/help/1553737468262661/?helpref=hc_fnav

(3) DISCLOSURE OF MINOR IN ABUSE

We are not directly asking participants if they or any minor is in abuse. However, if participants disclose a situation where a minor is in abuse, following actions need to be taken:

1. Inform the PI, who is a mandatory reporter. PI will work with clinical psychologists on the team to determine next steps. The protocol for reported child abuse is explained in Appendix F as developed by our team members who are clinical psychologists.
2. PI will contact the person who disclosed the situation of abuse and further inquire about it. If it is a minor in abuse, PI will aim to obtain the following contact information to report to Child Protection Services of their respective state within the time window of that state (e.g.; within 48 hours for WA).

Child:

- a. Name
- b. Address
- c. Phone

Parent:

- d. Name
- e. Address
- f. Phone

Perpetrator:

- g. Name
- h. Contact information
- i. Description of event

3. Depending on the situations (described in Appendix F) and whether the perpetrator is same as the parent contact or not, the PI will attempt to contact and work with an adult family member/emergency contact of the minor to inform them and assist with creating a safety plan after consulting our clinical staff. Child's safety will be of utmost priority.
4. PI will inform the IRB if and when we break confidentiality.
5. **If it is an adult in abuse**, PI will provide list of resources that the adult can reach out to for assistance and encourage them to contact the resources. In cases of an adult in abuse, it is ultimately the participants decision to take action or not and we will not break any confidentiality.

(4) EMOTIONAL DISTRESS: GRIEVANCES OF ONLINE HARASSMENT, BULLYING, HATE SPEECH, VIOLATING GROUP GUIDELINES

Study personnel will have admin rights to online groups. Admins can delete posts that violate Group Guidelines (Appendix F). These posts include text/images of harassment, bullying, disrespectful language towards any community, religious beliefs or group, perpetuating/using hate speech and/or physical violence towards another human being, spam or commercial advertisements.

When a study personnel identifies such a post or a participant reports a grievance based on the above:

1. Take a screenshot of the post or comment thread and save it in password protected device.
2. Contact the PI and other members of the study team to discuss if the post needs to be deleted.
3. Delete the post/comment or take actions based on the team's decision.
4. Contact the participants involved in the post/comment through private message. Inquire about the situation to clarify if we need more information and explain the reason to the involved participants for deleting or not deleting the post/comment.

When the study team is made aware of a situation of emotional distress:

5. We will respond to the participants involved within 24 hours on business days, and clarify what the situation is: Inquire if the participant(s) need any emotional support and if so, encourage them connect with an adult in their network for support and/or professional (such as school's counseling service). If this is not an immediate threat to self or other (not involving suicidal ideations or physical violence), study personnel should honor confidentiality and not contact anyone other than the involved participant regarding this matter.
6. If it is an emergency, we will inform the participants to contact 911 or a crisis hotline
7. If it is not an emergency, the study team will direct the participant towards the appropriate resources. The study team will not provide counseling but will inform the participant about the availability of resources
8. PI will inform the IRB if any identifiable information of any participant is compromised due to this.

Resources from Facebook on bullying and abuse: Participants will not be asked to report abuse through Facebook as it will compromise confidentiality. However, study team will have these resources provided by Facebook for reference in dealing with these online grievances.

This is for teens: <https://www.facebook.com/safety/bullying/teens>

Reporting abuse: <https://www.facebook.com/help/1417189725200547/>

How to report things: <https://www.facebook.com/help/reportlinks>

(5) PRIVACY AND CONFIDENTIALITY BREACH IN ONLINE GROUP SETTING

We are not seeking to obtain any identifiable information about third-party subjects **on the online group where other participants in the group can also view or access the information.**

In the event that a subject posts identifiable data (image or text) about themselves or a third party on the online group, study personnel should either:

- (A) request that the subject remove those data by explaining them the reason for protecting privacy; or
- (B) remove the data themselves and inform the participant on private chat or email what data was removed and reason for removal.

All participants in a group will be requested to honor confidentiality and privacy of other participants as explained in the pinned Group Guidelines (Appendix F). Through Appendix F, participants will also be informed to not post any identifiable information on the group. In case it is alleged or proven that a participant has deliberately violated privacy/confidentiality of another participants' information in the group setting,

1. the study personnel should contact all participants involved in the alleged confidentiality/privacy breach and inquire about the situation,
2. Discuss the case among research team with faculty advisors for planning next steps.
3. PI will inform the IRB if any identifiable information of any participant is compromised due to this.

APPENDIX F: PROTOCOL FOR DISCLOSURES OF CHILD

ABUSE

Emergency contact: All participants (including adolescents enrolled without parental permission) are required to provide emergency contact information for an adult in their network. The PI will reach out to this emergency contact under following circumstances:

- (4) Disclosure of physical harm to self (including medical emergencies)
- (5) Disclosure of physical harm to another individual.
- (6) Disclosure of a minor in abuse.

All participants are and will be informed about exceptions to confidentiality in their respective consent and assent forms. Protocol for disclosures of minor in abuse is explained below.

Involving parents: An emergency contact is an adult in the minor's network (e.g., parent sibling, aunt, uncle, significant other). In the following scenarios, if the emergency contact is a parent, we will be able to reach them directly. If the emergency contact is not the parent and we or the Child Protection Services (CPS) need to reach the parent(s), as explained below, we will work with the child and/or the emergency contact to obtain contact information of the parent. We will only contact the parent if they are not an emergency contact as directed by our clinical staff and CPS and inform the HSD about it.

Protocol:

In the state of Washington, there is a legal obligation to report current and/or past sexual or physical abuse of a minor, regardless of how long ago the abuse occurred. We are all mandated reporters.

<http://app.leg.wa.gov/rcw/default.aspx?cite=26.44.030>

**In the case of any reported abuse, contact the clinical back-up (Dr. Jenness and/or Dr. McLaughlin) as soon as study personnel/PI is made aware of the disclosure of situation of abuse. . In cases other than situations where CPS and parent are both aware of the abuse, contact clinical back up to assist with disclosure, reporting and safety planning as soon as possible.

- Criteria for physical or sexual abuse:
 - For a definition of neglect, physical abuse, and sexual abuse, see p.3-4 of “Protecting the Abused and Neglected Child” in the References section below. Basic definitions attached as final page of this document
- Priorities when presented with a case of:
 - Child safety
 - Gathering information about the event and parties involved
 - Law and Reporting

Research team members who do not have clinical training, should contact clinical back-up as soon as they can and inform them of the disclosure and context of the disclosure, and relevant contact information of the participants, legal guardian, and emergency contact available with research personnel. PI will discuss the case with clinical back-up and inform CPS within the timeframe of reporting as required by the minor's state.

Clinical professionals on our study team have developed the following protocol and study personnel/PI should assist them in collecting that information from participants, if and when required. **(Note: This protocol provides instructions so study personnel is aware what actions may be taken, please do not take steps on your own without consulting with clinical staff):**

Current Abuse

Scenario 1: Child is being abused by parent or caregiver (in household) and no CPS report has been made.

1. If the child reports present abuse, ask follow up questions:
 - i. Does the child feel in danger?
 - ii. Does the child feel scared?
 - iii. What type of abuse—physical and/or sexual What happened?
 - iv. Has the abuse happened more than once? If so, how often?
 - v. How many times was the child hit and with what object (fist, belt, open hand, etc.)?

- a. Were there any bruises or marks left from being hit?
 - vi. Was the parent under the influence of drugs or alcohol?
 - vii. Try to obtain as much information as possible including address and names of persons involved.
2. If the parent hit the child:
 - i. Some parents may endorse spanking/corporal punishment when their child misbehaves. This may not be a good parenting strategy, but such punishment does not necessarily rise to the level of abuse. To determine if it is a potential abuse situation, ask the child how often it happens, under what circumstances, and if there were any bruises or marks.
 - ii. Discuss with clinical back-up whether the case is corporal punishment or abuse – if abuse a report must be made.
3. Make a plan for Child Safety:
 - i. What will happen to the child when the parent finds out that the child disclosed the abuse?
 - ii. Determine if it is safe for the child to go home.
 - a. If not, identify potential places where child can stay (i.e., family members, friends) assuming the parent who is the contact person on the permission form/ emergency contact or caregiver in household is the abuser.
 - b. Try to involve parent (if parent who is the contact person on the permission form/emergency contact is not the abuser) as much as possible in safety planning.
 - c. CPS may need to transport child to alternative care.
 - iii. Parent may be hostile/upset, may need to separate parties to deescalate the situation; if you feel in danger ask for backup from staff and contact the police if necessary
4. Inform family and youth that CPS report will be made immediately:
 - i. The best outcome would be if the parent calls CPS with the researcher or our assistance.

- a. If in this situation, try to present yourself as being on the side of the family—you are required by law to do this and you recognize that it will be really hard for the family.
- b. If parent leaves abruptly with child contact CPS immediately.

Scenario 2: Current Abuse **not** by Parent/Caregiver – neither parent nor CPS knows about abuse.

1. Ask follow-up questions in #1.
2. Must report to CPS.
3. Create safety plan with parent:
 - i. Does child need to stay at a different house?
 - ii. Does the child need to change schools or their commute to/from home?
 - iii. Domestic violence shelter? Neighbors? Friends?
 - iv. Parent **should** be involved in making the report to CPS.

Note: The parent may become distressed and upset in learning about past or present abuse (angry that the event occurred, that they never knew, etc.). Reduce parental distress and normalize the child's reaction to their upset parent/the abuse.

Scenario 3: Current abuse not by parent – Parent is aware of abuse, but no CPS report.

1. This case is extremely rare, but must file CPS report.
2. Gather information regarding who, what, when, where, and how the child was abused. Information about the abuser is helpful and should be obtained if possible:
 - i. Name
 - ii. Phone number
 - iii. Address
3. If it does occur, follow the procedures above for debriefing the child and parent about why there must be a report filed to CPS.

Scenario 4: Parent and CPS know about past or current abuse.

1. Verify with parent this is accurate
2. If parent confirms, you do not need to report.

3. Document on session checklist that report has been made with CPS and parent confirms.

Previous Abuse

Scenario 5: Neither the parent nor CPS knows about the past abuse.

1. Talk with the child about why you have to break confidentiality:
 - i. Discuss how the child wants to tell the parent – find out if he/she is comfortable or would rather you tell the parent. If child prefers to tell parent it must be in presence of research staff.
 - ii. Prepare the parent for what their child is about to tell them (or what you are about to tell the parent). Start with the least amount of detail.

Note: The parent may become distressed and upset in learning about past or present abuse (angry that the event occurred, that they never knew, etc.). Reduce parental distress and normalize the child's reaction to their upset parent/the abuse.

2. Discuss with parent how the reporting should happen; e.g. whether they want to report it with you or if they would prefer you to report it.
3. Make sure the child is safe and does not come in contact with abuser.

Scenario 6: Parent is aware of past abuse by other caregiver or adult, but Child Protective Services (CPS) does not know about the past abuse.

1. Explain to parent we are obligated to tell CPS; ask parent if they would like us to report it or if we should report the incident together.
2. Get as much information about perpetrator as possible and about what happened (see Reporting section about the specific information needed).
3. Report to CPS.
4. Create safety plan if child is in contact with abuser in any way.

Scenario 7: Parent who is the contact person on the emergency contact previously abused child and CPS does not know.

1. Follow steps as listed in scenario 1 that parent is currently abusing child.

Reporting to CPS (to be done by clinical back up)

Daytime - Find your [local office number](#) to report abuse or neglect in your area.

Nights & Weekends - call **1-800-562-5624** to report abuse during the evening or on weekends.

Hotline - call **1-866-ENDHARM**

Any reports to CPS should be made within 48 hours of the child's visit to the lab.

- Child:
 - o Name
 - o Address
 - o Phone
- Parent:
 - o Name
 - o Address
 - o Phone
- Perpetrator:
 - o Name
 - o Contact information
 - o Description of event

IRB: Any cases of abuse also have to be reported to the IRB by the PI.

RCW 26.44.020

Definitions.

1) "Abuse or neglect" means sexual abuse, sexual exploitation, or injury of a child by any person under circumstances which cause harm to the child's health, welfare, or safety, excluding conduct permitted under RCW [9A.16.100](#); or the negligent treatment or maltreatment of a child by a person responsible for or providing care to the child. An abused child is a child who has been subjected to child abuse or neglect as defined in this section.

(16) "Negligent treatment or maltreatment" means an act or a failure to act, or the cumulative effects of a pattern of conduct, behavior, or inaction, that evidences a serious disregard of

consequences of such magnitude as to constitute a clear and present danger to a child's health, welfare, or safety, including but not limited to conduct prohibited under RCW [9A.42.100](#). When considering whether a clear and present danger exists, evidence of a parent's substance abuse as a contributing factor to negligent treatment or maltreatment shall be given great weight. The fact that siblings share a bedroom is not, in and of itself, negligent treatment or maltreatment. Poverty, homelessness, or exposure to domestic violence as defined in RCW [26.50.010](#) that is perpetrated against someone other than the child does not constitute negligent treatment or maltreatment in and of itself.

RCW 9A.16.100

Use of force on children — Policy — Actions presumed unreasonable.

It is the policy of this state to protect children from assault and abuse and to encourage parents, teachers, and their authorized agents to use methods of correction and restraint of children that are not dangerous to the children. However, the physical discipline of a child is not unlawful when it is reasonable and moderate and is inflicted by a parent, teacher, or guardian for purposes of restraining or correcting the child. Any use of force on a child by any other person is unlawful unless it is reasonable and moderate and is authorized in advance by the child's parent or guardian for purposes of restraining or correcting the child.

The following actions are presumed unreasonable when used to correct or restrain a child: (1) Throwing, kicking, burning, or cutting a child; (2) striking a child with a closed fist; (3) shaking a child under age three; (4) interfering with a child's breathing; (5) threatening a child with a deadly weapon; or (6) doing any other act that is likely to cause and which does cause bodily harm greater than transient pain or minor temporary marks. The age, size, and condition of the child and the location of the injury shall be considered when determining whether the bodily harm is reasonable or moderate. This list is illustrative of unreasonable actions and is not intended to be exclusive.

References:

Collect Information:

- <http://app.leg.wa.gov/rcw/default.aspx?cite=26.44.040>
- Health and Human Services PPT:
 - http://www.acf.hhs.gov/sites/default/files/fysb/mandatory_reporting_508.pdf
- Protecting the Abused and Neglected Child:
 - <http://www.dshs.wa.gov/pdf/publications/22-163.pdf>
 - <http://app.leg.wa.gov/rcw/default.aspx?cite=26.44.030>

Clinical Backup: Who to Contact

When contacting clinical staff start with Dr. Jenness and move down the list: call first; if no answer, then text; if still no answer, then email.

1st Contact:

- Dr. Jessica Jenness
- [Phone number]
- jennessj@uw.edu

APPENDIX G: CODE BOOK FOR STUDY 1: STRESS

MANAGEMENT ARC

Engaging Teenagers in Asynchronous Online Groups to Design for Stress

Management

Research questions:

- RQ1: What needs do teenagers envision for support with stress management?
- RQ2: How might technologies support needs of teenagers for stress management?
- RQ3: What are opportunities and challenges in using asynchronous online groups as a method to engage teenagers in designing for wellbeing?

Coding Library:

	Code	Description of Code
RQ1: What needs do teenagers envision for support with stress management?		
1.	Stressors and coping	
1.1	Stressor	Stressor is a stimulus that invokes a stress response. The perception of stimuli is subjective to each teen but there are common stressors of school, family, romantic relationships, self-image, future (college/work).
1.2	Stress perception or appraisal	An individual can perceive stress stimuli to be significant or threatening to them to different degrees or not relevant to them at all. This perception can also be viewed as appraisal of stress (Lazarus et al. [1]) – individual’s assessment of how significant the stimuli is to them (primary appraisal) and assessment of their resources for coping (secondary appraisal).
1.3	Stress response	Automatic physiological, physical, and emotional reactions to stressors. These responses can also vary from

		<p>person to person. As one learns coping, automatic response can be changed with training. For the purpose of coding, we will treat it as the “as is” response without any intervention and not how the person wishes they should respond.</p>
1.4	<p>Coping</p> <ul style="list-style-type: none"> • Coping_Problem focused • Coping_Emotion focused • Coping_Meaning based 	<p>Strategies implemented by individuals to change the stress response [1]. Coping can be:</p> <ol style="list-style-type: none"> 1. Problem focused coping: focused on changing the stressful situation (information seeking, problem solving, active coping) 2. Emotion focused coping: changing the way one thinks about the situation (venting, avoidance, denial, seeking social support) 3. Meaning based coping: Interpretation of a stressful situation in a personally meaningful way – positive reinterpretation, acceptance, use of religion and spirituality, spirituality <p>Coping may also be situational, depend on a person’s personality, self-efficacy beliefs, available resources, and knowledge.</p>
1.5	<p>Coping style</p>	<p>Coping style is an individual’s general style of coping. Willingness or openness of a teen to adopt a coping style. E.g., In group 1, most teens preferred distraction and venting. Coping styles are considered to be:</p> <ol style="list-style-type: none"> 1. Adaptive and maladaptive ways of coping 2. Engaging and disengaging ways of coping: <p>This includes problem solving, support-seeking, escape, distraction, cognitive restructuring, positive restructuring, rumination, helplessness, social withdrawal, emotional</p>

		<p>regulation, information-seeking, negotiation, opposition, and delegation.</p> <p><i>Disengaging:</i> cognitive avoidance, distancing, behavioral avoidance, distraction, denial – when perceived highly threatening and uncontrollable situation – can be maladaptive or intrusive over time</p> <p>[note: based on the data, distraction can also help to return to the stressor with a fresh or different perspective, later. It is counterproductive when the distraction leads to avoidance and a teen never want to come back to the problem]</p> <p><i>Engaging:</i> active coping, planning problem solving, information seeking, making use of social support. (these can include both problem-focused and emotion-focused coping)</p>
1.6	Coping resources	Resources available to teens to access: e.g., social support network (family, peers, mentors), school counselor, professional counselor, technology such as mobile device, tv, financial support, health insurance
1.7	Perceived control	<p>Appraisal or judgement of how much control one has to change a stressful situation or their stress response. It can also determine and alter one’s coping style over time.</p> <p>E.g.; some teens perceived lack of control over stress and/or stressful stimuli as something that has control over them and not let them function as they otherwise would like to.</p> <p>There are positive associations between perceptions of control over illness and psychological adjustment</p>

		<i>Coping in situations that cannot be changed:</i> In situations that cannot be altered, perceived control may increase distress or dysfunction (e.g., severe or fatal illness) – beliefs about control are likely to be adaptive only to the extent that they fit with reality – acceptance is said to be the adaptive coping style in such cases [note: Also relates to hopelessness, helplessness, optimism]
1.8	Barriers to coping	Challenges in emotional regulation, challenges in accessing external resources (social support, stigma, financial support), comorbid health concerns (e.g., anxiety)
1.9	Autonomy/Ownership/Self-reliance	The desire of teens to want to make decisions, take ownership of their health, use self-help measures, and self-management tools. E.g., not wanting to follow parents’ decision when planning goals
2.	Social needs and support	
2.1	Type of social support <ul style="list-style-type: none"> • Social_informational • Social_logistical • Social_companionship • Social_emotional • Social_appraisal 	The type of support teens expect or receive from others in their network during stressful situations (Langford et al. [2]). Sub-codes include: <ol style="list-style-type: none"> 1. <i>Informational support:</i> practical advice or suggestions, provides resources and information, shares their own experience 2. <i>Logistical support:</i> Helping me with chores or school work, driving me places, help me with planning or saving time 3. <i>Companionship:</i> holding me accountable, distraction, doing activities together

		<p>4. <i>Emotional support</i>: listening or venting, positivity/encouragement, validates/acknowledges how I feel, comforting.</p> <p>5. <i>Appraisal</i>: assessment of self or a situation</p>
2.2	<p>Social Ties</p> <ul style="list-style-type: none"> • Social ties_helpful • Social ties_unhelpful 	<p>Social ties include people in the participants' offline and online social network – Friends, best friend, other friends/not close friends, mom, older brother</p> <p>Social ties that are not helpful or make teens feel uncomfortable in asking for support – e.g., dad doesn't understand, mom worries more</p> <p>Social ties that teens do not consider helpful feel comfortable in asking for support – e.g., preferring venting to strangers as opposed to friends or family</p>
2.3	Barriers to social support	<p>Barriers perceived by teens in reaching out for support. E.g., stigma, not having people who listen, unavailability of people in network</p> <p>Include characteristics of unhelpful support from social ties</p>
2.4	Family interdependence	How much do teens depend on family, emotional dependence, how they are affected by parents' stress, codependence
2.5	Family conflict	Teens find family to be a source of conflict or stress. E.g., separation of parents, uninvolved parent
2.6	Family support	Teens find support from their family during stressful situations. E.g., face time home for distraction. Support with prioritizing and logistical support, empathizing, wanting emotional support (being there).
2.7	Family change	Where teens envision scope of improvement in their relationship with family. This includes how they envision

		design of technology can support change in how they interact with technology.
2.8	Peer influence	When teens want to do activities with peers, influenced by peers, or share with peers. The influence can be positive or negative. For example, peer pressure for maintaining romantic relationships, peer influence on social media
RQ2: How might technologies support needs of teenagers for stress management?		
3.	Design and Technology: Includes both existing and envisioned technologies.	
3.1	Technology: positive perception	Positive perceptions or expectations of use of technology for coping with stress <ol style="list-style-type: none"> 1. Technology_self_positive: e.g., using for self-reflection, tracking, journaling, venting 2. Technology_social_positive: using with others or to access support from others , empathy building
3.2	Technology: negative perception	Negative perceptions or expectations from use of technology <ol style="list-style-type: none"> 1. Technology_self_negative: e.g., tracking or reminders being intrusive 2. Technology_social_negative: using with others or to access support from others e.g., social media as a source of stress, privacy or overriding autonomy
3.3	Technology: Venting	Technology provides a platform to vent (e.g., text message, digital agent)
3.4	Technology: Increasing exposure	Technology suggests activities or measures for teens to cope and/or take breaks from stressful work or circumstances.
3.5	Technology: Positive restructuring	Technology is a platform for logging positive events (e.g., good things) for memory keeping and may support reflection later.

3.6	Technology: Tracking Mood/Journaling	Technology supports logging mood – both positive and negative. Technology is a platform for journaling thoughts and feelings (free writing).
3.7	Technology: Mindfulness/meditation	Technology supports with guided or unguided meditation, adding personalized music and backgrounds (e.g., Headspace)
3.8	Technology: Logistical support_self	Technology supports with managing time, planning and breaking down tasks, setting reminders, and
3.9	Technology: Facilitating social support	Technology connects with teens with similar stressors. Technology helps share a stress checklist with loved ones who can send check-ins and reminders to do the activities during stressful times.
3.10	Systemic change	Expectations of changes in policy, school curriculums, societal stigma
RQ3: What are opportunities and challenges in using asynchronous online groups as a method to engage teenagers in designing for wellbeing?		
4	ARC Method	
4.1	Method <ul style="list-style-type: none"> • Method: anonymity • Method: asynchronous • Method: format • Method: other 	Aspects of the ARC procedures and Slack that teens found helpful or unhelpful/would like to change. Sub codes include: <ol style="list-style-type: none"> 1. Anonymity – feedback and preferences on anonymity (e.g., what teens say about using Facebook, privacy) 2. Asynchronourous – feedback and preferences based on asynchronous nature of the study 3. Format: Feedback on format of the study 20 minutes, weekly structure, posting days, compensation) 4. Other: general feedback not in any above category

4.2	<p>Activities</p> <ul style="list-style-type: none"> • Activities_reflection • Activities_stress/mental health • Activities_other 	<p>Aspects of the online group activities that teens found helpful or unhelpful/would like to change (helpful/unhelpful for stress management and mental health, reflection or learning)</p>
4.3	<p>Group interactions</p>	<p>Interactions among group members.</p> <p>Sub codes include:</p> <ol style="list-style-type: none"> 1. Disclosure: comfort, privacy, confidentiality 2. Influence: of other people's posts on their posts 3. Reciprocity: or responses from others 4. Negative experiences 5. Positive experiences
4.4	<p>Comparison w/ Face to Face</p>	<p>Perceived benefit, challenges, and differences if the study format was face to face (speculated).</p>
4.5	<p>Safe space</p>	<ol style="list-style-type: none"> 1. characteristics of people in the safe space, 2. characteristics of conversations in a safe space 3. physical or structural characteristics of safe spaces 4. Examples of safe spaces provided by adolescents 5. Suggestions from teens on creating a safe space (online/offline)
4.6	<p>Researcher strategies/reflexivity</p>	<p>Strategies that researcher needed to adopt and adapt and challenges in running the group (e.g., moderating, maintaining a safe space, dropouts, issues with slack interface)</p>

Note: codes can overlap and are not mutually exclusive. E.g., preferred coping style, social support, and technology_positive can overlap.

Existing app feedback:

	Function appreciated by participants	Apps tried
1	Mindfulness meditation – relaxation, helping relax before sleep	Headspace
2	Tracking mood	Moods
3	Tracking and positive restructuring	Happify
4	Track habits	What’s up
5	To do list/planners	WunderList, SplenDo
6	Venting, listening, advice from trained professionals	7cups of tea
7	Distraction or takes mind off from stressor	I love Hue Netflix Spotify
8	Distraction and connect with family	Facetime

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APPENDIX H: CODE BOOK FOR STUDY 2 –

UNDERSTANDING NEEDS FOR DEPRESSION MANAGEMENT

The following codes were used for analyzing qualitative data from interviews and online posts of both teen and clinician ARC studies. Codes were not mutually exclusive, and excerpts of data had multiple codes.

Code	Description
<p>Access Access issue face to face</p> <p>Access issue online</p> <p>Access benefit online</p>	<p>Concerns about how accessing treatment face to face (f2f) is difficult due to burden on time, transport, parental support, availability of clinic, and stigma</p> <p>Concerns that teenagers would be unable to have access to the resources appropriate for online treatment</p> <p>Participants mentioning reasons for patients to have better access to therapy online</p>
<p>Client-therapist relationship Better rapport with clinicians</p> <p>Online boundaries</p> <p>Patient accountability</p> <p>Teen engagement</p> <p>Parental Involvement</p>	<p>Signifies the perceived need for building rapport and have human connection with clinicians, which participants perceived was more cohesive in face to face interactions than online interactions</p> <p>Clinicians express concerns and ideas about time spent online and setting expectations with clients on when to expect responses on a platform that is available asynchronously and 24x7. These included concerns of clinicians about being contacted outside hours working</p> <p>How to hold teens accountable for doing the assignments required?</p> <p>Perceived concerns and discussions about the engagement (and lack of engagement) of teens in the online treatment format</p> <p>Teens mention about the need for parent involvement including transportation and payment; also includes where they mention parental involvement may not be necessary; clinician discussions on parental involvement</p>
<p>Added burden of online work Billing concerns</p>	

<p>Clinician burden online</p> <p>Liability concern</p>	<p>Any billing or payment related discussions for remote treatment; for example, therapy delivered online or the time spent online by clinicians is not billable currently in their practices</p> <p>Lack of information that exists for clinicians when it comes to online platforms such as Slack. Added time burden for moderating and responding to posts.</p> <p>Will clinicians be liable for anything they are unable to address online, especially, adverse events.</p>
<p>Online Platform</p> <p>Privacy concerns</p> <p>Teen communication styles</p> <p>Platform interface difficulty</p> <p>Platform adoption concern</p> <p>Content organization on the platform</p> <p>Platform notification</p> <p>Instructions for using platform</p>	<p>Concerns expressed by clinicians about privacy and HIPAA compliance on Slack; concerns of teens about anonymity, online disclosures, and data sharing policy of Slack</p> <p>Addresses concerns about how teens communicate, what their usual practices are in terms of how they communicate with others around them and what would be the most beneficial circumstances for them in regard to communication, essentially leading to what they might need online when communicating with a possible therapist and/or group of patients</p> <p>The difficulties that clinicians and teens express with Slack specifically with regards to the interface</p> <p>The concerns clinicians share about adopting Slack into their current workspaces. These adoption concerns included the policy and security in their workplace with using an external tool such as Slack, their computer set up, or their personal ability to use technology such as this platform</p> <p>The organization of content on Slack chats and different channels.</p> <p>whether notifications tend to be turned on or not; why or why not</p> <p>Need for adding instructions on how to use a platform that was unfamiliar to some participants.</p>
<p>Technology based functionalities</p>	

Chatbot	Using automated prompts for interacting with teen patients
Online reminder	Feature to remind patients to do homework or do BA assignments
In-the-moment support for crisis	Support that would be necessary in an emergency with a patient
Online possibilities	Other functionalities that can be added on online platforms for benefiting teens
BA Format	
Long format benefit	This includes the benefits of the longer format of BA therapy (i.e.12 weeks)
Long format challenge	This includes the challenges mentioned with the long format of BA therapy
Short format benefit	This includes the benefits of the shorter format of BA (i.e. 4-6 weeks)
Short format challenge	This includes challenges mentioned for the shorter format of BA
Online check-in support	Slack being used as a support tool when patients need additional non-therapeutic assistance such as sending reminders, check-ins with clinicians
Supplement online therapy	Combination of both online therapy and in person therapy by delivering and teaching therapeutic content online
One on one online therapy	comments about the need for one-on-one therapy online rather than group therapy
Online_group_therapy	possible group therapy online
Online_therapy_ideas	Other comments about the benefits and ideas related to therapy online
BA therapy critique	Critique of the content of BA therapy (and not the technical adaptation). An example included critiquing the language that can be perceived to set expectations of being always positive.
Teaching	
Teaching techniques	Some techniques mentioned on how to remotely teach BA to teens
Interactive components	

	How to make the content more engaging in order to ensure teens are doing the work. For example, comments about how the animated video is good; concern expressed about video ideas presented.
<p>Clinician experience</p> <p>Previous BA therapy experience</p> <p>Patient meeting frequency</p>	<p>Have the clinicians used BA with their patients in the past and how often</p> <p>How often are clinicians meeting their patients or teens seeing their therapists</p>
ARC study design	Comments on how to change the study or add ideas, or appreciation for current study design (e.g., amount of time spent on activities, asynchronous nature of activities, and content)

APPENDIX I: ADDITIONAL RESULTS FROM STUDY 1: UNDERSTANDING NEEDS FOR STRESS MANAGEMENT

Table I. An outline of weekly 20-minute online activities presented in the study, their purpose, participation, helpfulness ratings, and frequency of interactions between teens (excluding researcher interactions).

Week	Activity	Purpose	No of participating teens	Average helpfulness rating (n=20)*	Frequency of interactions in Group 1	Frequency of interactions in Group 2
1	1.1. Entry survey – stress response scale and parent adolescent communication scale 1.2. Introduction, ice breaker, share a meme on stress	1.1. Learn about baseline stress level 1.2. Icebreaker to get teens to know each other	23	3.3 (n=19)	1	21
2	React to video on physical manifestations of stress, psychoeducational video	Learn about how teens recognize stress and how it affects them.	23	3.8 (n=19)	7	7
3	Value sorting exercise, activities aligning with values and may also be stressful, and value conflicts	Learn about activities that are stressful as well as meaningful.	22	3.5 (n=20)	0	0
4	4.1. Advice column: Provide advice on scenarios of stress with fictional personas (Family, school, relationship, health, friends,	Technology ideas and eliciting what support they need from tech	22	3.6 (n=18)	5	13

	social media/perceptions , self-image) 4.2. Provide feedback on others' advice					
5	Stress diary with structured prompts (spend 5 minutes for at least 4 days) Each day the prompt changes: write what was stressful, what measures they used to overcome it or how they wished it could have been different/ideal, photo elicitation, write a letter to stress, write a stress checklist	Scaffolding reflection. Data gathering of needs, understanding context, understanding benefits and challenges of journaling	19	3.9 (n=17)	0	0
6	Draw your support network map	Understanding types of support important to teens (logistical, companionship , informational, emotional support). Understanding whom do teens approach for support?	16	3.1 (n=15)	2	1
7	Custom diary (free writing at least 4 days of the week)	Journal about stress, more freedom in reflection	16	3.8 (n=16)	0	0
8	App feedback (gave them a list of 10 free apps)	Feedback on existing features – such	15	4 (n=16)	0	0

	Teen try one app for 4 days and provide feedback.)	as mindfulness, mood tracking, positive restructuring				
9	Teens provide feedback on storyboarded design ideas	Researchers present storyboards for feedback What support do teens expect from technology to navigate social dynamics to help with stress?	11	3.8 (n=16)	11	0
10	10.1. Teens codesign 3 ideas for stress management 10.2. Teens provide feedback on 2-3 other ideas	Eliciting design ideas from teens	15	4.4 (n=14)	12	5
	Exit Interviews and surveys	Obtain feedback on the method and follow up questions on stress management.	20	NA	NA	Na
	Feedback survey on activities	Obtain feedback on utility of each online activity and suggestions to make improvements.	20	NA	NA	NA

*20 out of 23 participants completed the exit survey to provide ratings on helpfulness of activities. 1= very unhelpful, 5 = very helpful.

Optional activities

The following two activities were optional to participate in and were available from week 3 through end of the study. There was no compensation associated with these activities.

Activity	Purpose	
1. Three good things	<ul style="list-style-type: none"> To maintain a positive environment in an otherwise negative discussion on stress. 	<ul style="list-style-type: none"> 9 participants reported using this activity
2. Vent line	<ul style="list-style-type: none"> Teens can call on this phone number to vent by texting or leaving a voicemail To allow teens to vent about stressful things when they like. 	<ul style="list-style-type: none"> Only one participant used this once and rated it as very helpful

Network Analysis

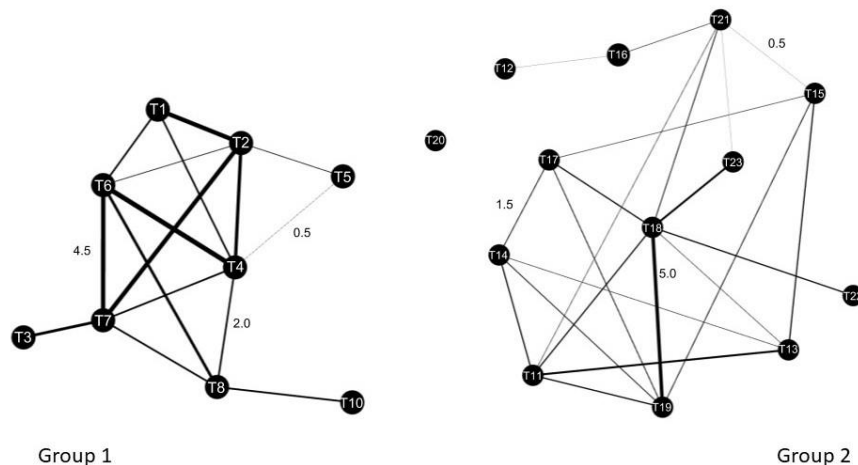


Figure I. Network analysis of responses and reactions between teen participants in Group 1 (left) and Group 2 (right). Each node is a participant, edge represents, weight of the edge represents frequency of interactions (1 point for responses, 0.5 points for reactions).

APPENDIX J: SUMMARY OF SHORT BA SESSIONS (4-6 WEEKS) IN STUDY 2

Session	Description	Example
Week 1: Introduction to Behavioral Activation (BA)	<ul style="list-style-type: none"> ● Introduce the BA model of depression and treatment. ● Review how situations, feelings, and actions lead to downward or upward spiraling of mood. ● Introduce tracking activities and how you feel (mood) during or after each activity throughout the day. 	<ol style="list-style-type: none"> 1. BA Model example: Stressful situations can lead to negative mood and behaviors that make things harder to feel better (e.g., staying in your room more, not doing homework). 2. Those negative behaviors may lead to more problems/stress which results in a <i>downward spiral</i> towards low mood/depression. <p>Upward spirals: When your actions follow a <i>goal</i> instead of your <i>mood</i> to help improve how you feel</p>
Week 2: Goal Setting	<ul style="list-style-type: none"> ● Talk through how to set SMART goals (Specific, Measurable, Appealing, Realistic, and Time-Bound) related to improving mood ● Introduce importance of breaking down the goals into smaller steps, i.e., mini steps to reach a goal. ● Practice setting up SMART goals and mini steps for the week for yourself. 	<ol style="list-style-type: none"> 1. SMART Goal Example: I plan to go on a 30-min walk with my dog and friend 3x this week 2. Mini steps: 1) Check the weather to find the best days; 2) text my friend to see which days work; 3) pick a park or walking route; 4) send myself/my friend a google calendar invite

<p>Week 3: Identifying Barriers & Problem Solving</p>	<ul style="list-style-type: none"> ● Importance of identifying internal and external barriers that get in the way of accomplishing goals. ● Introduce problem-solving to help overcome barriers ● Practice goal-setting. 	<p>1. Examples of Barriers:</p> <p><i>Internal barriers</i> include not feeling motivated, getting distracted, difficulty communicating your needs, feeling overwhelmed.</p> <p><i>External barriers</i> include not having the right “tools” (e.g., need exercise equipment from a gym), need help from others (e.g., need a ride), other people not following through, or cost.</p> <p>2. Problem-solving example: When encountering a barrier, you can use <i>COPE</i>: Calm yourself then Clarify the issue, brainstorm Options, Pick and Perform an option, Evaluate how it went.</p>
<p>Week 4. Overcoming Avoidance</p>	<ul style="list-style-type: none"> ● Explaining that wanting to avoid something (avoidance) is a common internal barrier. 	<p>1. Examples of Avoidance:</p> <p><i>Brooding</i> over a problem instead of solving it,</p> <p><i>Procrastinating</i> taking action, <i>Hibernating</i> in your room or withdrawing socially,</p> <p><i>Bursting</i> at people out of anger.</p>
<p>Week 5 & 6: Practice</p>	<p>Practice setting SMART Goals and Overcoming Barriers to goals.</p>	

APPENDIX K: CODEBOOK FOR STUDY 3 — FEASIBILITY

STUDY OF DEPRESSION ARC USING BA

Code	Definition or explanation
BA conceptual understanding	Difficulties in understanding concepts of BA
BA applicability to personal context	How BA applies or does not apply to the teens' life? Do they see any relationships between mood and activities?
Barriers to SMART goal	Understanding internal and external barriers
Logging expectation or motivation	<i>Why did they log?</i> Extrinsic motivation: helping the study [so we have data], for reward from the study, parent told them to log intrinsic motivation to learn about their mood, help with structure, or other expectations
Emotional Awareness	Difference in perception of emotions and intensity (e.g., neutral versus depressed, different intensity of neutral), Difficulties in logging emotions, identifying emotions, overwhelmed with how they are feeling Averaging out the emotions for an activity – figuring out what to log
Long-term and short-term mood	How they feel in the moment while doing the activity versus how they feel overall during the day after cumulative activities
Barriers to logging - technology based	Not getting notified, ignoring notifications, feeling overwhelmed, not having Slack open
Barriers to logging - personal/structural routine	Times not matching with personal routine, difficulty in logging as not feeling motivated to do anything, feeling overwhelmed with notifications, not meeting expectations (of self or perceived from the study), nothing new to log, difficulty identifying emotions
Data mismatch or missing information	There being a mismatch in how they actually feel versus what is logged – not logging all activities Not supporting reflection due to lack of data
Social logging	A family member is helping the teen to log

Personal routine	Explaining how logging may or may not fit into their personal routine
Activity and mood	Identifying or confirming relationship or patterns between type of activity and mood
Mood and time of day	Identifying or confirming relationship or patterns between type of activity and mood
Reflection levels [34]	
R0: no additional explanation	Description or statement about events without further elaboration or explanation. Not reflective.
R1: descriptive with some elaboration	Description including justification or reasons for action or interpretation, but in a descriptive way. No alternate explanations explored, limited analysis and no change of perspective. Describing what is going on in specific activity or mood or event
R2: dialogic - exploring relationships	A different level of thinking about. Looking for relationships between pieces of experience or knowledge, evidence of cycles of interpreting and questioning, consideration of different explanations, hypothesis and other points of view. Taking a step back from a specific activity or mood to more in-depth exploration of them as a person or patterns in their behavior (e.g., routine or personality) – a holistic view
R3: transformative – into action	Revisiting an event or knowledge with intent to reorganize and/or do something differently. Asking of fundamental questions and challenging personal assumptions leading to a change in practice or understanding.
R4: critical (societal and ethical thinking)	Where social and ethical issues are taken into consideration. Generally considering the (much wider) picture.
Generating ideas	Using ActivaTeen suggestion cards, personal knowledge or data to come up with goals
Goal setting	Teens are talking about setting a specific goal in the future
Mini steps	Confusion about mini steps, lack of use of mini steps
Action	Did the teen follow through with the goal? Why or why not? What was the Process?
Nature of interaction	Privacy, barriers to sharing, benefits if any, did they read the posts Presence of peers

Expectations	Wanted more or less interactions? It was fine? Why?
Ideas for interactions	Suggesting how it can be improved, in-person groups
Reflection prompt	Clinician prompted the teen with some insight on their data or summary or goal and the teen responds in acknowledgement Reflecting with support from someone else
Nature of interaction	Comfort in interacting with clinicians, barriers, expectations from interaction Feeling acknowledged Feeling validated Getting advice or ideas Getting a different perspective Nothing much
Therapy context	How participants envision this type of online intervention to be integrated within real world therapy? Format (online synchronous or DMs) Frequency Content (psychoeducation (teaching material), reviewing data charts, planning goals)
Study Structure	Timing of activities, format of study
Slack Platform use Feasibility Social Impact Impact on relationship with friends, family, new people? Personal Impact Impact on daily regiments, family, habits, mindset	
Design changes	Summary of expected change in the design
Logging time: What times did they prefer logging? What times are bad or not possible to log? Logging frequency: How many times did they log or prefer logging? Logging reminder modality: Via phone app or text message, computer	

APPENDIX L: GRAPHS PRESENTED DURING EXIT

INTERVIEWS IN STUDY 3

Intensity of an emotion was logged between 1 (not at all) and 10 (most intense).

Options for logging emotions were based on the circumplex model of emotions [85]. For summarizing and graphical representation, I categorized valence into:

- **Positive (red):** Content, Relaxed, Focused, Happy, Excited
- **Negative (blue):** Angry, Overwhelmed, depressed, anxious, tired, sad, bored
- **Neutral (green):** Neutral

Time blocks were divided as

- Morning – 9 am to 12 pm
- Afternoon – 12 pm to 6 pm
- Evening – 6 pm to 12 am

Participant: T34

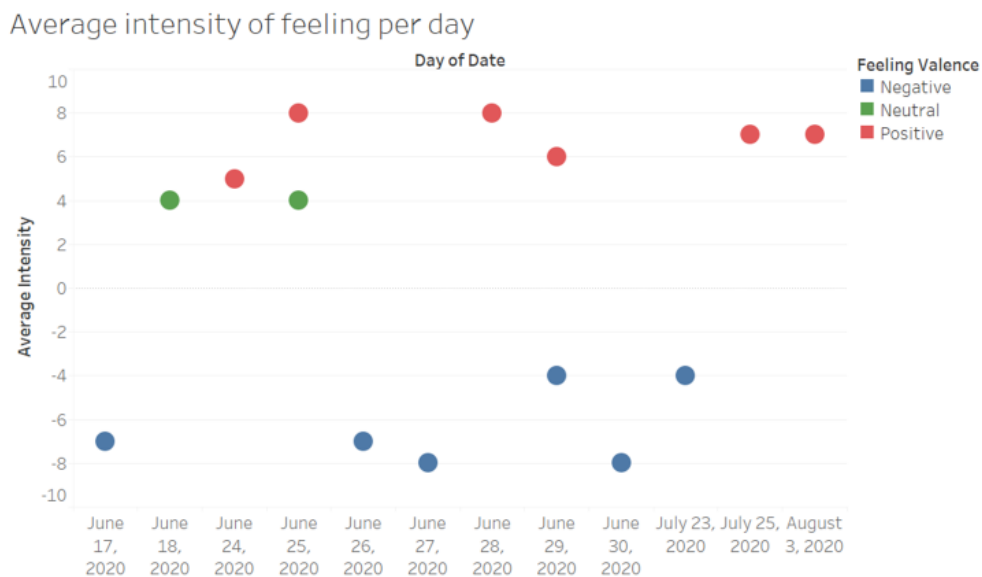


Figure: Intensity vs days of logging

Average intensity of feeling per category of activity

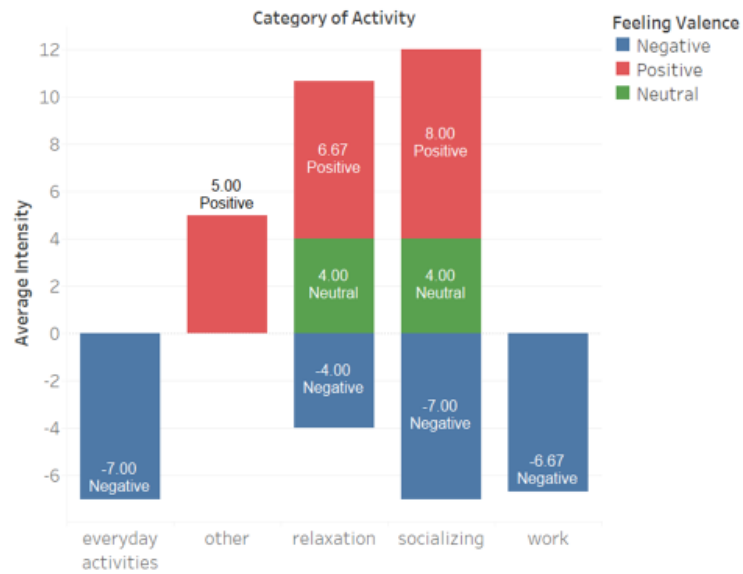


Figure: Intensity Vs days of logging

Average intensity of feelings in each time block during the day

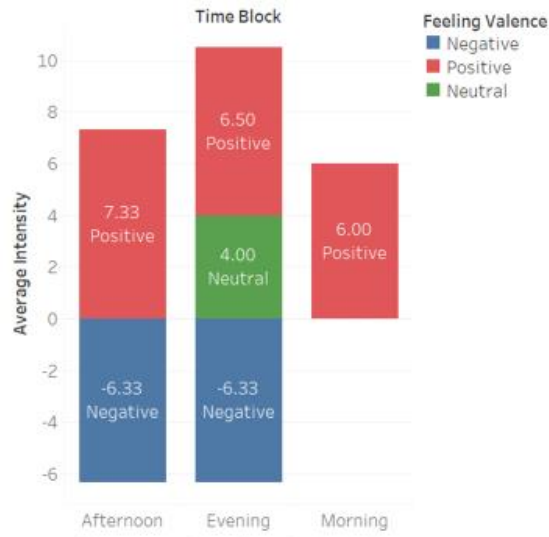


Figure: Intensity Vs days of logging

Activity and valence

Time Block	Feeling Valence		
	Negative	Neutral	Positive
Morning			Slept in
Afternoon	Had a nap Scrolled Tik Tok Went to work		Organized and cleaned my bathroom Showered Went shopping with a friend to the grocery store
Evening	Had an 8 hour shift Went shopping for summer clothes Work	attended my sister promotion parade Skincare	Drove to the dentist with my sister and actually didn't get lost Spent the day at my boyfriends

Figure: Intensity Vs days of logging

Feeling vs time block

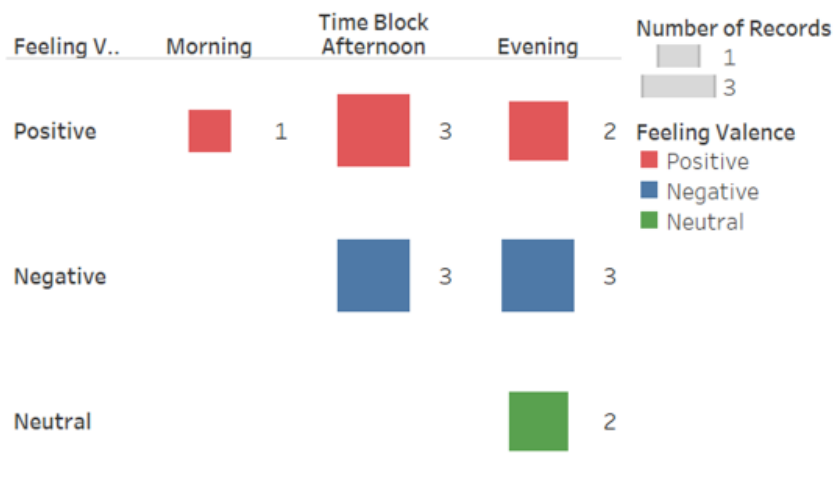


Figure: Intensity Vs days of logging

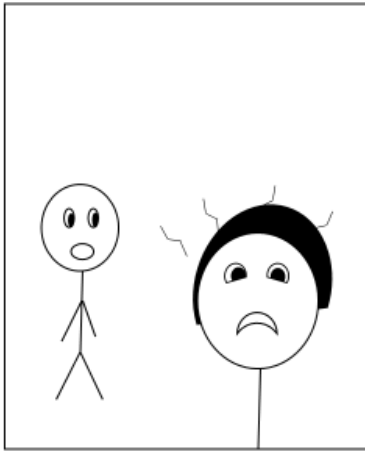
Feeling vs category of activities



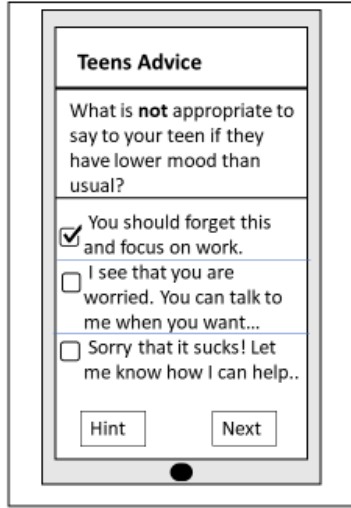
Figure: Intensity Vs days of logging

APPENDIX M: EXAMPLE STORYBOARD USED IN STUDY 1

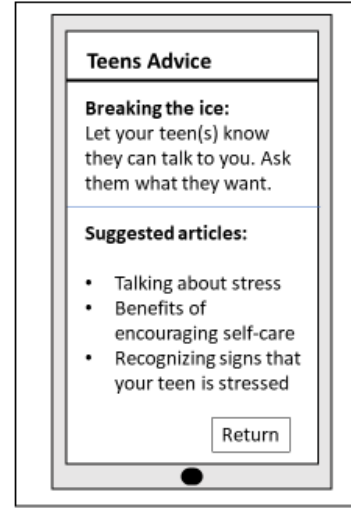
Teens Advice – an app curated by teens volunteers with information to support parents and teens with topics that are relevant for teen mental health.



Roz's dad does not know how to approach Roz about her stress. Dad downloads an app made by teens which guides parents on speaking to teens about stress.



The app quizzes parents regarding stressful topics, provides information, and suggests coping mechanisms.



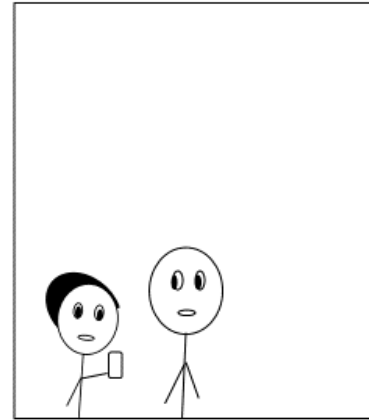
If the parent does not know an answer or gets it wrong, the app provides hints and additional readings regarding the topic, recommended by other teens.



After several uses of the app, dad feels more equipped to approach Roz about her stress.



Roz starts talking with dad about her concerns. Dad listens, shares advice, and also tells Roz about the app where they can ask teen volunteers for advice.



Roz and dad sit down to read and discuss suggestions together.

VITA

Arpita is a PhD Candidate in the Department of Human Centered Design and Engineering (HCDE) at the University of Washington, Seattle, USA. She completed her Master's in Computer Science from Georgia Institute of Technology in May 2015. She has been working on research projects on understanding needs and designing technologies for health, gaming, and collaboration. Her dissertation research is on engaging with teenagers and clinicians through asynchronous online groups for designing technologies for adolescent stress and depression management using the clinical practice of Behavioral Activation. She has been teaching and mentoring undergraduate and master's students in courses on user experience research, qualitative research methods, and design thinking in University of Washington's HCDE and Global Innovation Research (GIX) programs. She wants to keep working towards methods to increase access for marginalized communities to participate in research.