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"I Kind of Bounce off It": Translating Mental Health Principles into Real Life Through Story-Based Text Messages

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Abstract

Adopting new psychological strategies to improve mental wellness can be challenging since people are often unable to anticipate how new habits are applicable to their circumstances. Narrative-based interventions have the potential to alleviate this burden by illustrating psychological principles in an applied context. In this work, we explore how stories can be delivered via the ubiquitous and scalable medium of text messaging. Through formative work consisting of interviews and focus group discussions with 15 participants, we identified desirable elements of stories about mental health, including authenticity and relatability. We then deployed story-based text messages to 42 participants to explore challenges regarding both the stories' content (e.g., specific versus generalized) and format (e.g., story length). We observed that our stories helped participants reflect on and identify flaws in their thinking patterns. Our findings highlight design implications and opportunities for mental wellness interventions that utilize stories in text messaging services.

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Keywords

stories; text messages; cognitive distortions; narrative intervention; mental health

1 INTRODUCTION

Improving mental wellness often requires adopting new practices or thinking processes, which demands substantial motivation and effort [32]. This endeavor can be especially challenging when individuals are unable to recognize the benefits of engaging in the difficult process of change or visualize how those strategies apply to their own lives [17]. Therefore, when it comes to promoting mental wellness, it is important that researchers devise engaging and innovative ways of capturing people's interest and demonstrating the value of change.

We posit that stories from real people about their personal struggles can serve as an engaging method of promoting mental wellness by illustrating theories and principles of psychology in an applied context. Stories have historically been a well-established medium for sharing knowledge and experience, particularly in the form of fables, parables, and allegories [4, 103]. A growing literature also speaks to the potential efficacy of stories in supporting mental health [6, 67, 68, 84]. Stories can normalize mental health challenges and validate the difficulty involved in making changes [128]. Past work in CSCW has found that individuals experiencing mental health concerns draw on interactions with others to motivate and guide their own behavior change process, but these interactions need not require face-to-face or direct communication [19, 85]. We hypothesize that stories could likewise provide a low-burden experience through which readers can connect with others. By giving concrete examples of how others have overcome similar challenges, stories can potentially create a blueprint for how readers can take action on their own struggles. For example, a story about someone who learns how to overcome rejection while trying to find a new job could help other individuals who are actively experiencing rejection of their own. Stories also invite comparison between the circumstances of the story character and the reader. Such comparisons provide an implicit point of self-reflection [33], helping people notice patterns in their behaviors or thoughts and yielding insights that can support change [62].

Stories can be written, formatted, and shared in many different ways. We explore text messaging as a medium for story delivery since it is by far one of the most accessible services to a wide range of people. A large proportion of the population routinely carries their mobile phones with them and engages with text messaging throughout the day [34]. Text messaging also has accessibility advantages relative to app-based tools, which require downloading an app, opening the app to refresh its content, and maintaining access to data services. Past works have leveraged text messaging services to help people manage negative emotions, build awareness of mental health resources, engage in strategies to manage symptoms, and enhance their psychological wellbeing [26, 75, 76, 89, 111]. However, researchers have not extensively used text messaging services to deliver stories, leaving many open questions about how stories can be best designed and integrated into text messaging services to support mental wellness. This motivated us to investigate the following research questions:

- **RQ1:** What features of story-based text messages related to the content and format can motivate people to apply mental health lessons (e.g., management of cognitive distortions) into their lives?

- **RQ2:** How can story-based text messaging interventions elicit the benefits of self-reflection with regards to mental health?

- **RQ3:** What design tensions might arise when story-based text messages for promoting mental health are deployed in real life?

In this work, we present insights generated from interviews, focus group discussions, and a real-world deployment of a story-based SMS service. We focus our investigation on young adults between 18–25 years old — an adult age group with a high prevalence of mental health concerns, but limited use of traditional options for mental health treatment (e.g., face-to-face therapy) [1]. Mobile phone usage is also particularly high in this age range, irrespective of demographics or socioeconomic status [14, 44, 118]. We first conducted a formative study consisting of six one-on-one interviews and four focus group discussions with 2–5 participants each. We asked our participants about how they envisioned a text messaging service with stories could support their mental wellness. We found that participants emphasized the importance of concreteness and authenticity in story-based text messages, as well as an appropriate balance between presenting positive and negative aspects of people's experiences.

Based on what we learned from our literature review and formative work, we designed a series of true stories to be delivered via text messages. These stories centered on cognitive distortions [11, 92], which are frequently recognized and addressed as a component of cognitive behavioral therapy (CBT) [101]. Cognitive distortions involve exaggerated or unhelpful thought patterns and are often linked to affective disorders like depression and anxiety [101]. We examined stories that demonstrate how characters were able to recognize these distortions and subsequently expand their ways of thinking, reduce negative biases, and improve their psychological wellbeing. We then deployed these stories through text messages to 42 participants, experimenting with features like the amount of details the stories contained and the inclusion of reflection prompts. We then interviewed a subset of our participants to investigate the implications of our design decisions and to surface other possible refinements. Our participants appreciated that our stories were drawn from real-life experiences, which helped them connect with the characters. Explicit explanations of cognitive distortions at the end of the stories also helped them come away with a concrete lesson, adding to the stories' value. At the same time, we observed trade-offs between story depth and message length; although people appreciated learning more about the story characters, longer stories required more effort to read and were thus inconvenient at times.

In summary, this paper aims to shed light on desirable properties of story-based text messaging when applied to mental wellness, highlighting design challenges encountered while deploying such interventions in the real world. To achieve this, we first present data from a formative study of people's perspectives on story-based text messages, consisting of (i) six interviews and (ii) four focus group discussions. We use these insights to design and deploy story-based text messages with 42 participants, and conduct further interviews

to better understand how people perceive and gain benefit from these text messages in their everyday lives.

2 RELATED WORK

For the following overview of related work, we first describe how stories have been used to communicate principles related to mental health. We then summarize recent efforts that have leveraged text messaging to promote behavior change and mental wellness. We conclude by describing psychological strategies that can be applied to address cognitive distortions — unhelpful patterns of thought that can exacerbate depression and anxiety symptoms.

2.1 Theories and Applications of Stories

Storytelling is a historically common practice for communicating morals and lessons [39, 103]. Stories with lessons can take many forms: fables, allegories, parables, poems, etc. One of the most famous examples of stories explicitly designed to communicate morals are Aesop's Fables [4], which end with brief takeaway messages like "slow but steady wins the race" or "look before you leap". There is growing literature that speaks to the efficacy of stories in helping people manage their mental wellness [6, 67, 68, 84]. Stories can help normalize difficult experiences and illustrate a road to recovery from these challenges [106], inspiring audiences to apply the same approaches in their own lives [66, 84, 124]. Moreover, stories promote self-reflection by giving people the opportunity to draw parallels between the stories' characters and themselves [30, 47, 88]. For these reasons and many others, stories are a significant component of certain therapies wherein individuals share stories with one another to learn about others' processes for overcoming struggles [66, 88].

Evidence has emerged supporting the efficacy around narrative-oriented approaches to mental wellbeing. For example, entertainment-education interventions insert educational content into an entertainment framework [109], and narrative persuasion transports the audience into the story to influence their attitudes and behaviors [80]. Stories have been successful in reducing symptoms of depression among adults with severe depressive disorder [121], primary school children [105], and cancer patients [98]. Stories have also been used in interventions to encourage healthy eating [42] and physical activity [102], promote citizen journalism [72], and counter stigma towards sexual harassment victims [25].

Digital tools are becoming increasingly popular for exchanging peer narratives [71, 78, 82, 90]. Many individuals with symptoms of depression use dedicated online support groups (e.g., 7 Cups [9], National Alliance on Mental Illness programs [2]) and general social media platforms [82, 96] (e.g., Facebook and Twitter) to share their lived experiences with others, read about others' experiences, or solicit advice from people who are going through similar problems. By interacting with peers' stories online, individuals can form social connections that induce a feeling of belonging to a group and can gain knowledge about mental health management [82]. Zachariah et al. [129] and Thiha et al. [117] demonstrated the potential of this approach by using peer narratives as part of an online education program among high school students to prevent youth suicide. Several digital campaigns have also crafted stories from individuals' personal experiences and shared them with targeted communities to mitigate stigmas surrounding mental illness [20, 31, 49, 107]. Online groups

can provide a safe space for people to discuss sensitive issues and explore their identity [15, 30], such as the online fandom communities that have given people a platform for combating prejudices about the LGBTQ+ community [30].

Although the promise of narrative-based interventions has been explored to some degree, limited prior work has explored the different design dimensions and challenges associated with delivering stories through particular computer-mediated communication platforms. This paper explores how one of the most commonly used communication mediums — text messaging — can present both challenges and opportunities for story delivery. To understand how the features of texting can be leveraged to deliver stories that will engage users in improving mental wellness, we explore questions like "What are the desirable properties of peer stories that are sent through text messaging?", "What forms of interactivity would support users in reflecting on and learning from stories?", and "How can a message with only a few sentences still be engaging?".

2.2 Text Messaging as a Medium for Promoting Behavior Change and Mental Wellness

Text messaging services have shown promise in producing behavior change for various physical and mental health challenges. For example, Haug et al. [45] developed a combination of personalized motivational messages and behavioral-change support texts to promote smoking abstinence among adolescent smokers. Their approach resulted in lower cigarette consumption rates, particularly among occasional smokers. A similar approach [46] was also effective in reducing binge drinking among vocational school students. Suffoletto et al. [116] delivered text messages that prompted users to set a goal for their weekly drinking limit; the messages helped users stick to their drinking limit goal and eventually reduce alcohol consumption. Informational texts on behavioral change have been found to be effective as well, particularly in the context of weight management [55]. Even simple reminder texts can be useful, as several studies have used regular reminders to help people attend their appointments with doctors [16] or improve medication adherence [36, 57].

Text messaging services for promoting mental wellness are also varied in form and purpose [7, 21, 28, 51, 63, 70, 77, 114, 125]. For example, Levin et al. [65] sent a combination of psychoeducational messages, reminders, and mood rating probes to help users manage their hypertension and bipolar disorder. Participants reported that the messages were helpful because they found the messages informative and applicable within their own lives. Memo, a text messaging service by Whittaker et al. [123], was also able to mitigate depression among adolescent participants by sending psychoeducational texts grounded in cognitive behavioral therapy (CBT) that addressed common challenges for young people (e.g., cybersecurity, healthy eating). More generally, reminder messages have been used as cues for people to integrate specific healthy activities into their daily lives [56, 62, 81].

An important motivation behind our work is to find ways of promoting self-reflection through stories. Self-reflection is considered an important mechanism for converting an individual's intention into immediate action [10]. Some digital tools have leveraged interactive agents like chatbots to encourage people to participate in self-reflection. Tielman et al. [119] suggest that chatbots can encourage people to maintain digital diaries, improving awareness about their mental state. Inkster et al. [51] created a chatbot called Wysa that

prompts users to reflect on their mental wellness by asking questions like "How was your day?" and "Last time we talked, you were feeling anxious. How are you feeling now?". They found that highly engaged users experienced significant improvements in their self-reported symptoms of depression. Another chatbot called Reflection Companion [62] sent adaptive mini-interventions on a daily basis to encourage physical activity (e.g., graphs of physical activity, prompts for daily comparisons). Participants who used the chatbot appreciated the messages since they served as timely reminders and helped participants keep track of their daily progress.

Only a few recent text messaging interventions have leveraged the benefits of stories to support behavior change and mental wellness. Story-based text messages were found to be an effective intervention strategy for addressing obesity [27, 52]. Moreover, Irvine et al. [52] reported that 80% of their participants appreciated reading story-based text messages to the point that they would recommend the text messaging program to others. Stories have also been used in text messaging services to educate students about sexual and reproductive health [35]. Lastly, Willoughby et al. [126] explored the potential of using story-based text messages for discouraging binge drinking and unprotected sex among young college women. All of these examples show the potential power of narratives in text messaging interventions; however, none of them have explored how decisions around the content and format of the stories affect their reception.

2.3 Cognitive Distortions

Psychological interventions can target a number of transdiagnostic and disorder-specific mechanisms in order to motivate change and symptom reduction. For example, common targets when treating affective disorders like depression and anxiety can include cognitive (e.g., thought patterns or styles), behavioral (e.g., engagement in pleasurable or mastery activities), and relational mechanisms (e.g., addressing interpersonal role changes). In this work, we craft our stories to help people identify and address cognitive distortions — systematic errors in an individual's thinking that can negatively skew that individual's experience of reality [11, 92]. These distortions represent proposed cognitive mechanisms that drive affective systems, particularly depressive ones. Challenging cognitive distortions is a key element of CBT [101] — a form of psycho-social intervention rooted in the understanding that there are fundamental connections between how we think, feel, and behave. CBT is one of the most well-researched approaches for addressing mental health difficulties and has been shown to be effective for problems ranging from depression to eating disorders [69, 93, 99].

Our story topics cover three of the many cognitive distortions that exist: overgeneralization [59], all-or-nothing thinking [87], and fortune-telling [113]. We provide a brief overview of these three distortions below:

- **Overgeneralization** refers to the act of drawing overly broad conclusions from a few selected negative experiences [59]. An example of this distortion would be the following: "My plant died despite watering it every day. I could not take care of the plant, so I won't be able to take care of my kids." A person who

overgeneralizes is prone to viewing negative occurrences in their life as revealing an inevitable pattern of mistakes [50].

- **All-or-nothing thinking** is a negative thought process where someone splits their views into black-and-white extremes with little gray area in between [87]. An example of this distortion would be the following: "If I can't give this 100% of my time and attention, then it's not going to work" People with this pattern of perception may view their experiences in rigid, polarized ways [120].

- **Fortune telling** involves anticipating that a negative outcome will occur regardless of the context of the situation [113]. Key distinctions of fortune telling from other cognitive distortions are that it is focused on future situations, generally involves a negative or catastrophic outcome, and comprises a disregard for the true or realistic likelihood of a negative outcome. An example of this distortion would be the following: "Even though I have an interview and am prepared, I will mess it up and will lose the job." People who frequently experience this cognitive distortion weigh the negative outcome of an upcoming scenario more heavily than a neutral or positive outcome [113].

Past work has leveraged computer-mediated communication to help people re-evaluate thought patterns associated with cognitive distortions. O'Leary et al. [86] designed a messaging platform that guided asynchronous conversations between people using a sequence of reflective prompts. Earlier prompts motivated people to open up and share their worries, while latter prompts encouraged them to seek possible solutions. Other work in this space has leveraged behavioral chaining [97] — the process of reminding individuals about past situations by asking them specific questions on how certain emotions were triggered. Behavioral chaining can help people recognize their own faulty thinking patterns and help them prepare for similar events in the future [22]. We expand upon this literature by exploring how stories can prompt people to reflect on cognitive distortions.

3 FORMATIVE STUDY

To create story-based text messages for promoting mental wellness, we first conducted a formative study to better understand the features people would appreciate in them. The formative study consisted of six semi-structured interviews and four focus group discussions, which we describe below.

3.1 Participants

For the semi-structured interviews, we recruited six undergraduate and graduate students between 18–25 years old from a North American university via snowball sampling [40]. At the time of the interviews, the students were either studying computer science or psychology.

Recruitment for the focus group discussions was facilitated by Mental Health America, a community-based nonprofit organization that promotes mental wellness in the United States. Individuals who showed at least moderate levels of depression or anxiety symptoms according to the Patient Health Questionnaire-9 (PHQ-9) [64] and the General Anxiety

Disorder-7 (GAD-7) [112] (i.e., scores of 10 or higher) were invited to learn more about study activities by following a link presented alongside their results. Potential participants completed an additional screening survey and were eligible if they were located in the United States, were between 18–25 years old (or 19–25 years in Nebraska, reflecting the state's age of majority), and owned a mobile phone. Nine individuals in total were involved as focus group participants, and they attended as many of the focus group meetings as they wished.

Our diverse participant pool allowed us to assess the perspectives of people with and without symptoms of depression or anxiety, reflecting that many mental health interventions appeal to and benefit those in the both general and clinical populations; however, drawing explicit comparisons between these groups is beyond the scope of this work. We refer to our one-on-one interviewees as FP1–FP6 and focus group participants as FP7–FP15. Overall, the mean age of our participants in the formative study was 22.3 ± 0.4 years old. The participants identified with multiple genders (12 female, 3 male) and several racial groups (7 Asian, 4 white, 1 African American, 2 with more than one racial identity, 1 undisclosed).

3.2 Procedure

We anticipated that some people would feel comfortable discussing their experiences and preferences one-to-one because of the sensitivity of our research topic, while others would prefer to open up in a group and collaboratively generate ideas. As such, we gathered feedback through both individual interviews and focus group discussions. Our questions centered on understanding participants' mental health needs and how these needs could be met by a text messaging service that provides story-based interactions. We first asked people to share their experiences with existing mental health applications. We then asked questions to understand how story-based messages could help them manage their mental health concerns. Our questions included, but were not limited to: "What types of messages do you think you'd like to receive about other people's experiences?", "How can a story about someone else be made more engaging?", "Would you want to pick the topic of the story? Why or why not?", "How much background information do you want about the person whose experience is being shared? What do you need to know about them to get something out of the story?". We also asked participants if they could foresee any challenges to delivering peer stories through the medium of text messaging. Since the interviews were semi-structured, we deviated from the interview script as needed to follow up on participants' insights and observations that were relevant to the research questions.

Both the individual interviews and focus group discussions were conducted via the Zoom videoconferencing platform. Interviews were conducted by a single member of the research team. The size of the focus groups ranged from 2–5 participants each and were facilitated by two members of the research team. The interviews and focus group discussions centered on participants' experiences with digital tools for mental health and their ideas for how such programs could support them in changing their behaviors and thought patterns. In addition, we sought to better understand the features participants would like to see in a text messaging-based program and participants' ideas for how narratives could be incorporated into text messaging. Each interview lasted 20–30 minutes, while focus group discussions

lasted 60–75 minutes. All of the participants were compensated at a rate of $20 USD per hour. Research activities took place in two universities and were approved by both universities' Research Ethics Boards.

3.3 Data Analysis

After transcribing the interviews and focus group discussions, we followed a thematic analysis approach [23] to analyze the qualitative data. Two team members, referred to as "coders", first reviewed all transcripts to become familiar with the data. The coders then assigned segments of the data to distinct codes through an open-coding process [60]. Each coder developed a preliminary codebook on their own before convening to decide on a shared one. These deliberations occurred across several meetings, during which they identified overlapping codes, refined code definitions, and excluded codes that were not central to our research questions. The coders then each applied the shared codebook to a subset of the data (four interview transcripts), before meeting to refine the codebook to better fit the data. After repeating this iterative process, the coders reached a consensus and applied the final codebook to separate halves of the data.

3.4 Ethical Considerations

Our team members included graduate students and faculty members in computer science, human-computer interaction, cognitive science, and clinical psychology. Since research promoting mental wellness can raise several ethical considerations, we have addressed these issues throughout the research process. During the interviews and focus group discussions, participants were informed of the fact that they could leave the conversation or skip any questions if they felt uncomfortable. Interviewers were also trained to conduct the Columbia-Suicide Risk Assessment protocol [91] and address any emergent suicidal thoughts or behaviors in a collaborative manner that aligned with best practices (e.g., delivery of safety planning, referral to crisis services). No such risks emerged during the study.

4 FINDINGS FROM FORMATIVE STUDY

Several themes emerged from our formative work regarding the desirable features participants envision in story-based text messages. Below, we discuss each of these themes and their implications for our deployment.

4.1 Conveying Authenticity

Findings: Participants expressed a strong desire for messages that convey "authenticity" — by which they meant the feeling that a message is from a real person. Participants like FP7 and FP37 mentioned that knowing a story is written by a real person would increase the sense of authenticity, allowing them to connect to story characters and find greater motivation for change. They anticipated that such stories would also give them a sense of comfort in knowing that someone else was able to overcome their difficult situation, which would boost their confidence in dealing with their own struggle. FP9 said,

> "I like hearing other people's stories and what they did, and it kind of helps me feel a little better. And I kind of bounce off it and do what they did and try these new things that they're doing."

Some participants also shared negative experiences reading what they believed to be manufactured stories that were fabricated to make them feel better. These individuals preferred stories that came from real people since they felt that manufactured stories were disingenuous and had little credibility. When we asked our participants how they distinguish manufactured stories from real ones, they stated that they often relied on "gut feelings". However, FP7 speculated that stories with less specificity were more likely to be manufactured: *"If the story sounds like this could happen to anybody, my mind makes me think, 'Oh, then it didn't happen to anybody.'"*

Implications for Our Deployment: We engendered authenticity in our stories using three different approaches. First, we created stories as a research team by drawing from our own real-world experiences rather than fabricating scenarios. The stories were written by members of our research team (see Section 5.1 for details about story generation). To make the origin of the stories clear, each one started with a sentence that explicitly indicated that they were true stories from real people. Second, we wrote stories in the first-person perspective with the intention to give the story character a voice, which would in turn help form a connection with the reader [24]. Third, we included enough details about the characters and situations to paint a concrete image in the readers' minds. For example, rather than just referring to college students in general, we included details like their academic majors or their relationship to other characters in the story (e.g., an economics student sharing their problems with a close friend). These details are not always necessary for understanding a story, yet messages with more details are often perceived as more credible since they are more likely to trigger people's memory of related experiences [100]. These nuances align with practices that generate authenticity while creating personas (i.e., concrete representations of target users) in user-centered design [3].

4.2 Having Concrete Takeaways

Findings: Participants perceived that existing online resources and digital intervention services for mental health only provide superficial and generic suggestions like "do not overthink" and "try out a fun activity". Despite sometimes finding these suggestions useful, participants felt that they have little impact because people often do not have the time or energy to think through how to apply them in their own lives. Hence, participants advocated for messages that give more precise guidance and suggestions. Participants recommended that messages should be able to explain why a certain practice would be beneficial to their wellbeing. FP12 explained that even a brief justification would be beneficial to them:

> "I think one sentence would be nice. So, for me, I didn't ever take breathing exercises seriously until someone said to me, 'Oh, but the reason why it helps is because it brings you back to the present and helps you concentrate or prevent anxiety.' So, that makes me take it more seriously."

Implications for Our Deployment: Inspired by the structure of Aesop's Fables [39, 103], we explicitly provided a concrete takeaway message for the reader at the end of each story. This practice aligns with Barthes' three-layer narrative structure [8], which consists of layers for actions, characters, and morals. The action and character layers describe the physical setting of the world and the characters involved, while the moral layer pinpoints the goal of the story [29]. For the action and character layers, our stories involved real people in real situations. For the moral layer, we introduced a psychological concept (e.g., "This person experienced a thinking trap of 'overgeneralization'.") and expanded on how the concept is tied to the story. Thus, we prompted readers to reflect on the purpose of the story and what it illustrates rather than on particular details or characters. In our case, a team member trained in clinical psychology designed the concrete takeaway messages to highlight how the stories illustrate common cognitive distortions.

4.3 Encouraging Active Participation

Findings: A frequent suggestion from our interviews was that the users of a story-based text messaging service should be involved as active participants rather than as passive readers. Our participants suspected that if all of the communication is one-way (i.e., from the system to the user), users might not spend as much time reflecting on the stories. FP1 and FP3 posited that we could increase engagement by following the stories with prompts for people to share their own experiences. When this suggestion was mentioned to other participants, many agreed that there is value to composing their own messages, but concerns were also raised. Some participants expected that people would be hesitant about sharing their personal details through a messaging platform, while others speculated that people will not always have the time or energy to write more than a couple of sentences.

Implications for Our Deployment: We encouraged active and reciprocal participation in our deployment by asking users a reflective question at the end of each story, typically along the lines of "Have you had a situation where you had to deal with a similar challenge?". To mitigate some of the concerns raised about people's willingness to share personal information, participants in our deployment were made aware that their responses would not be shared beyond the research team. We anticipated that by answering such questions, users would be able to reflect on their own experiences and how the stories' messages could be applied to their situation. This approach is similar to dialogic inquiry between parents and children during storytelling, in which the parent periodically pauses to ask the child to relate the story to their own experience [110].

4.4 Balancing Positivity with Realistic Struggles

Findings: Participants in our studies suspected that reading too much about people's struggles could sometimes induce sadness or decrease motivation. They instead suggested that we should focus on positive stories that inspire hope. That being said, participants also mentioned that presenting too rosy a picture of living with mental health symptoms would appear disingenuous or set unrealistic expectations for people. Therefore, participants suggested finding a balance between positivity and a realistic depiction of people's struggles. FP8 explained that stories should show how a person overcame their struggles without trivializing the time and effort involved in making change:

> "I like the idea of a successful story. But I would also like to be like, 'Oh, people were going through something really bad, and now they're getting help. Even though they're not 100%, they are seeing how that's helping and how it's making everything better'. So not really just skipping directly to the end, just being able to say, 'Hey, I'm still struggling, but I'm getting better.' It's just kind of a reminder, like, 'Hey, it's not going to fix itself overnight.'"

Implications for Our Deployment: Although we avoided content around experiences that have potential to trigger secondary trauma (e.g., sexual assault, family deaths) [79], we sought to relay the serious issues young adults face. These topics included, but were not limited to, struggles precipitated by academic stress, relationships with parents, or failures in school and careers. We ended each of our stories on a positive note wherein an individual achieves some level of improvement in their situation or a new outlook on their problems, allowing the reader to see the value of making change. We sought to make these conclusions as realistic as possible; instead of claiming that characters had made tremendous progress or completely resolved their problems, our stories showed that small steps can be made to improve one's situation.

4.5 Message Format and Length

Findings: Participants provided a range of opinions regarding the appropriate length of stories. Four interview participants preferred longer stories that provided more context, detailed explanations, and clear examples. FP6 said,

> "When you receive just a short like one sentence, it's very easy just to like read it and be like, 'Okay, I'm done.' But if you force someone to read five sentences, then they're much more likely to like take those like extra 10 seconds to process what they're reading."

Participants in the focus groups also felt that people would be able to more easily connect with messages that had more detail, expecting that shorter messages would be "vague" and "unclear". In contrast to these views, FP2 and FP5 worried that longer stories would be broken across a long series of consecutive text messages, reflecting that most text messaging services limit the number of characters per message. Breaking stories across too many messages was predicted to lead to annoyance, particularly since many people set their phones to vibrate or ring whenever they receive a notification. FP5 speculated that seeing and hearing many notifications in quick succession would be overwhelming, especially for people who are preoccupied with other tasks. Another point that was raised by participants was that it would be nice to have a mechanism for customizing the kinds of stories that users would see. FP7 expressed that the feeling of control would create a sense of ownership over the system, which would keep them engaged.

Implications for Our Deployment: To investigate the importance of message length, we created short and long versions of each story with either 3 or 5 messages, respectively. Most of the consolidation for the short versions came at the beginning of the stories; while the long stories used a couple of messages to set up the context and describe the characters and their problems, the short stories only used one message for that purpose. The short versions

were also condensed when the character reaches a resolution to their problem, but both the short and long versions had similar amounts of text at the end dedicated to explaining how the story illustrates a common cognitive distortion.

Participants also wanted the ability to control the content of the stories that they read. We also experimented with a couple of different mechanisms for allowing participants to control the content of the stories that they read:

- *Up-Front Choice* **format**: With this approach, participants were given a single sentence or question to gauge their interest in a particular story (e.g., "Do you ever feel like everything is going wrong at once?"). If the participant expressed interest in that topic by responding "yes", they were sent the rest of the story; if not, they were sent another prompt and the process repeated until a suitable match was identified.

- *Start and Switch-Out* **format**: With this approach, users received the first 3–4 messages of the story and then an additional message asking them if they wanted to continue hearing the rest of the story. Users who requested more of the same story would see the rest of the story that they had already started, while users who requested a different story were given a new story on a different psychological principle.

Our rationale behind both of these formats was that seeing a short teaser or segment of a story would be less overwhelming and would also give users enough information to decide if they want to engage with it. Although the *Up-Front Choice* format arguably allows the greatest control in selecting a relevant story, it also demands more action from the user at the outset. Therefore, we were interested in how users would respond to both strategies. Figure 1 illustrates the key interactions in these two approaches. Note that the *Start and Switch-Out* format was only applied with longer stories since there is no need to extend shorter ones.

5   DEPLOYMENT STUDY PROCEDURE

In this phase, our goal was to test and extend the findings from our formative work. We developed a small collection of stories using the findings and design questions that emerged from our formative study. We integrated these stories into a text messaging probe that was deployed to participants. We describe the logistics of this deployment below.

5.1   Story Generation

We followed an iterative design process within our own research team to generate stories suitable for our investigation. Team members were asked to share their real life experiences that could be linked with one of the three cognitive distortions listed in Section 2.3 (overgeneralization [59], all-or-nothing thinking [87], and fortune-telling [113]). They were aware that their stories could potentially be shared with people outside the research group, so they did not disclose private information during this brainstorming period. The connection with cognitive distortions enabled us to craft a clear takeaway message for the readers. The takeaway messages was designed by a clinical psychologist from our team. After collecting around ten stories, we held multiple meetings to refine their content

according to our findings in the formative work and subsequently selected one story per cognitive distortion.

The stories themselves are briefly summarized in Table 1. The stories all share a similar flow: the characters and their unique challenges are introduced, the characters experience negative thoughts that center on one of the identified cognitive distortions, and the characters eventually reach some sort of resolution. The first four design elements we elicited from our formative study — conveying authenticity, having concrete takeaways, encouraging active participation, and balancing positivity with realistic struggles — had yielded clear implications which we followed when crafting stories. The appropriate message formats were less clear, so our probes considered a range of possible solutions by introducing stories of shorter and longer lengths and by testing multiple options for topic selection. Figure 2 shows the long and short versions of the same story involving overgeneralization.

5.2 Participants

We used two distinct recruitment methods to enroll participants between the ages of 18–25 for our deployment study. The first group of participants (P1–P14 and P39–P42) was recruited via snowball sampling [40] with no inclusion criteria beyond having interest in a text message-based intervention to promote mental wellness. The second group of participants (P15–P38) was recruited via targeted ads posted on the Mental Health America website, the same community-based nonprofit organization that facilitated the focus group discussions. Five of those people came from our focus group discussions (P34–P38). These participants self-reported symptoms of moderate depression or anxiety according to their scores on the PHQ-9 and GAD-7 [112]. Deploying our probe to both populations allowed us to assess the suitability of our approach for people with and without symptoms of depression or anxiety; as with our formative study, however, we do not attempt to draw comparisons between these two groups. We first deployed our probe to the student sample to gauge any unforeseen issues with the messaging and study approach before moving to the population with clinical symptoms who are potentially more vulnerable.

Overall, our deployment study involved 42 participants who were living in North America at the time of the study. The mean age of our participants was 22.0±0.4 years. Our cohort spanned multiple genders (29 females, 13 males) and ethnicities (40.5% Asian, 35.7% White, 9.5% African American, 4.8% American Indian or Alaska Native, 4.8% multiple racial identities, and 4.8% undisclosed).

5.3 Procedure

Our investigation of story-based messages was part of a broader project that aimed to understand how different types of messages (e.g., didactic messages, action prompts and reminders, and stories) can be delivered via texting to support mental wellness. Participants were recruited in several waves. For the purposes of this study, our deployment lasted between September 2020–February 2021.

The composition of the overall program was adjusted between waves. Specifically, the project was initially structured so that participants would be enrolled for a week of messages, of which one day was dedicated to story-based messages. In order to test

additional content types and formats, the protocol was later extended to two weeks, allowing us to distribute story-based messages to participants for two days. All participants (in the one-week and two-week deployments) received one long or short story in the *Up-Front Choice* format. Participants who had an additional day for stories (two-week deployment only) also received a long story in the *Start and Switch-Out* format (the *Start and Switch-Out* format was not conducive to short stories). Table 2 shows which participants received which formats of story-based messages. Because we had three stories, participants were able to change their story up to two times. Those who received stories on multiple days never saw the same story twice. On the days that participants were assigned stories, their first message was sent around 9:30 AM in their local timezone and subsequent messages were sent in 30-second intervals unless they required a user response.

At the end of each story, participants were sent an additional text message asking whether they could relate to the story scenario with an instruction to reply with "yes" or "no". We refer to this question as the *relatability* prompt. If a participant responded "no", they were thanked for their participation and received no further messages that day. If a participant responded "yes" or did not respond within a two-hour window, they were also asked to further contemplate the cognitive distortion depicted in the story via an open-ended *reflection* prompt. The prompt asked them to write about a similar situation from their life. Participants who provided a written response were thanked for sharing.

Participants were sent messages using Twilio, an automated message delivery platform. Research team members sent the messages manually using a Wizard-of-Oz approach [83]. This enabled our research team to handle unexpected participant responses using human judgment (e.g., open-ended responses to closed-ended questions). The team members followed a detailed script that specified the timing of each message and how the messages should be selected based on experimental condition assignments and participant replies. Participants were informed during the consent process and at the start of the study that a research team member would be reviewing their responses.

After participants completed the study, they were invited to take part in a semi-structured interview to provide feedback on the stories and other messages they had received; 20 people accepted this invitation. In the interviews, we asked people to comment on the design themes from our formative work (e.g., authenticity, concrete takeaways). We also asked them about the factors that impacted their level of engagement with the intervention (e.g., busyness, mood). Finally, we asked participants what thoughts and feelings, if any, they experienced during and after engaging with the messages. The interviews took 10–30 minutes. Participants were not compensated for engaging with the text messages to ensure that payment would not influence the extent to which people would interact with them. However, all participants were compensated for their time participating in the interviews.

5.4 Data Analysis

We analyzed participants' responses to the stories using mixed methods. We report the response distribution for the *relatability* and *reflection* prompts, as well as the average word count to the open ended *reflection* prompt. The interview transcripts were analyzed using the

same thematic analysis procedures used for our formative work [23], albeit with a separate codebook.

5.5 Ethical Considerations

Participants were informed at the beginning of our study that our messaging program was not intended to be a crisis service. We provided participants with the contact information of several crisis services (e.g., crisis text lines and suicide hotlines) in the possible event that such information would be useful. Although we did not solicit suicide-related information at any point in the study, we recognized that given the open-ended nature of text messaging, there was an unlikely possibility that participants may disclose (unprompted) suicidal thoughts or behaviors. Therefore, we developed procedures to ensure safety of participants. We reviewed all received text messages on a daily basis. If any message indicated a risk of self-harm or suicide, team members were trained to reach out to the participant and conduct the Columbia-Suicide Risk Assessment protocol [91]. Similar considerations were applied to the interviews, as previously described in Section 3.4. No risks emerged during the study, and therefore no follow-up assessments were needed.

6   FINDINGS FROM DEPLOYMENT STUDY

In this section, we discuss the insights generated from the text message responses and the post-study interview sessions. We first talk about how participants engaged with the stories and the accompanying prompts, as well as the factors that impacted their responsiveness. We then describe the feedback we received on the four design features we identified from our formative study. Finally, we conclude our findings by discussing the diverse opinions people had regarding message format and length.

6.1   Overall Engagement with the Story-Based Text Messages

Engagement with a text messaging service like ours is challenging to measure since people can read and reflect on messages without writing and submitting a response. With that in mind, we turned to both quantitative and qualitative data to understand the extent to which people engaged with our stories. In our deployment study, 7 people did not respond to the question on selecting a story topic in the *Up-Front Choice* format, so 35 out of 42 participants received a complete story after in response to one of our selection methods. Table 3 shows that participants were moderately responsive to the *relatability* prompt and the *reflection* prompt across the various formats.

During our interviews, we spoke with two participants (P2 and P22) who did not not respond to any of the story-based messages but engaged with other messages in our broader program. P22 stated that they never responded to the *Up-Front Choice* format prompts because they anticipated the stories would be from the perspective of famous celebrities and would not resonate with their situation. Meanwhile, P2 stated that they saw the prompts for choosing a story topic but simply forgot to reply. When we asked our other interviewees about situations that might cause them to not respond to messages, the most common explanations related to forgetfulness, being preoccupied with other tasks, or a lack of energy. Some participants said that they generally disable audio or vibration notifications on their phone,

and so they did not see our messages until later in the day and felt that it was too late to respond. To address the potential for missed messages and forgotten responses, participants like P35 advocated for reminders:

> "I forget to do stuff for myself sometimes, so I might forget to reply as well. So you can send me prompts that come a little bit after the initial message. Those messages will work as reminders."

6.2   Feedback on Previously Identified Design Elements

Based on insights from our formative work, we explicitly considered four design features when crafting our story-based text messages. We revisit these features below to assess the degree to which we satisfied our goals.

6.2.1   Authenticity.

Participants believed that the stories were authentic and actually came from a real person. When we asked them why they believed this to be true, some noted the level of concrete details within the stories. A few reported that they found the stories authentic because the scenarios they described mimicked what was happening in their own lives. For example, P27 coincidentally took an economics class just like the central character in the overgeneralization story and was thus able to imagine themselves in that character's situation:

> "As the person was describing how they were trying to look for ways to snap themselves out of it, I saw those as coping mechanisms that anybody could use with the things that they were trying to do."

Others expressed that although they had not gone through similar experiences to the ones presented in the stories, they could still connect to the feelings being portrayed. After reading the story on all-or-nothing thinking, P3 and P35 resonated with the feeling of being unproductive due to procrastination, despite being involved in different occupations and fields. Nevertheless, P11 acknowledged that it is impossible to come up with a small set of stories that resonate with people across all demographics, occupations, cultures, and circumstances; even so, they argued that stories with specificity could still seem relatable since most people have felt helpless or anxious at some point of their lives.

Contrary to these perspectives, our stories did not resonate with P37, who advocated for greater personalization:

> "If you guys already had basic information about me, like I am out of school or working or whatever, and then gave me stories that were already tailored to what my life might be, then I think that would be really helpful and it would just resonate with me easier."

On the whole, we observed that participants were more likely to regard stories as authentic if they described experiences that they had gone through themselves, either in terms of characters' specific circumstances in life or their feelings and mental health struggles. In other words, participants often correlated relatability with authenticity. One suggestion we received for making stories more relatable was to leverage literary tropes since they are generally familiar to many audiences. An example of a broadly recognizable literary trope

would be an underdog story in which a character is able to overcome significant adversity relative to their peers to achieve a successful outcome.

6.2.2   Concrete Takeaways.—Most of our participants appreciated the fact that each story was explicitly connected to a concept from psychological literature. For many, the connection transformed reading the text messages from being a casual leisure activity into being a productive learning opportunity with a concrete benefit: the lesson that was learned at the end of the story. P30 mentioned that "putting a name [psychological term] to the story" was helpful because it gave them the knowledge and terminology they needed to conduct further online research. Other participants felt that without the concrete takeaway message at the end, they may not have known how to interpret the stories or make use of them. P28 stated,

> "I like that stories were tied to a principle because if this was used with a younger crowd, like teenagers, and if the teenagers I know read this, they'll be like 'Why did you make us read this?'. So you have to connect it back to something so that people understand why it's being told."

On the other hand, P3 felt that the explicit connections to psychological concepts detracted from the emotional experience of reading the stories and made them sound too prescriptive. They went on to say that stories should have room for interpretation so that people can decide for themselves how to best apply the lessons to their own lives. P13 felt similarly and said that stories should leave room for interpretation since "*psychology does not have a definitive solution for everyone's problems*". These findings suggest that more work is needed to understand how explicit messaging should be when connecting stories to the principles they are meant to illustrate.

6.2.3   Active Participation.—We added the *reflection* prompt to encourage participation from users and help them to reflect on their life experiences similar to the stories. In the interviews, participants like P11 noted that the writing activity was a "fun break" from their other work and school obligations. Other participants expressed that the action of writing responses to the *reflection* prompt made the stories feel more interactive and helped them better understand a persistent source of troubles in their lives. Some participants went as far as suggesting that the reflective prompt should explicitly request users to share stories that they think would help other people, creating a sense of community with the broader userbase.

People who did not respond to the *reflection* prompt noted that they did not always have the time or energy to write about their life, although some of them clarified that they did not necessarily dislike the prompts. In some cases, people told themselves that they would find a better time to respond to the prompt, only to forget later in the day. Another common complaint was that some people had difficulty writing long messages on their mobile phones. P7 said,

> "It's kind of hard to text or message a lot on the phone. The reason why I had done the writing is that I could do it on my computer since my phone and computer are linked, so it was easier to do it that way. I wouldn't have done it if it was just on

my phone, because there's just too much typing and if you make edits, it's just too much."

6.2.4   Balance between Positivity and Realistic Struggles.—Participants generally desired stories that had the reasonable balance between portraying the struggle of the character and inspiring hope in the end. P20 commented that although having a positive ending results in a psychologically healthier mindset, reaching an improbable resolution to complicated issues (i.e., a fairytale ending) could be dissatisfying. In this regard, P39 appreciated acknowledgements of people's struggles, saying:

> "I found the stories helpful because they weren't trying to spread toxic positivity, like 'ignore bad thoughts' or 'concentrate on all the good'. It's about acknowledging the bad as well."

Some participants felt that our stories should have also covered more sensitive topics like child abuse or sexual harassment. For example, P27 posited that our text messaging service would have significant benefit for them if our stories acknowledged traumatic experiences like child abuse and illustrated how people have overcome such experiences. Nevertheless, participants suggested that stories with sensitive topics should be designed with caution so that they validate the readers' struggles without inducing secondary trauma.

6.3   Perceived Benefits of the Stories

We now describe how the participants applied the stories into their life and the corresponding benefits they experienced.

6.3.1   Scaffolding Feelings of Connection.—Participants often reported that they felt connected with the story characters, with the degree of perceived authenticity playing an important role. The authenticity of our stories led our participants to recognize that there are other people in the world who are going through similar experiences. Moreover, the feeling of connectedness gave them the confidence to overcome their struggle. In the words of P34,

> "Remembering that other people experienced the same thing is encouraging. It reminded me, 'This is life, I can deal with it.'"

Finding connection with others also gave participants a new perspective on their own problems. P36 reported that due to the COVID-19 pandemic they could not reach out to friends to talk about how they were struggling academically, but they perceived that reading the stories and answering the *reflection* prompt served as a sort of replacement for supportive discussions. On a different note, P20 felt that the story characters were experiencing even more severe problems than them, which gave them confidence to tackle their relatively less difficult life issues.

6.3.2   Adapting Stories to Personal Contexts.—The *reflection* prompt that we added after the story encouraged people to identify and elaborate on similarities between the characters' situation and their own. Many participants voluntarily shared their own life experiences after this prompt, writing in detail about their struggles and their negative thought processes. For example, P1 connected the cognitive distortion of fortune-telling to

their relationship with their roommates, finding that they had made assumptions about what their roommates were thinking and feeling without ever testing these assumptions:

> "I can easily tell when my roommates use some of my things that are not theirs (e.g., olive oil, body wash, etc.) and I often think that me confronting them about it will make them dislike me and use my stuff even more out of spite — because in my head, I think they'll say I'm being uptight since they only use a little bit at a time. "

Participants informed us that the stories gave them a template into which they could insert their own experiences to better visualize how certain behaviors affected themselves and others. In P12's words,

> "I want to simulate people in my brain. I prefer to know their initial state. I want to know what their input and output was, given such a problem exists. I want the information to be complete so I can do a simulation more properly. It helps me figure out how I can apply those situation in my own life."

In some cases, placing one's situation into the story format helped people identify faults in their behavior for the first time. For example, P14 was not familiar with the concept of fortune-telling before reading the story on that topic, nor did they realize that they had the habit of expecting bad things from any situation; the story made them aware of their own pattern of thinking despite the example being in a different context.

6.3.3   Exploring Alternative Solutions.—In addition to reflecting on their experiences, participants also used the *reflection* prompt as a chance to devise alternative ways of approaching their problems. For example, P16 read the story about all-or-nothing thinking and subsequently reflected on their approach to online courses:

> "When needing to complete school work, there are times where I'm just not in the mood to do so even though I know something is due soon and needs to get done. I usually end up spending hours with distracting myself and forget all about what needed to be done in the first place. The thing that I forget is I should always leave myself with plenty of time between assignments and I know this, it's just that I tend to forget that fact when I get into one of these moods."

The stories also had continuing impact after participants wrote out their thoughts. For example, P27 informed us that the overgeneralization story stayed in their mind a few days after they had seen it. The story made them realize that they should not have manage their situation alone, and prompted them to reached out to their social circle for support. P27 also noted in the interview that they planned to deal with future situations differently.

6.4   Feedback on Message Format and Length

Lastly, we talk about the diverse responses we received regarding message formats and length.

6.4.1   Message Format.—Table 3 suggests moderate to high levels of engagement for different formats, but we refrain from making claims about a preferred format due to the

small sample size and potential confounds (e.g., for those in the two-week deployment, the *Start and Switch-Out* format was received after the *Up-Front Choice* format, which may cause order effects). Instead, we rely on the qualitative data from our interviews to understand the potential benefits and challenges related to different formats. In our interviews, participants appreciated that the *Up-Front Choice* format allowed them to choose a story topic instead of directly starting a story. Participants like P4 and P33 expressed that choosing the topic of the story gives a sense of control and helps them to find relatable contents. However, P3 felt that asking multiple questions before the actual story may make users "overwhelmed".

Participants provided diverse opinions about the *Start and Switch-Out* format. P34 felt that this approach gave them the opportunity to see the actual story, with the choice to continue or to switch out a story allowing them to dismiss content they found boring or unrelatable. The people who did not appreciate the *Start and Switch-Out* format usually felt that the story was cut off in an awkward position when they were asked about continuing, potentially leaving the stories unresolved. Since the first few sentences of each story introduced the characters and their struggles, participants who never responded to the prompt for *Start and Switch-Out* format prompt only saw the negative setup for the story without any positive resolution. P19 said,

> "Don't just tease something horrible. And then, you know, if you never see more of the story, all you're left with is something horrible."

To address this, P12 suggested that the text messaging services could continue the story anyway after a certain time of non-response so that stories do not go unresolved.

6.4.2 Message Length.—Participants also had different reactions to the length of the stories we sent them. The qualitative data suggests that not all users were satisfied with the length of the stories they received. Some participants preferred shorter stories and felt overwhelmed when they received many consecutive messages. P39 recounted how receiving a long story made them feel like an emergency had arisen:

> "I am often in classes or meetings. If I get six or seven notifications in the middle of a class, I would probably think, 'Oh my God! What has happened?' I would probably panic, and if I see these text messages then, I would be very annoyed."

Another reason that some participants preferred shorter stories was because they felt that longer stories required them to "waste their brainpower" (P8) that could otherwise be applied to their work and responsibilities.

In contrast, people who enjoyed the longer stories appreciated the level of detail they included. Rather than having a single sentence to introduce the characters and set up the narrative, these stories used 2–3 sentences to convey rich information and draw the user in to read further. These participants felt that short stories were lacking context and ended too abruptly. P13 commented,

> "I want to know the person's initial mindset or his initial conditions. And how exactly the scenario leads to whatever decision he made. At least for me, I think

that's how I simulate people in my brain. I prefer to understand their initial state and then their input and output, given such a problem exists. I want the information to be complete so I can do a simulation more properly."

Because of the perceived effort it took to read stories, particularly longer ones, some participants delayed engaging with text messages until later in the day. There were also situations when people were either not around their phone or were preoccupied with other tasks. Regardless of the reason, participants encountered two problems while engaging with stories after-the-fact: (1) the story messages were buried in a collection of other unread messages, making them difficult to find; and (2) people struggled to find the start and end of each individual story Hence, participants requested some way for them to differentiate stories from other messages. P8 came up with one solution, suggesting that each story could be wrapped in a unique symbol (e.g., =, +) as a delimiter.

7   DISCUSSION

In the following discussion, we first summarize the key findings of our work and their relevance to CSCW. We then describe opportunities for future work and the limitations of our work.

7.1   Key Findings

7.1.1   RQ1: Applying Mental Health Principles into Real Life.—We used stories as a way of engaging people's attention and providing concrete examples of seemingly abstract concepts, thereby reducing the cognitive burden associated with other mental wellness interventions. Our investigations enabled us to identify desirable properties of narrative interventions that would motivate people to apply mental health lessons in their lives. The authenticity engendered by the realistic portrayal of events enabled participants to connect with the story characters and gave them the required confidence to overcome their own struggle. The concrete takeaways at the end played an important role in helping people translate the stories' lessons into their own lives. The explicit prompts for reflection went a step further by encouraging people to visualize the potential benefits of making changes in their own pattern of thinking. Together, the concrete takeaways and prompts for reflection not only reduced the cognitive effort needed to interpret the stories but also mitigated the potential for misinterpretation. That being said, some participants preferred a less prescriptive presentation of stories and wanted to interpret the stories on their own when they had the cognitive resources to do so. A potential way to resolve this tension could be to present the concrete takeaway message after first giving people the chance to contemplate the story on their own through a reflective prompt.

7.1.2   RQ2: Eliciting Benefits of Self-Reflection through Story-Based Text Messages.—Since automated text messaging interventions do not have a live conversational partner to motivate users, we took additional steps to build interactivity into our messaging program and to elicit active participation with our intervention — most notably adding a *reflection* prompt to encourage people to write about their own experiences. Some people used the prompt as an opportunity to draw connections between their own struggles and those of the story characters, ultimately giving them increased

confidence in solving their own problems. Other people used the prompt to assess their thought patterns and discover previously unknown cognitive distortions that had been affecting their decisions. Although we did not explicitly ask participants to seek a solution to their problem, some reported that they were often motivated to make changes after such reflections, including exploring new ways to frame their experiences and alternative actions they could take. Even when participants did not write anything, interview data suggested that the prompt still served as a valuable forcing function for users to read and reflect on the story. We therefore argue that a simple question at the end of a set of story messages can encourage self-reflection that may help users immediately after reading a story, and also beyond.

7.1.3 RQ3: Balancing Message Length and Story Depth.—Our investigations also allowed us to identify several design tensions between message length and story depth that should be considered for future deployments of story-based text messages. On the one hand, participants noted a greater degree of realism when they read stories with more specific details, such as the background of the characters and the actions that led up to their challenges; this finding echoes the observation from prior work that people seek some degree of honesty when they interact with computer systems [104]. On the other hand, participants expressed that text messaging interventions should also be respectful of people's time and energy since they may be received during a variety of activities. Longer stories take more effort to read and digest, and mobile phones can only fit so many characters on the screen at the same time. The combination of these factors led some participants to feel distracted or overwhelmed by our messages. Some participants appreciated our *Start and Switch-Out* format because it allowed them to first see the beginning of a story, which allowed an informed judgment about whether they should continue or not. However, since the previews often centered on the characters' struggles, they could also be off-putting at times. Future work could explore how to generate previews that recognize characters' struggles while also foreshadowing the success they will have in addressing them.

7.2 Contributions to CSCW

Our work extends a body of literature in CSCW on collaborative mental health self-management. A number of mental wellness interventions have sought to facilitate collaborative self-management by connecting peers to communicate with one another and exchange support. However, recent work also suggests that even when individuals are not directly interacting with one another, just learning about someone's experience can create a sense of "diffuse sociality" [19] — the feeling of connectedness with others without direct interactions. Facilitating "diffuse sociality" may be key in mental wellness interventions, because many individuals with mental health concerns may prefer to use interventions independently [94]. Our study shows that important benefits of sociality may be maintained through low-stakes and accessible interactions with an automated system. Furthermore, our work informs the literature on collaborative self-management by suggesting that people can connect to story characters even when knowing relatively little about them. Some related work on digital peer-support platforms has recommended matching people based on their similar life experiences, beliefs, or needs [85], but our findings suggest that just knowing other people are going through similar challenges can validate one's struggle and help them

manage their mental health [5, 66, 128]. Finding connections to story characters enabled participants to draw parallels between stories and their own lives, helping them identify flaws in their behavior patterns and take necessary actions.

We believe our approach could also be improved through further integration of peer support and use of crowdsourcing platforms, drawing on past work from CSCW. For example, after being provided with a short introduction to a psychological principle, crowdworkers could be asked if they have a relevant story that they would be willing to share with others. The quality of these stories could be improved by using a structured sequence of reflection questions (i.e., trigger → feelings → solutions [86]). We foresee that crowdworkers, if appropriately trained, could also help iterate on early story drafts and evaluate them to ensure that they meet a standard of authenticity, relevance, and clarity. Numerous studies suggest that individuals can actually benefit from the process of composing and sharing messages [61, 84], so this mechanism for story generation could also potentially serve as a mental health intervention in itself. Moreover, when a large number of user-written stories are stored in a structured format, peer support platforms can leverage information retrieval techniques to select relevant stories from people experiencing similar problems [77], which may further improve the experience of receiving stories.

7.3 Opportunities for Future Work

7.3.1 Rethinking Text Messaging Applications for Longer Exchanges.—There were some ways in which standard text messaging applications were not ideal for our envisioned interactions. Participants who received longer stories were overwhelmed by the amount of screen space and scrolling it took to read the messages [37], while those who wrote longer responses were forced to switch back-and-forth between the story and the text they were writing [115]. A dedicated smartphone app can address all of these inconveniences to better accommodate lengthier interactions. In fact, an app could even extend the benefits of narrative-based interventions by including multimedia content that makes the stories more engaging with rich multisensory experiences [127]. However, text-only interventions invite readers to use their own imagination to visualize the stories, simultaneously encouraging greater participation and providing greater flexibility as to how readers personalize the scenarios for themselves [41]. The decision of whether to use the default text messaging application or a separate dedicated app warrants further investigation and may require consideration of the target population. For example, text messaging might be one of the very few ways to reach non-smartphone users or people with limited access to smartphones [115].

7.3.2 Personalizing User Experience.—Past work suggests that personalization and variety can increase engagement with stories [114]. There are several promising avenues for engendering these features into our envisioned intervention. Although most participants in our deployment study were satisfied with the relatability of our stories, they also appreciated opportunities to customize stories, and participants made moderate use of two techniques for story topic selection in our deployment study (i.e., selecting a topic at the beginning of the interaction, and switching out a story for a more relevant one partway through). Future interventions could further build the extent of customizability of stories. For example, stories

may allow users to "choose their own adventure" by making decisions in multiple junctures about the way the story should unfold (e.g., picking not only the topic, but also the actions taken by characters), which may allow a more game-like and engaging experience while allowing users to narrow in on the content that interests them the most. Personalization can also be applied to the structure of the stories. Some of our participants appreciated how the concrete takeaway message at the end of the stories helped them interpret the content, summarizing and reiterating points that could otherwise be lost in a thread of messages or matching the straightforwardness of most text messaging interactions. On the other hand, other participants found the takeaway message to be too prescriptive and wanted to come to their own conclusions. Although past literature has noted the benefits of indirect pathways to persuasion [80] and collaborative approaches to sense-making like collaborative empiricism [12], our findings highlight that directness has considerable value for some people. Future work might therefore examine how text messaging systems can adjust the directness of the messaging to people's preferences. Lastly, personalization can be extended to the timing of the stories, as users are more likely to engage with their phones at certain times (e.g., weekend, non-working hours) than others [114].

7.3.3   Enabling Research on the Web.—The concrete takeaway messages at the end of our stories not only helped our participants interpret the content of the stories, but also provided them with vocabulary for situations or feelings that were previously difficult for some people to put into words. In doing so, participants felt that they were better equipped to search online for other helpful resources and examples. This opens up the possibility for stories to serve as a gateway to more expansive online resources, broadening the potential benefits of text messaging services for mental health support. However, due to the abundance of information about mental health online, people might still stumble upon unvalidated or counterproductive advice. Therefore, future work could investigate whether stories could be improved by integrating hyperlinks that lead readers to carefully chosen or crafted online resources.

7.3.4   Considerations for Large-Scale Deployments.—To sustain engagement for more than a few weeks and thereby support a broader set of cognitive interventions, there should be a mechanism for regularly generating new stories. Limiting story creation to a small group of individuals is not only inefficient but would also limit the diversity of the story content. One approach to facilitate large-scale story generation that reflects firsthand understanding of mental health problems would be to leverage users' own content [61]. Many users in our deployment study willingly shared detailed life experiences in response to the *reflection* prompt, which suggests potential for intervention users to crowdsource content during their use of the system. Taking motivation from literature on guided identification of cognitive distortions [86], rich stories could potentially be elicited through structured multi-step prompts that ask users to define their problems, elaborate their experience with the problem, and identify aspects of their behavior or lifestyle they changed to address the problem [54]. Since multi-step prompts require more effort from users, it will be important to understand how users feel about providing such detailed information and sharing it with others. To reduce burden, story generation could be suggested on an infrequent basis (e.g., once every 1–2 weeks) or only to participants who are highly engaged.

As mentioned earlier, another source of stories could be dedicated crowdsourcing platforms like Amazon Mechanical Turk (MTurk). Crowdworkers could be asked not only to create stories, but also rate them according to design goals like authenticity and proper balance of positivity and negativity [48, 61]. The provided ratings could be used to both identify stories that require iteration and examples that can be shared with other story creators. Promisingly, some prior studies have found that non-experts can produce content of comparable quality to experts, while also being much more efficient [13, 78]. However, it is important to note that crowdworkers may lack understanding of psychological strategies compared to mental health treatment experts, and it may be important for clinicians to continue to play a role in curating and editing stories to ensure they accurately represent psychological concepts and strategies. Highly engaged crowdworkers could also potentially be trained to recognize high quality stories, and could play a role in creating, rating, and revising others' stories over time [78]. Regardless of how users are prompted to provide stories, special considerations should go into maintaining users' privacy and acquiring their explicit consent before disseminating their stories to others.

7.4 Limitations

We designed our text messaging probe specifically for young people between the ages of 18–25 since mobile phone usage [118] and susceptibility to mental health concerns [1, 18, 58, 74, 95, 108, 122] are both high in that demographic. Although our participants spanned multiple races and ethnicities, all of them lived in North America at the time of our studies. Hence, our findings regarding people's perceptions of the stories' contents and qualities may be situated within those demographics and cultures. Future work could extend our investigation by recruiting participants from other backgrounds. We also recruited a diverse sample as far as representing both those with mental health symptoms and young adults from the general population, but we were limited in the conclusions that we could draw about differences between these groups due to our small sample sizes. We also believe having more participants would have allowed us to better identify salient themes about the message format.

We also limited our investigations to a subset of cognitive distortions, yet there are many more distortions (e.g., emotional reasoning [43], perfectionism [53]) and psychological principles (e.g., self-compassion [38], behavioral activation [73]) that may be well suited to our design space. Finally, we did not conduct an extended longitudinal deployment since we were primarily concerned with the prerequisite problem of understanding how stories should be designed in the first place. We anticipate that new challenges and opportunities would arise as people engage with a text messaging service over the span of several weeks or months. For instance, our participants generally stated a preference for seeing new stories every time, but seeing the same story weeks later may serve as a helpful reminder.

8   CONCLUSION

Adopting a new way of thinking for improving mental wellness requires a great deal of motivation and effort from people. In this work, we argued that narrative-based interventions have the potential to reduce that burden by concretely illustrating how certain theories

and principles from psychology can be applied in one's own situation. We investigated how stories can be sent via text messaging — a ubiquitous communication platform with limited affordances — using a combination of interviews, focus group discussions, and a deployment. We found that the features that participants appreciated included authenticity, relatability, and a balance between realistic struggles and positivity. We also uncovered challenges regarding the content and format of narrative-based interventions. For example, we found that although longer stories with more details were more relatable to some people, others found them to be overwhelming. We look forward to our findings serving as a catalyst for future investigations regarding narrative-based interventions on text messaging platforms.

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CCS Concepts:

• Human-centered computing → Empirical studies in HCI.
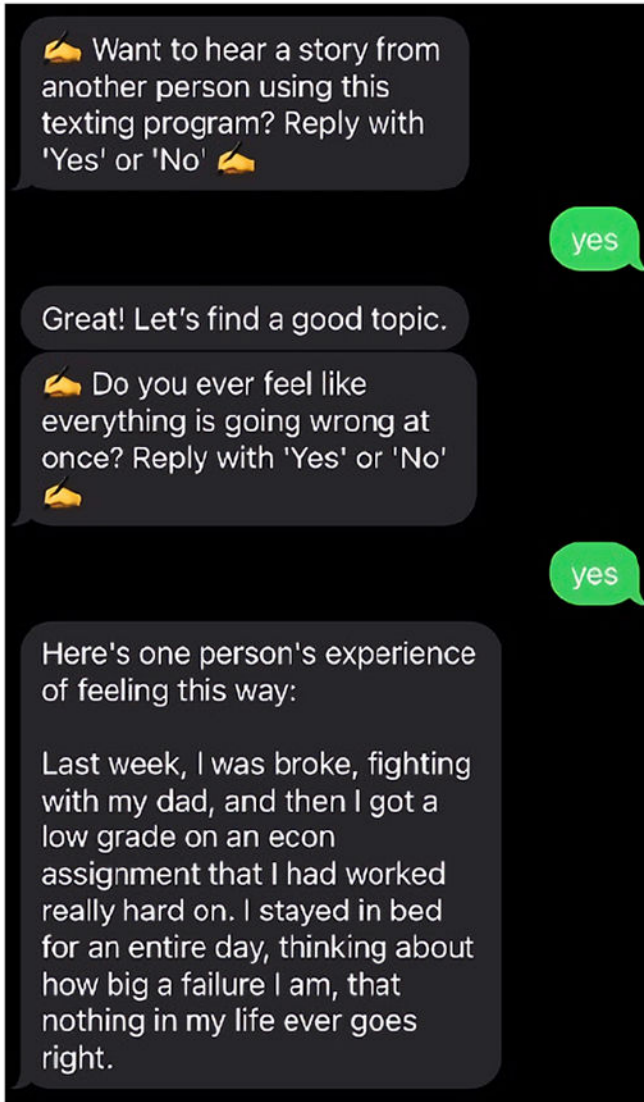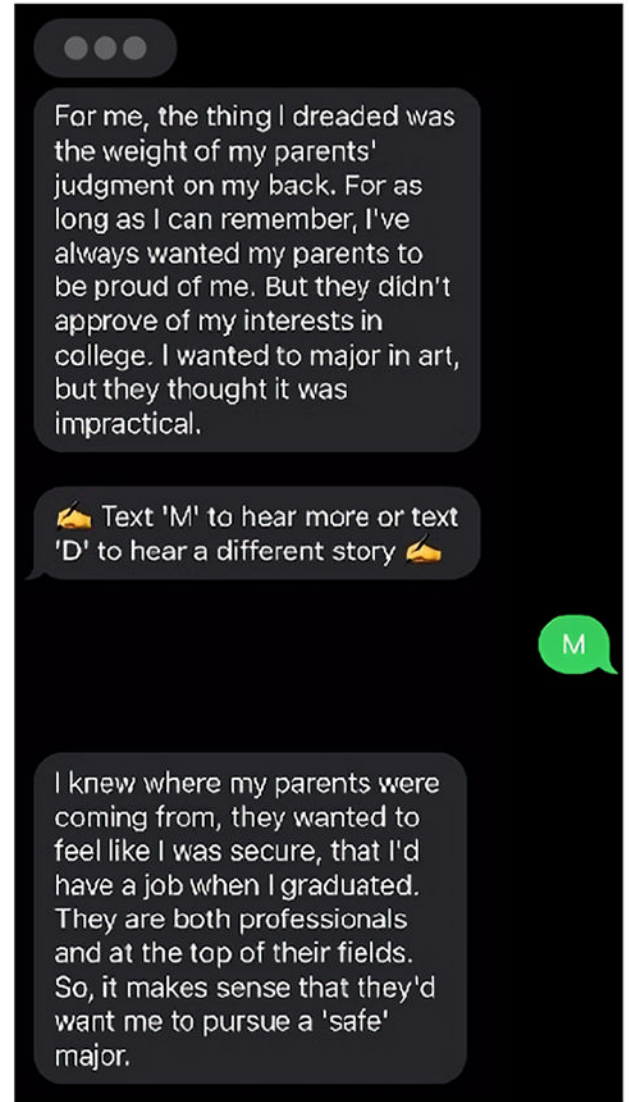
Fig. 1.
Illustrations of how participants would receive stories under (a) *Up-Front Choice* format and (b) *Start and Switch-Out* format. For the *Start and Switch-Out* format, participants would receive the first few messages of the story before being asked if they wanted to see the rest of it.

Fig. 2.
The (a) long and (b) short versions of the story involving the cognitive distortion of overgeneralization.

Table 1.

Summary of the three stories that were sent to participants in our deployment study.

Topic	Summary
Overgeneralization	This story is about an individual who had a series of unfortunate events happen to them over the course of a week, which left them "thinking about how big [of] a failure [they were]". They sought support from a roommate, who reassured them that everyone goes through periods where "everything is going wrong all at once". The roommate also suggests that experiencing one or two "unpleasant" events should not be an indicator of a "never-ending pattern of defeat." The narrator comes to accept that, by focusing only on the negative, they are overlooking that there are many positive events in their life as well.
All-or-nothing thinking	This story is about an individual who felt overwhelmed by all of the work they had to do on a given day. As a result, they "spent over two hours in bed on Instagram just scrolling", which made them feel even worse. They were able to break this cycle once they realized that they could still make some worthwhile progress even if they had not started their day in an optimally productive way. Thus, they challenged the assumption that everything must go exactly as planned in order for them to feel successful during a given day.
Fortune-telling	This story is about an individual whose career interests diverged from their parents' expectations. The narrator explains that they had been avoiding a conversation with their parents about switching their major due to worries it would lead to a fight. After getting advice from a friend, they decide to test their assumptions by having the much-dreaded conversation with their parents. Contrary to their expectations, the narrator finds that their parents are relatively supportive of the new career path and express that they just want their child to be happy. Therefore, the narrator learns that "fortune-telling" about other people's responses is not always a reliable way to navigate the world.

Table 2.

Distribution of story-based messages among different participants

Participants	*Up-Front Choice* format received?	*Start and Switch-Out* format received?
P1–P33	Yes	No
P34–P42	Yes	Yes

Table 3.

The response rates to the various message configurations during our deployment study.

Response Rate	*Up-Front Choice* **format long story**	*Up-Front Choice* **format short story**	*Start and Switch-Out* **format long story**
relatability prompt	13/17 (77%)	18/18 (100%)	5/9 (56%)
reflection prompt	6/17 (35%)	11/18 (61%)	5/9 (56%)