

Case Study

Treating Generalized Anxiety Disorder with Trait-Based Wellness Program: Case Examples

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Abstract

Background: Generalized Anxiety Disorder is a common and debilitating mental illness that may be treated successfully with Cognitive Behavioral Therapy. This study aims to explore how people with symptoms of Generalized Anxiety Disorder respond to an app-based intervention to reduce anxiety based on Cognitive Behavioral Therapy techniques.

Case presentation: A case-study was conducted that included three individuals with symptoms consistent with Generalized Anxiety Disorder. Each individual completed the Dharma wellness program, which utilizes a combination of neuroscience-backed games, journal activities, and challenges to isolate and rectify the cases' specific anxiety behaviors. Data collection consisted of interviews with the cases, results from the Dharma wellness program, and scores on a standardized measure of Generalized Anxiety Disorder symptoms. Each case underwent the 8-week wellness program. Interviews showed that participants reported high levels of success and satisfaction with the program. Results from the Dharma app showed gradual decreases in anxiety and increases in coping behaviors. Anxiety symptoms decreased in all individuals.

Conclusion: All three cases responded favorably to the wellness program. This intervention shows promise for clinical use, as discussed.

Keywords: Dharma Life Sciences; App-based intervention; Generalized anxiety disorder; Case study

Abbreviations

GAD: Generalized Anxiety Disorder; CBT: Cognitive Behavioral Therapy; NICE: National Institute for Health and Care Excellence; RWA: Real-World Actions

Introduction

Generalized Anxiety Disorder (GAD) is a common and disabling disorder. It is characterized by chronic, pervasive anxiety and persistent worry that is multifocal, excessive, and difficult to control [1]. These characteristics are accompanied by nonspecific psychological and physical symptoms such as restlessness, fatigue, difficulty concentrating, irritability, muscle tension, or sleep disturbances [2]. The term "generalized anxiety disorder" may incorrectly suggest that symptoms are entirely nonspecific, and this misconception many sometimes lead to the inappropriate use of this diagnosis. However, excessive worry is indeed, the core and defining feature of generalized anxiety disorder [1].

GAD is the most common anxiety disorder seen in primary care, with lifetime prevalence rates of 4% to 7% of U.S adults [3]. According to representative epidemiologic surveys, the estimated prevalence of

GAD in the general population of the United States is 3.1% in the previous year and 5.7% over a patient's lifetime, a similar rate to that found in other countries [3]. The highest prevalence (7.7%) occurred in the 45 years to 59 years of age range, and is approximately twice as high in women (7%) than in men (4%) [1]. The age at onset is highly variable with some cases beginning in childhood, most beginning in early adulthood, and another peak of new-onset cases occurring in older adulthood, often in the context of chronic physical health conditions [1]. In regards to the recent COVID-19 global pandemic, results of several studies suggest that rates of anxiety in the general population could be more than 3 times higher than that prior to the outbreak [4].

In terms of treatment for GAD, Cognitive Behavioral Therapy (CBT) is the most well studied and highly utilized [2]. Several well conducted meta-analyses have shown significant benefits of CBT compared with control groups and the National Institute for Health and Care Excellence (NICE) guidelines recommend CBT as first line treatment [3]. This technique traditionally combines cognitive therapy-which focuses on monitoring thoughts and understanding self-perpetuated cognitive distortions, habitual thought patterns, and subsequent behaviors-with behavioral therapy, which aims to expose the patient to feared experiences [5]. Exposure therapy is another well studied, effective and highly utilized treatment for fear and anxiety disorders such as GAD [6,7]. It is a repeated approach toward fear provoking stimuli and has been a basis of cognitive behavioral therapy for anxiety disorders since its establishment. Exposure takes various forms, such as graduated (i.e., gradual) *versus* intense and brief *versus* prolonged [8].

Dharma Life Sciences is a personality development intervention designed to help individuals manage and reduce excessive anxiety characterized by GAD. It entails going through an 8-week program

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in which individuals engage with a mobile app called Enhance Personality. This app involves several different types of actions—Brain, Mind, and This app involves several different types of actions—Brain Actions, Mind Actions, and Real-World Actions—that utilize the therapeutic techniques of CBT and Exposure therapy. These techniques are enhanced by neuroplasticity and repetition by having the individual engage with the app for 15 minutes a day. Each of these actions involves different kinds of activities. Brain Actions involve repetitive simulated games, Mind Actions involve CBT exercises, and Real-World Actions involve Exposure therapy exercises. In addition to the app, individuals also have weekly phone calls with a mentor to help facilitate the process. During the call, the mentor reviews with the individual their actions completed for the week along with introducing and explaining new actions to complete for the following week. The actions are gradually implemented and worked on throughout the 8 weeks in the following order: Brain Actions weeks 2-7, Mind Actions weeks 3-7, and Real-World Actions weeks 5-8. The first week of the program is for discovering the individual's maladaptive personality trait while the last is for discussing the individual's improvement.

Dharma Life Sciences introduces neuroplasticity and repetition as a key component of its intervention and, aforementioned, includes a focused approach to CBT and Exposure therapy. Neuroplasticity and repetition is utilized in the form of Brain Actions by having individuals engage in repetitive simulated events that are the opposite of their subconscious/implicit perceptual biases. These simulated events are designed to counteract subconscious/implicit perceptual biases through the fundamental processes of neuroplasticity: synaptic pruning and myelination. The more an individual engages in these simulated events, the stronger neural connections opposite of an individual's subconscious/implicit perceptual biases become (myelination) while simultaneously weakening neural connections of their present subconscious/implicit perceptual biases (synaptic pruning). CBT is enhanced by utilizing perceptual bias statements in the form of Mind Actions in which individuals' journal about trigger/avoidance provoking events (Journal), modify cognitive distortions and habitual thought patterns (i.e., perceptual biases) (Changing-Bias), and learn to appropriately weighing between perceptual-behavioral alternatives (Weighing-It-Out). Exposure therapy is also enhanced by utilizing perceptual bias statements in the form of Real World Actions in which the strength of neural connections opposite of an individual's perceptual biases and behaviors increase by creating new memories associated with actions—actions opposite of their perceptual biases and behaviors—done in the real world.

In regards to GAD, Brain Actions work by having the individual engage in repetitive simulated non-anxiety provoking events in which the strength of neural connections associated with the non-anxiety provoking events increases the more an individual engages with them through repetition. Mind Actions work by first having the individual journal. In Journal, they reflect on recent past events that triggered their anxiety and write notes to help identify aspects of the event that contributed to their anxiety. Changing-Bias is based on the journal entries and enables the individual to focus on the non-anxiety provoking information from the events in order to modify cognitive distortions and habitual thought patterns (i.e., perceptual biases). Weighing-It-Out is also based on the journal entries and enables the individual to appropriately weigh between anxiety provoking information and non-anxiety provoking information in order to predict a likely outcome and respond appropriately.

Changing-Bias example: some individuals with high anxiety who go through our program exhibit the trait high nervousness in which they focus on threatening information rather than non-threatening information. Changing-Bias enables the individual to focus on the non-threatening information rather than the threatening information, thus modifying their perceptual biases.

In regards to GAD, Real World Actions work by having individuals engage in activities (actions) they tend to avoid or get triggered by due to their anxiety. This helps individuals be more inclined to engage in situations they avoid due to their anxiety and improve their ability to handle situations that trigger their anxiety. Neural connections for the avoidance/trigger is formed and strengthened the more an individual avoids/is triggered by these situations. In terms of neuroplasticity, by engaging (being exposed) in activities that an individual typically avoids/is triggered by, the individual will begin to weaken neural connections associated with those triggers/avoidances while simultaneously strengthening neural connections associated with successfully engaging in and completing the activities.

The Real World Actions utilize the graduated form of exposure therapy by slowly and gradually exposing individuals to more and more raw aspects of their triggers and avoidances. This is done by first implementing easy activities, then intermediate activities, and finally challenging activities that expose individuals to more acute and fundamental aspects of their fears, anxieties and avoidances. The gradual increase in the magnitude of these challenges is done so the individual is more comfortable being exposed to the things they avoid and fear the most—therefore, improving the likelihood of having favorable experiences when exposed.

Dharma Life Sciences treats GAD using a trait-based intervention. These traits are assessed as unitary, bipolar constructs. We distinguish the traits based on their unique behavior, behavioral manifestations, triggers & avoidances, and perceptual biases. Furthermore, every trait has a polar opposite, which we refer to as trait-pairs (e.g., nervousness (low) vs. nervousness (high)). Because of this, the perceptual biases and behaviors specific to these trait-pairs are opposite of each other. Anxiety behaviors are associated with the following traits: Sensitivity (high), Sensitivity (low), Nervousness (high), Perfectionism (high), Confidence (low), Obsessiveness (high) and Complacency (high).

Case Presentations

Case 1

Presenting problem: L.R. (not his real acronym) was a White male in his 50s who works at an LGBTQ community center. He came in for complaints of anxiety when he's around people he's never met. This is an issue he's dealt with for as long as he could remember. However, it was exacerbated by the isolation he's had to endure during the Covid-19 pandemic. He also reported nail biting both before and after a work-related or social event, and at random times. Socially, the client was unable to interact with other people without first doing research on the individual. Additionally, fears of catching the Covid-19 virus made it more difficult for L.R. to attend spaces that have a lot of people and spaces where he was uncertain of the health-risk. He's expressed concern for both catching and spreading the virus to others in social settings. In congruence with the Generalized Anxiety Disorder 7 (GAD-7), [9] L.R. reported having "Trouble relaxing" nearly every day (GAD-7 item score 3) and "Worrying too much about different things" more than half the days (GAD-7 item score 2).

Assessment: The client's anxiety levels were assessed using the (GAD-7) inventory. The GAD-7 is a self-reported diagnostic tool used to test for Generalized Anxiety Disorder. It asks for the frequency of anxiety symptoms over a two-week time period using a 3-point scale, from 0 (Not at all) to 3 (Nearly every day). Cumulative GAD-7 scores of 10 indicate moderate anxiety, and 15 indicate severe anxiety. L.P. had an initial cumulative GAD score of 12 prior to the intervention, placing him in the moderate-anxiety range and a likely candidate for Generalized Anxiety Disorder.

Treatment plan: L.P. went in for a diagnostic first and second session with a mentor. After determining his problem areas and how his anxiety presented, he was assigned nervousness (high) as his primary trait. Since nervousness (high) was his primary trait, his treatment plan consisted of engagement in the app and weekly mentoring sessions that focused on rewiring his trait-specific biases. In this case, L.P. was biased to focus on the threatening cues present in a given scenario and as such, was required to focus on the non-threatening cues present in a scenario through an assortment of brain games, mind actions (journaling activities) and real-world actions (behavioral challenges). After journaling, the mentor identified emergent patterns. Firstly, L.P. was often triggered by situations where there was ambiguity. For instance, when dealing with a place or group of people that were new to him, he was unaware of the risk of catching Covid-19. Without such knowledge or preparedness, the client would avoid said situations. The client was additionally triggered by social interactions since he was unaware of how to engage with others without worrying about how he came across to them and what to talk about. In cases where the client felt his nervousness (high) triggered his anxiety-based behaviors, he was instructed to document the following: the trigger and the non-threatening cues he noticed in the situation. In other cases, when L.P. was unable to make a decision related to his high nervousness, he was instructed to turn to Weigh it Out, in which he detailed both the threatening and nonthreatening cues present in the scenario as to 1) objectively weigh which cue is the most prevalent and 2) help him assess whether his decision at the time of the trigger was the most appropriate.

Once L.P. had a few weeks to identify his triggers, he and the mentor decided upon the most appropriate set of Real-World Actions (RWA) to target behavioral change. First, L.P. and the mentor decided to work on his anxiety in social settings. Together, they created a challenge that aimed to improve his comfort in social settings. There were three challenges ranging from Easy ("Try to find common ground with a friend of a friend"), Intermediate ("Try to find common ground with a stranger") and challenging ("Be fully present in a group setting"). These set of challenges were curated to make him more comfortable interacting with unfamiliar people until he could engage with others in a group setting. L.P. reported doing research on the person he would interact with, and coming prepared with conversation topics in advance. When in their presence, he also felt apprehensive. Due to this, the most Challenging level RWA allowed L.P. to practice his social skills in a group setting (i.e. finding a topic to discuss on the fly, learning to relate to different people, and learning to focus on building a connection rather than "presenting" a certain way). From there, L.P. and the mentor were able to determine the easy and intermediate level challenge based on L.P.'s comfort level. The easy level challenge entailed interacting with one person at a time, starting with a friend of a friend. Then, the mentor and client increased the difficulty by having L.P. focus on interacting with a stranger.

L.P.'s second set of challenges centered around his fear of travelling. L.P. was assigned the following challenges: Easy ("Plan a trip to a new destination. Pick restaurants and sightseeing goals", Intermediate ("Visit the destination when it's not busy") and Challenging ("Explore that destination when it's the busiest time"). This challenge was chosen since the client explained feeling anxious in a big crowd and unfamiliar setting. This client wasn't always able to predict which Covid safety measures were integrated nor predict the size of the space. Planning this trip and starting with a less busy and therefore less crowded space eased the client into this challenge.

Lastly, the client was assigned a challenge geared towards risk taking behavior. The challenge—step out of your comfort zone without predicting negative consequences—challenges L.P. to not worry as much about new experiences. The challenges were as follows: Easy ("Make a list of things you have been avoiding without predicting negative consequences"), Intermediate ("Plan an activity to try from that list"), and Challenging ("Try the activity planned"). The client took this challenge one step further and personalized it. L.P. worked towards not avoiding people who may not be vaccinated or wearing masks by going to an unfamiliar crowd while focusing on his own Covid safety measures (i.e., sanitizing and wearing a mask). His ultimate goal was to go to a large crowd he was unfamiliar with, while maintaining his own safety measures.

Assessment of progress: Throughout the program, the client reached and exceeded the recommended rewiring time, which was approximately 75+ minutes per week. Overall, L.P. spent 3 hours and 40 minutes on the brain games, and 4 hours and 6 minutes on the mind actions. L.P. was highly motivated and completed all of the requested activities each week. As early as the 4th week, L.P. reported an increase in risk-taking behavior, relative to what he considered a risk. For instance, journal entries show L.P. taking a spontaneous visit to an indoor musical for the first time. Despite the fact that this was a new experience, an indoor space, and an event that required him to sit in a crowd, L.P. reported not worrying about Covid at all. In fact, the client reported focusing solely on the performance itself, which implied an improvement in mindfulness as well.

When the client attempted the challenges, he was overall relatively successful. For instance, when socializing, the client chose to attend a wedding, where he reported speaking to other guests—colleagues and strangers included. With the guests he didn't know very well, current events served as his main talking point. However, what made this a success according to the client, was his ability to engage with others without feeling nervous during the experience. It helped that his partner was a buffer for the experience. As such, the client agreed to interact with a group of people without his partner nearby for the challenging level activity. By the end of the program, L.P. reported feeling more engaged in group conversations and being more engaging—suggesting his comfort with social interactions did in fact improve.

L.P.'s travel-based challenges were executed when he went on a trip to another state. While there, L.P. went to multiple events that he considered "risky" both because of the size of the crowd, and because of the type of activity performed. Although the client expected to be fearful of catching Covid-19 he appeared pleasantly surprised at his ability to travel, speak to strangers, and fully engage in the activities. His execution of these challenges appeared to be facilitated by his focus on the non-threatening cues and the things within his control—

namely his own safety measures, the knowledge of safety measures in that state, and his newfound comfort socializing due to the prior challenge.

Similarly, L.P.'s last set of challenges, which required him to venture out into large unfamiliar crowds irrespective of Covid, were successful. His success was measured based on his ability to approach the crowds without worrying about Covid 19. L.P. reported "I attended several activities this weekend, including a visit to a casino, which had larger crowds than I expected. However, I was properly masked and used social distance." As shown, although he was unprepared for the size of the crowd, L.P. still managed to focus on the non-threatening cues and reported having a great time.

By the end of the program, L.P.'s reported a cumulative GAD score of 2, which falls within the minimal anxiety range. Although he had trouble relaxing and worried excessively, these behaviors likewise showed a decline by the end of the program. L.P. only reported "Trouble relaxing" several days (GAD-7 item score 1) and no longer "Worried too much about different things" (GAD-7 item score 0) when reflecting on his emotional state in the last 2 weeks of the program.

Case 2

Presenting problem: N.G. (not her real acronym) was an Asian medical student in her 20s. She complained of appearing visibly nervous when she did presentations. She also reported overthinking, feeling irritated when unplanned events occur, and experiencing numbness and tingling on her left wrist, and chest palpitations right before a presentation. N.G. also experienced anxiety when in a crowded space or an inescapable social gathering. In congruence with these problem areas, N.G.'s most frequent anxiety-based behaviors, according to the GAD-7, were "Trouble relaxing," nearly every day (GAD-7 item score 3), "Feels afraid as though something awful will happen," nearly every day (GAD-7 item score 3) and "Becomes easily annoyed or irritable" several days (GAD-7 item score 1). All of these behaviors occurred nearly every day for her.

Assessment: N.G.'s anxiety levels were assessed using the General Anxiety Disorder 7 (GAD-7) inventory. N.G. had an initial cumulative GAD score of 19 prior to the intervention, placing her in the severe-anxiety range and a likely candidate for Generalized Anxiety Disorder.

Treatment plan: After an assessment with the mentor, N.G.'s primary trait was found to be Sensitivity (high). This meant she was more likely than others to focus on information which may amplify her current emotional state, and may focus on information that is irrelevant to what she is doing at the time. As part of her treatment plan, the mentor introduced her to an assortment of activities, namely Brain actions, Mind actions, and Real-World Actions that would enable her to deamplify her current emotional state and focus on information that is relevant. In other words, by looking for information that challenges her current emotional state, N.G. could be able to address her overthinking, catastrophizing, and irritability. There were a few patterns that emerged when N.G. journaled. For instance, when the client was in a social setting, she felt an intense amount of distress. The client journaled "Local Oktoberfest." Once prompted, she expressed the sight of classmates made her uncomfortable because she fixated on how others perceived her. However, after thinking through information that could deamplify her feelings of distress, N.G. acknowledged the fact that it was a fun event, she was with her significant other, and others were too busy to pay attention to her.

Weighing between the information that amplified her emotional state and deamplified it allowed her to realize that staying at the event was the most appropriate course of action. N.G. continued to journal throughout the program using opposing cues to help her decide whether her emotional response was appropriate.

By the 5th week, N.G. and her mentor selected three sets of challenges that she could perform. N.G. often felt overwhelmed and had a tendency to over think. She felt it was appropriate to work on her emotion regulation and as such, agreed to the first challenge: Be emotionally strong by handling emotional situations. The challenges ranged from Easy ("Accept/plan to attend an emotional situation that you have been avoiding e.g. a wedding or separation or a conflict"), Intermediate ("Address an emotional situation you have been avoiding") or Challenging ("Actively engage yourself in the situation without letting your emotional override your ability to find a practical resolution").

The Second challenge, being flexible by embracing changes, was an additional attempt to manage N.G.'s emotion regulation. This particular challenge zeroed in on situations where N.G. perceived a lack of control, which would challenge her to be amenable to change rather than irritable when unexpected changes occur. This challenge consisted of Easy ("When an unexpected change/s occurs, take steps to incorporate the change/s into your existing plan"), Intermediate ("Make alternative arrangements so you can transition smoothly during the change") and Challenging ("Execute the altered plan and see it through").

Whereas the first two challenges were preselected from the app, N.G.'s final set of challenges (Accept Criticism) was personalized. One of N.G.'s main goals was to not appear as nervous in front of others, especially during a presentation. Additionally, as part of her Sensitivity, she was strongly averse to criticism. Due to this, N.G. and the mentor agreed it would be best to dually work on her response to criticism as to sharpen her presentation skills. For the challenge, N.G. was expected to ask close others for her strengths and weaknesses (Easy), choose one weakness to work on (Intermediate) and finally make that change (Challenging).

Assessment of progress: Most weeks, N.G. reached the recommended rewiring time (75 min/week). Overall, she spent 3 hours 25 minutes on the brain games, and 3 hours, 33 minutes on the mind actions. N.G. was compliant during the session and completed all recommended mind actions and nearly all real-world actions. However, she was did not progress as fast as she would have liked, likely due to the severity of her anxiety levels during the onset of the program. She did not complete many challenges in their entirety. For example, N.G. did not get to execute "Actively engage yourself in the situation without letting your emotional override your ability to find a practical resolution," since she spent her time making multiple attempts at the intermediate level challenge "Address an emotional situation you have been avoiding." As a result, N.G. was assigned an additional session. By the end of the 9th session, N.G. reported seeing a disappearance in her physical symptoms prior to and during her presentation.

When the client attempted the challenges, she was partially successful overall. For instance, when confronting an emotional situation, N.G. often chose to ask for letters of recommendation and a review of her personal statement to complete this challenge. These were requests that made her feel vulnerable as she would have

to confront people of authority and receive commentary on her performance. Although she was able to ask for the documents, which allowed her to address the emotional situation, she wasn't always actively engaged. In asking for this help *via* email, the client avoided uncomfortable feelings, such as feelings of overwhelm. Due to this, the mentor requested that the client ask for feedback in person. The client did so, but again did not hold a conversation for longer than a few seconds unless the doctor prompted her to do so. She reattempted this challenge multiple times before she was able to hold a substantial conversation in person regarding her personal statement.

The next challenge, requiring that N.G. handle an unexpected change, was not completed in its entirety. She attempted the easy level (Take steps to incorporate the change/s into your existing plan). The client needed her car to be fixed, which required bringing it to a car dealership. However, what made this challenge unsuccessful was the lack of initiative that the client took on her own; she reported panicking had someone address the situation on her behalf. Although it was recommended that N.G. address the next unexpected change on her own, the intermediate level challenge (make alternative arrangements so you can transition smoothly during the change) wasn't attempted. Rather, N.G. attempted the Challenging level (Execute the altered plan and see it through) when another situation occurred. In reporting the challenging activity, N.G. wrote of a last-minute physical exam she was asked to demonstrate in front of second year students. This was successful in her opinion, since she got it done despite feeling nervous.

Of the three challenges, N.G.'s most attempted pertained to accepting criticism. For easy (ask somebody about my strengths and weaknesses) and intermediate (choose one weakness to work on) level challenges, N.G. was not successful until several attempts. For instance, when she asked for feedback via email from people of authority at her medical school, it took her four days to read the responses. It was her avoidance of said feedback that dictated an unsuccessful challenge. However, when she did read the comments, she reported that she didn't take anything too personally. Many of the critiques she received were unsurprisingly related to her presentation skills. N.G. presented several times, however, still felt students could sense her nervousness. Due to this, the mentor recommended N.G. vary her presentations based on the audience (i.e., presenting to authority figures rather than other students) and based on the size of the audience. By her final week, she felt she was successful in improving her presentations since she was no longer accompanied by the physical symptoms she experienced prior to and during a presentation. She also felt her presentations were "okay" by her final week.

At the completion of the program, N.G. reported a cumulative GAD score of 8, which falls in the minimal anxiety range. All of her most frequent anxiety behaviors—"Trouble relaxing," "Feeling afraid as if something awful might happen," and "Becoming easily annoyed or irritable"—declined in duration. These behaviors reduced to several days (GAD-7 item score 1) in her final two weeks of the program.

Case 3

Presenting problem: R.V. (not her real acronym) was an 18-year-old White university student. R.V. was concerned with how much anxiety she experienced over many "little things". She hoped to be more in control of her thoughts and her life. After further exploration, it was revealed that she experienced overthinking and physical symptoms (racing heart, lightheadedness, and heat flashes) when

she had verbal confrontations with others. According to her GAD-7 scores, her congruent problem areas were "Feeling nervous, anxious, or on edge" nearly every day (GAD-7 item score 3) and "Being so restless that it's hard to sit still" nearly every day (GAD-7 item score 3).

Assessment: The client's anxiety levels were assessed using the General Anxiety Disorder 7 (GAD-7) inventory. R.V. had an initial cumulative GAD score of 17 prior to the intervention, placing her in the severe-anxiety range and a likely candidate for Generalized Anxiety Disorder.

Treatment plan: Once R.V. was assessed by a mentor, her primary trait was found to be Confidence (low). This meant she was biased to focus on her negative qualities and other people's negative evaluations of her. Low confidence may explain her tendency to over think how she comes across to others and her tendency to worry about her performance. As part of her treatment, R.V. was asked to focus on her positive qualities and other people's positive evaluations of her via Brain Actions, Mind Actions, and Real-World Actions. When the client completed Mind Actions, it was revealed her most common triggers were her appearance, critiques, social interactions, and feeling uncomfortable when she was uncertain. When the client journaled, she was asked to identify other people's positive opinions of her that may offset her own assumptions. She was also asked to think about her own self-concept—what were things that were characteristic of her? What were the benefits of having these qualities? And how can this reinforce a positive self-image? Through these considerations, the client started to acknowledge the following: 1) Critiques can simply be a difference of preference and 2) her opinions of herself can sometimes outweigh other people's opinions. Take this entry for instance: "My brother said I should add more color to a picture I painted, but he said it was painted nicely and he liked my shading." Here R.V. didn't focus solely on the critique. She started integrating the rewiring into her interpretation of this situation, as shown by her juxtaposing the critique with the positive commentary she witnessed. In doing so, she started focusing more on her positives.

The challenges R.V. agreed to were centered around her comfort in social settings, improving her wardrobe, and asking for help when it's needed. There were two sets of challenges that facilitated her ability to make friends and be comfortable speaking up in front of strangers. The first, "Mingle with others in a group and join their conversation", consisted of Easy ("Prepare a few topics for conversation"), Intermediate ("Make eye contact with individuals in the group and participate equally") and Challenging ("Take charge and initiate a new topic to be discussed with the group.") Whereas these challenges emphasized one-on-one interactions, the second challenge emphasized placing oneself in a space to make friends. This personalized challenge addressed social anxiety and was as follows: Easy ("Join a club that I'm interested in"), Intermediate ("Attend the first meeting of the club"), and Challenging, ("Reach out to somebody who seems interesting.")

The third challenge addressed R.V.'s level of comfort in the clothing she wore. This was integral to the client since feeling uncomfortable in what she wore inhibited her from feeling comfortable talking to others. Due to this, the client agreed it would be best to think about her individuality and start investing in clothing that best represents who she is and makes her comfortable. The challenges were as follows: Easy ("Find a store or website to purchase clothes from"), Intermediate ("Buy clothes and try them out") and Challenging ("Wearing the clothes around others without worrying about what they think.")

R.V.'s fourth and final challenge was a customization of a preselected challenge. The challenge, "Improve your capabilities by confidently pursuing an activity/task that you have put on hold—get help from psych teacher," was selected so R.V. could work on accepting help from others. R.V. had a tendency to procrastinate when she wasn't sure of what to do with an assignment. The perceived cause of the behavior was to not appear incompetent if she did ask for help. To improve her performance, R.V. agreed to the following challenge: Easy ("Consult a person who has expertise in the field about it"), Intermediate, ("Arrange for the resources and execute the task/activity"), and Challenging, ("Discuss your success with the expert, whom you approached before.")

Assessment of progress: Every week, R.V. met and exceeded the recommended rewiring time (75 min/week). Overall, she spent 3 hours 40 minutes on the brain games, and 4 hours, 6 minutes on the mind actions. R.V. was self-motivated and very receptive to suggestions made during sessions. As early as the 6th week, the things that typically triggered the client no longer bothered her.

R.V. reported success for all of her attempted challenges. For instance, to improve her socialization, R.V. thought about conversation topics related to her mutual interests with peers. When it was time to exercise her social skills, she accomplished the following: she made more eye contact than usual around others in the group and had a fun time. By the final week of the challenge, R.V. reported starting and maintaining conversations with her peers. She took an active role in extending the conversation, which reinforced her feeling of accomplishment. R.V. also took note of the lack of awkward silence present in the conversation as an indicator of success. The related series of challenges—whereby R.V. joins a club to increase her social connections—was likewise executed well. The client was able to join a club that aligned with her interests and learned interesting things during that first meeting. By the time she completed the challenging level challenge ("Reach out to somebody who seems interesting"). She reported no longer experiencing anxiety while talking to others. This challenge allowed her to realize her anxiety in social settings wasn't as bad as she originally thought.

R.V.'s second set of challenges centered around her choosing a new wardrobe for herself. Her easy level challenge ("Find a store or website to purchase clothes from") was a success as she was able to narrow down a few websites where she would choose to purchase the clothing. After buying the clothing, she was positively reinforced by a stranger's compliments on her clothing. Upon reflection, the client agreed that how others perceived her was a reflection of how comfortable she was in herself and her clothing. This gave R.V. the boost she needed to continue wearing this clothing in public. For her final challenge, she wore the clothing around her school, and marked her success based on the lack of critiques she encountered regarding her attire. She reported feeling comfortable as well—signifying a transition from being her own worst critic to more self-accepting.

R.V.'s final challenge—pursuing an activity that she's put on hold—was executed when she asked a psychology professor for help on an assignment. In all three of her attempts, she yielded positive results. For instance, in her easy level challenge, she consulted with her professor to figure out how to approach an assignment for class. After the consultations, she gained a perfect score on the assignment and took note of her professor being judgement-free when she asked for help. Realizing she would not be judged for not knowing what to do helped her continue this challenge. According to the client,

the intermediate ("Arrange for the resources and execute the task/activity") and challenging ("Discuss your success with the expert, whom you approached before") level activities also went well. She was able to execute another paper after asking for help. This ultimately made the writing process easier for her.

Upon completion, R.V. reported a cumulative GAD score of 5, which falls within the mild anxiety range. Prior to the program, she felt "nervous, anxious, or on edge" and was "So restless that it's hard to sit still" nearly every day. At the end of the program, she reported experiencing the former more than half the days (GAD-7 item score 2) and the latter only some days (GAD-7 item score 1)—demonstrating a decline in the frequency of both behaviors.

Discussions and Conclusions

These cases show how Dharma's intervention may reduce anxiety levels that are characteristic of GAD. In all three cases, the clients' cumulative GAD scores fell to a minimal or mild anxiety level after the 8-week program. Likewise, the most prominent anxiety behaviors as indicated by GAD item scores, declined for all three. As a result, overall anxiety levels and prominent anxiety behaviors were improved by taking a trait-focused & neuroscience-based approach. For instance, although all three clients reported some form of overthinking, the behavior occurred due to different triggers. Whereas R.V.'s was triggered by not dressing to her standards, N.G.'s was triggered by being in social settings, and L.R.'s was triggered by thoughts of risks of catching and spreading Covid-19. All three triggers accounted for their overthinking and inhibition around others; however these triggers were best explained by their respective traits (Confidence (low), Sensitivity (high), and Nervousness (high)). Therefore, trait-based approaches much like the one utilized here, can offer a targeted and personalized way of treating anxiety behaviors characteristic of GAD.

It is important to note that all three clients met or exceeded the minimum time required to fulfill the weekly activities. Additionally, the clients who had the lowest cumulative GAD scores were highly motivated. Therefore, it is plausible that two additional factors play a role in the improvements seen and that is level of motivation, and amount of rewiring time spent on the activities. A third factor that is important to note is the COVID-19 global pandemic. It has given rise to more cases that have developed anxiety. It has also shifted social dynamics. It is therefore not surprising that L.P., N.G., and R.V. had social shortcomings. Nonetheless, the cases all showed improvements navigating social situations. The paradigm for this program could potentially benefit those who have anxiety, are self-motivated, and are looking to re-adjust to their life circumstances.

Aforementioned, Dharma has identified several indivisible personality traits linked to GAD: sensitivity (high), sensitivity (low), nervousness (high), perfectionism (high), confidence (low), obsessiveness (high), and compliancy (high). As demonstrated by the case studies, each of these indivisible anxiety—related traits exhibit specific anxiety—related symptoms and behaviors. For example, the individual in the first case study, L.P., had the trait nervousness (high) and exhibited the specific anxiety-related behavior of hyper-vigilance and persistent worry due to constant anticipation of threat when being around people they had never met or after engaging in a social event. In comparison, the individual in the second case study, N.G., had the trait sensitivity (high) and exhibited the specific anxiety-related behavior of excessive emotional reactivity before giving a presentation, which manifested into overthinking and feeling irritated

when unplanned events occur.

For the clients to rectify their personality traits, each client engaged in activities opposite of their specific anxiety-related perceptions and behaviors *via* Dharma's mobile app Enhance Personality. For example, the client R.V. who had the trait Confidence (low) exhibited the following behavior: doubting her own abilities and capacities with regards to her ideas, opinion, actions, etc. Because of this, R.V. was biased to focus on others' negative opinions of her rather than positive opinions, and was unable to weigh between others' negative opinions and positive opinions of her to determine her identity relative to a situation. Furthermore, R.V. was biased to focus on her negative opinions of herself rather than positive opinion and was unable to weigh between her own positive and negative opinions of herself to determine her overall identity. Therefore, to help counteract these perceptual biases, R.V. engaged with the Enhance Personality's activities for the trait Confidence (low). These activities were designed to enable R.V. to 1) focus on others' positive opinions of her rather than negative, 2) focus on her own positive opinions of herself rather than negative, 3) weigh between others' negative opinions and positive opinions of her to help determine her identity relative to a situation, and 4) weigh between her own positive and negative opinions of herself to help determine her overall identity.

Aforementioned, these activities were divided into three categories—Brian, Mind, and Real-World Actions—and were gradually implemented over the course of 8 weeks, utilizing CBT and Exposure therapy as its key components. CBT and Exposure therapy were enhanced through neuroplasticity by having the clients engage in these various, repetitive activities on the Enhance Personality app for 15 minutes per day along with weekly mentor phone calls to facilitate the process.

Based on the outcome of the three case studies, Dharma's intervention may help individuals manage and reduce excessive anxiety that is characteristic of GAD. Overall, each client reported a decline in anxiety levels. In all cases the posttest anxiety levels reduced to a minimal-mild anxiety range *via* the GAD-7 in which they no longer had clinically significant levels of anxiety, suggesting that Dharma's approach may be helpful for reducing anxiety.

Declarations

Ethics approval and consent to participate

This study was approved the Advarra Internal Review Board (Pro00054638)

Consent for publication

No identifiable data of participants is included in this manuscript.

Availability of data and materials

The datasets generated and/or analyzed during the current study are not publicly available due to the risk of identifying participants; but are available from the corresponding author on reasonable request.

Competing interests

MP and SW are employed by Dharma LLC. JAW received a consulting fee from Dharma LLC.

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Authors' contributions

MP and JAW designed the study. MP and SW contributed to recruiting participants and the data collection process. MP completed the data analysis with input from the Dharma LLC mentors. All authors drafted and approved the manuscript.

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