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Emerging Role for Technology in Positive Psychiatry Interventions

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**Emerging Role for Technology in Positive Psychiatry Interventions:  
Importance of Convergence Medicine in Improving Mental Well-being**

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## Abstract

Increasing well-being, happiness, resilience, wisdom, and related positive psychiatry outcomes is possible via behavioral and psychological interventions. Convergence of psychiatry with computer science, engineering, and related disciplines will allow for the impact of these interventions to be personalized, maintained, and augmented in a number of ways. To illustrate such potential impacts, we use an example of a recent trial of a novel intervention to improve resilience within senior housing communities. Specialized technologies have the potential to improve fidelity and dissemination of positive psychiatry interventions. With the shortage of specialized mental health clinicians and the growing need for mental health services, technology can be used to extend the in-clinic services and provide greater support in the free-living environment. Development of such technologies to improve well-being will require mental health specialists to work directly with computer scientists, engineers, and people with mental illnesses. These collaborations will require infrastructure and support from research and academic organizations that partner with industry and community-based agencies and organizations.

**Keywords:** Positive psychiatry, resilience, wisdom, perceived stress, successful aging, technology

*Happiness is the consequence of personal effort. You fight for it, strive for it, insist upon it, and sometimes even travel around the world looking for it. You have to participate relentlessly in the manifestations of your own blessings. And once you have achieved a state of happiness, you must never become lax about maintaining it.”*

— Elizabeth Gilbert (from *Eat, Pray, Love*)

### **Positive Psychiatry**

Traditional psychiatry has focused on assessment and alleviation of specific symptoms and functional impairments (e.g., depressed mood, hallucinations, anxiety, sleep impairment). The psychiatric assessment methods currently in use rate the severity and impairment of targeted symptom and functional domains, and focus on how medications and psychotherapies can reduce problematic symptoms and alleviate impairment. However, this model does not consider going beyond symptom reduction and relapse prevention by seeking to increase happiness and greater well-being among people with mental illnesses. In short, traditional psychiatric research and practice are oriented around the traditional medical model, wherein the focus is on identifying and treating disease states and avoiding exacerbations.

Yet, the medical model itself is changing. Patient satisfaction and well-being are increasingly considered the top priority for modern healthcare. In that spirit, our group has been advocating positive psychiatry as the “the science and practice of psychiatry that seeks to understand and promote well-being through assessment and interventions aimed at enhancing behavioral and mental wellness” (Jeste, Palmer, Rettew, & Boardman, 2015, p. 676). Thus, improvement in positive psychological traits, such as optimism, resilience, wisdom, social

engagement, personal mastery, coping self-efficacy, and spirituality are the focus of positive psychiatry (Jeste and Palmer, 2015). Such traits have been closely linked with better well-being, lower perceived stress, greater posttraumatic growth, recovery, and prevention of psychopathology as well as improved physical health and cognitive function along with optimal levels of aging-related biomarkers and decreased mortality (Diener & Chan, 2011; Lee, Lavretsky, Renn, & Areal, 2018; Rasmussen, Scheier, & Greenhouse, 2009).

The roots of positive psychiatry can be traced back to the early perspectives of psychologist-physician William James who introduced the concept of a “mind-cure,” defined as the healing abilities associated with positive emotions and beliefs (Froh, 2004). Half a century later, James’s mind cure concept was expanded and extended by Abraham Maslow and colleagues in the form of humanistic psychology (Maslow, 1971). According to Maslow, clinical outcomes among people with mental disorders were best improved by assessing and enhancing overall health and creativity. In the late 1990s, Martin Seligman and colleagues shepherded the positive psychology movement, aiming to improve wellness in the general population, i.e., people without psychiatric, cognitive, or physical illnesses (Seligman & Csikszentmihalyi, 2000).

Positive psychiatry is an emerging subdiscipline that incorporates the complementary training backgrounds of psychiatrists, psychologists, and other mental health clinicians like nurses, social workers, occupational therapists, etc. to further enhance mental health for people with mental and physical illnesses (Eglit, Palmer, & Jeste, 2018; Jeste & Palmer, 2015; Jeste et al., 2015; Jeste, Palmer, & Saks, 2017). Thus, the purpose of the current chapter is to showcase positive psychiatry interventions and the opportunities for convergence psychiatry – *viz.*,

development and use of technology to both assess and promote positive psychological traits and experiences.

One challenge for positive psychiatry, especially in the arena of empirical evidence-based research, is the historically heavy reliance on self-rated assessments of positive psychological traits, common to most studies of personality and well-being. While there is great value in assessing the subjective experience of individuals, there are potential pitfalls of both conscious (e.g., deliberate deception) and unconscious (e.g., impression management) biases in human introspection and subsequent reporting (Chan, 2009). Development of well-validated and psychometrically sound scales for positive psychological traits is warranted for people with and without mental illnesses. Furthermore, there are opportunities to use technology in the form of mobile applications, passive sensors on smartphones, and wearable sensors to assess and promote behaviors that would improve positive psychiatry-related outcomes. For example, Ecological Momentary Assessment (EMA) on smartphones (such as an application that randomly surveys a participant throughout the day about how they are feeling and what they are doing) is one such tool that would more accurately gauge an individual's social engagement and their enjoyment of those activities. Similarly, passive sensors on smartphones could be used to objectively assess a person's online/social media-related activities in order to derive "behavioral biomarkers" that reflect traits like social advising, emotional regulation, compassion, or decisiveness. Data from wearable sensors that track sleep, heart rate, physical activity, and GPS location could be analyzed using Artificial Intelligence (AI) algorithms to track behavioral changes in real-time. Abrupt shifts in sleep or activity, such as a reduction in the number of hours of sleep in a person with bipolar disorder, could herald worsening mood symptoms like mania, depression, or psychosis. In this way, technology can be used to proactively connect

patients to their mental health treatment teams to avoid a full-fledged relapse via medication or psychotherapy-driven interventions.

Increasing well-being, resilience, happiness, and related positive psychiatry outcomes is possible via behavioral and psychological interventions. These interventions target populations with a range of levels of baseline well-being; meaning that people who are already doing fairly 'well' can benefit from these interventions as well as those who are actively symptomatic. Among some clinicians, there is a misperception that in persons with psychiatric disorders one must focus on remission of symptoms before working on increasing positive outcomes like happiness, meaning, and well-being. This is assuredly not the case. In fact, targeting outcomes like hope, self-determination, and meaning in life can often be the mechanism by which people with psychiatric disorders would find relief (Winsper, Docherty, Weich, Fenton, & Singh, 2020).

### **Positive Psychiatry Interventions**

Convergence of psychiatry with computer science, engineering, and related disciplines will allow for the impact of these interventions to be personalized, maintained, and augmented in a number of ways. To illustrate these potential impacts, we use an example of a recent trial of a novel psychosocial group intervention in senior housing communities to improve resilience and reduce perceived stress (Treichler, Glorioso et al., 2020).

Older adults commonly experience stressors related to a decline in physical, cognitive, and functional abilities, loss of purpose and of independence, bereavement, societal ageism, and financial hardships (Almeida et al., 2011). Chronic stressors have cascading effects on physical and mental outcomes, including worse overall well-being, increased depression, and greater physical disability and mobility limitation (Dautovich et al., 2014; Frias & Whyne, 2015;

Kulmala et al., 2013). Stressful events increase the likelihood of chronic metabolic, pulmonary, and cardiovascular diseases (Scott, et al., 2013). These stressors are often unavoidable in modern western societies, given the realities of aging, so identifying methods to enhance older adults' ability to manage stressors is essential.

Resilience refers to the trait as well as the process of adapting well in the face of adversity, trauma, loss, and other sources of stress (Ong et al., 2009; Rutter, 2007; Jeste, et al., 2013). Resilience is a modestly heritable personality trait and is partially malleable (Chmitorz, et al., 2018; Johnston et al., 2015). Resilience is associated with lower levels of anxiety, depression, and general psychological distress, and has a mediating effect on physical and mental health in people who have experienced trauma as children or adults, and those managing chronic health conditions (Hjemdal et al., 2011; Mujeeb & Zubair, 2012; Stewart, 2011; Wingo et al., 2010; Lee, et al., 2018). Resilience decreases perceived stress, and people who are less impacted emotionally by daily stressors have lower incidence of mood disorders 10 years later (Charles et al., 2013), indicating the long-term value of pursuing methods of decreasing perceived stress.

Among older adults, high resilience has been shown to be a significant determinant of well-being, and is associated with lower levels of perceived stress as well as greater happiness, and better quality of life (Jeste et al., 2013; Lavretsky, 2014; MacLeod et al., 2016; Smith & Hollinger-Smith, 2015). Similarly, other constructs characterizing positive psychology and psychiatry (Jeste, 2018), including wisdom, optimism, personal growth, and happiness, positively impact well-being, mental health, and physical functioning among older adults (Depp et al., 2014; Engel et al., 2011; Jeste et al., 2015; Laird, 2019; Reichstadt et al., 2010). Therefore, enhancing these outcomes may promote successful aging (Reichstadt et al., 2010; Depp et al., 2006). However, only about a third of the older adults score high on resilience measures (Jeste et



al., 2013; Hildon et al., 2010), indicating that increasing resilience may be a promising strategy to enhance well-being and quality of life among older adults.

Existing literature on methods to improve resilience among older adults is limited. The only published study in this specific arena that we found was a pilot study examining the use of a one-week savoring intervention, which reported that adults over age 60 who completed the brief intervention with high fidelity (i.e., engaged in the intervention for at least 6 days, 60% of the sample) showed reduced depression and improved resilience and happiness, unlike the other 40% participants, indicating that consistent engagement was important (Smith & Hanni, 2019). More broadly, a few interventions in older adults targeting related positive psychology/psychiatry domains have found evidence of benefit (Ho et al., 2014; Killen & Macaskill, 2015; Meléndez Moral et al., 2015).

The population of older adults living in senior housing communities is increasing (Jeste et al., 2019; Jeste & Childers, 2017), presenting an important opportunity to improve physical and mental healthcare in these communities (Borson et al., 2019; Guo et al., 2012). Implementing positive prevention strategies in senior housing communities offers a method to assist older adults in maintaining health, well-being, and independence as they age (Guo & Castillo, 2012; Dong, 2017). Our team at the University of California, San Diego, along with the Mather Institute developed a manualized psychological intervention, Raise Your Resilience (RYR), intended to improve resilience and related outcomes among older adults living in senior housing communities.

**[TABLE 1 ABOUT HERE]**

Development of RYR was driven by empirical literature including consistent findings that experience of positive emotions, savoring of positive experiences, and use of adaptive coping skills are associated with greater resilience among older adults (MacLeod, 2016). RYR included savoring, gratitude, and engagement in value-based activities to improve resilience. Group members were taught to savor by recording one event each day that made them feel happy and one accomplishment or activity that made them proud in a daily diary. Gratitude practices were incorporated because they are associated with improved physical and mental health (Jans-Beken et al., 2019; Killen & Macaskill, 2015). Due to past findings that perceived age discrimination negatively impacts well-being and mental health *via* more negative perceptions of aging (Marquet et al., 2018; Martin, et al., 2019), RYR incorporated explicit discussion of the impact of age discrimination and associated stereotypes along with methods to fight those stereotypes and improve self perceptions of aging.

RYR was delivered in three 90-minute sessions at weeks one, two, and four by an unlicensed but researcher-trained residential facilitator, and focused on three positive psychology-oriented topics: aging as a time of continued growth and enjoyment, making small changes to increase positive emotions, and engagement in values-driven activities. At the beginning of RYR, participants set short-term individualized goals to make life more enjoyable and meaningful. The group facilitator assisted in identifying and encouraging concrete values-driven activities to achieve participants' short-term goals. At the end of the one-month RYR intervention, the participants were encouraged to continue the daily diary and other activities during the 3-month follow-up period and beyond.

We designed our trial based on the principles of pragmatic clinical trials (Mdege et al., 2011; Patsopoulos, 2011). These are randomized controlled trials that focus on participants in

real world, with few exclusion criteria, randomization at group rather than individual level, and administration of the intervention by unlicensed non-research staff. This study used a modified stepped-wedge trial design, which is an alternative method of conducting cluster randomized trials (Copas et al., 2015; Hemming et al., 2015; Woertman et al., 2013). This approach allows for all participants to receive the intervention while still having data from a control period to compare the intervention data to. Unlike a classical stepped-wedge design, start dates were not uniformly staggered; they were chosen based on the availability and readiness of each site. The control period consisted of treatment as usual. Each group underwent baseline assessment at month 0, followed by pre-intervention assessment at month 1, post-intervention assessment at month 2, and follow-up assessment at month 5.

Eighty-nine older adults residing in independent living sector of five senior housing communities across three states (California, Illinois, and Arizona) participated. These individuals were expected to have relatively high resilience at baseline though they still experienced a range of significant stressors. Our primary hypothesis was that older adults who participate in RYR would have higher levels of resilience and well-being and lower level of perceived stress at the end of the one-month intervention. We also examined changes in these parameters at the end of the follow-up period.

We used generalized estimating equations (GEE; Tang et al., 2012) and self-report measures of resilience, well-being, perceived stress, and wisdom. Compared to the control period, resilience improved among participants from pre-intervention to 3-month follow-up, and perceived stress and wisdom improved from pre-intervention to post-intervention. Among wisdom subscales, emotional regulation and social advising improved significantly while tolerance of divergent values approached significance during the intervention period compared to

the control period. Effect sizes for the significant outcomes were small (Cohen's  $d = |0.115| - |0.221|$ ). There were no changes in physical or mental well-being.

Although the effect sizes of the outcomes that changed significantly were small, this may be attributable, in part, to the high baseline resilience of the sample, resulting in a ceiling effect. Still, it is notable that among these highly resilient participants, further significant improvements were detected, consistent with our goal of preventing decline in health and well-being by fostering protective psychological mechanisms. Although scores trended upwards from pre-intervention to post-intervention, changes in resilience were only significant from pre-intervention to 3-month follow-up. This indicates the value of continued use of the practices taught in RYR, including use of a daily diary and engagement in value-based behavior.

Our conclusions regarding maintenance of practices taught in RYR lead to the first potential way that technology could help maximize potential impact of positive psychiatry interventions. In many psychosocial and behavioral interventions, clinicians work with patients to learn new behaviors including coping mechanisms, and often provide resources like printed handouts for patients to use as they practice. For example, the RYR intervention included use of a daily gratitude diary. During the intervention itself, participants reported remarkably high adherence to the diary: the median number of days completed was 28 out of a possible maximum of 31. However, adherence to at-home practice is often low, despite its importance for treatment outcomes (Decker et al., 2016).

### **Technology for Positive Psychiatry**

Technology can be used to monitor and enhance treatment adherence outside of treatment appointments; for example *via* ecological momentary assessment (EMA; Moore et al., 2016).

Thus, EMA could be used to monitor engagement in previously identified value-based behaviors as they occur, or at  $n$  times throughout the day. EMA is most commonly used via apps installed on a smartphone that prompt participant response, although other models use automated or live phone calls (Shiffman, Stone & Hufford, 2008). EMA is more sensitive and more accurate than asking participants to estimate their behaviors retrospectively (Ebner-Priemer & Trull, 2009). In addition, clinicians can access EMA data as these are collected to monitor participant treatment engagement, increasing the ability to respond proactively and adjust treatment as needed. Implementation of EMA or other monitoring may itself improve treatment engagement on its own, by creating embedded reminders about at-home practice.

At the end of positive psychiatry interventions, patients are responsible for continuing the use of newly learned behaviors, with few interpersonal or functional supports to do so. It is no surprise, therefore, that many patients struggle to use such coping strategies learned, despite their effectiveness. For example, one small qualitative study of nine people who completed cognitive behavioral therapy (CBT) noted that in some moments, like times of crisis, it was more difficult to recognize that it was a good time to try a CBT technique, and that introducing new behaviors felt too overwhelming or challenging in specific situations like a long-term family conflict (Glasman, Finlay, & Beck, 2004). Technology offers valuable approaches to provide resources and support after therapy ends to facilitate maintenance of benefits already acquired, as well as continued growth in targeted areas. In the RYR study, we did not monitor continued use of the daily diary post-intervention, but posit that such use is key to continued benefit, given that the theoretical mechanism of change included gratitude and savoring practices, both of which were facilitated by the diary. Technological strategies like EMA can *measure* post-intervention

treatment engagement, but more than that, these strategies can *facilitate and promote* treatment engagement.

The ubiquity of smart phones, smart phone apps, and at-home access to the Internet among most adults provides an accessible way for ongoing, free methods to support ongoing engagement in positive psychiatry practices. These methods can be remarkably simple: for example, a reminder to complete the RYR daily diary at each participants' chosen time of day. Equipment that incorporates sensors can be paired with monitoring using reminders; for instance, collecting biological data like heart rate, movement and other activity to identify potentially impactful moments throughout the day to prompt for potential pleasure savoring later. By incorporating technological solutions like these, participants may continue to utilize effective strategies they learned during positive psychiatry interventions, leading to maintenance of benefits. In addition, some research indicates that patients continue to improve following the end of interventions (e.g., Jackson et al., 2007), and facilitating ongoing engagement in helpful therapeutic activities via technological means may increase the number of patients who experience this continued improvement.

However, it is important not to get ahead of the current technology available prematurely. A recent, large-scale review of smart phone apps for mental health noted that although there are thousands of apps, only a few are based on any scientific evidence and even fewer have been studied rigorously (Larsen et al., 2019; Torous et al., 2019). Therefore, although there is considerable promise in this area, there is much research to be done to identify specific, effective technologies. Fortunately, a number of innovative clinical trials are currently underway, and we expect that within five years of this book's publication, the number of evidence-based apps and similar technological methods will have greatly expanded.

Some interventions are already considering more complex and dynamic apps that are responsive to individual needs, including for example collecting daily moods and suggesting coping strategies based on past successful strategies for a given mood (Depp et al., 2018). The potential to use technology to improve treatment personalization is particularly promising. Psychiatry broadly has invested in precision medicine (sometimes also called personalized medicine), often focusing on the identification of biomarkers, an objectively measurable, dynamic or static indicator of presence or severity of a medical or psychiatric illness. Precision medicine is currently being used for purposes including identification of aberrant neurological, neurocognitive, and associated phenomena indicative of prodromal psychosis (e.g., Clark et al., 2016, Chung et al., 2019, Ramanathan et al., 2017), and indicators that given therapies are likely to be effective (e.g., Hochberger et al., 2019a; Hochberger et al., 2019b; Perez et al., 2017), using technology related to genetics, electroencephalography (EEG), magnetic resonance imaging (MRI), machine learning, and artificial intelligence (AI).

A recent review of AI techniques for mental illness detection and treatment highlights its potential and pitfalls (Graham et al., 2019). The authors reviewed 28 studies of AI and mental health that used electronic health records (EHRs), mood rating scales, brain imaging data, novel monitoring systems (e.g., smartphone, video), and social media platforms to predict, classify, or subgroup mental illnesses including depression, schizophrenia or other psychiatric illnesses, and suicide ideation and attempts. These studies indicated a high level of accuracy overall and provided excellent support for AI's potential in psychiatry. However, most studies were early proof-of-concept works demonstrating the potential for using machine learning algorithms to address mental health-related questions, and helping determine which types of algorithms yield the best performance. AI for mental illnesses and their treatments is not ready for broad

implementation at clinical level at the present time. As AI techniques continue to be studied and improved, it may be possible to use them in pursuit of more effective mental illness categorization, identify these illnesses at an earlier or prodromal stage when interventions may be more effective, and personalize treatments based on an individual's unique characteristics. Treatment personalization, in particular, may increase positive psychiatry interventions, and although this was outside of the review's scope, we also feel optimistic that AI could incorporate positive psychiatric constructs in its assessment for both prevention and early identification purposes in the future. However, caution is necessary to avoid over-interpreting preliminary results, and more work is required to bridge the gap between AI in mental health research and clinical care.

Person-centered care is highly overlapping with the intentions of precision medicine, although it typically focuses on integrating subjective data like patient perceptions, perceptions, and cultural values into care. Technology can play an important role here too, as it does in CommonGround, a program that uses software to increase the engagement of people with serious mental illness in their recovery (Deegan, 2007; 2010). For example, patients log into CommonGround prior to psychiatric appointments to help them organize their priorities for the appointment and communicate these priorities to their psychiatrists. CommonGround utilizes ideas like "personal medicine," activities that provide meaning and well-being to each patient, like spending time in nature or with family. These principles generalize easily to positive psychiatry; for example, use of similar software to identify individualized value-based behavior (which holds similarities to the principle of "personal medicine") could facilitate RYR sessions.

The strategies currently being deployed to identify, prevent, and improve treatment of psychiatric illnesses, including machine learning and other types of AI, could also be used to



identify and increase positive psychiatry outcomes like resilience, happiness, and wisdom. Positive psychiatry research includes a number of studies to identify factors that facilitate these coveted states of being like those targeted in RYR: pleasure savoring, gratitude practice, engagement in value based living, dismantling of self-stigma and other negative self-concepts, and other factors like positive social support, mindfulness, and behavioral activation. Use of machine learning could create a complex model of these factors that is responsive to individuals, enabling personalized well-being seeking. There are a range of positive psychiatry interventions available, and an even larger number of other behaviors that a given person might find effective in their search for greater happiness and well-being. For example, there are many ways to practice mindfulness, including Mindfulness-Based Stress Reduction (MBSR; Gu Strauss, Bond & Cavanaugh, 2015; Khoury, Sharma, Rush & Fournier, 2015), an empirically-supported therapy; Zen Buddhism; yoga; walks in nature; listening to instrumental music; mindful eating; or even mindful dishwashing. A personalized model created through machine learning or other AI strategies could help individuals cultivate a well-being practice that works best for them.

Perhaps the most exciting way that technology could benefit positive psychiatry research and positive psychiatry interventions is by increasing scalability and expanding accessibility of those interventions. Dissemination and implementation of evidence-based interventions is fundamental to positively impacting public health. However, the research-to-practice gap is large - according to some estimates, it takes an average of 17 years for an evidence-based health intervention to reach the general public (Westfall, Mold & Fagnan, 2007). Many promising interventions never reach the public at all, due to a lack of research or implementation funding, policy backing, administrative buy-in, provider training, or other essential resources (Aarons et al., 2009; Beidas et al., 2016; Bond et al., 2014; Rapp et al., 2010; Torrey et al., 2001).

Psychiatric interventions often face additional obstacles to implementation due to stigma, difficulty with insurance coverage for specialty care, and low mental health literacy among the public, and sometimes among primary care providers responsible for referring patients to specialty care.

In addition, even when behavioral interventions are available, some patients may struggle to engage in them due to the time commitment, difficulties with travel, and accessibility issues. Finding methods to break down these obstacles is key. Scalability looks to find strategies to increase access to through changing resources. For example, RYR is particularly scalable because it: 1) involves only three sessions; 2) is delivered by non-licensed staff already working at retirement communities; and 3) is offered where older adults live, rather than asking them to come to specialty care clinics. Technology offers a potential way to navigate such issues, especially for new or empirically supported but relatively non-pragmatic interventions. For example, cognitive behavioral therapy (CBT) is an empirically supported therapy for a range of psychiatric conditions including major depression disorder, schizophrenia, generalized anxiety disorder, obsessive-compulsive disorder, panic disorder, social anxiety disorder, and insomnia, among others (Burns et al., 2014; Carpenter et al., 2018; Linardon et al., 2017; Ljótsson et al., 2017; van der Zweerde et al., 2019). Traditionally, CBT is delivered in 12-16 (or more) in person, individual, weekly, 50-minute sessions, with at-home practice in between. However, implementation scientists have considered methods of scaling CBT interventions down to increase accessibility; for example, by decreasing the number of sessions required, or by combining in-person sessions with telehealth sessions via web, phone, or video connections (Karyotaki et al., 2017; Mohr et al., 2019; Reding et al., 2018). Through this method, technology

can augment interventions to increase accessibility and extend resources, ideally increasing the number of patients who access care while maintaining the high impact of care.

Mobile apps offer another method of augmenting CBT and other existing empirically supported interventions. A recent three-armed randomized controlled trial (Depp et al., 2018) evaluated how an app, CBT2go, could augment a single, 90-minute, in-person CBT session among 255 individuals with schizophrenia or bipolar disorder. The CBT2go app includes components to help guide participants through cognitive restructuring exercises that are individualized to specific symptoms and cognitive distortions that participants endorse. It also monitors symptoms, socialization, and medication adherence, and includes personalized adaptive coping prompts. The CBT2go condition was compared with two other interventions: treatment-as-usual (TAU), where participants continued to work with their regular providers and completed study assessments, but nothing else; and self-monitoring (SM), an active control condition where participants engaged in a 90-minute psychoeducational session and then had access to an app that included questions about symptoms, socialization, and medication adherence, but none of the intervention components (e.g., cognitive restructuring) that CBT2go provides. Both the CBT2go and SM groups experienced decreases in symptoms compared to TAU, but only participants in the CBT2go group experienced improvements in community functioning (compared to TAU) and declines in defeatist attitudes (compared to both TAU and SM). These improvements sustained over the 24-week follow-up, indicating the long-term impact of this scalable intervention.

These methods of augmenting intervention with technology offer a promising way forward for positive psychiatry interventions. For example, perhaps the existing RYR intervention could be extended by a CBT2go-style app, or a single in-person session of RYR or

other positive psychiatry interventions could be augmented by two or three monthly telehealth sessions. In this way, effective interventions can reach more people more easily, while maintaining or even increasing their effectiveness.

Another approach is online or smart-phone based forums, which many people already use to find likeminded people. Loneliness is a key problem facing older adults, among other populations, and can seriously undermine well-being and happiness (Lee et al., 2019). Online socialization is one way to decrease loneliness and increase social support, particularly for the individuals who struggle to find in-person social support, due to decreased mobility, transportation issues, living in a rural area, or other accessibility difficulties. A clinician- or peer-facilitated forum developed for people following engagement in a single-session of RYR could help older adults continue to engage in coping strategies learned in RYR and increase adherence to the daily diary while also providing an opportunity to make social connections. A peer-facilitated forum, in particular, would provide the peers new opportunities to take leadership roles and develop relationships with other members of the forum, giving them meaning and purpose in life, which is a key element to successful aging (Reichstadt et al., 2010; Aftab, et al., 2019).

A recent set of pilots of a positive psychiatry app called +Connect, targeting young adults with social anxiety disorder, with psychosis, and without any psychiatric diagnosis highlights the promise of this approach (Lim et al., 2019a; Lim et al., 2019b). These studies were small pilots that found evidence of initial feasibility, and preliminary evidence that +Connect reduced loneliness and increased social confidence among the young adults with psychosis. This evidence is early, but there is reason to think that not only can technology facilitate positive psychiatry's aims by extending its reach, but it can also provide an innovative way to reach people who may

not have been willing or able to engage in standard psychiatric treatments. Young adults with prodromal psychosis, for example, tend to be difficult to engage in traditional treatment programs (Becker et al., 2015). By combining positive psychiatry-related content areas of most interest, like meaning in life, social connection, personal identity development, and empowerment, with technology, using a familiar and comfortable approach, young adults may be more willing to engage in treatment, and more likely to benefit from it.

Some scalability efforts seek to use technologically-based interventions instead of in-person interventions, rather than solely as augmentation strategies. This can be particularly useful for patients for whom even one in-person session would be difficult to accomplish. For example, mobility can be difficult for many older adults, and asking them to leave their home for every medical and mental health appointment is burdensome and leads to attrition from care. Other people may not have access to personal transportation and live in areas without reliable public transportation, or may be caregivers of minor children or family members with disabilities. Transitioning as many appointments as needed, when possible, to in-home appointments using telehealth equipment allows for people who have increased burden due to various reasons to access their appointments.

Beyond the interventions themselves, technology can also be used for other aspects of scalability. For example, the staff who delivered RYR could be primarily trained through teleconferencing rather than in-person. Similarly, staff who deliver interventions can record their work through audio and/or video, and have long-distance supervisors provide feedback. This increases the reach of interventions and allows facilities and staff who otherwise could not afford such training opportunities. In the same vein, using technology to connect remote teams to the same training sessions or to pre-recorded trainings by experienced providers will improve

dissemination of the intervention. High fidelity to the original intervention relies heavily on the uniformity of the training. Staff should receive standardized training to ensure that they will deliver the intervention similarly in their different sites. Next, successful dissemination of interventions depends upon the adaptability of the intervention to different residential facilities. Again, technology can be used to personalize the intervention to senior housing communities of different sizes, educational backgrounds, primary languages, and economic challenges. Interpreter services, groups led via videoconference, or web-based class materials are among the ways in which technology can further the potential reach of interventions.

It is clear that positive psychiatry interventions are feasible, desirable, and effective, leading to outcomes that help improve quality of life across a number of outcome domains for both people with mental illnesses and those without. Investing in the further development and implementation of these interventions, including by scaling up and out, is essential. Across populations, the research literature identifies similar constructs of importance such as well-being, gratitude, resilience, wisdom, hope, meaning, values-based living, social connectedness, and connection to communities and activities relevant to personal, cultural, and spiritual meaning. Therefore, we can expect that the mechanisms by which effective positive psychiatry interventions work might be similar across populations, indicating that existing interventions may be effectively applied to new populations. For example, the +Connect app described above was tested in three young adult populations, two diagnosed with mental illness and one without.

However, adjustments would be needed to increase accessibility or to personalize treatments to individuals. As we describe above, use of technology can achieve both of these means, increasing the adaptability of a single intervention so it is optimally effective for each individual who engages in it. For example, some older adults who engage in RYR may benefit

from increased focus on pleasure savoring to increase daily positive emotion, while others may benefit from increased support around age-related stigma to help combat discrimination due to ageism that they are experiencing.

### **Conclusions**

Interdisciplinary approaches, like those supported by convergence science strategies are critical to expanding the field of positive psychiatry and increasing its impact. Continuing to invest in interdisciplinary collaborations with convergence scientists will aid in ongoing efforts to increase targeted outcomes *via* improved accuracy and precision of assessment, personalized behavioral assessment and interventions, improved fidelity and impact of interventions, increased accessibility and scalability of interventions, and broad dissemination and implementation of effective interventions. A marriage of positive psychiatry and convergence psychiatry is likely to help develop a new system of mental healthcare that would promote well-being across the lifespan for those with and without psychiatric diagnoses, leading to improved longevity and more fulfilling lives.

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**Table 1. Interventions described in this chapter**

| <b>Intervention</b>                                    | <b>Mode</b>   | <b>Target Population(s)</b>   | <b>Target Outcome(s)</b>   | <b>Implementation Considerations</b>   | <b>Convergence Potential</b>  |
|--|---|---|--|--|---|
| Cognitive Behavioral Therapy (CBT) <sup>1</sup>        | 12-16 individual or group sessions, including at-home practice                              | Children and adults with a range of psychiatric diagnoses and medical diseases                | Depression, anxiety, psychotic symptoms                                    | Effective for many different populations; allows for transdiagnostic training of therapists                        | Scaling down may increase accessibility; e.g., use of telehealth sessions                   |
| Mindfulness-Based Stress Reduction (MBSR) <sup>2</sup> | 8 session group based intervention; includes at-home practice                               | Adults with a range of psychiatric diagnoses; medical diseases; and those without a diagnosis | Quality of life, anxiety, depression, chronic pain                         | Effective for many different populations; scalable across settings   | Machine learning could help identify most successful mindfulness strategies for individuals |
| CommonGround <sup>3</sup>                              | In-office web application completed with peer facilitation prior to psychiatry appointments | Adults with serious mental illnesses  | Shared decision making, empowerment, appropriate treatment personalization | Increased cost, time, and technology requirements can be a barrier; use of peers can offset some of these concerns | Web application amplifies patient voices and increases patient-provider communication       |
| CBT <sub>2</sub> go <sup>4</sup>                       | Single 90-minute CBT session combined with CBT <sub>2</sub> go app                          | Adults with schizophrenia or bipolar disorder   | Global psychopathology, community functioning, defeatist attitudes         | Single session; use of app requires access to smart phone and computer literacy                                    | Connecting in-person session to evidence-based app increases access                         |

|  |   |   |                                      |  |  |
|--|---|---|--------------------------------------|--|--|
|  |   |   |                                      |  | to care  |
| +Connect <sup>5</sup>                    | Positive psychiatry app                                   | Young adults with social anxiety disorder, psychosis, and without any psychiatric diagnosis | Loneliness, social confidence        | No in-person session required; use of app requires access to smart phone and computer literacy | Using technology may increase engagement of young adults                           |
| Savoring Intervention <sup>6</sup>       | 1 week intervention; 5 minute savoring activity twice/day | Older adults  | Resilience, happiness, depression    | Short, savoring activity completed independently   | Use technology to increase fidelity (e.g., reminders)                              |
| Raise Your Resilience (RYR) <sup>7</sup> | 3 session group; includes ongoing use of daily diary      | Older adults  | Resilience, perceived stress, wisdom | Short; delivered by unlicensed residential staff in senior housing communities                 | Use technology to facilitate daily diary completion or otherwise augment treatment |

<sup>1</sup>Beck & Beck, 2011; <sup>2</sup>Gu et al., 2015; <sup>3</sup>Deegan et al., 2017; <sup>4</sup>Depp et al., 2018; <sup>5</sup>Lim et al., 2019b

<sup>6</sup>Smith & Hanni, 2019; <sup>7</sup>Treichler, Glorioso, et al., 2020.

Table summary: These seven interventions are the primary interventions described in this chapter. This table summarizes the key elements of these interventions, including their target population and outcome, along with their congruence with convergence mental health and implementation considerations. Some of these interventions (i.e., CommonGround, CBT2go, +Connect) were developed specifically for convergence purposes, and are therefore described in the chapter as models, while others (i.e., CBT, MBSR) were developed prior to the advent of many of the technologies discussed and are currently undergoing adaptation. The other two

interventions (i.e., Savoring, RYR) were included because of their focus on positive psychiatry outcomes and their clear scalability, leaving a number of entry points for convergence to maximize implementation potential.