DEVELOPMENT AND IMPLEMENTATION OF E-HEALTH INTERVENTIONS TO IMPROVE SELF-MANAGEMENT AND WELL-BEING IN PATIENTS WITH BIPOLAR DISORDER (WELLBE-BD)

Hundertwasser Werk 691 Irinaland over the Balkans, 1969

Bart Geerling

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Dit proefschrift is goedgekeurd door:
Promotoren
prof. dr. E.T. Bohlmeijer
prof. dr. R. Kupka

Co-promotor
dr. S.M. Kelders

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PROMOTIECOMMISSIE:

Voorzitter / secretaris: prof. dr. T. Bondarouk

Promotoren: prof. dr. E.T. Bohlmeijer
Universiteit Twente, BMS, Psychology, Health & Technology

prof. dr. R.W. Kupka
Amsterdam UMC

Co-promotor: dr. S.M. Kelders
Universiteit Twente, BMS, Psychology, Health & Technology

Leden: prof. dr. B.K.G. Van Meijel
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Universiteit Utrecht

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Universiteit Twente, BMS, Psychology, Health & Technology

prof. dr. G.J. Westerhof
Universiteit Twente, BMS, Psychology, Health & Technology

Voor Jantien Geerling,

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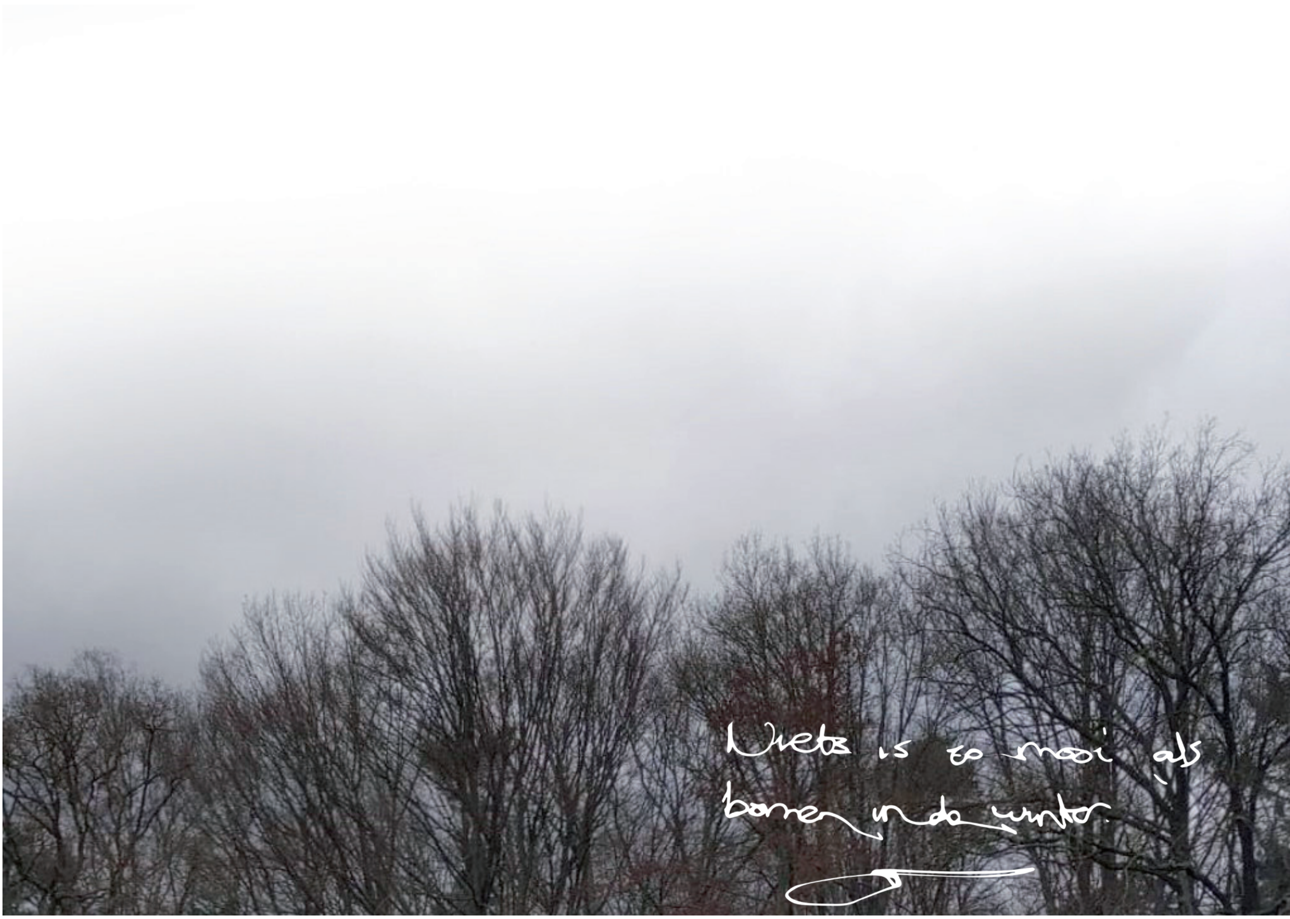
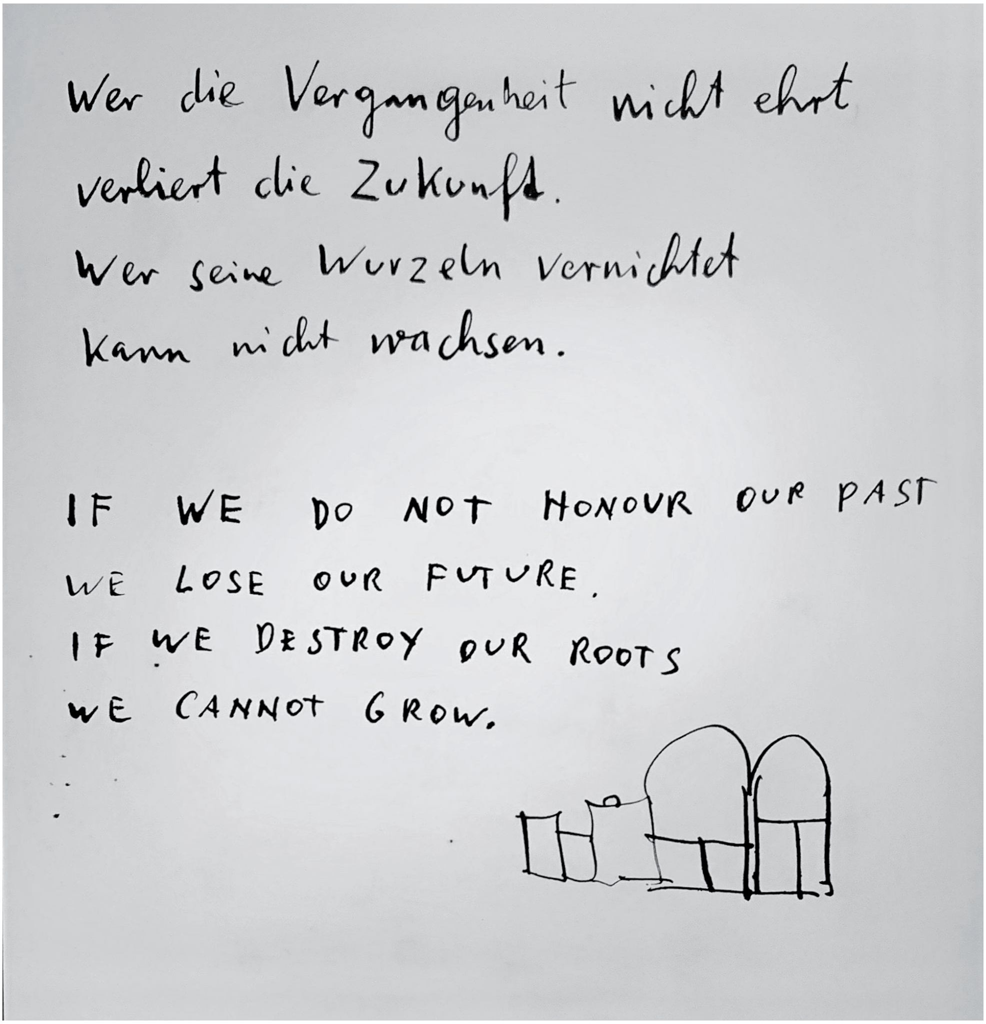


Niets is zo mooi als
bomen in de winter.



Wer die Vergangenheit nicht ehrt
verliert die Zukunft.
Wer seine Wurzeln vernichtet
kann nicht wachsen.

IF WE DO NOT HONOUR OUR PAST
WE LOSE OUR FUTURE.
IF WE DESTROY OUR ROOTS
WE CANNOT GROW.

Friedensreich Hundertwasser, Wenen (1928 – 2000)

Contents

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CHAPTER 1

General introduction;
An overview of the research field

1.0 Introduction

In my work as a nurse practitioner, I meet people who are living with bipolar disorder (BD) every day. I see the courage needed to make BD an inevitable part of daily life and to cope with pharmacological treatment and lifestyle adjustments. I am also aware of the resilience needed to recover after mood episodes and to bite the bullet. I can almost feel the daily struggle against stigma, the despair in avoiding mood episodes and searching for the proper treatment. Besides these drawbacks, I primarily see wonderful people who strive for a life in which they feel well and secure together with their loved ones. Therefore, I undertook this thesis to contribute to a better life for those dealing with BD.

To illustrate, I present throughout the introduction a vignette of a patient named Lynn[1].

> Lynn is 25 years old and has worked as an estate agent for a couple of years. She is married to Liam, who works as a bookmaker. They live in a rural area, and their home has a big garden, which Lynn loves to maintain. Friends and family who live nearby are integral to their social lives. Besides that, she is active on social media and is therefore connected with the world outside the village. Lynn had a happy and uncomplicated life until she became manic.

1.1 Technology and digitalisation

Technology plays an increasingly important role today. Many communications make use of the internet and electronic devices. In 2014, the world had over 2 billion smartphone users relying on them daily (McIlroy, 2015). By 2022, this number increased to 6.6 billion smartphone users, and it is expected to grow to 7.7 billion by 2027 (statista.com). Moreover, the time spent on mobile devices has increased. Among students, smartphone use ranges from 168 to 288 minutes per day (McCrann et al., 2021).

With these figures, it is no surprise that more and more technology is also being used in mental health care. Many patients seek technology-oriented and self-directed treatment options (Sandoval et al., 2017). Potential benefits of digital health interventions include improved flexibility in both standardisation and personalisation, interactivity and consumer engagement (Lal & Adair, 2014). If carefully developed, E-health applications can be tailored to personal needs and can be designed for every topic on mental health (Lal & Adair, 2014). Providing digital interventions can also improve the accessibility of mental health care (Donker et al., 2013). This is important for people in geographically remote areas and those who are housebound, and it

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[1] Lynn is a fictitious name, and the vignette is anonymous and not convertible.

makes it possible to perform treatment at convenient times (Lal & Adair, 2014). From the healthcare provider's perspective, advantages include the low threshold, cost reduction and the possibility of rapid communication (Seko et al., 2014). Interacting with patients via mobile phones as a healthcare provider can promote therapeutic relationships (Seko et al., 2014). However, implementing new interventions can be slow and painful and therefore, unsuccessful (May et al., 2011). Besides, there are concerns about stigma, skills, access, improper use of data and low adherence rates, especially in mental health (Wykes & Brown, 2016). These challenges should not prevent a push forward in the implementation of changes in healthcare technology. Rather, reflection is needed on ways to overcome such challenges (Safi et al., 2018).

The pleas of Wiederhold and colleagues (2013) for a change in the healthcare system from classic outpatient clinics to a more community-based treatment system with new technologies are common and indisputable (Wiederhold et al., 2013). The adaptation of digital treatment options during the COVID pandemic boosted the use and acceptance of these interventions (Balcombe & De Leo, 2021). To overcome the barriers mentioned above, developing and implementing technical innovations, require thoroughly communication and coordination among healthcare professionals and patients. In developing e-health applications, user involvement is essential if the technology is to be adopted and used, and user satisfaction, trust and usability must be increased for successful implementation (Kujala, 2003). If end users (patients and professionals) are highly involved, the end product may be more attractive or appropriate for them (de Beurs et al., 2017). Preece et al. (2015) defined user-centred design (UCD) as 'an approach, which views knowledge about users and their involvement in the design process as a central concern'. Therefore, it is helpful to engage end users throughout the process. In a UCD innovation, experts integrate concepts and strategies with information from the people who will ultimately use the innovation (Preece et al., 2015).

Moreover, the development of new interventions benefits from user involvement at all stages to meet the target group's needs (Kelders et al., 2013). To achieve co-creation throughout the development process, it is recommended that a method is used that can monitor and evaluate the process. One example of a validated tool to guide the process of developing interventions is the roadmap developed by the Centre for Health Research (CeHRes). The designers of the CeHRes wanted to develop a holistic pathway to developing eHealth technologies in which persuasive health technology theories are combined with a managerial approach (van Gemert-Pijnen et al., 2011). This method contains a framework of five steps: contextual enquiry, value specification, design, operationalisation and summative evaluation. Each step includes formative evaluation (van Gemert-Pijnen et al., 2011).

With the increase in the possession and use of smartphones, the use of apps increased too. The wide availability of apps made more intervention apps available; there are more than 10,000 health-related apps (Torous et al., 2018). Nicholas et al. (2015) reviewed 82 apps designed for people diagnosed with BD. They concluded: 'the content of currently available apps for BD is not in line with practice guidelines or established self-management principles' (Nicholas et al., 2015). Apps also fail to provide important information. For instance, help users assess their quality, with most lacking source citations and privacy policies (Nicholas et al., 2015). Healthcare providers can advise in the search for BD-related apps. In a survey of healthcare professionals (HCPs), almost 50% of the respondents discussed and recommended apps to their patients (Morton et al., 2021). The lack of awareness of existing apps is one of the main barriers for HCP to deliberate using them with their patients (Morton et al., 2021). Besides the benefits of freely available apps, caution is necessary where it matters to the quality of the content and safety. Health professionals can play a role in advice which app to use but also in the development of apps special for BD.

1.2 Bipolar Disorder

> Lynn has been familiar with depression since high school. After treatment, when she was 19 years old, the depressive symptoms didn't occur anymore. But for the past week, Lynn has been sleeping less than usual. She felt energetic, talkable and had increased self-confidence. She blamed it on the conditions at work and didn't worry, unlike Liam, who sees a different Lynn than he used to know. Over the days, symptoms worsened and eventually, Lynn was admitted to a psychiatric hospital where she has been diagnosed with bipolar I disorder. Lynn and Liam are staggered.

BD can be defined as a severe chronic mental illness characterised by recurrent mood episodes with manic, hypomanic and depressive episodes alternating with euthymic periods. The disease primarily develops in adolescents and young adults (Goodwin & Jamison, 2007). The course of BD is influenced by environmental factors like onset, seasons, childhood trauma and quality of life (Aldinger & Schulze, 2017).

The estimated prevalence of BD type I (with full mania) and type II (only hypomania and depression) is about 2% of the world's population, and an additional 2% is estimated to have subthreshold BD (Geddes & Miklowitz, 2013). In the Netherlands, the prevalence of BD is 1.3% (de Graaf et al., 2010). It's known that BD is not always recognised in the early stage of the illness. It can be up to 10 years between the first appearance of symptoms and the diagnosis (Drancourt et al., 2013). The duration of untreated BD is associated with a more severe course of the illness (Joyce et al., 2016). Of the patients with depression treated in primary care, 17% had unrecognised BD (Daveney et al., 2019). When BD is diagnosed, most people do not receive integrated best-practice care (McIntyre et al., 2020), while a timely and accurate diagnosis is critical (McIntyre & Calabrese, 2019). BD seldom comes alone; the lifetime prevalence of comorbidity in BD is 92% versus 46% in the general population (Merikangas et al., 2007).

1.3 Current treatment of BD

> During her admission, Lynn received pharmacological treatment and psychoeducation. After two weeks, she returned home and was referred to an outpatient clinic for further treatment during the recovery period. Lynn felt that she had failed, her life had turned upside down, and all that was without doubt for her had come to an end. Besides lithium, she received self-management interventions with lifestyle advice. Lynn followed this advice consistently. Little attention was paid to her feelings after being diagnosed and admitted.

In the treatment of BD, there are three phases: acute treatment, continued treatment and maintenance treatment. In all phases, pharmacological treatment and self-management interventions dominate, and they are the cornerstones of treatment in BD (Kupka, et al., 2015). Psychological and pharmacological treatments are more effective when applied in the early stages of the illness, and treatment by specialist programmes leads to better illness outcomes compared to general psychiatric care (Joyce et al., 2016; McIntyre et al., 2020).

Self-management is defined as 'the individual capacity to cope with symptoms, treatment consequences, physical consequences, psychological consequences and lifestyle changes inherent to living with a chronic health problem´ (Barlow et al., 2002). Learning and using self-management are unique processes in which people search for effective tools to support them (van den Heuvel et al., 2015). Mood monitoring is a key element of self-management in BD. It makes it possible to recognise early warning signs, monitor the course of BD and apply early intervention strategies (Koenders et al., 2015; van Bendegem et al., 2014). Mood monitoring on a daily basis facilitates early recognition and intervention, thereby improving personal functioning (Gershon & Eidelman, 2015). The prospective Life Chart Method (LCM) has been validated for daily mood monitoring, providing a graphic representation of mood fluctuations above (hypo/mania) and below (depression) a euthymic baseline (Denicoff et al., 2002). Current medication, comorbid symptoms, hours of sleep, and significant life events also are reported. The Dutch guidelines for the treatment of BD promote the use of the LCM (Kupka, et al., 1997). Although recommended in the Dutch guideline, the use of LCM in outpatient clinics was 47% (Renes et al., 2018). One of the reasons for this might be that, for some patients, it's a daily confrontation with their illness (van Bendegem et al., 2014). Other patients use the LCM only in case of early signs of relapse (van Bendegem et al., 2014). It also occurs that symptoms are reported retrospectively in the prospective LCM. This entails a noticeable risk of recall bias, especially when patients reported multiple daily ratings at a single time (Stone et al., 2003; Whybrow, et al., 2003). Therefore, the timing of introducing self-monitoring in the treatment and tailoring it to the potential user are critical for making mood monitoring successful (Lysaker et al., 2014; van Bendegem et al., 2014).

Compliance in mood monitoring can be improved with a digital instrument (Malik, Goodwin, & Holmes, 2012). Studies about digital mood monitoring tools like the LCM are scarce. Since the turn of the century, several digital mood monitoring systems have been developed (Bauer et al., 2004; Bopp et al., 2010; Depp, Kim, Vergel De Dios, Wang, & Ceglowski, 2012; Faurholt-Jepsen et al., 2015; Lieberman, Kelly, Douglas, & Goodwin, 2010; Matthews, Doherty, Sharry, & Fitzpatrick, 2008; Saunders et al., 2017; Schärer et al., 2002; van den Heuvel et al., 2018). In a systematic review, Faurholt-Jepsen et al., 2016 concluded that electronic self-monitoring appears to be a reliable way to measure mood in depression but not in mania. E-mood monitoring could lead to a better understanding of BD, because it provides increased insights into illness and promotes more effective self-management strategies (Saunders et al., 2017). The possibility of personalising the mood monitoring tool is highly appreciated by participants (Saunders et al., 2017). A Dutch study reported that patients had better insight into the factors contributing to mood instability or mood episodes when using digital mood monitoring (van den Heuvel et al., 2018). These findings underline that electronic mood monitoring can give a better impression of the course of BD (McKnight et al., 2017).

1.4 Burden of BD

> Although Lynn had recovered from the acute manic episode and was not clinically depressed, a great sorrow dominates her life; she's ashamed of her behaviour during the manic episode, tries desperately to understand what happened, and the fear of recurrence is huge. Liam tries to restore his confidence in Lynn and their relationship, but he keeps thinking about all she said and did. While Lynn tries to control her illness, feeling she's becoming the illness itself, Liam is gathering as much information as possible about BD. They don't level anymore, causing painful silences around the teapot that once was their safe haven.

The global burden of mental illness is estimated to account for 32.4% of the years lived with disability (YLDs) and 13% of disability-adjusted life-years (DALYs) (Vigo et al., 2016). Despite the relatively low prevalence of BD, the burden of BD is relatively high. BD is the 16th leading cause of YLDs, explaining 1.3% of total YLDs (Ferrari et al., 2016). Over the years 1990 to 2017, DALYs increased by 54%, from 6.02 million in 1990 to 9.29

million in 2017 (He et al., 2020). This increase is mainly due to the increase in low- and middle-income countries.

When facing a diagnosis of BD, there is a significant burden on patients and their relatives (Erten et al., 2014; Vieta et al., 2013). For instance, BD has a high risk for suicide compared to the general population (Baldessarini & Tondo, 2003), and it is associated with poor clinical, functional and cognitive outcomes (Goldberg & Chengappa, 2009; Goodwin & Jamison, 2007). The burden of BD is present in manic, depressive and inter-episodic periods, and functional deficits are also associated with periods of remission when those periods are substantial and sustained in length, even when there is symptomatic recovery (Fagiolini et al., 2005). Besides that, subsyndromal depressive symptoms are predominant and cause impaired functioning, and affective dysregulation during inter-episodic periods is related to functional impairment (Fagiolini et al., 2005; Gershon & Eidelman, 2015; Soreca et al., 2009). This impairment in functioning has a negative impact on the quality of life and well-being of people with BD (Revicki et al., 2005).

Besides the burden on patients and their relatives, the illness's economic burden is high. In the USA, the cost is estimated to be 201.1 billion a year (Cloutier et al., 2018). The UK's annual cost in 2018-2019 was £14,938 per patient, of which 68% accounts for lost productivity and informal care (Simon et al., 2021).

1.5 Unmet needs

> Despite the offered treatment, Lynn also had care needs that her clinicians did not provide. She knows it´s sensible that it requires time and patience to build a new life after an episode, but it leaves her with many questions. For instance, how to accept the BD, how she can create new meaning and how to deal with friends and family. Over the months, her relationship with Liam has been ameliorated, but it is not as obvious as it was. She tried to discuss her questions but experienced no acknowledgement from her therapist.

In BD, unmet needs and the burden of the illness are closely linked. Since the turn of the century, there has been a growing body of knowledge revealing that there are major unmet needs in the management of BD (Bauer et al., 2018; Chengappa & Goodwin, 2005; Fortuna et al., 2019; Goossens, Knoppert-Van Der Klein, Kroon, & van Achterberg, 2007; Hajda et al., 2016; Lewis, 2005; Maassen et al., 2018; Wolpert & Fonagy, 2009). Asadi-Lari (2004) defined needs as 'people's desire to receive healthcare services to improve overall health' (Asadi-Lari et al., 2004). The needs of patients with BD are closely linked to issues that patients must face during episodes. In symptomatic episodes, the needs can be summarised as encouragement to seek effective (pharmacological) treatment to reduce symptoms. During remission and subsyndromal episodes, there is a need for treatment that prevents future episodes and easily available psychosocial interventions (Chengappa & Goodwin, 2005; Hajda et al., 2016).

Regarding social and psychological functioning, support with loneliness, grief counselling, acceptance, social isolation, coping with others, hope, expressing feelings and increasing self-confidence are frequently mentioned as an unmet need (Bauer et al., 2018; Fortuna et al., 2019; Goossens, Knoppert-Van Der Klein, Kroon, & Van Achterberg, 2007; Hajda et al., 2016; Maassen, Regeer, Regeer, Bunders, & Kupka, 2018). Needs that are most often expressed but also most unmet are creating a new meaning of life, developing more self-confidence, learning to express feelings, dealing with unexpected situations and standing up for oneself (Goossens et al., 2007). Additional interventions have to be designed to cover these needs and to provide well-being. Creating such interventions with patients and clinicians can help achieve optimal wellness and recovery, not just the remission of symptoms (Lewis, 2005).

1.6 Recovery

> In her search for answers, Lynn had contact with a peer support group; she found recognition for the experiences she had. After several meetings, she felt a slight increase in hope and confidence. There is a future for her despite BD. This is an important step on the road to recovery and finding a balance in living with BD rather than being the BD. Liam joined her at the meeting; he became acquainted with other next of kin and was surprised to know that they faced similar problems. His understanding of Lynns' behaviour grew, which positively affected their relationship.

Besides symptom reduction and self-management interventions to prevent recurrence, there are serious challenges with personal recovery (PR) and adaptive tasks for patients with BD (Slade, 2009). Anthony (1993) describes PR as 'a deeply personal, unique process of changing one's attitudes, values, feelings, goals, skills, and/or roles' and 'a way of living a satisfying, hopeful, and contributing life even within the limitations caused by illness' (Anthony, 1993). The described needs for psychosocial interventions indicated in the previous paragraph are closely associated with PR (Leamy et al., 2011). The PR movement originates from people with lived experiences who want to use PR determinants of their own lives and give PR a prominent role in treating mental illness (de Vos et al., 2017; Mead & Copeland, 2000). Contrary to traditional treatment strategies, PR focuses on achieving personal goals and growth (Slade, 2009). Because PR is an individual process, each individual must determine what recovery means for him or herself.

To cover the broad concept of PR, Leamy et al. (2011) developed the CHIME framework (Leamy et al., 2011). The acronym reflects these concepts: Connectedness, Hope and optimism, Identity, Meaning in life and Empowerment. Herewith, they include people's recovery experiences from mental illness (Leamy et al., 2011). Bird et al., (2014) validated Leamy's model and added three concepts to the CHIME acronym to address the needs of those in an early stage of recovery. These are practical support, issues around diagnosis, medication, and scepticism. Jagfeld et al. (2021) developed the framework from Leamy and Bird further to fit it to the particular needs of people with BD (Jagfeld et al., 2021). The expanded framework reflects all aspects of the CHIME but adds the concept of Tensions (balancing acceptance with ambition, openness about the illness and ambivalence about mania). The result is a new acronym: Purpose and meaning, Optimism and hope, Empowerment, Tensions, Identity and Connectedness (POETIC) (Jagfeld et al., 2021).

Several interventions based on the CHIME framework have been developed, focusing on increasing hope, strengths, connectedness and empowerment, with a significant increase in well-being (Schrank, Bird, Rudnick, & Slade, 2012; Tew et al., 2012). Besides the emphasis on the meaning of well-being, posttraumatic growth, empowerment and confidence in one's own resources as key elements of PR, there are other goals, such as increasing skills of openness to others and connectedness, that can be added to care programmes to increase PR (Chirio-Espitalier et al., 2022). All these elements can be found in the domain of positive psychology (PP). Therefore, PP, with well-studied evidence-based interventions, can be a potential approach to treatment to improve PR and address the unmet needs of patients diagnosed with BD (Fortuna et al., 2019; Kraiss et al., 2018; Schrank, Brownell, Tylee, & Slade, 2014; Slade, 2010).

1.7 Positive Psychology

> One year after her manic episode, all have sailed into calmer waters. Lynn has picked-up work again, her mood is quite euthymic, and her relationship with Liam is almost as it once was. Still, she is not the same; insecurity and the fear of recurrence are still present. It has been a year entirely focused on misfortune and discomfort. Lynn is longing for something positive to occur. By participating in a new intervention, she became aware of the concept of Positive Psychology. She learned to look at herself and her environment in a different way and to rediscover her strengths. A couple of months later, Lynn says that despite all the sorrow, she had grown.

Two movements, PR and PP, developed separately but both strived to improve personal fulfilment and well-being rather than focusing on the symptoms of the mental illness (Resnick & Rosenheck, 2006; Slade, 2010). PR developed along the path of advocacy and is more activistic, while the PP movement followed the academic and empirical road (Resnick & Rosenheck, 2006). PP aims to research mechanisms and processes of optimal functioning of individuals, relations and societies and develop interventions that can enhance optimal functioning (Seligman & Csikszentmihalyi, 2000). Therefore, it can be a meaningful addition to the PR movement. Positive psychology interventions (PPIs) focus on improving positive feelings, behaviours or cognitions (Parks & Biswas-Diener, 2013; Seligman, Csikszentmihalyi, 2000; Sin & Lyubomirsky, 2009). Applying PPIs in mental health care fits well in a recently developed model of sustainable mental health (Bohlmeijer & Westerhof, 2021). This model proposes mental well-being as vital outcome in psychiatry. A core aim of treatment is to promote the ability to adapt. This ability is hindered by barriers such as dysfunctional biological and psychological processes, and it is enhanced by resources such as positive emotions, hope, meaning and positive relationships. Bohlmeijer & Westerhof (2021) argue that there is a need for balanced mental health care. PPIs primarily target the development of resources that support patients with adaptation, personal recovery and maintaining mental health (Bohlmeijer & Westerhof, 2021).

An essential criterion of PPIs is that the interventions are based on evidence-based mechanisms (Parks & Biswas-Diener, 2013). Schueller and Parks (2014) subsequently reviewed PPIs and identified six different categories of exercises: savouring, practising kindness, experiencing and expressing gratitude, creating meaning and goalsetting, positive relations and using personal strengths (Schueller & Parks, 2014). Savouring aims to lengthen and deepen pleasurable experiences (Peterson, 2006). Exercises in savouring include teaching and encouraging the practice of the principles of savouring or teaching specific savouring skills (Bryant, 2003; Bryant et al., 2005; Schueller, 2010). Performing kindness can boost happiness, and vice versa, happy people tend to act more kindly (Dunn et al., 2008). Even just reflecting on one's kindness also increases happiness (Otake et al., 2006). Experiencing and expressing gratitude positively affect well-being, increase positive emotions and reduce depressive symptoms (Bohlmeijer, Kraiss, Watkins, & Schotanus-Dijkstra, 2021; Seligman, Steen, Park, & Peterson, 2005; Wood, Froh, & Geraghty, 2010). Having meaning in life can forecast well-being, satisfaction with life and happiness (Steger et al., 2009). There are different pathways to 'creating meaning'. One is to increase the hope and, that one's goals will be reached (Snyder, 2002). Another is writing about life goals (King, 2001), or, more specifically, writing about the best possible self to increase the focus on one's own life goals (Sheldon & Lyubomirsky, 2006). Positive relations are almost necessary to experience happiness in the long run. Responding to good news actively and constructively is one exercise that can be performed (Gable et al., 2004, 2006). Finally, recognising and being aware of personal strengths can increase the feeling of well-being. Specific exercises can help identify and use personal strengths and be aware of their potential benefits for the individual (Seligman et al., 2005).

Several meta-analyses have found that PPIs have small to moderately significant effects on well-being and distress in general populations (Bolier et al., 2013; Hendriks et al., 2020; Sin & Lyubomirsky, 2009) and in clinical populations (Chakhssi et al., 2018). Some small studies also showed promising effects of PPIs on the mental health of patients with BD (Celano et al., 2020; Farquharson & MacLeod, 2014; Painter et al., 2019). Recently, a fully powered trial was conducted to evaluate the impact of a positive psychotherapy group treatment on the mental well-being of BD patients in comparison to treatment as usual (Kraiss et al., 2018). The results showed promising medium to large between-group effects, with a sustained effect after six months (Kraiss et al., 2021).

1.8 Summary and aim of this thesis

Patients with BD have a chronic condition with a cyclical and unpredictable course. In addition to pharmacological interventions, self-management interventions aimed at controlling the disease and maintaining self-regulation are essential pillars of treatment. Monitoring symptoms with the LCM can contribute to this. However, many patients do not monitor continuously. The use of e-health continues to increase, even if it has not always been laid down in guidelines and is not yet common in every mental health practice. In addition, the demand for online healthcare services is increasing. E-health appears to be ideally suited to improve and facilitate self-management of the disease and to offer interventions to increase well-being in a low-threshold and personalised manner.

Moreover, despite the broad consensus on the treatment of BD, patients also have unmet healthcare needs for their personal recovery such as finding meaning in life, developing self-confidence, learning to express their feelings, coping with unexpected situations, standing up for themselves and being able to function in the social context. These needs are closely related to the dimensions of psychological well-being (goal orientation, personal growth, autonomy, environmental control, self-acceptance and positive relationships) that are themes of the PP domain. Fulfilling these needs and increasing the well-being of patients with BD can further increase resilience so that stress can be managed better, possibly preventing relapse in a mood episode. As an additional advantage, using PP well-being interventions to fulfil unmet healthcare needs may improve compliance with self-management interventions, such as mood monitoring.

The aim of the current thesis is to develop an app based on positive psychology interventions in co-creation with BD patients and professionals and, to evaluate its acceptability and potential benefits for patients with BD. The main research questions were:

1. State of the art

- What are the effects of positive psychology interventions (PPIs) in people with severe mental illness (SMI) across studies? Although we intended to perform a systematic review of the application of PPIs in BD, at the start of the project in 2017, we found minimal research on this topic. Therefore, we broadened the search to SMI.
- What are, for patients diagnosed with BD, reasons to start using, continue or discontinue the use of health-related apps, and how frequently are health-related apps used by patients diagnosed with BD for self-management purposes?

2. Co-creation of online mood monitoring and digital intervention

- Identifying opinions of patients with BD and professionals about online mood monitoring and identifying preferences on design, technical features and options facilitating optimal use and implementation of online mood monitoring.
- Identifying patients' opinions with BD and health care professionals about (online) PPIs for BD and developing and pilot-testing an app containing PPIs specifically designed for patients with BD.

3. First evaluation of acceptance and benefits of developed digital intervention

- Is the developed PP intervention application acceptable, and how is it valued by patients when used for an extended period? Is the study design feasible for implementing the app in a more extensive trial? What are the results on well-being and psychopathology outcomes?

1.9 Outline of the Thesis

The Well-Being Bipolar Disorder (WELLBE BD) project was divided into three parts regarding the overall aim of the thesis: (1) assessing the state of the art in effects in PPIs for people with SMIs and app use by BD patients, (2) Co-creation of online mood monitoring and digital intervention and, (3) a first evaluation of acceptance and benefits of developed digital intervention.

State of the art

The first part provides an overview of the research field, focusing on collecting existing knowledge regarding the application of PPIs in severe mental illness (SMI) and how people with BD use health-related apps for self-management. The first chapter contains a systematic review in which we examine the effects of PPIs on both psychopathology and well-being. Although our intention was to perform a systematic review of the application of PPIs in BD, at the start of the project in 2017, we found minimal research on this topic. Therefore, we broadened the search to SMI. In the study, we conducted a meta-analysis of the effects of PPIs on mental health in people with SMI across studies.

In the second chapter, we gain insight from patients diagnosed with BD about reasons to use, continue or discontinue health-related apps. A mixed-method design was used, in which 41 patients with BD participated in a quantitative survey, and 11 participants also participated in in-depth interviews.

Co-creation of online mood monitoring and digital intervention

The second part of the thesis is dedicated to the determination of the requirements of both online monitoring and the application of online PPIs in the treatment of BD and to the development and rapid prototyping of an online PPI for BD. In chapter four, we identify opinions about online mood monitoring of patients with BD and professionals, and we identify preferences on design, technical features and options that facilitate optimal use, and implementation of online mood monitoring. This study used a qualitative design with focus groups. Participants were recruited from patients and care providers. The opinions of patients with BD and healthcare professionals about (web-based) PPIs for BD are described in Chapter Five. The study was conducted under the principles of the Centre for eHealth and Disease Management roadmap, and it incorporated co-creation and designing for implementation. Data were collected using focus group discussions, questionnaires, rapid prototyping and web-based feedback on a prototype from the participants. In total, three focus groups were conducted with 62% (8/13) of patients with BD and 38% (5/13) of professionals. The collected data were used to develop a smartphone app containing short PPIs. The content was based on PPIs for which a solid base of evidence was available. Finally, a pilot test was conducted to test the app.

First evaluation of acceptance and benefits of developed digital intervention

The third part contains one chapter about the first evaluation of the PPI app. In Chapter Six, we study the acceptability of the application and evaluate the feasibility of the design for use in a larger controlled trial (CT). We also studied the outcomes on psychopathology and positive psychology. Therefore, we used a mixed-methods quantitative and qualitative approach in an experimental CT design. The study sample consisted of an intervention group and a control group, each with 20 participants. To measure acceptability, we conducted semi-structured interviews based on a topic list and collected data about the use and value of the app. The number of completers of the intervention in both the intervention and control groups determined the feasibility. Outcomes were measured using an extensive set of pre- and post-intervention questionnaires.

With Chapter Seven, we complete this thesis. Here, we present a general discussion to reflect on the aim of this thesis and the findings of our project. We also reflect on the impact on clinical practice regarding the monitoring and application of PPIs in people diagnosed with BD.

Chapter Eight contains the summary, summary in Dutch, acknowledgements and curriculum vitae.

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PART 1

State of the art

CHAPTER 2

2

The effect of positive psychology interventions on well-being and psychopathology in patients with severe mental illness: A systematic review and meta-analysis

Bart Geerling
Jannis Kraiss
Saskia Kelders
Anja Stevens
Ralph Kupka
Ernst Bohlmeijer

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Abstract

There is a growing number of studies evaluating the impact of positive psychology interventions (PPIs) in people with severe mental illnesses (SMI). The results of these studies have not been quantitatively reviewed yet. In this study, we conduct a meta-analysis on the effects of PPI's on mental health in people with SMI across studies. Sixteen studies are included (nine RCTs), representing 729 patients. Meta-analyses were performed for well-being as the primary outcome at post-treatment. We found no significant effects on both well-being and psychopathology for the PPIs in comparison with the control conditions. Within-group effects revealed a moderate effect (Hedge's g = 0.40) on well-being and a large effect on psychopathology (g = 0.70). Though there is at present no evidence that PPIs are more effective in comparison with other active interventions, our findings demonstrated that people with SMI do benefit from PPIs in terms of enhancement of mental health.

Introduction

In an overview of the global burden of diseases, severe mental illnesses (SMIs) have a predominant place (Vos et al., 2015). The National Institute of Mental Health (NIMH) defines severe (or serious) mental illness (hereafter SMI) as 'a diagnosis of non-organic psychosis or personality disorder; duration characterised as involving prolonged illness and long-term treatment, operationalised as a two-year or longer history of mental illness or treatment' (NIMH, 1987). This three-dimensional model (psychosis, chronic illness, and long-term treatment) has been transformed into a two-dimensional model to also include nonpsychotic disorders (Ruggeri et al., 2000). Delespaul (2013) added the following criteria to define SMIs more strictly: a psychiatric disorder with severe functional problems, where the constraints are causal and consequential and which is not temporary, and there is a need for coordinated professional care (Delespaul, 2013). Examples of SMIs based on these criteria are schizophrenia, schizoaffective disorder, bipolar disorder (BD), personality disorder, and major depressive disorders (MDD).

The burden of SMIs is extensive. For example, people with schizophrenia have a lower life expectancy compared to the average population (Hjorthøj et al., 2017), and the suicide rates are significantly higher for people with schizophrenia (20–50%) than for the general population (9–13%) (Pinikahana et al., 2003). As another example, the burden of BD is great, for both patients and caregivers (Erten et al., 2014; Vieta et al., 2013). Bipolar Disorder contains a high risk of suicide compared to the general international population (Baldssarini & Tondo, 2003) and is associated with poor clinical and functional outcomes (Goodwin & Jamison, 2007). People with SMI also experience significantly less hope than the general population (Landeen, 2000; Landeen et al., 2000). Lower levels of hope are closely related to a lower quality of life (Hasson-Ohayon et al., 2009).

In spite of this major negative impact on quality of life, evidence-based treatments have mainly been focusing on the reduction of symptoms and, to a lesser extent, on functional recovery and the improvement of well-being (Bensing, 2000). Besides reduction and management of symptoms, there are also important personal recovery challenges and adaptive tasks for patients with SMI (Slade, 2009). Anthony (1993) describes personal recovery as 'a deeply personal, unique process of changing one's attitudes, values, feelings, goals, skills, and/or roles' and 'a way of living a satisfying, hopeful, and contributing life even within the limitations caused by illness' (p. 527). With regard to well-being and personal recovery, many people with SMI have unmet needs (Goossens et al., 2007; Wiersma, 2006). Moreover, patients with SMI express dissatisfaction with current treatment approaches such as dire predictions about the course of the illness and medication as the only rational option for treatment and 'learned helplessness' (Malmström et al., 2016; Mead & Copeland, 2000). Patients also argue for the importance of well-being-related outcomes, such as meaningful activities, self-efficacy improvement, and reduced reliance on support networks. This underlines the need for a shift towards more well-being oriented care (Bernstein, 2006; Fava et al., 2007; Malmström et al., 2016).

In recent years, there has been a growing interest in the potential benefits of positive psychology interventions (PPIs) for people with SMI (Parker et al., 2012; Russell & Moss, 2013). PPIs focus on the enhancement of positive feelings, behaviours, or cognitions (Sin & Lyubomirsky, 2009a). Parks and Biswas-Diener (2013) underscored that evidence of effectiveness is an additional important criterion of a PPI (Parks & Biswas-Diener, 2013). For patients with SMI, PPIs aim to develop resources that are supportive in realising personal recovery and well-being and in managing symptomatology (Slade, 2010; Slade et al., 2014). Recent meta-analyses have found that PPIs have small to moderate significant effects on well-being and distress both in general populations (Bolier et al., 2013; Hendriks et al., 2019; Sin & Lyubomirsky, 2009a) and in patients with mental or somatic illnesses (Chakhssi et al., 2018). Furthermore, a growing number of studies have examined the effects of PPIs on the mental health of people with SMI. However, evidence of their effectiveness has not been synthesised to date. In the context of this special issue of JOPP on the state-of-the-art of positive psychology, the aim of this study is, therefore, to make an initial assessment on the effects of PPIs in people with SMI across studies.

Method

This systematic review and meta-analysis were conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Liberati et al., 2009; Moher et al., 2016).

Search strategy

A systematic literature search was carried out in Scopus, PubMed, and PsycINFO. The initial search was conducted from 1998 (the start of the positive psychology movement) to 2017. We updated the search on 8 January 2020. The search string consisted of terms referring to well-being and positive psychology constructs, which were combined with terms referring to SMI (see appendix 1). In addition, we cross-checked included studies in prior meta-analyses and reviews conducted in this research field (Bolier et al., 2013; Chakhssi et al., 2018; T T. Rashid, 2009; Sin & Lyubomirsky, 2009a). The search was restricted to peer-reviewed studies in the English language.

Study selection

The search was aimed at identifying studies that focused on PPIs; it included a clinical sample with an SMI and used a well-being outcome measure. Therefore, studies were included if they (1) examined the effects of an intervention aimed at raising positive feelings, positive cognitions, or positive behaviour (Sin & Lyubomirsky, 2009), (2) included adult participants (18 years or older), (3) included participants with one or more of the following DSM-IV or ICD-10 diagnoses: bipolar disorder, MDD, schizophrenia, psychosis, schizoaffective disorder, or personality disorders, and (4) used outcome measures of well-being or related outcomes. To explore the potential benefits of PPIs in people with SMI, we decided to include studies with various designs, including randomised controlled trials, quasi-experimental, and uncontrolled pre-post-test design. We also included studies investigating the effect of interventions, which did not specifically call themselves positive psychology interventions but were also aimed at raising positive feelings, cognitions, and behaviour (e.g. recovery-focused or compassion interventions). Articles were excluded if they (1) were not published in an English language peer-reviewed journal, or (2) studied an intervention consisting of physical exercises, or (3) concerned qualitative studies, or (4) concerned abstracts or study protocols. Potentially eligible studies were screened based on the title in the first phase, on abstract in the second phase, and on full papers in the third phase. Two reviewers (BG & JK) selected the titles independently. The interrater-reliability was satisfactory (Cohen's kappa = 0.76, N = 2189). Abstracts and full texts were rated by the same reviewers, and disagreements were discussed until consensus was reached. The remaining issues were reviewed with the third and sixth authors (SK and EB).

Data extraction

Population characteristics (age, sex, marital status, and disorder), characteristics of the studies (design, sample size, measurements, controls, and control intervention), and characteristics of the interventions (type of intervention, duration, and additional treatment) were extracted.

Five authors were contacted due to missing information, and four of them provided additional data on request.

Primary and secondary outcomes

The main outcome of the meta-analysis was well-being at the end of treatment. If more than one measure of well-being was used, all measures related to well-being were combined. Psychopathology was the secondary outcome, which included depression, mania, psychosis, negative symptoms, and general symptom inventories.

Meta-analytical procedures

For all included studies, the number of participants and means and standard deviations of outcomes of well-being and psychopathology was extracted. If possible, values were extracted based on the intention-to-treat principle, and if not, values were extracted based on a per-protocol basis. For all included studies, within-group effect sizes for the PPI groups were calculated by subtracting average scores at pre-treatment from average scores at post-treatment and dividing it through the standard deviation of the difference. For studies containing a control group, additional controlled effect sizes were computed by subtracting average scores at pre-treatment from average scores at post-treatment and dividing it through the pooled standard deviation. The difference in effect size was calculated by subtracting the effect size of the treatment group from the effect size of the control group. Effect sizes were further analysed in Comprehensive Meta-Analysis (CMA), version 2.2.064. If the correlation between pre-treatment and posttreatment scores was not provided in published papers, we followed recommendations by Rosenthal (1986) and used a conservative estimation of r =.7 (Rosenthal, 1986). Since studies included in the meta-analysis were not functionally identical, effect sizes were pooled in CMA using a random-effects model instead of a fixed-effects model (Hedges & Vevea, 1998; Moses et al., 2002). As an indicator of effect sizes, Hedge's g and 95% confidence intervals were used. Hedge's g deals with bias caused by small sample size (Cumming, 2013). To assess the effect of PPIs on well-being and psychopathology, separate meta-analyses were performed for outcomes of well-being and psychopathology for both within-group effect sizes and controlled effect sizes. In addition, exploratory subgroup analyses based on within group effect sizes were conducted based on the following criteria: (1) duration of treatment; short (<8 weeks) vs. long (>8 weeks), (2) treatment format; group vs. individual therapy, and (3) diagnosis; MDD vs. schizophrenia vs. mixed populations (i.e. samples containing different types of diagnoses). Based on Lipsey and Wilson (1993), effect sizes were interpreted as small (0–0.32), moderate (0.33–0.55) and large (0.56–1.20). If one trial reported multiple outcomes of well-being or psychopathology, included effect sizes were averaged in CMA. The heterogeneity of effect sizes was assessed using Q and I2 statistics (Lipsey & Wilson, 1993). Significant Q-values are indicative of heterogeneity and test whether observed effect sizes are significantly more different from one another than would be expected on chance alone. I2 statistic shows the total variance across the included effect sizes, with higher values being indicative of more heterogeneity and zero of true homogeneity. Values of 25%, 50%, and 75% show low, moderate, and high heterogeneity, respectively (Higgins & Thompson, 2002). Due to the limited number of studies, we decided not to assess publication bias in this study.

Results

Study selection

In total, we found 3609 titles, and after the exclusion of duplicates, 2189 titles remained. After screening of the titles, 64 abstracts remained and were reviewed, and 22 studies were found eligible for full-text screening. In the final analyses, 16 studies were included. The study selection process is summarized in Figure 1.

Population characteristics

The 16 studies included 729 participants, of which 442 participants were in the PPI groups and 287 in the control groups. The mean age of the participants was 42.0 years in the intervention and 43.2 in the control groups. Furthermore, on average, 53.8% and 67.9% of the participants were female in the intervention and control groups, respectively. The dropout rates were 24.2% and 22.0%. The 16 studies included 45.3% individuals with MDD, 35.4% with schizophrenia, 10.4% with bipolar disorder, 4.4% with borderline personality disorder, 2.3% with schizoaffective disorder, and 2.2% with other, not specified disorders. Demographical data for the included studies are displayed in Table 1.

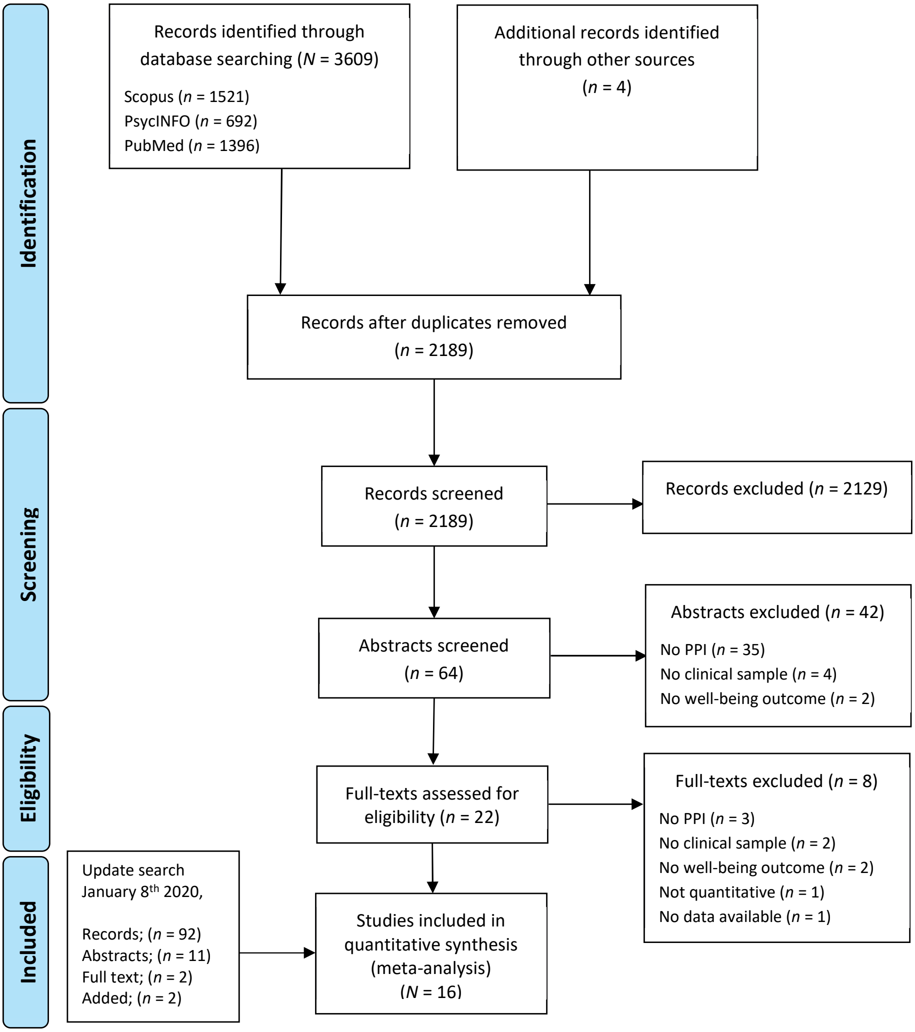
Study characteristics

Of the included studies, 10 studies used a control group. Of these 10 studies, 9 studies utilized randomised controlled trials (Asgharipoor et al., 2012; Braehler et al., 2013; Carr et al., 2017; C. Celano et al., 2017; Farquharson & MacLeod, 2014; Feliu-Soler et al., 2017; C. M. Celano et al., 2018; Schrank et al., 2016; Seligman et al., 2006) and one study used a quasi-experimental design (Chaves et al., 2017). Six studies used a pre-post design without a control group (Favrod et al., 2015; Ferguson et al., 2009; Johnson et al., 2011; Lai et al., 2015; Meyer et al., 2012; Painter et al., 2019). Study characteristics are summarized in Table 2.

Intervention characteristics

Intervention characteristics are described in Table 3. The interventions that were used in the included studies differed in both content and duration. The duration varied between 3 and 20 weeks, with an average duration of 8.8 weeks. Almost all interventions consisted of one session per week, with a length of 1 or 2 hours per session (2 hours being the maximum). The Recovery Program (Lai et al., 2015) is an exception, incorporating five sessions weekly. In the 11 studies which described the duration of the interventions, the average total duration of the interventions was 17 hours (range 7–40 hours). Thirteen studies evaluated group programs, and three studies evaluated an individual approach. The majority of the interventions comprised PPIs in combination with other approaches such as elements of cognitive behaviour therapy

Figure 1. Search strategy



(Carr et al., 2017), defeatist thinking (Favrod et al., 2015) and positive goal setting (Meyer et al., 2015). Other interventions primarily focused on compassion (e.g. Braehler et al., 2013; Feliu-Soler et al., 2017) or goalsetting (e.g. Farquharson & MacLeod, 2014; MacLeod et al., 2008). An overview of interventions is presented in Table 2.

Interventions in the control group A variety of control conditions were used in ten studies: three studies used treatment as usual (Braehler et al., 2013; Schrank et al., 2016; Seligman et al., 2006) and one study used a waiting-list group (Farquharson & MacLeod, 2014). In the other six studies, PPIs were compared to active interventions. The control conditions comprised a program comparable to the intervention group (Carr et al.,

Table 1. Sample characteristics of the included studies.

	PPI group (*n* = 442)	Control group (*n* = 287)	Total group (*N* = 729)
Age, years	42.0	43.2	42.5
Gender			
Female	238 (53.8%)	195 (67.9%)	433 (59.4%)
Marital status			
Single	277 (62.7%)	167 (58.2%)	444 (60.9%)
In relationship	165 (37.3%)	120 (41.8%)	285 (39.1%)
Drop-out rate	107 (24.2%)	63 (22.0%)	170 (23.3%)
Diagnosis			
Major depressive disorder	160 (36.2%)	170 (59.2%)	330 (45.3%)
Schizophrenia	186 (42.1%)	72 (25.1%)	258 (35.4%)
Bipolar disorder	55 (12.4%)	21 (7.3%)	76 (10.4%)
Borderline personality disorder	16 (3.6%)	16 (5.6%)	32 (4.4%)
Schizoaffective disorder	13 (2.9%)	4 (1.4%)	17 (2.3%)
Others not specified	12 (2.7%)	4 (1.4%)	16 (2.2%)

2017; Celano et al., 2018), cognitive behaviour therapy (Asgharipoor et al., 2012; Chaves et al., 2017), a cognition focused treatment (Celano et al., 2017), and a mindfulness continuation treatment (Feliu-Soler et al., 2017).

Outcomes

In total, the included studies used 74 different measurement scales. In the meta-analysis, we used only scales with outcomes related to well-being (36) and symptomatology (20). Of the measurement scales focusing on well-being, the Satisfaction With Life Scale (SWLS), Positive and Negative Affect Schedule (PANAS), Savouring Belief Inventory (SBI), and Self-Compassion Scale (SCS) were used most often (5, 5, 4, and 4 times, respectively). Of the symptomatology scales, the Beck Depression Inventory (BDI), Beck Hopelessness Scale (BHS), and Hamilton Rating Scale for Depression were used in more than one study (4, 2, and 2 times, respectively). One included study (Lai et al., 2015) only assessed well-being related outcomes.

Post-test effects

For the nine studies including a control group, a small nonsignificant effect on well-being (g = 0.17, p = .19, n = 287) and psychopathology (g = −0.10, p = .62, n = 287) between the PPI and control groups was found. Analyses of within-group effects for all 16 included studies revealed a moderate significant effect on well-being (Hedge's g = 0.40, p < .001, N = 729) and a large significant effect on psychopathology (g = −0.70, p < .001, n = 666) within the positive psychology groups. An overview of the total effects

Table 2 Characteristics of included studies

First author (year)	Diagnosis	Female %	N	Mean age (SD)	PP intervention	Control group	Drop-out rate (%)	Outcome measures
Asgharipoor (2012)	MDD	72.2	18	26.4 (5.9)	Positive psychotherapy	CBT	NR	OHS, SWS, BDI-II, SUDS
Braehler (2012)	Schizophrenia, schizoaffective disorder, psychosis, bipolar disorder	45.0	40	41.8 (10.3)	Compassion-focused therapy	TAU	32.0	PANAS, BDI-II
Carr (2017)	MDD	66.0	82	41.0 (NR)	Say yes to life	TAU + therapy	40.0	WEMBS, BDI-II, HRSD, MADS
Celano (2016)	MDD	69.0	65	44.0 (16.7)	Positive Psychology intervention	CF	10.0	PANAS, LOT-R, BHS, QIDS
Celano (2018)	Bipolar disorder	68.0	25	45.4 (13.0)	Positive Psychology intervention (+ telephone calls)	Recall neutral events (+ telephone calls)	20.0	PANAS, GQ-6, LOT-R, BHS, QIDS
Chaves (2017)	MDD	100.0	96	51.7 (10.4)	Positive psychology intervention	CBT	21.3	PANAS, PHI, PWBS, SWLS, LOT-R, BDI-II, BAI
Farquharson (2014)	Schizophrenia, bipolar disorder, MDD	53.0	82	45.0 (10.4)	Goal-setting and planning	WL	51.0	PANAS, SWLS
Favrod (2015)	Schizophrenia, schizoaffective disorder	35.0	37	39.5 (20.0)	Positive emotions program for schizophrenia	NA	16.0	SBI, CDSS, SANS
Feliu-Soler (2017)	Borderline personality disorder	94.0	32	33.8 (7.2)	Loving-kindness and compassion meditation	MCT	NR	SCS, FSCRS, BSL-23
Ferguson (2009)	Schizophrenia, bipolar disorder	0.0	14	40.1 (10.8)	Well-being therapy	NA	2.0	PANAS, SWLS, FTT, HADS, BHS, NSS
Johnson (2011)	Schizophrenia, schizoaffective disorder	17.0	18	29.4 (10.2)	Loving-kindness meditation	NA	NR	mDES, TEPS, PWBS, SWLS, THS, SBI, CAINS

Table 2 Continued

First author (year)	Diagnosis	Female %	N	Mean age (SD)	PP intervention	Control group	Drop-out rate (%)	Outcome measures
Lai (2015)	Schizophrenia, bipolar disorder, MDD	40.0	63	NR	Recovery program	NA	5.2	CHS, CSWEMWBS
Meyer (2012)	Schizophrenia	56.0	16	39.6 (8.8)	Positive living	NA	25.0	SPWB, SBI, DHS, BSI
Painter (2019)	Bipolar disorder	50.0	12	45.3 (12.3)	Positive emotion regulation intervention	NA	25.0	AVI, SBI, SCS-SF, YMRS, HRSD
Schrank (2016)	Schizophrenia, schizoaffective disorder	45.0	94	42.5 (11.3)	Well-focus positive psychotherapy	TAU	24.0	WEMWBS, PPI, SDHS, IHS, RSE-S, SBI, RES, SCS, BPRS
Seligman (2006), study 2	MDD	73.0	32	NR	Positive psychotherapy	TAU and TAU + medication	13.0	SWLS, PPTI, ZSRD

Note. AVI = Affect Valuation Index, BAI = Beck Anxiety Inventory, BDI-II = Beck Depression Inventory-II, BHS = Beck Hopelessness Scale, BSI = Brief Symptom Inventory, BSL-23 = Borderline Symptom List-23, BPRS = Brief Psychiatric Rating Scale, CAINS = Clinical Assessment Interview for Negative Symptoms, CBT = Cognitive Behavioral Therapy, CDSS = Calgary Depression Scale for Schizophrenia, CF = Cognition-focused, CHS = Chinese Hope Scale, CSWEMWBS = Chinese Short Warwick Edinburgh Mental Well-being Scale, DHS = Dispositional Hope Scale, FSCRS = Forms of Self-Criticism/Self-Attacking and Self-Reassuring Scale, FTT = Future Thinking Task, GQ-6 = Gratitude Questionnaire-6, HADS = Hospital Anxiety and Depression Scale, HIS = Integrative Hope Scale, HRSD = Hamilton Rating Scale for Depression, LOT-R = Life Orientation Test-Revised, MADS = Montgomery –Asberg Depression Scale, MCT = Mindfulness Continuation Training, MDD = Major Depressive Disorder, mDES = Modified Differential Emotions Scale, NA = Not applicable, NR = Not reported, NSS = Negative Syndrome Scale, OHS = Oxford Happiness Scale, PPTI = Positive Psychotherapy Inventory, PWBS = Ryff's Psychological Well-being Scale, PHI = Pemberton Happiness Index, PPI = Positive Psychotherapy Inventory, QIDS = Quick Inventory of Depressive Symptomatology, RES = Rogers Empowerment Scale, RSE-S = Rosenberg Self-Esteem Scale, SANS = Scale for the Assessment of Negative Symptoms, SBI = Savoring Belief Inventory, SCS = Self-compassion Scale, SCS-SF = Self-compassion Scale-Short Form, SDHS = Short Depression Happiness Scale, SERS-SF = Self-esteem Rating Scale – Short Form, SUDS = Subjective Units of Distress Scale, SWLS = Satisfaction with Life Scale, SWS = Subjective Well-being Scale, TAU = Treatment as Usual, TEPS = Temporal Experience of Pleasure Scale, THS = Trait Hope Scale, WEMWBS = Warwick Edinburgh Mental Well-being Scale, WL = Waiting-list, YMRS = Young Mania Rating Scale, ZSRS = Zung Self-Rating Scale on well-being and psychopathology can be found in Table 4. Individual effect sizes of the within-group effects are summarised in Figures 2 and 3.

Figure 2. Forest plot of within-group effects on outcomes of well-being of the included positive psychology interventions.

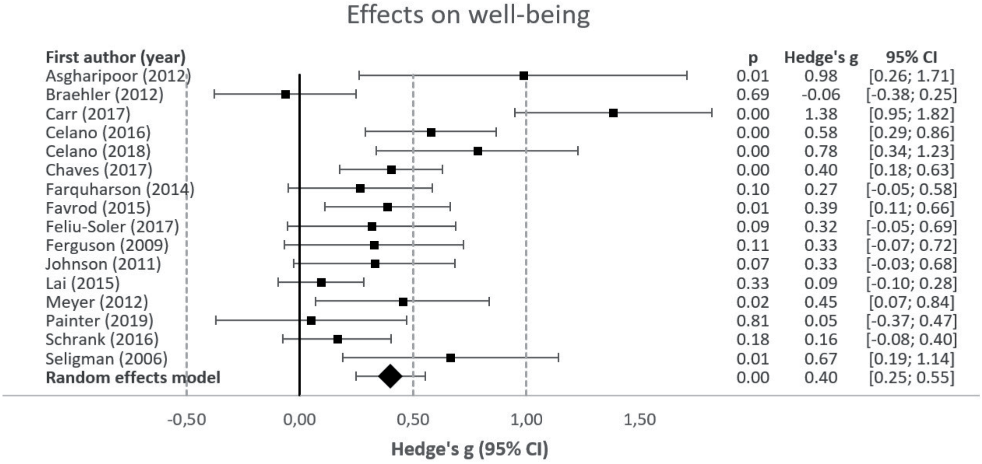


Figure 3. Forest plot of within-group effects on outcomes of psychopathology of the included positive psychology interventions.

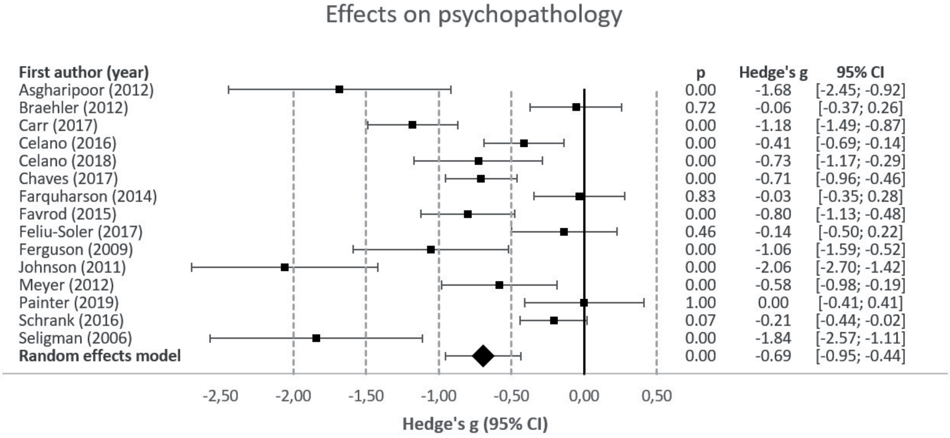


Table 4. Between- and within-group effects at post-intervention

Outcome measure	N_{comp}	Hedge's g	95% CI	Z
Between-group effects post-intervention				
Well-being	10	0.16	-0.08; 0.41	1.30
Psychopathology	10	-0.10	-0.49; 0.29	-0.50
Within-group effects post-intervention				
Well-being	16	0.40	0.25; 0.56	5.15***
Psychopathology	15	-0.70	-0.95; -0.44	-5.26***

Note. N_{comp} = number of comparisons; CI = confidence interval. *** $p < .001$

Subgroup analyses

Analysing potential moderators of the within-group effects, no significant differences between subgroups for treatment duration and format were found for both well-being and psychopathology. For the diagnosis subgroups, PPIs had a significantly stronger effect on well-being in people with MDD compared to patients with schizophrenia (Q = 4.52, df = 1, p < .05) and compared to studies with mixed samples (Q = 9.30, df = 1, p < .01). Furthermore, PPIs revealed a significantly stronger effect on psychopathology in people with MDD compared to studies containing mixed samples (Q = 4.19, df = 1, p < .05). Results of the subgroup analyses are summarised in Table 5.

Table 5. Subgroup analyses.

Outcome	Criterion	Subgroup	N_{comp}	Hedge's g	95% CI	Z
Well-being	Duration	<= 8 weeks	7	0.37	0.13; 0.60	3.05**
		> 8 weeks	9	0.44	0.22; 0.65	3.95***
	Format	Group	13	0.34	0.19; 0.50	4.25***
		Individual	3	0.66	0.32; 1.01	3.74***
	Diagnosis	MDD	5	0.73	0.47; 0.99	5.42***
		Schizophrenia	4	0.32	0.06; 0.59	2.38*
Psychopathology	Duration	<= 8 weeks	6	-0.68	-1.10; -0.25	-3.10**
		> 8 weeks	9	-0.72	-1.06; -0.37	-4.04***
	Format	Group	12	-0.65	-0.95; -0.35	-4.26***
		Individual	3	-0.90	-1.52; -0.28	-2.86**
	Diagnosis	MDD	5	-1.08	-1.56; -0.59	-4.36***
		Schizophrenia	4	-0.84	-1.33; -0.61	-5.32***

Note. N_{comp} = number of comparisons; CI = confidence interval. *$p < .05$ **$p < .01$ ***$p < .001$

Table 3. Characteristics of the interventions.

First author (year)	Intervention	Duration	Format	Goals	Modules/structure	Therapeutic techniques
Asgharipoor (2012)	Positive Psychotherapy	12 weeks, one session weekly	Group	Identifying potential capabilities and how to strengthen them	Awareness positive aspects of life, values in life, ranking, combine lifestyle with values. 1.) Orientation, 2.) Identify potential capabilities, 3. and 4.) Ways of appreciating positive affairs in life, 5.) Psycho education four life styles, 6. and 8.) Ranking activities of pleasure and meaningfulness, 8.-12.) Hierarchy of life-style and values.	Psycho-education, writing and planning
Braehler (2013)	Compassion-Focused Treatment	16 weeks, one 2 hour session weekly	Group	Building capacities in individuals suffering from psychosis to experience compassion	Based on compassion-focused therapy in high shame and self-critical individuals. 1.) Formation phase, sessions 1-5: insight in recovery, activation to build compassionate skills. 2.) Middle phase, sessions 6-13: developing compassion. 3.) End phase, sessions 14-16: reflect and integrate changes	Psycho-education, mindfulness and writing
Carr (2016)	Say Yes To Life Intervention	20 weeks, one 2 hour session weekly	Group	Learning a range of positive psychology and CBT-skills and providing a context for recovery	Positive psychology psychotherapy intervention for major depressive disorder. Positive psychology skills were included in the following sessions: 2.) Identifying personals strengths; 7.) Constructive use of humour, 13.) Strengthening adult attachments, 14.) Gratitude, 15. and 16.) Forgiveness, 17.) Strengthening social networks, 19.) Savouring positive experiences	Psycho-education, CBT exercises, homework and writing
Celano (2017)	Positive Psychology Intervention	6 weeks, weekly phone call	Individual	No specific goals were described	Telephone-based PP intervention for depressed patients hospitalized for a suicide attempt or suicidal ideation. Telephone session to review weekly sections of the treatment manual, highlighting a specific positive construct and its role in their recovery: 1.) Gratitude for positive events, 2.) Identifying and using personal strengths, 3.) Gratitude letter, 4.) Enjoyable and meaningful activities, 5.) Leveraging past success, 6.) Acts of kindness	Psycho-education, homework and writing
Celano (2018)	Positive Psychology intervention (+ telephone calls)	4 weeks, weekly phone call	individual	Increasing PPE vocubulairies, reinforcement of PPE, integrating PPI in daily life	Week 1 – Gratitude letter:Participants wrote a letter thanking someone for an actfor which they were grateful. Week 2 – Using personal strengths: Participants used a strength in a new way. Week 3 Performing acts of kindness: Participants performed three acts of kindnessin one day. Week 4 Imagining a best possible self: Participants wrote about their bestpossible life in the future.	Exercises, homework, reviewing excercises and writing

Table 3. Continued

First author (year)	Intervention	Duration	Format	Goals	Modules/structure	Therapeutic techniques
Chaves (2017)	Positive Psychology Intervention	10 weeks, one 2 hour session weekly	Group	Designed to nurture components of hedonic well-being and components of eudaimonic well-being	Program based on positive psychology for treating major depression: 1.) Objectives, expectations and attitudes on treatment, 2.) Positive emotions, 3.) Savouring and Emotion regulation, 4.) Gratitude, optimism and best possible self, 5.) Positive relationships and kindness, 6.) Self-compassion, 7.) Personal strengths, 8.) Sense of living and goal setting, 9.) Resilience, 10.) Relapse prevention	Psycho-education, homework and writing
Farquharson (2014)	Goal-setting And Planning Intervention (GAP)	4 weeks, one 2 hour session weekly	Group	Targeting goal-setting and planning skills to improve well-being	No further description of the intervention was given	No further description of the intervention was given
Favrod (2015)	Positive Emotions Program for Schizophrenia (PEPS)	8 weeks, one 1 hour session weekly	Group	Reducing anhedonia and apathy, helping to overcome defeatist cognitions and to increase the anticipation and maintenance of positive emotions	The intervention included meditation exercises, discussion of homework, exercise in challenging specific defeatist thoughts, develop an alternative and a more positive way of thinking, learn and practice a new skill to improve their anticipation or maintenance of pleasure. The sessions included: 1.) defeatist thinking, 2.) savouring pleasant moments, 3.) accentuating the behavioural expression of emotions, 4.) making the most of pleasant moments by sharing them with others, 5.) savouring past pleasant moments, 6.) anticipating pleasant moments, 7.) anticipating pleasant moments, 8.) review of all skills	Visual and audio materials, psycho-education, homework and writing
Feliu-Soler (2016)	Self-compassion and Loving-kindness meditation	3 weeks, one session weekly	Group	Establishing motivation for LKM and compassion practice and provide an evolutionary understanding of compassion by explaining the three emotion regulation systems.	Psycho-educational content from Gilbert's theoretical model of compassion, DBT techniques based on the use of kindness and affection. Other techniques included: affection in acceptance of negative emotions, loving-kindness meditation, and specific exercises from the Mindful Self-Compassion programme. LKM and compassion exercises were practiced during clinical sessions, and participants were strongly encouraged to practice daily	Psycho-education, audio material with LKM and compassion for practicing at home

Table 3. Continued

First author (year)	Intervention	Duration	Format	Goals	Modules/structure	Therapeutic techniques
Ferguson (2009)	Goal-setting and Planning Intervention (GAP)	6 weeks, one session weekly	Group	Developing goal setting and planning skills with the aim to increase well-being	Focus on positive engagement with goals: 1.) Introduce the concept of well-being, role of goals and plans and their relation to well-being, identify valued personal goals, 2.) Select goal practice a visual imaging technique, discuss planning, 3.) Review plans of action and discuss common obstacles, 4.) Discuss action steps, obstacles and solutions, 5.) Discuss maintaining motivation, identify topics for final session, 6.) Revise some of the techniques used in the group and identify members of the team who can offer support	Psycho-education, writing, planning, homework
Johnson (2011)	Loving-kindness meditation	7 weeks, one 1 hour session weekly	Group	Cultivating kindness towards self and others, change the orientation to life experiences, aiming to broaden the range of emotional responses	Sessions incorporated 3 components: discussion, skill teaching, and practice. Practice began with mindfulness, participants then contemplated a person for whom they already feel compassion or a social situation where they felt kindness. Participants were led in guided meditations to sequentially extend these feelings to themselves as well as others. Participants were encouraged to practice LKM formally by listening daily to meditation audio material	Psycho-education, meditation, audio material for practice at home
Lai (2015)	Recovery Program	3 weeks, five 1 hour sessions weekly	Group	Promote successful recovery through goal setting, positive thinking, taking control and empowerment	Five elements as therapeutic modules: hope, support and managing symptoms, empowerment, relationship and coping, including 1.) Identification of hope and development of faith, 2.) Enhancement of personal responsibility and productivity, 3.) Promotion of self-management and autonomy, 4.) Importance of peer support and community life, 5.) Building frustration tolerance and learn forgiveness, 6.) Social acceptance and enhanced self-awareness; 7.) Adaptability and capacity to change, 8.) Situational applicability	Psycho-education
Meyer (2012)	Positive Living	10 weeks, one 90 minute session weekly	Group	No specific goals were described	Six behavioural exercises: Using your strengths, three good things, biography, gratitude visit, active/constructive responding, and savouring. Designed to increase positive emotions, as well as build character strengths and meaning. Also included positive goal and mindfulness minute	Homework, writing

Table 3. Continued

First author (year)	Intervention	Duration	Format	Goals	Modules/structure	Therapeutic techniques
Painter (2019)	Positive emotion regulation intervention	9 weeks, 90 minute session weekly	Group	Improve emotional dysregulation in BD	The Learning Affective Understanding for a RichEmotional Life (LAUREL): Week 1: introduction to bipolar disorder, Week 2: emotion education, Week 3: noticing and savoring positive experiences, Week 4: mindfulness, Week 5: reappraisal, Week 6: gratitude and small acts of kindness, Week 7: self-compassion, Week 8: setting and achieving attainable goals ,Week 9: feedback andimplementation	Psycho-education, CBT, dadatic skills, , daily log and homework
First author (year)	**Intervention**	**Duration**	**Format**	**Goals**	**Modules/structure**	**Therapeutic techniques**
Schrank (2016)	Wellfocus Positive Psychotherapy	11 weeks, one 90 minute session weekly	Group	Increasing positive experiences, amplifying strengths, fostering positive relationships and creating a more meaningful self-narrative	Introduction, savouring, good things, identifying personal strengths, personal strength activity, strength activity with significant other, forgiveness, one door closes another door opens, gratitude, and positive responding. Sessions begin and close with a music savouring exercise. In contrast to standard PPT, this intervention has a reduced focus on literacy and didactics but instead includes more experiential and interactive components	Psycho-education, homework and writing, supporting phone-calls
Seligman (2006), study 2	Positive psychotherapy	12 weeks and 14 sessions	Individual	No specific goals were described	1.) Orientation: lack of positive resources maintains depression, 2.) engagement: identifying signature strengths, 3.) Engagement/pleasure: cultivation of signature strength and positive emotions, 4.) Pleasure: good versus bad memories, 5.) Pleasure/engagement: forgiveness, 6.) Pleasure/engagement: gratitude, 7.) Pleasure/engagement: mid-therapy check, 8.) Meaning/engagement: satisficing instead of maximizing, 9.) Pleasure: optimism and hope, 10.) Engagement/meaning: love and attachment, 11.) Meaning: family tree of strengths, 12.) Pleasure: savouring, 13.) Meaning: gift of time, 14.) Integration: the full life	Psycho-education, homework

Note. CBT = Cognitive Behavioural Therapy, LKM = Loving-Kindness Meditation, PP = Positive Psychology, PPE = Positive Psychology Emotions

Discussion

The current explorative meta-analysis aimed to assess the effects of PPIs on well-being and psychopathology in people with SMI across studies. Nine controlled studies, eight of which used randomised allocation to conditions, and seven non-controlled studies were included. For the nine controlled studies, a non-significant, small effect was found across studies between intervention and control groups for both well-being and psychopathology.

Across all studies, a significant moderate pre-post intervention effect was found for well-being and a significant large effect for psychopathology. These results demonstrate that people with SMI do benefit from PPIs in terms of well-being and psychopathology. However, at present, there is no evidence that PPIs are more effective in improving mental health when using controlled studies. One explanation for the absence of significant effects in the controlled studies is that the majority of these studies used an active intervention such as cognitive behavioural therapy, cognition therapy, and mindfulness as a control condition. It is a common finding in meta-analyses that therapeutic interventions are more effective in comparison to waiting-list groups or no-intervention conditions than active interventions (Davis et al., 2016; Sin & Lyubomirsky, 2009a).

We also found that PPIs are more effective in improving well-being in patients with MDD compared to patients with schizophrenia and mixed diagnoses and that PPIs are more effective in reducing psychopathology in patients with MDD in comparison with mixed samples. These findings suggest that PPIs are the most impactful on recovery in patients with MDD. One possible explanation is that many PPIs are aimed at enhancing positive emotions and cognitions and that these processes have the most substantial impact in people with MDD since negative emotions and cognitions are the core symptoms of MDD. However, a depressed mood is not exclusive to individuals with an MDD diagnosis. Within the other SMI-diagnosis groups (e.g. bipolar disorder and schizophrenia), depressive episodes are common as part of the diagnosis in BD or as a comorbid disorder in other diagnosis groups. A recent study found that affective symptoms had a greater influence on the personal recovery of patients with SMI than with psychotic symptoms (Van Eck et al., 2018). Another possible explanation is related to the characteristics of the disorders themselves. Schizophrenia is characterised by a complex set of symptoms and often has a chronic and life-long course (Miller et al., 2014). In addition, recovery rates are extremely low, and relapse rates are very high (Emsley et al., 2013; Ventura et al., 2011). Though PPIs may support the personal recovery of patients with schizophrenia, it may thus be harder to demonstrate the impact on well-being and symptomatology in this more persistent and complex disorder. The findings of this meta-analysis can be placed in the context of recent pleas for a more balanced approach in clinical psychology (e.g. Wood & Tarrier, 2010). Until recently, the roles of positive emotions, cognitions, and behaviour in mental health have largely been ignored, but there is growing evidence demonstrating that including positive psychotherapeutic interventions in treatment models has the potential to increase the effects on mental health (e.g. Rashid, 2009; Seligman et al., 2006; Tayyab. Rashid, 2015; Wood & Tarrier, 2010). Additionally, there is substantial evidence that well-being and psychopathology are two related but distinct dimensions of mental health (e.g. Franken et al., 2018; Lamers et al., 2011) and that positive functioning reduces the risk of future incidence of mental illness (Schotanus-Dijkstra et al., 2018; Hendriks et al., 2019). Also, people with mental illness describe the development of positive functioning as an important outcome of their treatment (de Vos et al., 2015; Zimmerman et al., 2006). These studies underscore the need to further develop and evaluate PPIs in people with mental illness.

Several important limitations apply to this meta-analysis. Firstly, only 16 studies were included in the review, and only eight studies used a randomised controlled design. Also, many studies included a limited number of patients, and the total number of included patients in this meta-analysis is relatively small. This warrants a cautious interpretation of the results. Hendriks et al. (2019) stated in a re-analysation of the two main meta-analyses in PPIs that, due to small sample size bias, the effects are possibly much smaller than previously reported (White et al., 2019). It is to expect that this bias also applies to our study. Second, there is a large variety in the studied types of interventions, and the limited number of studies precludes an assessment of the relative impact of specific types of interventions. Third, follow-up assessments were largely lacking, and therefore, the long-term impact of PPIs on mental health in people could not be assessed.

Conclusion

At present, there is no evidence that PPIs are more effective in comparison with other active interventions and treatment as usual in improving mental health in people with SMIs. However, the results also show that people with SMIs do benefit from PPIs in terms of enhancement of well-being and reduction of psychopathology. To further broaden the evidence regarding the effect of PPIs in SMIs, we recommend to further evaluate the effectiveness of PPIs in these target groups by means of adequately powered, randomised controlled trials. Moreover, it is recommended to include measures of specific positive proximal outcomes, which are the primary focus of PPIs.

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Appendix 1 search string

Search string: Scopus

#1 TITLE-ABS((well-being} OR wellbeing} OR well-being} OR happiness OR happy OR life satisfaction} OR satisfaction with life} OR positive psych*} OR positive emotion*} OR positive feeling*} OR positive cognition} OR positive behavio*} OR compassion OR optimism OR gratitude OR kindness OR Savouring OR Strengths OR Flourishing OR resilience)

#4 TITLE-ABS(severe mental illness} OR psychosis OR Schizophrenia OR major depressive disorder} OR bipolar disorder} OR Mood disorder} OR mania OR personality disorder})

#3 TITLE-ABS(intervention* OR therap* OR treatment* OR training* OR program* OR exercise)

#4 TITLE-ABS(effect* OR effic* OR outcome* OR evaluat* OR feasibility OR acceptability)

#5 #1 AND #2 AND #3 AND #4 (filters: English, article, limit to subject area psychology and social sciences)

Search string: PubMed

#1 ("well-being"[tiab] OR happiness OR happy OR “life satisfaction”[tiab] OR “satisfaction with life”[tiab] OR "positive psychology"[tiab] OR "positive emotion"[tiab] OR "positive feeling"[tiab] OR "positive cognition"[tiab] OR "positive behaviour"[tiab] OR compassion[tiab] OR optimism[tiab] OR gratitude[tiab] OR kindness [tiab]) OR Savouring [tiab] OR Strengths [tiab] OR Flourishing [tiab] OR resilience [tiab])

#2 (Happiness[Mh] OR Positive Psychology[Mh] OR Well Being[Mh] OR Optimism[Mh] OR Life Satisfaction[Mh] OR Compassion[Mh] OR Optimism[Mh])

#3 (intervention*[tiab] OR therap*[tiab] OR treatment*[tiab] OR training*[tiab] OR program*[tiab] OR exercise[tiab])

#4 (Therapy[Mh] OR Psychotherapy[Mh] OR Training[Mh] OR Exercise[Mh])

#5 (“severe mental illness” [tiab] OR psychosis [tiab] OR Schizophrenia [tiab] OR “major depressive disorder” [tiab] OR “bipolar disorder” [tiab] OR “Mood disorder”[tiab] OR mania [tiab] OR “personality disorder”[tiab])

#6 (“Severe mental illness” [Mh] OR Psychosis [Mh] OR “Disorder Schizophrenia” [Mh] OR “Major depressive disorder” [Mh] OR “Bipolar disorder” [Mh] OR “Mood disorder”[Mh] OR Mania [Mh] OR “Borderline personality disorder”[Mh])

#7 (effect*[tiab] OR effic*[tiab] OR outcome*[tiab] OR evaluat*[tiab] OR feasibility [tiab] OR acceptability [tiab]) condition[tiab])

#8 #1 OR #2

#9 #3 OR #4

#10 #5 OR #6

#11 #8 AND #9 AND #10 AND #7 (filters: English, Adults)

Search string: PsycINFO
#1 ("well-being" OR happiness OR happy OR “life satisfaction” OR “satisfaction with life” OR "positive psych*" OR "positive emotion*" OR "positive feeling*" OR "positive cognition" OR "positive behavio*" OR compassion OR optimism OR gratitude OR kindness)
#2 (DE “optimism” OR DE “well-being” OR DE “life satisfaction” OR DE “happiness” OR DE “positive psychology” OR DE “gratitude”) OR “Savouring” OR “Strengths” OR “Flourishing” OR “resilience”)
#3 (intervention* OR therap* OR treatment* OR training* OR program* OR exercise)
#4 (DE “Intervention” OR DE “Therapy” OR DE “Psychotherapy”)
#5 (“severe mental illness” OR psychosis OR Schizophrenia OR “major depressive disorder” OR “bipolar disorder” OR Mood disorder” OR mania OR “personality disorder”)
#6 (DE “severe mental illness” OR DE “psychosis” OR DE “Schizophrenia” OR DE “major depressive disorder” OR DE “bipolar disorder” OR DE “Mood disorder” OR DE “Mania” OR DE “Borderline personality disorder”)
#7 (effect* OR effic* OR outcome* OR evaluat*)
#8 #1 OR #2
#9 #3 OR #4
#10 #8 AND #9 AND #5 AND #7 (filters: academic journals, adults English)

CHAPTER 3

3

Why patients diagnosed with Bipolar Disorder start, continue or discontinue health-related apps supporting their self-management: An exploratory mixed-method study

Bart Geerling
Saskia Kelders
Anja Stevens
Ralph Kupka
Ernst Bolhmeijer

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Introduction

Self-management is one of the cornerstones in the treatment of bipolar disorder (BD). Complementing interventions by apps are seen as a good opportunity to support self-management. However, there is insufficient knowledge about understanding the use of health-related applications by consumers with BD for self-management purposes.

Aim

The study aims to gain insight from patients diagnosed with BD about reasons to use, continue, or discontinue health-related apps.

Method

This study employed a mixed-method design in which 41 participants diagnosed with BD participated in a quantitative survey, and 11 participants also participated in an in-depth interview.

Results

The survey showed that 44% (n=18) of the participants use health-related apps, and 26.8% (*n* = 11) use those apps consistently. Interviews revealed that adjustability, usability, trustworthiness, and the guarantee of privacy were the main reasons determining whether participants used or terminated the use of a health-related app.

Implications for practice

Although we found that a substantial number of patients diagnosed with BD use one or more apps to support self-management, their use is often discontinued due to content that needs more robust to address their needs. Besides appropriate content, tailoring and persuasive technologies will likely promote the continued use of an app for self-management purposes. Cooperation between those diagnosed with bipolar disorder and health professionals (like mental health nurses) in developing and designing applications that are aimed to support self-management in BD is necessary for successful implementation and adaptation.

Keywords

bipolar disorder, E-health, self-management

Accessible summary

What is known about the subject?

- Self-management is essential in the treatment of those who have bipolar disorder.
- There are many apps to support self-management, but we know that these apps only sometimes cover the users' needs.

What is added to existing knowledge?

- In our research, we made an inventory of apps that people with bipolar disorder use to cover their needs in self-management. We also have searched for the reasons to start, continue, switch or quit the use of those apps.
- We found that 44% (n=18) of our respondents use health-related apps for self-management purposes. Apps for physical activity, planning and structure and apps for relaxation were most used.
- In the use of apps, the 'freedom of choice' and user-friendliness are the most important in continuing the use of apps, while malfunctioning and 'not fitting in individual needs' the main reasons were for quitting the use of apps.

Implications for practice

- Various apps can be used for self-management purposes as long as these apps meet the individual user's requirements.
- Clinicians and patients should have a broad view when looking for suitable apps and not limit the search to just professional apps.
- In developing new apps, patients, clinicians and developers should collaborate in the development process, requirements and design.

Introduction

Bipolar disorder (BD) is a severe mental illness characterised by recurrent manic, hypomanic, depressive and/or mixed episodes alternating with euthymic periods. The first episodes of mania or depression often manifest in adolescence and young adulthood (Goodwin & Jamison, 2007). BD types I (with full mania) and II (only hypomania and depression) are estimated to be prevalent in 2% of the world's population, and it is estimated that another 2% has a form of subthreshold BD (Geddes & Miklowitz, 2013). In adults, the prevalence of BD in the Netherlands is 1.3% (de Graaf et al., 2010). Due to early-onset, severity, and chronicity, BD poses a significant burden on patients and their relatives and causes an impaired quality of life both during and between mood episodes (Erten et al., 2014; Ferrari et al., 2016; Vieta et al., 2013). Contributing factors are mood symptoms, stigmatisation, cognitive dysfunction, comorbid conditions and pharmacotherapy's side effects (Kasper, 2004).

In addition to psychopharmacological treatment, self-management is one of the cornerstones in the treatment of BD to manage and prevent mood episodes and personal functioning in inter-episodic periods. The use of the Life Chart Method for monitoring the course of BD (Denicoff et al., 2002), using a relapse prevention plan (Morriss et al., 2007), and improvement of active coping strategies are examples of self-management interventions (Murray et al., 2011). Learning and applying self-management is a unique process in which people search for effective tools to support them (van den Heuvel et al., 2015) Nowadays, these tools can also be found in applications for smartphone use. There are more than 10,000 mental health-related apps (Torous & Roberts, 2017) and over 500 apps just for BD (Nicholas, Larsen, Christensen, 2015). As a result, more and more patients can be informed about and proactive with their mental health care. Many seek technology-oriented and self-directed treatment options (Sandoval et al., 2017). Nicholas et al. (2015) reviewed 82 apps designed for individuals diagnosed with BD. They concluded: 'the content of currently available apps for BD is not in line with practice guidelines or established self-management principles. Apps also fail to provide important information to help users assess their quality, with most lacking source citations and a privacy policy (Nicholas et al., 2015).' Therefore existing apps do not sufficiently fulfil users' needs for disease management (Sandoval et al., 2017). Because of this 'maze of apps', clinicians are advised to discuss the availability and use of apps with their patients (Torous et al., 2018) to avoid using apps that can harm patients. Furthermore, there is a clear call to develop good quality, evidence-based mobile interventions to support patients in managing their illness (Nicholas, Larsen, Christensen, 2015). Although apps are frequently used, it remains unknown which demands or needs patients diagnosed with BD have in using these apps. To 'open the window' to these demands and needs, this study aims to gain insight from patients diagnosed with BD about reasons to start using, continue use or discontinue the use of health-related apps and how frequently health-related apps are used by patients diagnosed with BD for self-management purposes.

Method

Design

We used a mixed-method study with an explorative design. For the study's quantitative component, a questionnaire was developed to collect data about the types of apps used and the frequency of use. In the qualitative part of the study, semi-structured interviews were conducted to gain insight into why people diagnosed with BD begin to use, continue or discontinue the use of health-related apps. Health-related applications were defined as 'apps aimed at, or are used for, improving and managing personal health'.

Participants

Participants were recruited in a specialised outpatient clinic for BD. All patients were diagnosed with BD I or II and received specialist care according to the Dutch BD guidelines (Kupka, et al., 2015). Patients were euthymic when entering the study. The exclusion criteria were; a major depressive or manic episode, psychotic episode, suicidal, or did not possess a smartphone.

Procedure

Ethical approval for the study was obtained from the Dimence Mental Health Institute Scientific Research Committee. All patients that met the inclusion criteria were potential participants. The clinicians in the outpatient clinic selected potential participants for the study and asked them if the research may approach them. The researchers approached patients who agreed and received an information letter with an informed consent form. After signing the form and completing the questionnaires, patients were asked to participate in the interviews. The selection was a-selective and was based on voluntary participation in the qualitative part of the study. The face-to-face semi-structured interviews, lasting 20–30 minutes, were based on a topic list and were conducted and recorded in the outpatient clinic. Data collection was continued until data saturation had been achieved.

Materials

Two questionnaires were used: the Revised Personal Involvement Inventory (RPII) (Zaichkowsky, 1994) and the 'Use of health applications in mental health'. The RPII was developed to establish involvement with products, adverts and purchase situations as a context-free measurement. Involvement is defined as *'A person's perceived relevance of the object based on inherent needs, values and needs.'* (Zaichkowsky, 1985). The RPII was used to deepen information about patients' involvement with the apps (Zaichkowsky, 2012). The RPII has ten items on a seven-point Likert scale from positive to negative (e.g. important – not important, meaningful – meaningless). The total score (10-70) is divided into three levels of involvement (low; 10-29, average 30-50 and high 51-70). The RPII has two sub-scales (cognitive and affective involvement). For both scales, the total score lies between 5-35, with also can be divided into three levels (low; 5-14, average 15-25 and high 26-35). The participants filled in the inventory when they used health-related apps. The questionnaire covered all apps used. Participants were asked to give information about the three most-used apps when they used more than three.

For the semi-structured qualitative interviews, the following topics were addressed:

- Features that are important in using the apps
- Aspects of starting with applications
- Aspects of maintaining the use of applications
- Aspects in discontinuation of use

The latter inventory (appendix 1) was specifically developed for this study to gather information on health-related applications by patients diagnosed with BD. The questions focus on the number of apps used, the specification of the type of apps and information about the duration, frequency, and purpose of the used apps.

Data analysis

Quantitative analysis

SPSS (IBM, version 22) was used for the quantitative data. Descriptive analysis of the different types of apps, duration and frequency of the use of apps. Spearman's rank correlation was used for the relation between the categories of apps and the frequency of use.

We classified the apps according to self-management purposes in BD:

- Physical health and fitness
- Planning and activity structure
- Social media
- Meditation and relaxation
- Sleep
- Treatment
- Medical information

Qualitative analysis

For the qualitative data, ATLAS.ti7 was used for the analysis. A descriptive phenomenological method was used (Colaizzi method as described by (Shosha, 2012). The interviews were ad verbatim transcribed; next, successively open and axial and selective coding was applied. The first interview was coded by two researchers (ELA & BGG) independently from each other. Then the codes were discussed until consensus was achieved. A code-three was made after four interviews. Triangulation was used to increase the objectivity of the data analysis. To avoid personal bias, the process of bracketing was carried out. The interviewer performed member checks after each interview to establish if the content represented the participants' perspectives. After ten interviews, data saturation was achieved an eleventh interview was carried out to verify the data saturation.

Results

Participants

Of the 98 outpatients, 15 patients were excluded by the clinicians due to mood instability (5), no diagnosis of BD (9), or not being a native speaker (1). Eighty-three patients were approached to participate in the study. However, nine potential participants did not start because they did not own a smartphone, and 33 patients refused to participate in the study. Forty-one patients were included in the study and completed the questionnaire. Eleven of these participants also participated in the qualitative interview.

Quantitative data

Twenty-three participants (56%) indicated that they did not use health-related apps at all. The remaining 18 participants (44%) used 41 health-related apps. These apps are divided into seven categories (see table 1). Twenty apps were used to improve self-management in BD. Eleven participants (26.8%) used one or more apps as a self-management tool for BD. These apps were mainly used for improving physical health (n=16), day planning/structure (n=8), or relaxation purposes (n=7). The remaining seven participants did use health-related apps but not specifically for BD self-management purposes. The average number of health-related apps used by the 18 participants was two; 50% used one app, 22% used two apps, and 28% used three or more apps. Table 1 shows the results of the number and categories of the apps they used. Appendix 2 presents a list of the apps they used. Interestingly, none of the participants used mood-monitoring apps for BD.

Table 1 Number and categories of apps

	N = 41 (100%)*
Use of apps	
yes	18 (44%)
no	23 (56%)
Number of apps	
1	9 (50%)
2	4 (22%)
3	2 (11%)
4	2 (11%)
Five or more	1 (6%)
Categories	
Physical health and fitness	16 (39%)
Planning and activity structure	8 (19%)
Relaxation/meditation	7 (17%)
Sleep	3 (7.5%)
Social media	3 (7.5%)
Medical information	2 (5%)
Treatment	2 (5%)

*N = Number of participants

The duration of app use varied from two weeks to four years; twelve participants (31.6%) had been using the apps between one and three years. A majority of the apps (75%) were used at least weekly. We found no correlation between the categories and the frequency of application use (Spearman: rs = 0.19, p = .265). Table 2 shows the duration and frequency of the use of health-related apps.

In order to deepen information about the level of involvement with the apps, the Revised Personal Involvement Inventory (RPII) was assessed. The participants had an average to high level of involvement (*M = 52.33, SD 8.46*). The levels of involvement on sub-categories cognitive and affective involvement are average to high (M = 27.85 versus M = 24.48). The results regarding the three most frequently used categories of apps are shown in table 3.

Qualitative data

Eleven participants that used health-related apps participated in the qualitative interview. Four codes were identified for each of the four topic areas; 1; features that are important in using apps, 2; aspects in starting the use of apps, 3; continuing use of apps or 4; discontinuation or quitting the use of apps, as outlined in Table 4.

Table 2 Duration and frequency of the use of health-related apps

	N = 41 (100%)*
Duration of use	
1–2 weeks	1 (2.4%)
2–4 weeks	2 (4.8%)
1–3 month	9 (22%)
3–6 month	5 (12%)
0.5–1 year	6 (15%)
1–3 years	13 (31.8%)
4 or more years	5 (12%)
Frequency of use†	
<1 day/2 weeks	6 (15%)
1 day/2 weeks	4 (10%)
1 day/week	4 (10%)
2 days/week	3 (7%)
3 days/week	7 (17%)
4 days/week	0 (0%)
5 days/week	2 (4.8%)
6 days/week	3 (7%)
7 days/week	12(29.2%)

*N = number of used apps, † frequency, x times weekly

Table 3 Level of involvement measured with the Revisited Personal Involvement Inventory (RPII)

	RPII score (*SD*) (range)*
Outcomes on the RPII	
Total score	52.33 (*SD = 8.46*) (10–70)
Cognitive subscale	27.85 (*SD = 5.16*) (5–35)
Affective subscale	24.48 (*SD = 4.59*) (5–35)
Subgroups cognitive involvement	
Physical health and fitness	25.37 (*SD = 4.02)*
Planning and activity structure	32 (*SD = 4.76)*
Relaxation/meditation	27.86 (*SD = 5.9)*
Subgroups affective involvement	
Physical health and fitness	23.82 (*SD = 4.96)*
Planning and activity structure	25.75 (SD = 3.95)
Relaxation/meditation	24.14 (SD = 3.72)

*based on the outcome of the RPII involvement total score (low; 10-29, average 30-50 and high 51-70) and the scores on the subcategories (low; 5-14, average 15-25 and high 26-35)

Features that are important in using apps

The first topic in the interview was related to the use of health-related apps. Features important in using the apps are 'freedom of choice' and 'user-friendliness'. The code **Freedom of choice** was the most often mentioned aspect (6/11). Participants liked to have freedom of choice in the setup of applications, such as being able to turn off notifications and sound, to choose which voice they want to hear, or to set personal data, all to adjust the application to their individual needs:

> *'That you can say, for example, I am so old, that is how much I weigh, that is how much I want to do sports. Something that he can then make a kind of picture for you. That's great, that's really great'* (participant 1)

The code **User-friendliness** was mentioned five times as an essential feature of an app. User-friendliness consists of various elements such as clarity in structure and design, facilitating and carrying out specific daily actions more quickly and efficiently, applying categories, or distinguishing the importance of components within the application. Also mentioned was the easy use of the application (four):

> *'Yes, that you can easily be referred, but you can easily go back. Then sometimes, you also have an app that you throw something in a shopping cart, and then you press the back button, and then you return to your home screen. While I think, yes, you know, I just wanted to go back to the previous page'* (participant 4)

Also, **clarity and survivability** are important factors in using apps for the participants. This code refers to intuitive use and a clear display of functionalities. The last code, **trustworthiness**, refers to clear privacy statements and acknowledgement. This gives participants the feeling that they can safely use the application.

> *'I want a app to have a clear design without features that hinder the way you use the app, and I find it important that I can easily find my way throughout the app'. (participant 1)*

> '*For example, that you know with company is behind the app, so that I can trust the app and know that my personal data are save and in good hands'. (participant 2)*

Six participants found that the assumed **purpose of an application** was a reason to start with the app. Specific factors were goalsetting, collecting knowledge and insight, and exercises for relaxation.

> *'The determining factor is that I have in advance the feeling that I am really going to do something with it, just to say'. (participant 4)*

Aspects in starting of use

The second topic refers to factors that influence starting the use of health-related apps. The most important codes that affect the starting of applications were awareness of the app and the purposes of the app. Six participants mentioned **awareness of the app**, e.g., that the different ways to become acquainted with an application's existence were important. These include hearing about apps from other users or professionals and through recommendations from others, both verbally and via other (social) media. Also, getting a notification from an application that is standard on the phone can be helpful in this:

> *'And my health app ... It was just standard.* (i.e. participant wasn't aware of the existence of the app) *In one go, I received a message, "you have reached your goal". That was funny because I think I would not have downloaded it because I am not very concerned about that, but I think it is very funny, and in the meantime, I use it very often'. (participant 2)*

Four participants cited the **possibility of support** as a reason to start with an app, meaning that they were searching which support an app can offer before starting with that app. The support entailed both support in the use of the app (e.g., a manual or helpdesk) (2) and the knowledge that the participant could receive supportive messages during the app's use that encouraged the use of the app (2).

> *'For me, I'm not that technical, a kind of support is important, so to say that when I didn't succeed in the installation, there is a kind of help to solve the problem'. (participant 10)*

The last code refers to the coherence between the app's purpose and the user's personal goals, defined as; **support of the purpose of use**. If these are in line with each other, the participants are more willing to start using an app.

> '*For example, that it's a bit of a gloomy day, and they recommend a scent that's very refreshing, uplifting, kind of Citrus, that sort of thing. That it makes you think oh, how nice I am supported and I am offered knowledge and help that I don't have myself'. (participant 10)*

Aspects of maintaining using applications

The third topic relates to aspects that influence the continuation of the use of health-related apps. **Freedom of choice** and **user-friendliness** were dominant codes in continuing the use of apps. Freedom of choice is the most often mentioned code to continue using an app (6). For some participants, autonomy was important.

> *'You decide when you switch it on' (participant 3)*

> *'That you don't necessarily have to use everything on the app. But just if you can indeed choose, this suits me, and this is useful to me, that is indeed nice' (participant 5)*

Four participants mentioned excellent **user-friendliness**. For them, the app needed to be well-arranged and easy to use. In addition, four participants mentioned that an app had to provide valuable information for them.

> *'It is also just fun—all kinds of information. I like information, so to say, and there is all sorts of things, like it equals to so many stairs, okay! So it kind of makes you feel good too. Maybe that is also important, that you can get a bit of a good feeling ... that it could be stimulating or something' (participant 2)*

In line with the above-mentioned codes are the following two codes that refer to the degree of **informativeness** (does the app provides me with accurate information that I can use for my purposes) and to the degree of **completeness,** with refers to the thorough content of the app. If participants start with an app and during the use, they find out that the content is not exhaustive enough, they find this disappointing.

> *'For me it has to be complete, for example, I like to share with others, like, that you can say to fellow sufferers like, oh, if this bothers you, I always do this when I feel a little depressed, then I listen to someone on YouTube who says inspiring things can tell'. (participant 10)*

Aspects in discontinuation of use

The last topic inquired about the aspects that are important in discontinuation of the use of an app. Experiencing that the purpose of the app did not fit the individual need was, besides disruptions and malfunctioning, the most important reason to quit using an app. Nine participants mentioned **not fitting their individual needs** as the most important reason to discontinue using an app.

> *'Well, it just annoys me when it doesn't work, so when an app doesn't run or is very difficult, that you really have to take 20 or 30 steps before you get what you're looking for. Then I think, yes, I do mind that'. (participant 2)*

In addition, **disruptions and malfunctioning**, such as broken links, incorrect information, and the inability to turn off notifications or sound, were reasons to quit using an app.

> *'If he gets stuck every time and doesn't work properly, no, then it won't help me either if you have to start it ten times each time' (participant 5)*

The other codes that lead to discontinuation are **adverts** and the **lack of use**. Returning adverts lead to aversion and distraction and, therefore, can lead to quitting an app.

> *'I found it irritating when I use an app, and unwanted adverts interrupt the use of the app. For me, it could be a reason to quit'. (participant 11)*

> *'If I, for instance, don't want to use the app for a few weeks, and I know that I don't think the first trigger is cool or fascinating, then it won't happen after that' (participant 6).*

Table 4 overview codes using apps

Topic	Code	X mentioned (max. 11)
Features that are important in using apps	Freedom of choice	6
	User friendliness	5
	Clarity and surveyability	4
	Trustworthiness	3
Aspects of starting of use	Awareness of the app	6
	Purpose of the app	6
	Possibillity of support	4
	Support of purpose of use	3
Aspects of maintaining using applications	Freedom of choice	6
	User-friendliness	4
	Informativeness	4
	Completeness	3
Aspects in discontinuation of use	Not fitting the individual needs	9
	Disruptions and malfunctioning	5
	Adverts	4
	Lack of use	3

Discussion

There is a lack of knowledge about the patterns of use of these apps in individuals diagnosed with BD. This study aims to gain insight into how frequently patients with BD use health-related apps for self-management purposes for BD and their general health. We found that 44% (n=18) of the participants use health-related apps, and 26.8% (*n* = 11) use those apps consistently. A second aim was to gain insight from patients diagnosed with BD about their reasons for beginning use, continuing use, or discontinuing the use of health-related apps. Interviews revealed that adjustability, usability, trustworthiness, and the guarantee of privacy were the main reasons determining whether participants used or terminated the use of a health-related app.

We found that almost half of the participants used health-related apps. This is a higher rate than generally found in the general population. Carroll et al. (2017) found that more than one-third of the general population with smartphones had health-related apps, but only 20% of the participants used those apps (Carroll et al., 2017). Furthermore, in a study about the factors that aimed to predict e-health use, only 3.2% of the participants (adult internet users; N = 2358) used an online diary or blog about any health topic (Kontos et al., 2014). Krebs and Duncan (2015) found a higher percentage of health app users in a nationwide survey (58%), but almost half of them had stopped the use for various reasons such as loss of interest, a high entry data burden, or hidden costs. (Krebs & Duncan, 2015). Our findings suggest that having a significant health problem (like BD) can lead to higher usage of health-related apps. The awareness of the necessity of self-management interventions by people diagnosed with BD can also increase use. The type of apps that the participants in our study used were mainly focused on the use for physical activity, planning, and relaxation purposes goals; these functionalities can be related to the definition of self-management by Barlow (Barlow et al., 2002). Physical activity is linked to a healthy lifestyle and remaining physically active while in a (mild) depressed episode. Apps that offer planning and structure day activities or apps that stimulate or improve relaxation and sleep are linked to interventions that will enhance the social rhythm. Ehlers et al. (1988) defined social rhythm as the social relationships, social demands or tasks that serve to entrain biological rhythms (Ehlers et al., 1988). For people diagnosed with BD, disturbance of social rhythm can be emergence mood episodes; therefore, interventions that enhance the stabilisation of social rhythms are important (Crowe et al., 2016). The apps mentioned above' activities are not directly (BD) illness-related; we hypothesise that this may be more acceptable for people diagnosed with BD. Previous research has shown that people diagnosed with BD need apps that support work, social relations, finances and leisure management (Morton, Michalak, & Murray, 2017; Emma Morton, Torous, Murray, & Michalak, 2021; Murnane et al., 2016; Nicholas, Fogarty, Boydell, & Christensen, 2017; Todd, Jones, & Lobban, 2013)

Another explanation could be that the Netherlands has a higher possession rate of smartphone users than other countries (91%) (Huizer et al., 2018). Finally, we defined health-related apps as an application aimed at, or used for, improving and dealing with health, which is a broadened definition compared to the studies mentioned above (Kamel Boulos et al., 2014).

In BD, it is recommended that patients monitor their mood and use self-management approaches; apps can support this. There are specific apps for mood monitoring and self-management of mood. Surprisingly, we found that none of the participants used any mood-monitoring apps. One explanation is the apparent reliance in the Netherlands on the freely available paper and pencil (P&P) Life Chart Method (LCM) (Denicoff et al., 2000). This P&P LCM is often used within the treatment to monitor mood. An app might not be seen as an addition to this standard approach. A second explanation could be a lack of awareness of existing apps both among patients and clinicians (Morton et al., 2021). Several studies have shown that the uptake of e-health in mental health, in general, is a complicated process (e.g. adapting, continuation, techniques) with relatively low participant rates (e.g. (Beentjes et al., 2018; Klein et al., 2014).

The second aim of this study was to gain information about the considerations for starting, continuing, and discontinuing using health-related apps by people diagnosed with BD. Our findings show that most participants had a clear self-management purpose when using a health-related app, such as goal setting, collecting knowledge and insight about the illness, and finding exercises for planning and relaxation. However, we found that freedom of choice, user-friendliness and trustworthiness are important factors determining (dis)continuation of use of apps. The fact that these factors appear in different topics of the interviews means that they could be of decisive importance when developing new apps. Also, a lack of content fitting with personal needs, technical problems, and adverts were important reasons for quitting an app. All these factors can be considered important facilitators of engagement. O'Brien (2008) developed a 'model of engagement' to define engagement and establish critical components that lead to engagement (O'Brien & Toms, 2008). This engagement model can be a crucial part of the successful implementation of applications. O'Brien stated, 'Successful technologies are not just usable; they engage users'. The model consists of three phases of engagement: the point of engagement, the engagement phase and the disengagement phase. If we look at our findings and compare them with phases of engagement, we see at the 'point of engagement' partial similarities, like interest, motivation, and the use for a specific goal. In the engagement phase, there are fewer distinctive similarities. Topics like completeness, adjustability and usability cannot satisfy the model's engagement attributes, while our participants did not mention graphics, rich interface, enjoyment and fun. It could be argued that our participants are seeking a practical self-management tool rather than a gamification application, which requires possibly more engagement elements.

Finally, in the disengagement phase, we found that disruptions and malfunctioning, not fitting the individual needs, adverts, and lack of use are the most dominant reasons to stop using apps. O'Brien mentioned usability, negative affect, and interruptions that can be linked to our findings, disruptions, malfunctioning, and lack of interest. Studies among chronic psychiatric disorders report topics partly cover our results like motivation, customisation, interconnectivity, data inaccuracy, convenience, and competitiveness (Anderson, Burford, & Emmerton, 2016). Our findings of technical dysfunction and loss of interest (or when content is too familiar) are reasons to quit in other studies (Anderson et al., 2016; Peng et al., 2016). To overcome disengagement, persuasive technologies can be used. A review conducted by Hamari (2014) shows that persuasive technologies are one of the main (psychological) goals to increase engagement and motivation (Hamari et al., 2014). Applying persuasive technologies, such as reduction, tunnelling, tailoring, personalisation, self-monitoring, simulation, and rehearsal (Oinas-Kukkonen & Harjumaa, 2008), can improve adherence. But only when the appropriate principles of persuasive technologies are deployed at the critical moments when non-adherence begins (Kelders & Van Gemert-Pijnen, 2013). Still, this did not improve the intervention outcome measured by effect size (Wildeboer et al., 2016). It can thus be suggested that in any newly developed application, careful integration of persuasive technology is needed to avoid non-adherence.

Limitations

Some important limitations apply to the current study. Participants were recruited in one outpatient clinic, and the number of participants was relatively small. Therefore, our results may not be fully generalisable for all individuals diagnosed with BD. Moreover, surprisingly, the participants in our study did not have any experience with mood-monitoring apps. Since mood monitoring can be considered one specific type of self-regulation in the context of health and therefore fits the definition of health-related apps we used for this study, our results will also apply to mood monitoring apps. Still, we must consider that mood-monitoring apps have additional specific requirements.

Conclusion

Patients diagnosed with BD have enormous challenges in terms of self-management related to their mood disorder and health in general. Apps can play a prominent role in supporting people in meeting these challenges. Although we found that a substantial number of patients diagnosed with BD are using one or more apps to support self-management, their use is often discontinued due to content that is insufficiently addressing their needs. Besides appropriate content, tailoring and persuasive technologies will likely promote the continued use of an app for self-management purposes. This study revealed some vital and minimal requirements, such as freedom of choice, user-friendliness and clear objectives. It is important that future apps, apart from appropriate content, must be accompanied by tailoring and persuasive technologies to promote continued use for self-management purposes.

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PART 2

Co-creation of online mood monitoring and digital PP intervention

CHAPTER 4

4

How to make online mood-monitoring in bipolar patients a success? A qualitative exploration of requirements

Bart Geerling
Saskia Kelders
Anja Stevens
Ralph Kupka
Ernst Bolhmeijer

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Background

The Life-Chart Method (LCM) is an effective self-management treatment option in bipolar disorder (BD). There is insufficient knowledge about the consumers' needs and desires for an e-monitoring solution. The first step towards a new mood monitoring application is an extended inventory among consumers and professionals.

Methods

The aim of the current study was: to identify opinions about online mood monitoring of patients with BD and professionals and to identify preferences on design, technical features and options facilitating optimal use and implementation of online mood monitoring. This study used a qualitative design with focus-groups. Participants were recruited among patients and care providers. Three focus-groups were held with eight consumers and five professionals.

Results

The focus-group meetings reveal a shared consciousness of the importance of using the Life-Chart Method for online mood monitoring. There is a need for personalization, adjustability, a strict privacy concept, an adjustable graphic report, and a link to early intervention strategies in the design. Due to the fact that this is a qualitative study with a relative small number of participants, so it remains unclear whether the results are fully generalizable. We can't rule out a selection bias.

Conclusions

This study demonstrates the importance of involving stakeholders in identifying a smartphone-based mood charting applications' requirements. Personalization, adjustability, privacy, an adjustable graphic report, and a direct link to early intervention strategies are necessary requirements for a successful design. The results of this value specification are included in the follow-up of this project.

Keywords

Bipolar disorder, Monitoring, Focus-group, Digital, Life Chart

Background

Bipolar disorder (BD) is a severe mental illness characterized by recurrent manic, hypomanic, and depressive episodes alternating with euthymic periods. The illness often manifests in adolescence and young adulthood (Goodwin and Jamison 2007; Kupka et al. 2008). It is estimated that BD types I and II occur in 2% of the world's population and that another 2% has a form of subthreshold BD (Geddes and Miklowitz 2013). In the Netherlands, the prevalence of BD in adults is 1.3% (de Graaf et al. 2010). Monitoring of mood is an important element in self-management and treatment of BD. The prospective Life Chart Method (LCM) has been validated for daily mood monitoring (Denicoff et al. 2002). It provides a graphic representation of mood fluctuations above (hypo/mania) and below (depression) a euthymic baseline. Current medication, comorbid symptoms, hours of sleep, and significant life events are also reported. The primary purpose is to gain insight into the course of the illness and early signs of relapse. Daily monitoring facilitates early recognition and intervention, thereby improving personal functioning (Gershon and Eidelman 2015).

Despite these advantages, the use of the LCM can be a regular confrontation with the illness (van Bendegem et al. 2014). Some patients use the LCM only when early signs of relapse occur and not consistently (van Bendegem et al. 2014). Draisma et al. (2015) found that 35% of the participants had missing LCM-data during a 1-year follow-up (Draisma et al. 2015). When data are reported retrospectively, there is a considerable risk of recall bias, especially when patients complete batches of daily ratings at a single time (Stone et al. 2003; Whybrow et al. 2003).

Carefully choosing the right moment to introduce self-monitoring in the treatment and tailoring to the potential user is a critical success factor (Lysaker et al. 2014; van Bendegem et al. 2014). In their study van Bendegem et al. (2014) plea for further customization and personalization to optimize motivation and compliance.

Redesigning the LCM from a paper and pencil method (P&P) into a digital instrument may facilitate daily compliance (Malik et al. 2012). Over the past decades, several electronic mood monitoring systems have been developed and assessed (Faurholt-Jepsen et al. 2016; Matthews et al. 2008; Saunders et al. 2017). In some studies, digital monitoring aimed to improve compliance (e.g. by sending reminders or increasing user-friendliness) (Lieberman et al. 2010; Matthews et al. 2008). Other studies are focused on detecting differences between P&P and digital monitoring in depressive and manic symptoms (Bauer et al. 2004; Bopp et al. 2010; Depp et al. 2012; Faurholt-Jepsen et al. 2014; Schärer et al. 2002; Whybrow et al. 2003). In a systematic review, Faurholt-Jepsen et al. (2016) concluded that electronic self-monitoring of mood appears to be a reliable measure of mood in depression but not in mania (Faurholt-Jepsen et al. 2016). This finding is in contrast to the validation study of the Life Chart Method. Denicoff et al. (2000) found that the LCM ratings have a strong correlation to the Yong Mania Rating Scale and the Global Clinical Impression BD (Denicoff et al. 2000; Young et al. 1978, 2004).

A qualitative study demonstrated that e-mood monitoring could lead to a better understanding of BD, increase insights into illness, and change behaviours towards more effective self-management strategies (Saunders et al. 2017). The participants also mentioned the possibility of being too preoccupied with monitoring as a potential risk of e-mood monitoring; in addition, the participants highly appreciated the option of personalizing the monitoring system to their insights (Saunders et al. 2017). Van den Heuvel et al. (2018) found that patients had better insight into the factors that contribute to mood instability or mood episodes when they used digital monitoring (van den Heuvel et al. 2018). This underlines that electronic longitudinal mood monitoring can lead to a better impression of the course of mood fluctuations in BD (McKnight et al. 2017).

Although several studies have described patients' experiences (including the benefits and their doubts) and measured satisfaction or user experience after development (Faurholt-Jepsen et al. 2019; Saunders et al. 2017; van den Heuvel et al. 2018), only a few studies had involved patients and professionals in (or before) the development of an online monitoring tool (e.g. Goodday et al. 2020). The current study aims to explore patients' and professionals' opinions about online mood monitoring ('must-haves' and 'don'ts') before developing a digital version of the widely used LCM. To the best of our knowledge, our study is the first and only study in (online) mood monitoring in bipolar disorder that involved consumers and professionals during the development process, which included the contextual inquiry, value specification, and the design of the application. The development process of interventions is described in several studies (e.g. van Gemert-Pijnen et al. 2011).

Method

Design

A qualitative design was used to identify and characterize the opinions about and needs ('must-haves' and 'don'ts') of relevant stakeholders (patients and professionals) of online monitoring. Three focus-group meetings (FGMs) were held. FGMs are an efficient way of gathering information on how people express their ideas on a construct (Polit and Beck 2015). FGMs are chosen as part of a qualitative design to gather participants' narratives, generate experiences and opinions, and stimulate discussion on peers' opinions (Gray 2014; Green and Thorogood 2018). To get a broad perspective on online mood monitoring in the Netherlands, the target group was defined as patients, professionals, and developers/researchers. This approach is also known as an patient-centered digital health design (Birnbaum et al. 2015) and is an example of an initiative with enables more engaged research participation.

We designed the study to conform to holistic development principles, as stated in the CeHRes roadmap (Centre for e-Health Research and Disease management, van Gemert-Pijnen et al. 2011). This study covers the first two steps of the model, which are contextual inquiry and value specification. The CeHRes endeavours to facilitate a continuing process of evaluation and participation of all stakeholders. Ethical approval for the study was obtained from the University of Twente (Utwente; 18067) and the scientific board of Dimence, the mental health centre where the research was conducted.

Participants

The inclusion criteria to participate in the focus-group were: (1) patients with BD or professionals who were treating BD or developers and researchers, (2) in possession of a smartphone, and (3) the willingness to travel to attend FGM. In the recruitment of our sample, we aimed to get a maximum variation sample to get a wide range of dimensions and a maximum variation among the participants of the FG. Therefore we use several recruitment options.

The professionals in the focus-group came from various disciplines (psychiatrists, psychiatric nurses, and psychologists). The professionals were recruited from the Dutch national knowledge institute for BD (Kenniscentrum Bipolaire Stoornissen, KenBiS), a chapter of the International Society for Bipolar Disorders (ISBD). Recruitment took place during a lecture at one of the periodic meetings of KenBiS and via leaflets.

Participating patients were recruited in an outpatient clinic and the national advocacy group (Plusminus) in order to represent patients from different regions in the Netherlands and avoid potential selection bias. All the participants received treatment for BD I or II, but the treatment approaches could differ from each other due to the selection method. An announcement with a call for participation was posted in the magazine of the advocacy group.

The researchers (BG and SK) were not involved in the participants' treatment to avoid selection bias. Patients were asked if they were euthymic at the start of the FGM, although no specific questionnaire was conducted to established mood. All participants signed an informed consent form, in which they also agreed on audio recordings during the focus-groups. Thirteen participants (eight patients and five professionals) participated in one or more FGM.

Procedure and materials

We used the data from a previous study that aimed to gain insights from patients with BD about reasons to use, continue, or discontinue health-related apps in supporting self-management to operationalize topics for the FGM held in September and October 2018. In three semi-structured, 2-hour meetings, the following topics were discussed; experiences with monitoring, technology and monitoring, the requirements of a monitoring app, and a monitoring app that can provide users with their needs. The participants were informed about the topics before the FGM. After the brief introduction of the focus-group (FG), participants were asked to write down the pros, cons and wishes on post-it memos collected on flip-charts. These statements comprised the basic assumptions used to start the discussion about the different opinions. The agreements and disagreements were summarised, and in the following FG, the members were asked again to find a preference until consensus was reached. In doing that, we gained insight into how the participants valued the current methods that give information for developing the digital version of the LC. The conversations were recorded and transcribed, and they were then followed by a consensus check. After each session, a report was made and sent to the participants for validation and comments to increase objectivity (member checking).

For the goal of mood monitoring we used the definition for the LCM as described by Denicoff et al. (2000): "The LCM allows for the daily assessment of mood and episode severity based on the degree of mood associated functional impairment" (Denicoff et al. 2000). The results gain insight in the course of the mood episodes and is used within the relation patient—professional to established proper treatment options.

Data analysis

The discussion and consensus rounds were transcribed and analyzed by deductive coding. Open coding, via ATLAS.ti, is used to process the data. Concepts of a 'consensus document' were discussed in the second and third meeting and finally, after the last meeting established.

Results

Participants

We recruited 17 participants (11 patients with BD and six mental health professionals). Three patients and one professional withdrew before the start of the study for various reasons, like not being available at the time of the FGM or having a current mood episode. One psychiatrist, one psychologist, two nurse specialists, and one psychiatric nurse represent the professionals. There was a balanced representation in the sample across age (16–24 years one person = 7.7%; 25–40 years four persons = 30.8%; 41–55 years five persons = 38.5%; and 56–70 years three persons = 23%), gender (53.8% female) and residence (rural 46.2%, urban 53.8%). In education (high school, 23%; higher professional education, 61.5%; university, 15.5%), the distribution was less balanced. Although preferences didn't seem to differ between subgroups (e.g. age or education).

Emerging themes FGM

The FGM were structured in five themes or categories; positive and negative experiences with monitoring, positive and negative aspects of technology and monitoring, and requirements for a monitoring app. The topics that the FG members initially brought forward (by post-it memos) are placed within these categories and summarized in Table 1. Topics that came forward from the FGM are outlined in Table 2.

Experiences (positive and negative) with mood monitoring

First, we discussed the positive and negative aspects of monitoring. The Life Chart Method (LCM) was often mentioned as a monitoring tool, and some remarks refer primarily to the LCM. These valuable remarks were placed in the broad concept of mood monitoring to avoid 'tunnel vision' on the LCM in the FG's early stage.

The following positive experiences were mentioned: 'providing insight', 'guiding in self-management' and 'insight into the course of the illness over a more extended period/historical overview'. These items refer to the utility and necessity of the monitoring. Not only insight into the course of the illness was mentioned but also factors that can influence the mood (e.g., medication and sleep). Monitoring can also give direction about how to handle when early signs of relapse do occur.

> *'Provides a good insight into the course of bipolar disorder' (participant 1).*
>
> *'Provides insight into the combination of sleep, mood and events' (participant 6).*

'Provides quick insight, but must be used with the relapse prevention plan' (participant 11).

Table 1 Overview results focus group

Topic	**Code**	**Times initially mentioned**
Positive experiences with monitoring	Provides insight	4x
	Gives direction	3x
	Insight into the course of the illness	2x
Negative experiences with monitoring	Stressful	3x
	Confrontation with the disease	3x
	Lack of privacy	2x
Positive aspects of technology and monitoring	Getting more insight	3x
	More overview options	2x
	Possibility to use notifications	4x
	Better availability	2x
	More secure	1x
Negative aspects of technology and monitoring	Need for a device	2x
	Privacy	2x
	Focus on illness	2x
	Provoke the use of the telephone	2x
Requirements for a monitoring app	**Freedom of choice** Possibility to add text/photos/videos Monitor temporary items Adding own parameters Adjustable notifications Free wording	8x
	User-friendliness No unnecessary features Linking possibilities (e.g., RRP) Compatibility with other devices Notifications Clear design Easy to operate	5x
	Trustworthiness Clear privacy statement No hidden data extraction Reliable supplier Clear access protocol with the logging option	4x
	Goal-setting Personal feedback Increase of self-management Self-regulation	3x
	Remaining Based on the LCM	3x

On the opposite, participants mentioned several negative experiences or aspects of mood monitoring. Mood monitoring can be experienced as a stressful task that 'has to be' accomplished daily, especially in the early stage of the illness. Monitoring is also seen as a confrontation with the illness that can even induce self-stigma. When used in treatment, monitoring can also be *'experienced as a violation of privacy'* since caregivers can wander through personal data.

> *'Being involved with the disease every day by the LC can eventually become compulsive' (participant 6).*
>
> *'It's [monitoring] not always necessary can lead to panic reactions' (participant 4).*
>
> *'You may also be displeased because of the monitoring, you are too focused on the disease' (participant2).*

Table 2 Additional topics

Additional topics after discussion in the FGM				
Requirements for a monitoring app				
Freedom of choice	**User-friendliness**	**Trustworthiness**	**Goal-setting**	**Remaining**
• Handle algorithms • Monitor temporary items • Choose words that apply to the user • Flexibility • Add text, photos, videos or music • Scroll function to zoom in or out on the graphic of the LC • Diary function	• Exactly meet the users' demands • Connect with different applications • Multiple-use (phone, tablet, pc) • No daily login	• Clear privacy statement • Clear who has access to the data • Clear who can watch the LC	• Supporting in the regulation of the users • Personalized feedback	• No compulsory use • No linking with other social media

What could technology mean to improve monitoring?

Secondly, the use of technology as a possible solution was discussed (both potentially positive and negative). As positive aspects, the participants came forward with several expected benefits of online mood monitoring, like 'get more insight' in the monitoring and that there will be 'more overview options'. The FGM expect better availability when the monitoring is always in reach (on mobile devices), the possibility to zoom in and out on the long term course, the option to 'use notifications', and the data to be shared with their caregivers. All the aspects mentioned above contribute to better insight; the FGM didn't expect significant changes in mood monitoring base principles.

Also mentioned was; the ‘possibility of getting feedback’, the idea that it fits in the modern technological age, that the users have ‘more control’ and, because of having a personal account, ‘better privacy’ is guaranteed. The participants partly related their expectations to their experiences with online applications that support their P&P mood monitoring;

> *‘I discovered when I did the monitoring on my desktop (in Excel, I had made a program for it) that it was easier to fill in the LC because I am sitting daily behind the desktop computer’ (participant 6)*
>
> *‘I used notifications from another app to remember me to fill in the paper and pencil LCM’—(participant 11)*

On the other hand, the participants named different possible negative aspects of online mood monitoring. The need for a device is conditional. The participants are concerned about privacy issues; access to the data has to be limited to patients, caregivers and researchers. Online mood monitoring can lead to a focus on the illness, according to the FGM.

The FG concerns are divided into two themes; technical aspect of mobile phone use and the ‘side effects’ of mobile phone use. The ‘*problems in operating the app’* and the *‘incompatibility with other devices’* are mentioned as possible technical barriers. The complex operation required to use an app can reduce the motivation to use the app. The same is expected to occur when the app is not compatible with other devices (e.g., desktops). Also, *‘too many functionalities’* is mentioned as a possible barrier; people can get lost in all kinds of functionalities that distract them from mood monitoring’s main goal. The second theme, ‘side effects’, concerns a technical application that can *‘provoke the use of the mobile phone’* (too much). Even users are *‘unwillingly switch to social media’*, especially when they are in a (hypo) manic mood episode.

> *‘I don’t want any interaction with other people, like on social media, because I’m afraid of what I would say when I am manic or depressed.’ (participant 4)*
>
> *‘One of the disadvantages is that you always, it could be out of power or broken (the mobile device BG); with the booklet (paper and pencil LCM), you do not have that problem.’ (participant 1)*

(Technological) requirements

To establish perceptions of an online mood monitoring application’s essential elements, we discussed possible features and how they can tribute to compliance. The identified features can be classified into four categories: *freedom of choice, user-friendliness, trustworthiness and goal-setting*. The participants unanimously stressed that the LCM principles must be leading in developing the online mood monitoring application.

Freedom of choice seems to be one of the most important topics (8× mentioned). This topic comprises the following aspects: the application must '*exactly meet the users' demands*', the possibility to *'handle algorithms'*, although that may also be a bit threatening, like 'Big Brother'. A clear wish to be able to *'monitor temporary items'* and that you can *'choose the words that apply to you'* in the monitoring. '*Flexibility*', in addition to a fixed basis, is considered highly desirable. Also, the possibility '*to add text, photos, videos or even music fragments'* was mentioned. If there are elements in the app that are personally '*indispensable*' for you, using the app makes it more natural (for example, a link with calendar appointments).

The following items were mentioned in the FGM about user-friendliness: the desires to use the app on *'multiple applications'* and to *'combine different applications'* are also widely shared (e.g. the combination of the LC with relapse prevention plan, wellness recovery plan or mindfulness app), possibly with a link to the personal health file (PGD) or the electronic patient records (EPD).

The trustworthiness of the application is the third subcategory. The app must have a *'clear privacy statement'* and a reliable company that markets the application. It must be clear *'who has access to the LC's data'* and *'who can watch the data'*. When others view data, one can receive messages (logging).

Finally, goal setting could be identified as an important topic. '*Goalsetting in self-management'* and the importance of being able to '*regulate yourself*' seems essential. Also, *'personalized feedback'* is a motivational option to achieve monitoring goalsetting and increase compliance. In summary, the following quotes show the most important requirements as mentioned by the participants:

> *'I would like to see a kind of scroll function that you zoom in or out on the graphic of the LC; I think that would be absolutely fantastic' (participant 1)*
>
> *'I would like to have a kind of diary function in the app so that I can see my appointments with the clinician, and even can monitor of the visit is worsened or improve my mood' (participant 2)*

> *'The opportunity to load up a video or audio recordings on moments that I being Euthymic so that, when I'm depressed, I can play like a kind of mantra… It could be everything; even a barking dog can you remember at good times.' (participant 11)*

> *'Clear graph, the possibility to add notes, the option to add extra data, medication to be filled in per day, the possibility to add additional data (on or off), clarity about data exchange, applicable to multiple devices. No more functions than necessary, no chat function, no hidden data exchange.' (participant 6)*

> *'User-friendly, using LC indicators, additional options for monitoring, sending reminders every day (to be set up), giving positive feedback.' (participant 8)*

> *'Easy to operate, customizable, different variables, combined with a plan, in addition to having it monitored, being able to turn off notifications. No compulsory use.' (participant 10)*

Based on the results of the FGM, the first concept of functionalities of the app was made.

The consensus within the FG

In the last meeting, the definitive consensus was achieved on how the monitoring application should be working. In developing an online mood-monitoring application, the LCM principles should be the priority. Adjustability and personalization are vital components to start and maintain the use of the application. Privacy must be strictly described, and the patients should own the data. The consensus statement is shown in Table 3.

Discussion

The aim of the current study was twofold: to identify opinions about online mood monitoring of patients with BD and professionals and to identify preferences on design, technical features, and options facilitating optimal use and implementation of online mood monitoring.

Regarding the first aim, the results showed a shared consciousness of the importance of using the LCM, but only when it's appropriate in the context of patient's treatment and recovery process. These findings are consistent with previous studies in which both patients and professionals underscored the importance of the LCM (van Bendegem et al. 2014). Lysaker et al. (2014) claims that, when not carefully integrated into the

Table 3 Consensus monitoring

Consensus agreed on elements for online monitoring;

- A basis in which all elements of the Life-Chart method are included:
    - Functions in this part are not adjustable.
    - Notifications for monitoring are adjustable.
- Graphic display of the course of mood:
    - In weeks, months and years;
    - Possibility to adjust different parameters and to switch on/off or to combine in the graphics (for example, the parameters sleep and mood);
    - The graphics display is adjustable (like zoom in and out).
- Additional options to adjust the app to personal circumstances and preferences:
    - Possibility to add text/photos/music/link to the Life- Chart;
    - Possibility to add own parameters like substance use or work duration,
    - Possibility to receive personalized feedback,
    - Possibility of personalizing with photos.
- Provide a link with the relapse prevention plan or with WRAP.
- Adjustable notifications.
- Quick to fill in for daily use.
- Useable on all devices.
- Guarantee for privacy:
    - Distinctness about data storage,
    - No access to the personal data by ICT-company or others who are not involved with the treatment of the patient,
    - The patient who is monitoring is the owner of the collected data and is the only one who can add others (like professionals) to his/her chart
- **NO** link with other social media to prevent uploading of personal data from the LC during an episode.
- **NO** 'forced' monitoring; this will reduce the motivation for mood monitoring.
- **NO** log in for daily use (only at the start of using the application).

patient’s recovery process, the LCM can be contra-productive and can even lead to self-stigma and low self-esteem levels (Lysaker et al. 2007; Lysaker et al. 2014). The FG members in our study mentioned similar experiences, such as the daily confrontation with the disease that eventually can lead to self-stigma and over-focus on the disease.

This underlines the necessity for flexibility. Not only flexibility in the application of the LCM (in with stage of the treatment of BD it is applied) is an important requirement for successful monitoring, but also personalization of the use of the LCM.

Regarding the second aim, our results confirm the importance of tailoring and personalization in digital monitoring tools (Saunders et al. 2017; Valenza et al. 2014). First, customization can be used in a way that patients are able to add text or photos. Also, adjustability can be integrated by using own parameters such as alcohol consumption or notifications. The FGM underlines the importance of adding (temporary) monitoring items that can influence the course of the BD, such as removal, unemployment, marriage and family extension. In BD, life events can lead to mood episodes (Koenders et al. 2014). Therefore, it can support monitoring life events more closely, even during long(er) euthymic episodes. Another aspect is the possibility to link to other self-management tools, such as a relapse prevention plan (RPP). Interventions from the RPP should appear when (mild) depression or (mild) mania is rated in the monitoring application. Such a link seems to be conditional for our participants to use online monitoring tools, which indicates the importance of personalization. In a phenomenological study of the use of the RRP, Daggenvoorde et al. (2013) found that it can be difficult for patients to put early signs of relapse into concrete prevention actions (Daggenvoorde et al. 2013). Especially in longer euthymic episodes, the RPP can be drawn to the background for some patients and can't be applied effectively (Murray et al. 2011). If concrete early interventions, when indicated, directly appear in the monitoring application, we expect that it is easier to perform those early interventions. This pleads for integrating the RPP in the online monitoring tool to improve early interventions and improve self-control. Moreover, our results underline the importance of tailoring and personalization in a digital monitoring tool.

Besides the importance of personalization, online monitoring provides the possibility for patients and professionals to share the monitoring data at any time. Although data security has to be guaranteed, the FG members label this possibility as useful. When digital monitoring is shared with professionals, there is enhanced communication between patients and clinicians. This could lead to a better understanding of factors that influence mood (van den Heuvel et al. 2018; McKnight et al. 2017). The concerns about privacy focus on the data exchange, access to the data and in addition who can exactly can see the life-chart. Vendors should add a proper, transparent statement about data collection and view (Motti and Caine 2015). This seems conditionally for a successful implementation of an online mood monitoring system.

The results also yielded some important concerns about online monitoring. Connection with social media platforms is seen as one of the risks by the FG. The participants fear posting anything during depressed episodes and more so during (hypo)manic episodes that they will subsequently regret during euthymic episodes. Although in some papers the benefits of social media on mental health have been discussed (O'reilly et al. 2019; Välimäki et al. 2016). Naslund and Aschbrenner (2019) discovered that in a cohort of people with severe mental illness (37% with bipolar disorder), about one-third expressed concerns about privacy risks similar to our findings. The concerns are related to using social media, addressing fears of stigma, the impact on personal relationships, and facing hostility (Naslund and Aschbrenner 2019). In the FGM, the members reveal similar concerns. Therefore, it is essential to be careful in including features in applications, such as social media links, that may harm the target group.

Although health applications are widely available and a majority (90%) of patients are interested in digital interventions (Ranney et al. 2012). Only a minority of patients are actually using that kind of interventions cause of various reasons. Patients do use interventions when it fits in their needs (Lupton 2013). Like many developing groups, we held focus-group sessions to determine content (Rosen et al. 2015). By using the model of the CeHRes, in with participation throughout the whole development process is one of the preconditions of the model, we tried to bridge the gap between the needs of end users (patients and professionals) and the development of a new E-monitoring tool, that enables us to create a patient-centred digital health tool (Birnbaum et al. 2015; Gemert-Pijnen et al. 2011).

In sum, we argue that the results provide a number of important prerequisites for developing a mood-monitoring app that is in line with the target group's needs. In this process, we followed the steps of the CeHRes (van Gemert-Pijnen et al. 2011). A development process using the CeHRes roadmap, can 'clarify areas that would otherwise remain unanswered, unclear, or unknown' (van Gemert-Pijnen et al. 2011). We believe that we have succeeded to clarify this in our study, especially possibilities for personalisation, adjustability and need for integration of self-management tools in the daily monitoring.

Limitations

The study has some limitations. The first is a potential selection bias in the recruitment of professionals. They were voluntarily recruited in the Dutch chapter (KenBiS) of the International Society of Bipolar Disorders (ISBD) network. It is conceivable that the professionals who are interested in the topic of online monitoring have come forward to participate in this research and are overrepresented. The same applies to the consumers; they were partly recruited in one outpatient clinic and partly in the Dutch advocacy network 'plusminus'. That may raise a question: do the participants represent the overall target group? We think that our study sufficiently represents the target group in combining advocacy members and patients treated in an outpatient clinic. In our sample both extensive app users and users with less experience with apps were participating. This increases the chance that the findings are a balanced representation of patient experiences and opinions.

Another limitation is that the FG members involved in this study were mainly highly educated, which implicates a potential higher level of digital skills and a more positive attitude towards new digital applications. A recent study found that low levels of education can be linked to meagre digital skills, low use of the internet, and anxiety for new digital developments (Vasilescu et al. 2020). It is recommended to involve more patients with lower levels of education when developing mood-monitoring devices. Although we argued that the FG mix of patients and professionals was beneficial, we cannot rule out the possibility that other participants influence the FG members' opinions. We tried to avoid this bias through an individual member check after every meeting and the individual opinions' inventory before the discussion started.

Finally, the present study is mainly a qualitative study with a relatively small number of participants, so it remains unclear whether the results are fully generalizable. We didn't explore the possibilities of auto-tracking and returning objective measures of symptoms options by devices. Despite these shortcomings, we believe that the findings give a relevant overview of consumers' and professionals' thoughts and opinions on the topic of online mood monitoring in BD.

Conclusion and practical implications

This study demonstrates the importance of involving stakeholders when identifying the requirements of a smartphone-based mood-charting application. We found a shared consciousness of the importance of using the Life-Chart Method as a leading principle for online mood monitoring. The design of online mood monitoring devices needs to include personalization, adjustability, strict privacy, an adjustable graphic report, and a direct link to early intervention strategies.

The value specifications are included in the follow-up of this project. Consumers and professionals will also be involved in the design and operationalization phases of the development of an online monitoring app.

Our findings imply that any newly created application needs the careful integration of persuasive technology to increase adherence. This thorough approach is necessary for developing a monitoring app that stimulates sufficient compliance among people with BD. In the next step of the development of online mood monitoring, we suggest that consumers and professionals shine their light on the subject of passive sensing or EBT related tasks like activity levels, or objective sleep.

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CHAPTER 5

5

Developing an online positive psychology application for patients with bipolar disorder (Expectations of consumers and professionals turned into an intervention): Development study

Bart Geerling
Saskia Kelders
Anja Stevens
Ralph Kupka
Ernst Bolhmeijer

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Abstract

Background

Patients with bipolar disorder (BD) report lower quality of life and lower levels of well-being than the general population. Despite the growing availability of psychotherapeutic and self-management interventions, important unmet needs remain. These unmet needs are closely linked to positive psychology domains. Although a growing number of studies have evaluated the impact of positive psychology interventions (PPIs) on patients with severe mental illness in general, only few have addressed the application of positive psychology for BD.

Objective

This study aimed to gain insight into the opinions of patients with BD and health care professionals about (web-based) PPIs for BD and to develop and pilot-test an app containing PPIs specifically designed for patients with BD.

Methods

The study was conducted in accordance with the Center for eHealth and Disease Management road map principles and incorporated cocreation and designing for implementation. Data were collected using focus group discussions, questionnaires, rapid prototyping, and web-based feedback on a prototype from the participants. In total, 3 focus groups were conducted with 62% (8/13) of patients with BD and 38% (5/13) of professionals. The collected data were used to develop a smartphone app containing short PPIs. The content was based on PPIs for which a solid base of evidence is available. Finally, a pilot test was conducted to test the app.

Results

Focus groups revealed that PPIs as part of the current BD treatment can potentially meet the following needs: offering hope, increasing self-esteem, expressing feelings, acceptance, and preventing social isolation. Some patients expressed concern that PPIs may provoke a manic or hypomanic episode by increasing positive affect. The pilot of the app showed that the PPIs are moderately to highly valued by the participants. There were no adverse effects such as increase in manic or hypomanic symptoms.

Conclusions

With the systematic use of user involvement (patients and professionals) in all steps of the development process, we were able to create an app that can potentially fulfill some of the current unmet needs in the treatment of BD. We reached consensus among consumers and professionals about the potential benefits of PPIs to address the unmet needs of patients with BD.

The use of PPI for BD is intriguing and can be usefully explored in further studies. We emphasize that more evaluation studies (quantitative and qualitative) that are focused on the effect of PPIs in the treatment of BD should be conducted. In addition, to establish the working mechanisms in BD, explorative, qualitative, designed studies are required to reveal whether PPIs can address unmet needs in BD.

Keywords

bipolar disorder; positive psychology; cocreation; mobile health; mHealth; web-based; psychology; bipolar; intervention; quality of life; mental illness; pilot; self-esteem; acceptance; social isolation; manic episode; manic; self-help; positive; mobile phone

Introduction

Bipolar disorder (BD) is defined as a chronic mental illness with recurrent mood episodes, with manic, hypomanic, and depressive episodes alternating with euthymic periods. The illness mostly begins in adolescence and young adulthood (Goodwin & Jamison, 2007). It is estimated that BD I and II disorders occur in 2% of the world's population, and another estimated 2% has a subthreshold BD (Geddes & Miklowitz, 2013). In the Netherlands, the prevalence of BD in the adult population is 1.3% (de Graaf, ten Have, & van Dorsselaer, 2010).

Patients and their significant others face significant burden when confronted with BD. Owing to the early onset, severity, and chronicity, BD is a potentially disabling illness (Erten, Alpman, Özdemir, & Fistikci, 2014; Ferrari et al., 2016; Vieta et al., 2013). Even during euthymic periods between episodes, the illness may lead to impairment and significant burden (Kasper, 2004). Factors contributing to the burden are persistent subsyndromal mood symptoms, stigmatization, cognitive impairment, comorbid conditions, and side effects of pharmacotherapy (Kasper, 2004). The burden of BD may increase over the longitudinal course of the disease. Illness progression has been described using various staging models for BD (Kupka et al., 2021), and it is expected that the burden of illness is more prominent in the later stages with multiple recurrences or persistent unremitting illness (Berk et al., 2007). Persistence of mood symptoms between episodes is a significant predictor of depression and functional impairment (Gershon & Eidelman, 2015). The level of (subsyndromal) depressive symptoms correlates positively with the degree of functional impairment (Fagiolini et al., 2005) and, therefore, with a high burden and low quality of life. Despite the growing availability of psychotherapeutic and self-management interventions, important unmet needs remain, including those that are not directly related to mood symptoms in patients with BD.

Previous studies have established that there are major unmet needs in the management of BD (Bauer et al., 2018; Chengappa & Williams, 2005; Fortuna et al., 2019; Goossens, Knoppert-Van Der Klein, Kroon, & Van Achterberg, 2007; Hajda et al., 2016; Maassen, Regeer, Regeer, Bunders, & Kupka, 2018). Needs are defined as what people "desire to receive from healthcare services to improve overall health" (Asadi-Lari, Tamburini, & Gray, 2004). The most common needs during depression and mania or hypomania can be summarized as encouragement to seek effective (pharmacological) treatment to reduce symptoms. During remission and subsyndromal episodes, there is a need for treatment that prevents future episodes and a need for easily available psychosocial interventions (Chengappa & Williams, 2005; Fortuna et al., 2019; Goossens et al., 2007; Hajda et al., 2016).

Most common needs are satisfied to some degree during regular treatment. Some studies have categorized additional unmet needs addressing social and psychological functioning using questionnaires (Need for Care Questionnaire or self-developed questionnaires) (Fortuna et al., 2019; Goossens et al., 2007). In social functioning, support with loneliness, grief counseling, acceptation, social isolation, and coping with others are frequently mentioned (Fortuna et al., 2019; Goossens et al., 2007; Maassen et al., 2018). Hope, expressing feelings, and increasing self-confidence are mentioned as unmet needs in psychological functioning (Bauer et al., 2018; Fortuna et al., 2019; Goossens et al., 2007; Hajda et al., 2016; Maassen et al., 2018). These needs are closely linked to the domain of personal recovery (Leamy, Bird, Le Boutillier, Williams, & Slade, 2011). The similarity lies in the aim to apply interventions to increase mental well-being, rather than just symptomatic recovery. In personal recovery, there are 5 recognizable components: connectedness, hope, identity, meaning, and empowerment, indicated by the CHIME acronym (Leamy et al., 2011). Bird et al added 3 components (practical support, issues around diagnosis and medication, and skepticism surrounding recovery) to CHIME to address the needs of those who are in an early stage of recovery (Bird et al., 2014). Several interventions have been developed based on the CHIME framework, focusing on increasing hope, strengths, connectedness, and empowerment (Schrank, Bird, Rudnick, & Slade, 2012; Tew et al., 2012). A potential treatment approach to improve personal recovery and address the unmet needs of patients with BD is positive psychology (PP) (Fortuna et al., 2019; Jannis T. Kraiss, ten Klooster, Frye, Kupka, & Bohlmeijer, 2021; Slade, 2010; Slade et al., 2014).

PP is a relatively new field in psychology that focuses on improving positive feelings, behaviors, and cognitions (Parks & Biswas-Diener, 2013; Seligman & Csikszentmihalyi, 2000; Sin & Lyubomirsky, 2009). Some important evidence-based types of PP interventions (PPIs) are savoring (Bryant, 2003; Bryant, Smart, & King, 2005; Bryant & Veroff, 2018; Schueller, 2010), practicing kindness (Otake, Shimai, Tanaka-Matsumi, Otsui, & Fredrickson, 2006), experiencing and expressing gratitude (Boehm, Lyubomirsky, & Sheldon, 2011; Lambert, Clark, Durtschi, Fincham, & Graham, 2010; Seligman, Steen, Park, & Peterson, 2005; Sheldon & Lyubomirsky, 2006; Wood, Froh, & Geraghty, 2010), creating meaning and goal setting (Green & Grant, 2006; King, 2001; MacLeod, Coates, & Hetherton, 2008; Sheldon, Kasser, Smith, & Share, 2002; Sheldon & Lyubomirsky, 2006; Snyder, 2002), positive relations (Gable, Impett, Reis, & Asher, 2004; Kraiss et al., 2021; Reivich, Seligman, & McBride, 2011; Sheldon & Lyubomirsky, 2006), and using personal strengths (Seligman et al., 2005). Meta-analyses have found that PPIs have small to moderately significant effects on well-being and distress in general populations (Bolier et al., 2013; Carr et al., 2021; Hendriks, Schotanus-Dijkstra, Hassankhan, de Jong, & Bohlmeijer, 2020; Sin & Lyubomirsky, 2009) and clinical populations (Chakhssi, Kraiss, Sommers-Spijkerman, & Bohlmeijer, 2018; Geerling et al., 2020). Some small studies have also shown promising effects of PPIs on the mental health of patients with BD (Celano et al., 2020; Farquharson & MacLeod, 2014; Painter et al., 2019). Recently, a fully powered trial was conducted to evaluate the impact of a positive psychotherapy group treatment on the mental well-being of patients with BD in comparison with treatment as usual (Kraiss et al., 2021; Kraiss et al., 2018), reporting promising medium to large between-group effects, with sustained effect after 6 months (Kraiss et al., 2021). Applying PPIs in mental health care fits well in a recently developed model of sustainable mental health (Bohlmeijer & Westerhof, 2020). In this model, both mental illness and mental well-being are proposed as vital outcomes in psychiatry. A core aim of treatment is to promote the patients' ability to adapt. This ability is hindered by barriers such as dysfunctional biological and psychological processes and enhanced by resources such as positive emotions, hope, meaning, and positive relationships. Bohlmeijer and Westerhof (2021) argue that there is a need for balanced mental health care. PPIs primarily target the development of resources that support the patient with personal recovery and maintaining mental health (Bohlmeijer & Westerhof, 2021).

Digital health interventions are increasingly common in mental health treatment. In PP, eHealth interventions are known as online PPIs (OPPIs). Studies in this area have shown that OPPIs can enhance well-being and reduce depressive symptoms (Bolier & Abello, 2014). Results from recent studies show a significant effect of OPPIs (Gander, Proyer, & Ruch, 2016; Görges, Oehler, von Hirschhausen, Hegerl, & Rummel-Kluge, 2019; Wellenzohn, Proyer, & Ruch, 2016). For those individuals who found that the interventions are relevant for their symptoms, OPPIs seem more acceptable (Walsh, Kaselionyte, Taylor, & Priebe, 2018). It has also been found that the adjustability of a digital application improves its acceptability (Walsh, Kaselionyte, et al., 2018; Walsh, Szymczynska, Taylor, & Priebe, 2018). Patients with depressive symptoms seem to benefit more from OPPIs (Sergeant & Mongrain, 2015). These findings suggest that digital applications can be a promising way to implement PPIs for patients with (bipolar) depression or those with low well-being levels.

Potential benefits of digital health interventions lie in the improved accessibility, flexibility in both standardization and personalization, interactivity, and consumer engagement (Lal & Adair, 2014). Successful implementation of eHealth applications requires careful consideration of individual needs and cocreation with key stakeholders in both the design and implementation phases. However, adoption by users and professionals is not always easily achieved; professionals can be skeptical about the potential benefits and experience little support in using eHealth applications (Chaudhry et al., 2006). Implementing a web-based recovery treatment program for patients with severe mental illness revealed that they were not easily engaged (Beentjes et al., 2018). However, these challenges should not prevent a push forward for health care technology changes (Safi, Thiessen, & Schmailzl, 2018). Therefore, development and implementation of technical innovations require thorough communication and coordination between health care professionals and patients. In developing eHealth applications, user involvement is essential for technology adoption and use, increased user satisfaction, trust, and usability and is needed for successful implementation (Kujala, 2003). To achieve engagement, commitment, confidence, and a more positive attitude toward new eHealth interventions from potential users, van Gemert-Pijnen et al., 2011 developed a holistic approach for designing and implementing eHealth applications.

In summary, the overall burden of BD is vast and significantly impairs patients' quality of life. There are important unmet needs for patients with BD, which are mainly related to personal recovery. PP is a promising treatment approach to improve personal recovery. Implementing PPIs in digital interventions is potentially empowering and cost-effective. However, systematic user involvement in digital health interventions is vital. This study aimed to gain insight into the opinions of patients with BD and health care professionals about (web-based) PPIs for BD and to develop and pilot-test an app containing PPIs specifically designed for patients with BD.

The following stages were addressed in the study:

1. Assessment of opinions in Focus group meetings (contextual inquiry)
2. Assessment of preferences and requirements (value specification [VS] and design)
3. Assessment of use and satisfaction with positive psychology app and interventions (operationalization)

Methods

Design

The study focused on gathering information from patients and professionals about the use of PP to develop an app containing PPIs for patients with BD. A qualitative design was used to identify and characterize opinions and needs. The target group comprised patients with BD and professionals (end users). To enable a broad perspective on the potential benefits of web-based PPIs for patients with BD, focus group discussions (FGDs), paper prototyping (PPT), and pilot test (PT) were used. The method was modeled on the principles of the holistic development approach described in the Center for eHealth and Disease Management (CeHRes) road map, for example, the participatory process and continuous evaluation cycles (van Gemert-Pijnen et al., 2011). Our study covered the first 3 steps of the model: contextual inquiry, VS, and design.

The CeHRes aims to facilitate continuing process of evaluation and participation of all stakeholders.

Ethics Approval

Ethics approval was obtained from the University Twente (18067) and the scientific board of the Dimence Mental Health Institute, where the study was conducted. All participants signed an informed consent form, in which they also agreed to be audio recorded during the focus groups (FGs).

Participants

Participants were patients with BD I or II in a euthymic episode and professionals treating patients with BD who were in possession of a smartphone and were willing to travel to attend the FGs. They participated in all 3 steps of the development process. When recruiting our sample, we aimed for maximum variation among the participants of the FG. Therefore, we used several recruitment strategies. Patients were recruited from an outpatient clinic and the national advocacy group (Plusminus) to receive input from different regions of the Netherlands. In using this method of recruiting, we tried to avoid selection bias. All the patients received treatment as usual for BD. A call for participation was posted in the advocacy group's magazine. The researchers who participated in the FGs (BG and SK) were not involved in the participants' treatments. Professionals in the FG were involved in various disciplines (psychiatrists, psychiatric nurses, and psychologists) and recruited from the Dutch Foundation for Bipolar Disorders (Kenniscentrum Bipolaire Stoornissen), a chapter of the International Society for Bipolar Disorders.

Participants contributed to all study phases (FG, PPT, and PT); however, not all participants attended every FG. None of the participants in the FG had professional relationships with the researchers, which means that none of the patients were treated by the professionals or otherwise involved with each other.

Procedure and Materials

Overview

In total, three 2-hour FGDs were conducted in September 2018 and October 2018. At the beginning of the FG, a clear statement was made about confidentiality to ensure that the participants can independently provide their opinion. The sessions were semistructured, with the use of a topic list. In the first FGD, we explored experiences with PP. In the second FGD, we gathered the requirements for a potential PP app and the needs that will be covered by a PPI app. In the third FGD, the final requirements for the PPI app for BD were established. Each FG was briefly introduced with a powerPoint

(Microsoft Corp) presentation to reveal the purpose of that discussion. The participants were informed about the topics before the FG. Table 1 provides an overview of the techniques used during the FGs.

Table 1. Overview of techniques used during the focus groups.

FGD[a]	Brown paper exercise	Paper prototyping	Rapid prototyping test	Valuation PP[b] exercises
1	✓			
2	✓	✓		✓
3			✓	

[a]FGD: focus group discussion.
[b]PP: positive psychology.

Assessment of Opinions in FMGs (Contextual Inquiry)

After the brief introduction to the first FG, participants were asked to write down the experiences with PP, needs that PP could address, and requirements of a PPI app on post-it memos collected on flip charts (brown paper exercise). These statements were the basic assumptions used to initiate the discussion about the various opinions. The agreements and disagreements were summarized, and in the next FG, the members were asked again to mention a preference. This process was repeated until consensus was reached. The discussions were recorded and transcribed, followed by a consensus check. After each session, a report was made and sent to the participants for validation and comments to increase objectivity (member checking). Concepts of a consensus document were discussed in the second and third meetings and established after the last session.

Assessment of Preferences and Requirements (VS and Design)

We also used the PPT method in FG 2 to test the preferences. On the basis of the preferences mentioned in the FG, we created a PP exercise (being grateful). The participants rated screenshots of the exercise in terms of content, wording, and design. Subsequently, we asked the participants their opinions and valuations about different PPIs to establish which PPIs seemed suitable for patients with BD. The 6 categories of PPIs (positive emotions, resilience, positive relations, optimism and hope, self-compassion, and strengths) were explained and practiced with 1 exercise per category. Then, the participants scored each type in a positive or negative appreciation. We conducted a rapid prototyping (RPT) test to establish the participants' opinions about a possible web-based PPI. On the basis of the first FG input, we built an exercise in 'The Incredible Intervention Machine,' an app specially designed to perform prototyping and pilot-testing of newly developed apps in a research setting (Kelders, 2019). On the basis of the results of the FGs, an app with PPIs (WELLBE BD; Well-being Bipolar Disorder) was designed. Then, this app was evaluated in a PT.

Assessment of Use and Satisfaction With PP App and Interventions (Operationalization)

After the development process, we tested our app to evaluate whether the results of the previous steps of the development process had been implemented satisfactorily. Then, we maximized user involvement. In the PT, we tested the intervention app containing 7 PPI exercises in 1 week. The participants were asked to perform 1 exercise daily. After they completed 1 exercise, the following exercise appeared the next day. We collected data on the exercises separately through ranking after every exercise and the possibility to provide remarks about the exercise. We also collected data on the use of the app (preferences in settings, frequency of use, and number of completed exercises). After completing all the exercises, a final evaluation within the app was conducted to establish experiences about the intervention.

Data Analysis

ATLAS.ti7 was used for the analysis of the data from the FG. The Colaizzi method, as described by Shosha (2012), was used to process the data. The FG recordings were transcribed verbatim for the analysis in 3 phases: open coding, axial coding, and selective coding. Researcher triangulation was used to increase the objectivity of data analysis. The app's quantitative data (rating of the exercises) were collected, and average scores for each exercise and all the 7 exercises were calculated using SSPS. In addition, we also calculated the average scores of the differences between professionals and patients. The qualitative data (open answers in the evaluation module) were collected and analyzed through inductive coding.

Results

Participants

For the study, 17 participants (n=11, 65% patients and n=6, 35% professionals) were recruited. In total, 24% (4/17) of the participants withdrew (3/4, 75% patients and 1/4, 25% professional) before the start of the study owing to personal reasons or because they were not available at the time of the FGs. For the last phase (ie, PT of the app), 6 participants were added to broaden the input with opinions of participants who did not participate in the FGs. Demographics are shown in Table 2. Table 3 shows the participation in the FG, RPT, and PT.

Table 2. Demographics of participants of the focus groups.

Characteristics	Total (N=13), n (%)	Patients (n=8), n %	Professionals, (n=5), n (%)
Age (years)			
16-24	1 (8)	1 (13)	0 (0)
25-40	4 (31)	3 (38)	1 (20)
41-55	5 (38)	2 (25)	3 (60)
56-70	3 (23)	2 (25)	1 (20)
Sex (female)	7 (54)	4 (50)	3 (60)
Marital status			
Single	2 (15)	2 (25)	0 (0)
In relationship	6 (46)	4 (50)	2 (40)
In relationship and has children	5 (38)	2 (25)	3 (60)
Education			
Primary school	0 (0)	0 (0)	0 (0)
High school	3 (23)	3 (38)	0 (0)
Higher professional education	8 (62)	5 (63)	3 (60)
University	2 (15)	0 (0)	2 (40)

Focus Group Discussions

The results of all FGs are presented based on the different stages of the CeHRes road map. The results of the contextual inquiry and VS are summarized to provide a good overview of the FG results.

Table 3. Participation in the different stages of the study (N=19).

Part of the study	Number of patients	Number of professionals	Total
FGM[A] 1	4	2	6
FGM 2	4	3	7
FGM 3	4	4	8
PPT[b]	4	3	7
RPT[c]	4	4	8
PT[d]	10	9	19

[a] FG: focus group.

[b] PPT: paper prototyping.

[c] RPT: rapid prototyping.

[d] PT: pilot test.

Assessment of Opinions in FMGs (Contextual Inquiry)

In the FG, first, we discussed the participants' level of experience with PP. Second, we created an inventory of expected advantages and disadvantages when PPI is applied for BD. The results are summarized in Table 4.

Among the FG members, there was little experience with PP, as shown in Table 4. The participants did not have experiences with specific evidence-based PPIs. The experiences can be found in adjoining therapeutic areas (eg, mindfulness) or more personal PP solutions (eg, recognizing positive moments or thinking about possibilities rather than about problems). The FG members mentioned possible advantages: focusing on small steps, making positive pictures or movies, monitoring positive feelings, and giving themselves a positive message. Unmet needs such as hope, acceptance, and increasing self-confidence appear to be the most promising ones that PPIs may address in BD. The participants also mentioned various potential disadvantages of PPIs in 2 categories: illness-related and personal factors. The expectation of disadvantages regarding their illness is seen in both mania and depressive episodes. The participants did not expect benefits from PPIs in severe depressive episodes, or even the inability to perform the exercises during severe depression, leading to disappointment rather than satisfaction. They also foresaw further mood dysregulation toward manic stages when they are already hypomanic owing to exercises that stimulate positive emotions, feelings, or happiness. On a personal level, the participants fear forced positive statements that are not consistent with their self-esteem and the risk that PPIs can push the goal setting level very far (perfectionism). For both mentioned domains, they fear a possible counterproductive outcome when PPIs are applied.

Assessment of Preferences and Requirements (VS)

The aim of the FGs was to address opinions about the use and requirements of an app. First, the participants were asked about their opinions on the different categories of PPIs (Table 5). The FG participants were unanimous in the appreciation of the exercises in positive emotions and resilience categories and found positive relations and strengths to be applicable for patients with BD. In the categories of self-compassion, hope, and optimism, the FG participants were less convinced; there was fear that they could not fulfill high expectations of themselves or the app demands. Second, a recurring topic in the discussion was personalization; individuals can have different preferences for exercises. Therefore, all types of exercises should be available within the app. In addition, the individual user can choose certain types of exercises. Third, some participants found it important that the choice was made in alignment with the professional caregiver. Fourth, we concretized the app's design on 2 levels: the app's use (VS) and its feel and look (design).

Table 4. Contextual inquiry, experiences, and expectations.

Experiences	Number of times initially mentioned in brown paper exercise[a]	Expectations (advantage)	Unmet needs, as described in the literature]	Expectation's disadvantage	Label
Make mantras for yourself	1x	Avoid stigmatization	Social isolation and acceptation	Forced positive statements	Personal level
Exercising mindfulness	2x	Helpful in "gloomy" periods	Hope	Not beneficial when severely depressed	Illness-related factor
Caring for others	1x	Monitoring of positive feelings	Grief counseling and acceptation	Possibility of high goal setting	Personal level
Writing a "stoic journal" daily	1x	Focusing on small steps (near future)	Hope	Fear that positive feeling can lead to hypomania or mania	Illness-related factor
Knowing through reading about PP[b]	1x	Express gratitude	Expressing feelings	—[c]	—
Recognize positive moments	1x	Positive messages to yourself	Increasing self-confidence and hope	—	—
User involvement as a positive activity	1x	Create positive daily pictures or movies	Increasing self-confidence and hope	—	—
Thinking in possibilities	2x	—	—	—	—

[a] Participants wrote their thoughts and opinions on memo blocks sheets before the discussion started.

[b] PP: positive psychology.

[c] Not available.

The most prominent subtopics in the use of the app were the following: when the app is used and under what conditions. Furthermore, the FG members made suggestions for more advanced use. These results are summarized in Table 6. The participants were unanimous that the best way to use OPPIs is during euthymic or mild depressive episodes. Participants were divided over the use of an OPPI in episodes of mania or hypomania. The FG members expected that use in the early stages of hypomania can provoke positive feelings and lead to a more severe manic state. However, when users are in a full manic state, they did not expect any temptation to use the app in a full manic episode because, when manic, they are quickly distracted, and the exercises require time and tranquility.

The participants also indicated that the app should be adjustable; however, most FG members think that they want to use it daily, during periods when it is beneficial to

Table 5. Valuation positive psychology interventions for use in bipolar disorder.

Theme	Positive remarks	Negative remarks	Appreciate (n=6), n (%)	Not appreciate (n=6), n (%)
Positive emotions	• "Creates freedom to concentrate on your positive emotions."	• "It's difficult to allow yourself to do what you want to do."	6 (100)	0 (0)
Resilience	• "Gives energy." • "Achieve relaxation." • "Seeking solutions that fit me rather than always must to..."	• "Right wording is essential."	6 (100)	0 (0)
Positive relations	• "Focus on connecting with other people." • "The positive contact with others inspires me."	• "Contacts have to be trusted before sharing feelings."	5 (83)	0 (0)
Strengths	• "No remarks were made."	• "I don't give myself time for that either." • "Right wording is essential."	5 (83)	0 (0)
Self-compassion	• "Allow yourself to comfort yourself."	• "It's problematic to allow yourself to give some consolation." • "It mustn't be compulsory." • "Difficult to perform the exercises."	4 (67)	2 (33)
Optimism and hope	• "Hope is important; perhaps the exercise doesn't fit."	• "Doesn't fit people with perfectional traits." • "High expectations that maybe can't be satisfied." • "It seems to be a bit 'Trump-like.'" • "Too ambitious."	3 (50)	2 (33)

them. The duration of the practices should be between 5 and 10 minutes, so that it fits into daily routines. The participants also mentioned that allowing sufficient time and having a quiet place is important for successfully using the app. In addition, the FG members suggested that, after performing a complete set of practices, the user can choose which practices are suitable and adjust the app to those preferences. In the discussion about the potential advanced possibilities, the FG members found it helpful to connect PPIs with the Life Chart Method (LCM) (Denicoff et al., 2000). A PPI should occur when an advanced set value is reached while monitoring symptoms such as mild depression (within the LCM). Incorporating PPIs in the early relapse prevention plan was also suggested, as users can apply this intervention to handle the (starting) mood episode. In the ideal world, the FG members want to be automatically directed to the PPI when they reach pre-established levels in the LCM.

Table 6. Design and overview of the use of web-based positive psychology interventions for bipolar disorder.

Subcategories in using and remarks made by FG[a] members	Agreed by all FG members
When to use the app	
"In gloomy periods but not in severe depressive episodes."[b]	Yes
"In mild hypomanic episodes."[c]	Yes
"In euthymic episodes."	Yes
"Suggest the user exercises on fixed times."	No
"Adjustable frequency of the exercises."	Yes
How to use the app	
"Work through all exercises; eg, 1 exercise every day for 6 weeks and then integrate it into the Life/Chart[d]."	Partly
"In the beginning, the user goes through a module with practices of the themes; positive emotions, positive relationships and resilience." and "the themes hope, and optimism, strengths and self-compassion are offered as an option."	Yes
"Suggest clearly to do the exercises in a safe environment."	No
"Set up realistic goal setting."	Yes
"The duration is between 5-10 minutes per exercise."	Yes
Advance possibilities	
"Connection with the LCM[e]."	Yes
"Connection with the relapse prevention plan or other recovery plans."	Yes
"Going through the different exercises with the practitioner to choose a set of exercises."	No

[a] FG: focus group.

[b] Compared with Life Chart Method—mild or moderate depression.

[c] Compared with Life Chart Method—mild hypomanic episodes.

[d] LC: Life-Chart.

During FG 2 and 3, participants were asked about their views on the requirements for the design of the app. The remarks obtained can be separated into the following subcategories: personalization, look and feel, text, vision and sound, and preferred options. Table 7 summarizes the results.

The participants considered personalization to be a vital aspect. The FG members wanted to have a wide range of adjustable options as long it does not affect the app's clarity. The main topics in personalization were the frequency of use, choice between reading or listening, notifications, writing space in the exercises, and possibility to select the exercises. In addition, the proper use of wording was considered necessary by the participants. The text in the app should be concrete, clear, and short. Within the suggested exercises, the choice of words was sometimes perceived as compelling.

Table 7. Design and overview of the *feel and look* requirements.

Subcategories and remarks made by FG[a] members	Agreed by all FG members
Personalization	
"The choice between reading or listening to the exercise."	Yes
"Pleasant voice; voices can be chosen."	Yes
"Space to type keywords within the exercises."	No
"Ability to select which exercise you want to do."	Yes
"The degree of customization must be large, but the app must remain clear to promote easy use."	Yes
"The notifications must be flexible, with the option of carrying out the exercise later."	Yes
"Personalization, not only in exercises but also in the used pictures, videos and music fragments."	Yes
Look and feel—text	
"There must be a choice between spoken or written exercises."	Yes
"Use not too many words; make clear short exercises."	Yes
"The text should be inviting with a smooth choice of words but not too clever and easy to read."	Yes
"Working with examples in the exercises."	No
"Limited the amount of text per screen."	Yes
Look and feel—vision	
"Quiet design, with a nice layout and images."	Yes
"Use appropriate images for the exercises."	Yes
"Offer the possibility to add pictures yourself."	Yes
"Be visually appealing; photos/graphics."	Yes
"Use animations for the explanation in the exercises."	No
Look and feel—sound	
"Pleasant voice; voices can be chosen."	Yes
"There must be a choice between spoken or written exercises."	Yes
"Possibility to add music."	No
Preferred options	
"Feedback, compliments after every completed exercise."	Partly[b]
"Selection menu for the exercises."	Yes
"Add your own exercises (in a simple layout or only as a reminder)."	No
"Being able to give a score yourself and make this visible in a graph."	No
"To be able to share the results of the exercises with others."	Yes
"Receive an anonymous response from others–as a tip or encouragement, which must be adjustable."	No

[a] FG: focus group.

[b] A participant did not like the option to obtain feedback in the app.

Examples to illustrate the exercises were seen as helpful and supportive. The FG members had a preference for appealing messages in both exercises and notifications. They preferred a design that is quiet and attractive. The use of pictures can have a calming effect. We also discussed the option of obtaining feedback after completing an exercise. Approximately all participants (7/8, 88%) liked some type of feedback. They also expressed the need for external motivation to continue practicing (apart from the notifications). Significant others can be part of this motivational aspect. Valuing the exercises was seen as a good instrument to decide which exercises were preferable.

As part of the VS and design, we conducted an RPT test. Owing to technical problems in registration, 25% (2/8) of the participants did not succeed. The feedback obtained from the participants was divided into 4 categories: experienced effects, facilitating factors, impediments, and suggestions. Regarding experienced effects, 75% (6/8) of the participants found exercises to be beneficial and experienced more positive emotions than before. The experienced positive emotions did not qualify as 'threatening' in terms of risk for a (hypo)manic episode. One participant did not experience any difference, and another participant found it difficult to perform the exercise owing to personal circumstances. Regarding facilitating factors, the participants appreciated the layout with different pictures, videos, and music and the calm design. In addition, participants emphasized the possibility of adding the option to personalize the look and feel of the app. In total, 38% (3/8) of the participants experienced impediments while testing the app. Overall, 25% (2/8) of the participants mentioned that they were very severely depressed to perform the exercise.

Assessment of Use and Satisfaction With PP App and Interventions (Design and Operationalization)—Exercises of the Intervention

On the basis of the consensus reached in the FG and results of the RPT, we developed the Wellbeing Bipolar Disorder app. The app contains 7 exercises in the 4 domains of PP preferred by FG members. The exercises based on the previous work of (Bohlmeijer & Hulsbergen, 2013) are shown in Table 8. The app differs from other apps that provide PPIs, primarily owing to the selection of PPIs. Some exercises were withdrawn because of the fear of compassion or had to be altered. Other exercises were withdrawn because they may provoke symptoms of mania. Moreover, the app had special design features, such as calm design, proper use of wording, and so on, which, according to the FG members, can lead to high compliance rates. Finally, the app can be integrated into the LCM.

We chose a 1-week period in which the participants were provided 1 exercise daily, with mood monitoring before and after exercise and a valuation of the exercise after completing it. The app was personalized with the following choices: when to use the

Table 8. Domains and exercises in the Well-being Bipolar Disorder app.

Exercise number	Exercise	Domain of positive psychology
1	Experience positive moments again	Positive emotions
2	Active listening to good news	Positive relations
3	Three good things exercise	Resilience
4	Discover your strengths	Strengths
5	Positive focus	Positive emotions
6	Expressing gratitude	Positive relations
7	Being strong and becoming stronger	Resilience

app, notifications, types of notifications, written or spoken video explanation, and guidance by a professional or expert by experience. The app's design was calm. All exercises had 1 picture throughout the practice (Figure 1).

The participants were asked if they had succeeded in the exercise; if they did not, they could start again. We wrote 2 different scripts (professional or expert by experience), and the videos were set in the background picture belonging to the exercise.

Figure 1. screenshot intervention

Positieve focus

Je bent net klaar of net weer thuis van de activiteit die je gedaan hebt.

Geef hieronder in het kort weer wat je hebt gemerkt bij jezelf. je kunt ook een foto maken wat weergeeft wat er gebeurd is na het doen van de oefening.

Laat de oefening nog een paar minuten bezinken.

After the development process, we tested our app to evaluate whether the results of the previous steps of the development process have been implemented to the participants' satisfaction. The results of the PT are shown in Tables 9 and 10.

Table 9. Overview of the outcome of pilot test of the Well or being Bipolar Disorder app I.

Exercise number	Number accomplished[a]	Valuation by patients (scale 0-10)[b]	Valuation by professionals (scale 0-10)	Valuation—total (scale 0-10), mean (SD)[d]
1	14	7.37	7.5	7.43 (0.650)
2	12	5.7	7.8	6.58 (1.054)
3	13	7.37	8.2	7.69 (0.418)
4	13	6.87	7	6.92 (0.065)
5	13	7.22	8	7.38 (0.411)
6	11	6.28	8	6.91 (0.870)
7	11	7.42	7.8	7.45 (0.211)

[a] Total number accomplished=87.
[b] Valuation by patients (total)=6.85.
[c] Valuation by professionals (total)=7.7.
[d] Valuation by all participants (total)=7.25.

Table 10. Overview of the outcome of pilot test of the Well-being Bipolar Disorder app II.

Participants	Percentages of accomplished exercises[a]	Valuation of the app (positive)[b], %	More extended use of the app (positive)[c], %	Frequency to high[d], %
Patients	(75.7)	83	83	30
Professionals	(54)	100	100	80

[a] Number of exercises (total)=65.4%.
[b] Valuation of the app (positive; total)=91.5%.
[c] More extended use of the app (positive; total)=91.5%.

Of the 133 exercises (7×19 participants), 87 (65.4%) were completed. Patients completed more (101/133, 75.9%) exercises than professionals (72/133, 54.1%). In total, 11% (2/19) of the participants chose the video explanation. Of the 19 participants, 8 (42%) preferred the expert by experience and 8 (42%) preferred the guidance by a professional. Overall, the average rating of all exercises in total was 7.35 (scale 0-10, SD 0.525), and the median was 7.5, with a slightly high rating among professionals (mean 7.7 vs 6.9; median 7.5 vs 7.25).

The evaluation of the individual exercises was between 7.5 (exercise: be strong and be stronger) and 6.6 (exercise; listing to good news). Notably, a participant rated all exercises relatively low (average 3.3), and owing to the small sample size, this influenced the total outcome. The other individual ratings were between 8.7 and 5.6.

The app's overall valuation was high; 91% (15/16) of the participants were positive about the app and wanted to use it for an extended period. However, according to 55% (9/16) of the participants, the frequency of the exercises seemed very high for an extended period. Besides positive comments, made in the app's evaluation, about the effect of the exercises, there were remarks for improvement of the app. Some comments referred to the intensity of the exercises; a new exercise every day is not doable for all participants. Another advised option is to read the exercises in the morning to accomplish it during the day.

Discussion

Principal Findings

This study investigated the opinions of care professionals and patients with BD regarding OPPI for BD.

The first aim was to rate the extent to which participants had experience with PPIs and expected them to be supportive in addressing unmet needs. We found that the participants did not have experience with specific evidenced PPIs; however, they mentioned experiences in adjoining therapeutic areas (eg, mindfulness) or more personal PP solutions. The FG members mentioned possible advantages: focusing on small steps, making positive pictures or movies, monitoring positive feelings, and giving yourself a positive message. These topics can be related to various unmet needs in treating BD, specifically, offering hope, increasing self-esteem, expressing feelings, promoting acceptance, and preventing social isolation. Regarding expectations about PPIs, participants expect that PPIs can accomplish some unmet needs in BD.

The second aim was to establish the preferences and requirements of the app with PPIs. First, we determined which PP exercises patients and professionals prefer. Positive emotions, resilience, positive relations, and strengths were highly valued among the 6 categories of PP exercises. Some exercises were withdrawn due to the fear of compassion or had to be altered. Other exercises were withdrawn because they may provoke symptoms of mania. Moreover, the app had special design features, such as calm design, proper use of wording, and so on, which, according to the FG members, can lead to high compliance rates. Finally, the app can be integrated into the LCM. Therefore, we developed an app that differs from other apps that provide PPIs, primarily owing to the selection of PPIs.

The third aim of our study was to evaluate the use and satisfaction of the app. An interesting finding is that approximately all users (15/16, 91%) found it to be beneficial to perform the exercises and wanted to do it regularly. However, the frequency of the exercises seems to be very high. The valuation of the exercises was promising (7.35 on a scale of 1-10; median 7.5). Despite the small number of participants, we seemed to have found the proper exercises for our target group. Before releasing the app for clinical practice, further studies with adequate measurements (quantitative and qualitative) are necessary.

Comparison With previous Studies

Unmet needs can include topics such as support with loneliness, grief counseling, acceptation, social isolation, coping with others in social functioning (Fortuna et al., 2019; Goossens et al., 2007; Maassen et al., 2018), hope, expressing feelings, and increasing self-confidence in psychological functioning (Bauer et al., 2018; Fortuna et al., 2019; Goossens et al., 2007; Hajda et al., 2016; Maassen et al., 2018). The positive expectations underscore the potential of PP for personal recovery and support the value of integrating PPIs into mental health care (Bohlmeijer & Westerhof, 2021; Bolier & Abello, 2014). PPIs may help patients with resources that increase their ability to adapt and support them in personal recovery (Slade, 2010). Our results are largely consistent with previous findings (Iasiello, van Agteren, Keyes, & Cochrane, 2019; Leamy et al., 2011; Tse et al., 2014). Mental well-being is recognized as an essential resource for the recovery from mental illness and in preventing relapse. Therefore, it is recommended to include mental well-being interventions (such as PPI) in the treatment (Iasiello et al., 2019; Keyes, Dhingra, & Simoes, 2010).

Participants also raised some critical concerns about applying PPIs for BD. The FG members expressed concerns about fast and more severe changes in mood and energy when a used PPIs during manic or hypomanic episodes. Although "joy and amusement" are associated with increased manic severity, compassion—one of the key elements of PP—tends to decrease the symptoms of mania (Gruber et al., 2009). Positive emotions are not often mentioned as triggers that can provoke manic episodes. Lack of sleep is the most predominant factor in triggering manic episodes (Harvey, Talbot, & Gershon, 2009). However, morousness is the predominant factor among young adults, followed by stressful life events (Proudfoot et al., 2012). Periods of strong personal growth are also factors that induce manic symptoms (such as an extremely motivational workshop) (Proudfoot et al., 2012). Although this seems to be linked to PPIs, it is not satisfactory to conclude that PPIs can induce manic episodes. In a study among a large population of patients with BD (n=149), by applying a group PPI, the researchers found no increase in manic symptoms, thus confirming our findings (Kraiss et al., 2021). In contrast, damping emotions lead to more severe depressive symptoms (Gilbert, McEwan, Matos, & Rivis, 2011). Therefore, it is recommended to inform potential participants properly before applying PPIs for BD. Interestingly, the PT results did not show dysregulation among the participants.

An unexpected finding was that the categories of self-compassion, optimism, and hope had low ratings. On the basis of the unmet needs, as described previously, we did not expect this outcome. This result may be explained by the fact that the FG members found the themes and exercises to be very ambitious. For example, the exercise, "the best possible self," seems not to fit with the participants' level of self-esteem. They had high expectations that they could not satisfy. The "fear of compassion" can explain the fact that the FG members valued compassion relatively low. The fear of compassion is closely linked to self-criticism and depression (Gilbert, McEwan, Matos & Rivis, 2011). Women with BD seem to be more self-critical than controls (Rosenfarb, Becker, Khan, & Mintz, 1998). Nitzburg (2016) suggest that the negative experiences in the course of BD can worsen the level of self-criticism and argue that in an early stage of the illness, interventions should also target decreasing self-criticism (Nitzburg et al., 2016). However, owing to the small sample size, we cannot rule out that our findings are coincidental. Nevertheless, it is necessary to develop interventions targeting compassion and hope in BD to pay attention to the fear of compassion and transform exercises in a feasible manner for patients with BD.

We determined when to use the app. Some of the FG members expect the exercises to be a daily routine, for example, in addition to mood monitoring. Integration with a (digital) mood monitoring application and relapse prevention plan can provide a comprehensive tool in which the PPIs assist in preventing severe mood episodes (Geerling, Kelders, Kupka, Stevens, & Bohlmeijer, 2021). The FG members foresaw the use mainly during euthymic or mild depressive episodes. The members of the FGs were unanimous in that they did not expect any beneficial effects from PPI in severe depressive episodes. In contrast, they expected the opposite effect: worsening of depressive feelings if the goals of the exercises are not achieved. Previous meta-analyses have demonstrated that PPIs seem to be more effective in populations that are nondepressed or mildly depressed (Geerling et al., 2020; Sin & Lyubomirsky, 2009) than in populations with major mood disorders (Geerling et al., 2020). This supported the FG members' suggestion to apply PPI only in mild depressive episodes and euthymic episodes. Carr (2021) published a meta-analysis showing that in patients with depression, PPIs had a small to moderate effect on depression in terms of symptom reduction (Carr et al., 2021). However, in that paper, the severity of the depression was unclear. The considerations mentioned previously can underline our finding that personalization is one of the main topics in designing a PPI app for BD. Lack of personalization is, among with depressive symptoms, an important barrier to adapting digital mental health interventions (Borghouts et al., 2021). Recognizing and resolving these barriers in the development process can contribute to the adaptation of new interventions (Borghouts et al., 2021).

Finally, we reflected on the method. We recognized that cocreation and user involvement are important in developing an app to be accepted by end users (Van Bruinessen et al., 2014). Specific findings, such as the preferences for the exercise categories or the possible risks in applying PPIs, will not be revealed, as we developed the app without user involvement. The participation of end users is the main element in user-centered design, defined by Preece (2015) as "an approach, which views knowledge about users and their involvement in the design process as a central concern" (Preece, Sharp, & Rogers, 2015). The development process conformed to the CeHRes (Gemert-Pijnen et al., 2011). This method allowed us to systematically involve users (patients and professionals) in the study's development process. This enabled us to modify the app's design through all stages of the development process and guaranteed maximum involvement of all stakeholders. Previous studies using the same principle support our findings (Preece et al., 2015). The development of new interventions benefits from user involvement in all stages to meet the target group's needs (Kelders, Pots, Oskam, Bohlmeijer, & Van Gemert-Pijnen, 2013).

Limitations

Our study has some limitations. When recruiting professionals, there is a risk of selection bias owing to the voluntary recruitment from a highly specialized professional pool (the Dutch Foundation for Bipolar Disorders). It is conceivable that the professionals interested in web-based monitoring are stepping forward to participate in this study. However, this method was chosen to obtain professional input from different parts of the Netherlands to avoid inputs from only one region.

The same applies to the consumers; they were partly recruited from an outpatient clinic and partly from the Dutch advocacy network, "Plusminus." Although this may raise the question of whether the participants represent the target group, we assume that, by combining advocacy members and patients treated in an outpatient clinic, our study is sufficiently representative.

The use of FGs has some limitations, such as the possibility of "group effect," in which patients tend to adapt to the group leading opinions. Therefore, it is difficult to separate a personal opinion from a group opinion (Litosseliti, 2003). We tried to avoid this bias by collecting individual data (post-it memos) before the discussion in the group.

Furthermore, it is sometimes difficult to generalize the outcome of FGs (Litosseliti, 2003). We tried to avoid this bias as much as possible through nationwide recruitment.

Finally, this study is mainly a qualitative study with a relatively small number of participants; therefore, it remains uncertain whether the results are sufficiently generalizable.

Despite these limitations, we believe that we shed light on consumers' and professionals' thoughts and considerations about using PP apps for BD.

Conclusions and Practical Implications

Despite recognizing the possible benefits of PPI in BD and that they may address unmet needs in BD, very little is known about the effect of applying PPI in the treatment of BD.

In this study, we realized the shared assumptions about the application of PPIs for BD. The consensus on the different topics regarding the use of PPI shows that both patients and professionals underline the beneficial possibility of applying PPIs for BD. The use during subsyndromal and mild depressive episodes seems to be the most fruitful period for patients with BD. We did not establish the risk of provoking mania or hypomania by performing PPIs, but we could not draw firm conclusions because of the small sample size.

With the systematic use of user involvement (patients and professionals) in all steps of the development process, we were able to create an app that can potentially fulfill some of the current unmet needs in the treatment of BS.

The use of PPI for BD is intriguing and can be usefully explored in further studies. We emphasize that more evaluation studies (quantitative and qualitative) that are focused on the effect of PPIs in the treatment of BD should be conducted. In addition, to establish the working mechanisms in BD, explorative, qualitative, designed studies are required to reveal whether PPIs can address unmet needs in BD.

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PART 3

First evaluation of acceptance and benefits of developed digital intervention

CHAPTER 6

Can digital positive psychology interventions improve the quality of life in bipolar disorder? Feasibility, acceptability and preliminary outcomes of a positive psychology application for people with bipolar disorder

Bart Geerling
Saskia Kelders
Peter ten Klooster
Anja Stevens
Ralph Kupka
Ernst Bolhmeijer

In review
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Background

Bipolar disorder (BD) is a severe mental illness characterised by recurrent manic, hypomanic and depressive episodes alternating with euthymic periods. The burden of BD is vast, and many patients have unmet needs in their treatment. To better support patients in their personal recovery and well-being, positive psychology interventions (PPIs) have shown to be a promising tool. Recently, a mobile application has been developed to offer PPIs: the WELLBE BD-app.

Aim

The current study was designed to study the acceptability of the WELLBE BD-app and evaluate the feasibility of the design for use in a larger controlled trial (CT). We also studied the potential effects on mental health.

Method

This pilot-study used a mixed-methods quantitative and qualitative approach in which participants were randomly assigned to an intervention- or a treatment-as-usual control group, each with 20 participants with BD. The study sample consisted of a seven weeks during intervention. To assess acceptability, we held semi-structured interviews in the intervention group and collected log data and questionnaire data on the actual use of the app and perceived value of the accompanying exercises. Feasibility was determined by the number of completers of the intervention in both the intervention and control groups. Potential effects on mental health outcomes were measured using an extensive set of pre and post-intervention questionnaires.

Results

The intervention was fully completed by 52.7% (n = 11) of the participants and partly completed (1 to 4 modules) by 37.8% (n = 8). The post-test response rate was 73% in both groups. On average, the exercises were rated with a value of 7.5 on a scale of 1 to 10 (*SD* = 1.2). Users found the application easy to use, useful for people with BD, and to have an attractive design. Problems with installation, technical problems, and lack of support were barriers to using the app. Guidance by an expert by experience (in videos before the exercises) was preferred by 80% of the participants instead of guidance by a professional. Effects on mental health outcomes were small and statistically non-significant, both between- and within groups. Although we found no significant results in the quantitative part of our study, the qualitative results show that people with BD appreciated the content and design of the intervention. The minimal effects on mental health may be partly explained by the small sample size and the relatively high levels of mental health of the participants at baseline.

Conclusions and Implications for Practice

Based on this study a larger trial on the effects of the WELLBE-app appears feasible and warranted. Next to minor modifications based on this pilot study, to create optimal impact including patients with lower levels of well-being is recommended and the guidance by experts or peers needs to be considered.

Introduction

Bipolar disorder (BD) is a severe and chronic mental illness characterised by manic, hypomanic and depressive mood episodes alternating with euthymic periods. The disease primarily develops in adolescence and young adulthood (Goodwin & Jamison, 2007). About 2% of the world's population has BD, and an additional 2% is estimated to have subthreshold BD (Geddes & Miklowitz, 2013). In the Netherlands, the lifetime prevalence of BD is 2.1% (ten Have et al., 2022).

BD is associated with a significant burden for patients and their relatives (Erten et al., 2014; Vieta et al., 2013). It is the sixteenth leading cause of years lived with disability (YLD), explaining 1.3% of total YLDs (Ferrari et al., 2016). Functional impairment occurs not only in manic or depressive episodes but also in inter-episodic (Fagiolini et al., 2005). Subsyndromal depressive symptoms in the inter-episodic periods are the predominant causes of impaired functioning (Fagiolini et al., 2005; Gershon & Eidelman, 2015; Kupka et al., 2007). Functional impairment has a negative influence on the experienced quality of life and well-being of people with BD (Revicki et al., 2005).

The last two decades have seen a growing interest in research on unmet needs in BD in both symptomatic and inter-episode periods (Bauer et al., 2018; Chengappa & Goodwin, 2005; Fortuna et al., 2019; Goossens et al., 2007; Hajda et al., 2016; Maassen et al., 2018). In symptomatic episodes, these needs can be summarised as a need for encouragement to seek effective (pharmacological) treatment to reduce symptoms, while in inter- and subsyndromal periods, there is a need for strategies to prevent future episodes and a need for easily available psychosocial interventions (Chengappa & Goodwin, 2005; Hajda et al., 2016)

In recent years the need for psychosocial interventions that enhance personal recovery (PR) in BD has been stressed (Dodd et al., 2017). PR is defined as: 'a deeply personal, unique process of changing one's attitudes, values, feelings, goals, skills and/or roles . . . a way of living a satisfying, hopeful and contributing life even with the limitations caused by illness' (Anthony, 1993). Leamy et al. (2011) developed the CHIME framework (Connectedness, Hope and optimism, Identity, Meaning in life, Empowerment) to cover the five most important recovery processes of PR. Bird and colleagues validated this model by adding three components to CHIME (practical support, issues around diagnosis and medication, and scepticism surrounding recovery) to address the needs of those in an early stage of recovery (Bird et al., 2014; Leamy et al., 2011). To fit the particular needs in PR for people with BD, Jagfeld and colleagues (2021) developed the POETIC framework (Purpose and meaning, Optimism and hope, Empowerment, Tensions, Identity and Connectedness) (Jagfeld et al., 2021). By adding the concept of tensions (balancing acceptance with ambitions, openness about the illness, and ambivalence about mania), the authors included the special needs of people with BD (Jagfeld et al., 2021). Many of these elements are also at the core of positive psychology (Resnick & Rosenheck, 2006).

Positive psychology (PP) is a movement focusing on improving mental health. Positive psychology interventions (PPIs) focus on enhancing positive feelings, behaviours, or cognitions (Sin & Lyubomirsky, 2009) and using evidence-based treatment methods or exercises. In a review of PPIs, Schueller & Parks (2014) identified six different categories of exercises; these include savouring, practising kindness, experiencing and expressing gratitude, creating meaning and goalsetting, positive relations, and using personal strengths. Meta-analyses have demonstrated small to moderate significant effects of PPIs on well-being and distress in clinical and non-clinical populations (Bolier et al., 2013; Carr et al., 2021; Sin & Lyubomirsky, 2009) and patients with mental or somatic illnesses (Chakhssi et al., 2018; Hendriks et al., 2020). In severe mental illness, a meta-analysis found a small effect of PPIs on well-being and a moderate effect on psychopathology in pre-post testing (Geerling et al., 2020). Although not frequently used or studied in BD patients, some recent trials have shown face-to-face or telephone-delivered PPIs to be associated with improved optimism, positive affect, mental well-being, and PR (Celano et al., 2020; Kraiss et al., 2018; Painter et al., 2019).

In mental health treatment, digital interventions have become more and more common. Since the beginning of this century, this increase has been rapid, and the COVID-19 pandemic has further boosted the use of digital treatment (Balcombe & De Leo, 2021). Online positive psychology interventions (OPPIs) offer an easy and accessible way to provide PPIs. OPPIs can increase well-being and reduce symptoms of depression (Bolier & Abello, 2014). OPPIs are more acceptable when individuals find them relevant to their symptoms and more effective when participants are distressed (Sergeant & Mongrain, 2015).

Recently, we developed an application for mobile phones containing PPI exercises for people with BD: the WELLBE BD-app (Geerling et al., 2022a). The functionality of and exercises in this application were established in co-creation with patients and professionals in focus group (FG) meetings and by questionnaires. Results from the FGs suggested that both the content and the 'look and feel' of the app were congruent with the expected needs of people with BD. Therefore, we hypothesised that, after some adjustment, patients with (bipolar) depression or those with low well-being can benefit from the WELLBE BD-app. The current pilot study was designed to further examine the acceptability of the adjusted application and the feasibility for testing the app in a full randomised control trial (RCT). We aimed to test whether the application was acceptable for patients to use for an extended period of seven weeks. We also aimed to test if the design was feasible for implementing the app in a more extensive trial. To explore the information on the possible effects of the intervention, the current study employed a control and an intervention group. The outcomes of this study will be used to inform the development and design of a future RCT to investigate the effectiveness of the application. We employed a mixed-method approach: using both quantitative and qualitative methods: we conducted 11 interviews and administered questionnaires on mental health pre-and post-intervention.

Methodology

The study was approved by the Ethical Committee of the University Twente and the Scientific Board of the Dimence Mental Health Institute, where the study was conducted. The study was also assessed by an independent medical ethic committee for research in mental health (2020-6301). They concluded that the study did not require further assessment other than the approval of the scientific committees of the institutes involved.

Study Design

The study used a mixed-methods design employing both quantitative and qualitative methods within a pilot randomised controlled trial design that aimed to investigate (1) the acceptability of the WELLBE BD-app intervention for use with the target group, and (2) to inform the feasibility of conducting a full RCT design to be used in the proposed future study.

Acceptability is a broad concept, defined by Seklon et al. (2017) as: ‘a multi-faceted construct that reflects the extent to which people delivering or receiving a healthcare intervention consider it to be appropriate, based on anticipated or experienced cognitive and emotional responses to the intervention’ (Sekhon et al., 2017). They developed a Theoretical Framework of Acceptability that was used to study the acceptability of our intervention (Sekhon et al., 2017). For our qualitative data collection, we used the ‘60 Acceptability Concepts’, a comprehensive definition and model of technology acceptance developed by Garton, Moody and Woodcock, 2012. We established the acceptability in semi-structured interviews after the post-test measurement. We also gathered data about the app’s ease of use and participants' valuations of the individual exercises.

Feasibility studies are defined as: ‘Pieces of research done before a main study. They are used to estimate important parameters that are needed to design the main study…

…used to estimate important parameters that are needed to design the main study.' (Arain et al., 2010). This study focused on testing the first-time use of the WELLBE BD-app among BD patients in a psychiatric outpatient clinic setting, in combination with the use of several process and outcome measures (questionnaires and data extracted from the app), to establish the response rates to the questionnaires, app usage rates, and the number of potentially eligible and interested participants. Orsmond and Cohn (2015) suggest that researchers use both qualitative and quantitative measures to best examine the research and intervention process during a feasibility study; this can help accelerate a study to a larger RCT (Orsmond & Cohn, 2015).

Participants

All participants were recruited from four outpatient clinics within one mental health care network organisation (Dimence Bipolar, https:/dimence.nl/bipolair). The sample size of feasibility studies ranges from 10 to 300, with a median of 36 participants (Billingham et al., 2013). We included 20 participants in the intervention group and 20 in the control group.

Inclusion criteria

- Patients with a diagnosed Bipolar I or Bipolar II disorder (classified according to DSM-5 criteria; (American Psychiatric Association, 2013).
- 18-65 years old.
- In possession of a smartphone.
- Willing to participate in the study and agreed to complete the questionnaires.

Exclusion criteria

- Patients who did not speak the Dutch language.
- Patients who were participating in another self-management group intervention during the study.
- Patients who had participated in the B-Positive study (Kraiss et al., 2018).
- Patients who had experienced a major depressive or manic episode immediately preceding to the study.

Procedure: Intervention and Control Groups

The participants were randomly assigned to two groups: intervention and control. The participants were recruited from the network 'Dimence Bipolair'. Practitioners conducted an 'interest interview' with all the patients who potentially met the inclusion criteria. After giving their informed consent, interested patients received information about the research and, an Informed Consent Form from the researcher by postal mail. The Informed Consent Form was signed and included in the EPD (electronic patient file). Subsequently, participants filled in the pre-test questionnaires. The research assistant then randomised the participants to the intervention or the control group using a provided scheme (ABBA, AABB, etc). The intervention group received a seven-week positive psychology intervention in which the participants received one exercise per week. Both the intervention and control groups received Treatment as Usual (TAU) based on the Dutch guidelines for bipolar disorder (Kupka et al. 2015).

Treatment as Usual (TAU) procedures

TAU consisted: pharmacologic therapy and interventions focused on self-management and preventing mood episodes. Participants in the control group were given access to the new app after the study had ended. Besides the two measurement occasions (e-mail contact to remined those participants who did not complete the questionnaires), the investigator (JV) had no contact with the participants.

Additional procedures for the intervention group

The intervention group received access to the app that contained a seven-week positive psychology intervention in which participants were asked to perform one exercise every week. They had the opportunity to contact the investigators when they experienced problems with the installation or using the app. If participants did not proceed with the exercises, the investigators asked them if they had any problems using the app. Contact with the participants was by email or phone; in some cases, participants were helped personally with the installation of the app. Completing one to four of the seven exercises was valued as partly completion, five or more exercises were valued as fully completed. After the intervention period, a selection of participants took part in a semi-structured interview of approximately 45 minutes long. Interviews were conducted until data saturation was achieved, which was after 10 interviews (Fusch & Ness, 2015).

Intervention

The WELLBE BD-app intervention is a seven-week digital health intervention for people with BD. The intervention aims to support personal recovery, improve well-being, improve positive relations and positive feelings, and reduce depressive symptoms or subsyndromal feelings of depression (Geerling et al., 2022).

The intervention is based on the principles of positive psychology. The app contains exercises in different categories of PPIs based on the outcomes of a study among people with BD and professionals treating patients with BD (Geerling et al., 2022). Based on that study, we adjusted the app to an intervention in which participants receive one PPI a week for seven weeks. The exercises used in the intervention app relate to the following domains of positive psychology interventions: savouring, experiencing and expressing gratitude, using personal strengths, and positive relations (Geerling et al., 2022).

The app contains seven different exercises, each followed by two evaluative questions. The different exercises are listed below (the numbers in brackets indicate where the exercise is sequenced in the app: first, second, etc.):

- Positive relationships: Active Listening (2), Expressing Gratitude (6).
- Positive emotions: Keep a Positive Focus (5), Gratitude (Appreciating What Is) (1).
- Resilience: Three Good Things (3) Getting Stronger (7).
- Discovering and using strengths: Discover Your Strengths (4).

Each exercise takes approximately 5 to 10 minutes, except 'Discover Your Strengths, which takes 20 to 30 minutes to complete. Participants could choose whether to do a shorter or extended version of the latter exercise. The participants were asked to do each exercise three times a week, and a new exercise became available after that week. The used exercises were adjusted from the evidence-based self-help book *This is Your Life* (Bohlmeijer, 2013; Bohlmeijer & Hulsbergen, 2013; Schotanus-Dijkstra et al., 2017). The publisher approved the use of elements from this book for the WELLBE BD-app intervention. The app was created by researchers from the University of Twente using the 'The Incredible Intervention Machine' (TIIM) videos (Kelders, 2019). The TIIM offers researchers the rapid prototyping of new interventions. In the WELLBE BD-app, users can choose several options; notifications can be tailored to their preferences. There are also two 'persons' who lead the participant through the app; a professional and an expert by experience. Each exercise is accompanied by video and text. By completing an emotion quadrant pre- and post-exercise, participants can monitor whether the exercise affects their mood. Within the app, participants can rate the value of each exercise. To increase the valuation data in this study, we also included the data from the control group participants who used the intervention after finishing the study.

Questionnaires

The used questionnaires were divided into two categories: positive psychology outcomes and psychopathology outcomes. The set of questionnaires was based on those used for a previous PPI group intervention for BD (Kraiss, ten Klooster, Chrispijn, Stevens, Doornbos, Kupka, & Bohlmeijer, 2021) so that the scores across the studies could be compared at a later stage. The questionnaires are listed below.

- The anxiety subscale from the **Hospital Anxiety and Depression Scale (HADS-A)** (Zigmond & Snaith, 1983) was used to assess anxious symptomatology. The Dutch version of the HADS-A (Spinhoven et al., 1997) has been shown to have good internal consistency in a sample from the general population (α = 0.84) and a sample of psychiatric outpatients (α = 0.81) (Rush et al., 2003).

- The **Altman Self-Rating Mania Scale (ASRM)** measures (hypo)manic symptoms. This self-rated scale consists of five items representing different manic symptoms (Altman et al., 1997). All five items are rated on a 5-point Likert scale with different categories. The ASRM has high sensitivity (93%) and specificity under 33% (Altman et al., 2001).
- The **Quick Inventory Depressive Symptoms (QIDS-SR)** is a shortened version of the IDS-SR (Rush et al., 2003) designed to establish the severity of depressive symptoms. The QIDS-SR is a self-completion questionnaire of 16 items, measured on a 4-point scale (0–3). The total score is compared with a fitting table (five categories ranging from no depression to severe depression).
- **The Mental Health Continuum (MCH-SF)** measures emotional, psychological and social well-being. Emotional well-being (three items), social well-being (five items), and psychological well-being (six items) are scored on a 6-point scale from never (0) to every day (5). The Dutch version of the MCH-SF has been shown to be valid and reliable in general (Lamers et al., 2012) and clinical populations (de Vos et al., 2018; Franken et al., 2018).
- The **EuroQol 5 Dimensions (EQ5D)** has been used to evaluate individual health perceptions (Herdman et al., 2011). The EQ5D has been translated and validated in Dutch (Versteegh et al., 2016).
- The **Positive and Negative Affect Schedule (PANAS)** measures current emotions. It measures two different dimensions – positive and negative affect – on a 5-point Likert scale (Watson et al., 1988).
- Personal recovery was measured using the 15-item version of the **Questionnaire Process of Recovery (QPR)** (Law et al., 2014; Neil et al., 2009). The QPR has been translated into Dutch via forward and backward translation by Kraiss and colleagues (Kraiss et al., 2018). The QPR has also been explicitly validated for people with bipolar disorder (Jones et al., 2013).
- The process of dampening was assessed by the **Responses to Positive Affect Questionnaire (RPA)**; this consists of 17 items and measures cognitive responses to positive affective states (Raes, Daems, Feldman, Johnsons, & Van Gucht, 2009).
- The subscale Positive Relationships of the **Scales of Psychological Well-Being (SPWB)** were used to measure the process of positive relationships (Ryff & Keyes, 1995).
- The **Self-Compassion Scale Short form (SCS-SF)** was used to measure self-compassion (Neff, 2003; Raes et al., 2009).

Data Analysis

Quantitative data

The quantitative analyses were performed using SPSS Version 27 for Windows. Rating of the exercises were collected from the app, and average scores for all the exercises were calculated. We also calculated the app usage data and response rates as part of the feasibility element of the study.

Pre-post changes in outcomes in both the intervention and control group were analysed using paired *t*-tests. Within-group changes were also expressed as Cohen's *d* effect sizes, where .20, .50, and .80 indicate small, medium, and large effects, respectively (Cohen, 1988). Between-group differences in post-test scores were tested using ANCOVAs, with the baseline scores of the respective outcomes as covariate. Two-sided *p*-values < .05, without correction for multiple testing, were considered significant.

Qualitative data

We used the 60 concepts of technology acceptance by Garton and colleagues (Garton et al., 2012) and summarised these in a 10-item topic list (Technical functioning, Technical support, Usability, Unintentional harmful effects, Reliability, Look and feel, Personalisation, Enjoyment and satisfaction, Involvement, and Expectations). We added 'Usefulness for BD' to the list as a separate concept. The questions for the semi-structured interviews covered all elements of these concepts to receive a complete insight into the acceptability of the developed application. ATLAS.ti7 was used to analyse the data, which was based on the Colaizzi method (Shosha, 2012). We combined this seven-step method, which was based on identifying phenomena in the data (reading transcripts, formulating meanings, formulating categories, description of the phenomenon, fundamental structure, and validation) with the 60 concepts of acceptability.

The interviews were recorded and subsequently transcribed verbatim for analysis. The transcripts were read and reread, and each interview was analysed and coded by the researcher. The participant quotes that referred to any of the 60 concepts of acceptance were brought together and grouped to formulate the phenomena, i.e. the topic. In the last phase of the analysis, the relations between the found phenomena were compared to all concepts of acceptability and placed under the most fitting concept.

Ethical Considerations

This study was performed following guidelines and regulations from the Dimence-Group and the University of Twente, and in accordance with the EU General Data Protection Regulation (GDPR). The obtained data were anonymised and stored on the secure server of the Dimence-Group following ISO (International Organisation for Standardization) standards for mental healthcare and research (Iso number 9001 and NEN7510). The data were only accessible to the principal investigators (BG&JV) using a login password. Obtaining personal data is a standard procedure in mental health care, and this study did not collect any personal data outside what was already given in the patient's file. According to Regulation 93/42/EEG, the eHealth application of the current study is not a medical device. Even though the intervention is considered to be stand-alone software (an app), it was not installed on a medical aid or device and did not perform tasks other than storage, archiving, data compression, or simple search tasks.

Results

Overview

In total 41 participants were recruited. There were no significant demographic differences between the intervention and control groups. More participants were female (intervention group = 73%; control group = 79%). Table 1 presents the participant demographics. One participant (2%) withdrew before the study began for somatic reasons. The post-intervention questionnaires were completed by 62% (n=13) intervention and 84% (n=17) control participants. Of the 21 participants in the intervention group, 9.5% (n=2) did not start the intervention, 37.8% (n=8) only partly completed the intervention (one to four exercises completed), and 52.7% (n=11) fully completed the intervention (five exercises or more). There were no differences in outcome between both groups. Reasons for stopping in the intervention group were technical problems, relapse in mood episodes, PPI did not fit with the person's needs, or unknown. Reasons for not beginning the intervention (*N* = 2) were lack of time. The reasons for non-completion are summarised in Table 2.

Qualitative Results: Acceptance

In the interviews, the participants (n= 11) mentioned an average of eight subcategories (range = 5–10, median = 9) related to pre-defined aspects of acceptance. Most of the comments were coded as expectations (65), while only a few (6) were coded as unintentional harmful effects. The participants' quotes were coded by the 10 concepts of acceptance topics: Table 3 provides an overview of the number of quotes per topic. Each topic is discussed in turn below.

1. Technical Functioning

The remarks made by the participants were divided into four subcategories: frustration, reliability, user control, and error prevention. The code *frustration* contained bugs in the

Table 1. Participant demographics.

	Total ***N* = 40 (%)**	**Intervention group** ***N* = 21 (%)**	**Control group** ***N* = 19 (%)**
Age			
16–25 years	7 (17.5)	3 (14.4)	4 (21)
26–35 years	4 (10)	3 (14.4)	1 (5.3)
36–45 years	5 (12.5)	2 (9.5)	3 (15.8)
46–55 years	10 (25)	5 (23.7)	5 (26.4)
56–65 years	10 (25)	6 (28.5)	4 (21)
66 and older	4 (10)	2 (9.5)	2 (10.5)
Gender			
Female	30 (75)	16 (72.7)	15 (78.9)
Marital status			
Married/live together	19 (47.5)	10 (47.6)	9 (47.4)
Divorced	6 (15)	2 (9.5)	4 (21)
Widow(er)	1 (2.5)	1 (4.8)	-
Single	14 (35)	8 (38.1)	6 (31.6)
Daily activities			
Paid job	15 (37.5)	6 (28.5)	9 (47.4)
Entrepreneur	3 (7.5)	3 (14.3)	-
Volunteer job	4 (10)	2 (9.5)	2 (10.5)
Unemployed	7 (17.5)	4 (19.1)	3 (15.8)
Retired	5 (12.5)	3 (14.3)	2 (10.5)
Student	4 (10)	2 (9.5)	2 (10.5)
Other	2 (5)	1 (4.8)	1 (5.3)
Education			
Primary school	-	-	-
High school	12 (30)	5 (23.8)	7 (36.8)
Higher professional education	20 (50)	11 (52.4)	9 (47.4)
University	7 (17.5)	5 (23.8)	2 (10.5)
Other	1 (2.5)		1 (5.3)

system and recurring error notifications, which impacted motivation to continue using the app:

> *Sometimes the push notifications didn't work properly. While there was an exercise ready and I thought 'I will not get a new exercise for a long time.' But it turned out that the old one was still there and that I didn't get a new one yet, but that I hadn't had push messages, while you sometimes do get them. So that was a bit strange.* (Participant F16[2])

In *user control* and *error prevention,* the remarks were divided into those who found it easy to use the app (six participants) and those who had some issues, mainly with the installation process (four participants). The participants were unanimous in their appreciation of the app's performance (*reliability)*:

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[2] F = female participant, M = male participant.

Table 2. Reasons for partial- or non-completion.

Reasons for non-completion	***N***	**%**
Technical problems	3	14%
Relapsed in mood episode BD	2	9.5%
No time	2	9.5%
PP did not fit the participant's needs	2	9.5%
Unknown or other reason	1	4.8%
Completers	11	52.7%
Total	21	100%

Table 3. Number of quotes per acceptance topic.

Acceptance topic	Number of quotes, Stage 1 of analysis	Number of quotes, Stage 2 of analysis
1. Technical functioning	37	19
2. Technical support	19	9
3. Usability	57	22
4. Unintentional harmful effects	6	6
5. Reliability	9	5
6. Look and feel	13	8
7. Personalisation	53	24
8. Enjoy and satisfaction	34	21
9. Involvement	38	19
10. Expectations	65	21

> *And it actually always worked, it's not like I've had it not worked once. No, I just got a nice message from, 'Hey, there's another one waiting for you.' So no, it was, yes, perfect. (Participant F20)*

> *I found that quite difficult, it was not entirely clear in the beginning how to do it. I had also sent some e-mails about it… Yes, that was complicated, let's say. It wasn't immediately clear how to do that.* (Participant F10)

2. Technical Support

The participants had the opportunity to get in touch with the researchers when they experienced problems using the app. Approaching the researchers by phone or personal help was more highly valued than by mail and was perceived to be more helpful. In three cases, inadequate support led to drop-out:

> *Well, I found that very difficult to install. X* [the researcher] *helped me with that to get it right on my phone.* (Participant F8)

3. Usability

In the usability category, remarks were made about ease of use, accessibility, and intrusiveness. The participants mentioned that after installing the app, it was easy to use and accessible. One participant found the number of words in the text fields too limited. For some participants, the app was not intuitive enough, and they did not understand the timing rules and the repeated exercises; therefore, they stopped using the app. Participants said:

> *Anyway, I didn't fill it in for a while at the beginning because I didn't understand that you got the same assignment three days in a row. I made that first assignment. And then the second was the same. I think: 'Yes, I already made that. Then I wait for the next one.' So that wasn't clear to me. And then, yes, a few days later: 'It's still there! Yes, but I've already made that one, so I'll wait for the next one.'* (Participant M7)

> *Well in general, I liked it* [the app] *very much. It is very accessible. It is easily described, no fancy words or fuss, things I don't understand or something.* (Participant F12)

> *It's all clearly explained, and yes, you can read it, but you can indeed play a video, so yes, actually it's just perfect.* (Participant F20)

4. Unintentional Harmful Effects

Three participants made remarks about the potentially harmful effects of using the app. They Experienced tension when a red cross appeared if an exercise was not completed. For example:

> *What really was annoying was that you got an alert with a red cross when you didn't succeed in the exercise*. (Participant F5)

One participant felt pressure (tension and premature commitment) to perform the exercise even when she was not in the mood:

> *Then I thought, 'F**k you with all your good advice, I just don't want to do it today.'* (Participant F12)

Regarding the emotion scale at the beginning and the end of the exercise, for one participant, it was difficult to carry on with the exercise if she could not fill in this scale:

> *Sometimes I didn't know how I feel, and yes, what should I fill out? So I put it aside*. (Participant F11)

5. Reliability

One comment was related to transparency. This was confusing for one participant who had access to their data and was reading the answers to the open questions in the app:

> *So not to get bogged down in, say, extensive reports. Also, to your side, if all that needs to be read or will be… I don't know if all of that will be read, by the way. Or that it's just for m*e. (Participant M7)

6. Look and Feel

Five participants commented on the look and feel of the app and its aesthetics. Although participants could choose from being two accompanied by two people in the app, one participant had a personal aversion to their chosen presenting person. All six participants appreciated the possibility of choosing between text or video. Besides this, they also liked how they could choose between an expert by experience and a professional. The videos were not too long and made it clear what the exercises aimed to do. Two participants mentioned that the app also had a calming effect. Quotes that represented these issues are:

> *And this is, this was really around a minute, just below, just above... That was great, that was really ehh… and also very clear of what the assignment is*. (Participant F8)

> *So in itself good, but only yes, I may not say it aloud perhaps, but that lady, she was unpleasant. But yeah, that's, that's very personal, of course, huh, she did a very good job and was also very clear and all that, but… oka*y. (Participant F8)

> *I also liked that there was a video and the text above it, so to speak. If I didn't feel like watching the video, I could just read the text and vice versa. I liked that*. (Participant F10)

7. Personalisation

In this category, remarks were made regarding flexibility, customisability and feedback. The choices of the person who guided them through the app, especially helping participants choose between text and video were highly valued. Conversely, the rigid way the exercises had to be performed was less appreciated. The time settings were considered beneficial, although some participants mentioned that they could not perform the exercise at the moment of the notification. Some participants would also have liked more personalised feedback at the end of each exercise, although it was difficult for them to explain what kind of feedback they expected. Some quotes on these points are:

> *You can listen to the videos, you can read them. You can choose from two people, so that's really nice*. (Participant F24)

> *I would take a step in between, like getting some feedback anyway, even if it's just… well, the suggestion, how could you do that? Well, it's so static... I don't know how to explain that properly, I think you have little interaction.* (Participant F5)

> *I think if I do it* [time rules] *in the morning, I do it in the morning, but if I do it in the evening, that is, I wouldn't think 'Oh, the app is here* [the notification BG] *and I'm going to sit down for it right away.' I wouldn't do that very quickly, and then it also feels like an obligation: 'Hey, I have to do that at eight.' Yes… …I really know when I want to do the exercise.* (Participant F20)

8. Enjoyment and Satisfaction

Participants found the use of the app emotionally fulfilling and enjoyable. They made remarks about using it in their daily life and how the exercises contributed to their activities and personal relationships. Other comments focused on the atmosphere of the app (positive use of colours and short but to-the-point videos). Some example comments are:

> *Well, I really liked the focus on the positive, that it was continuous. The variety is also very nice. And also, sometimes they are exercises where you… some things come to you, such as mentioning three positive things of the day, for example. I've done it before, but a lot of things were also new, so it's fun, oh, you can't think of that otherwise. And then you get new ideas. Also nice, that one, which was focused on… your own powers.* [It is] a*lso nice that you really focus on the positive side, while I am very inclined to always say, 'Oh well, what could I have improved?'* (Participant F11)

> *Sometimes it really helped me. A small example is that I had an important conversation on, and then I just happened to read that exercise that you have to think about nice things and such. Those nice memories, and that helped a lot. For example, I got rid of the nerves. Because then I was busy with something else, so that was nice*. (Participant F12)

> *The positive, that you have a positive mindset, and that you come to have a positive attitude in life. Yes, I actually thought so, that's the most important thing.* (Participant F8)

> *Yes, just that it is good to do that once and become aware of the fact that I am normally more often focused on the negative sides of myself. So yeah, you get aware of that again, sort of.* (Participant F10)

9. Involvement

Participants' motivation to use the app fluctuated between feeling that they were obligated to perform the exercise (for instance, because they agreed to participate in the study) and more intrinsic motivation because of what the app could offer them in terms of improving their well-being. But feeling obligated to use the app did not seem to impact satisfaction with using the app:

> *So no, it was not reluctantly. Otherwise, I wouldn't have signed up for trying that app, of course.* (Participant F24)

> *Yes, it is a must-do, but not an annoying one. It's expected of me. I've said I'm in, then I'll do it. That's just how I'm put together. So you can say: 'It's a must'.* (Participant M7)

10. Expectations

The participants made remarks about their expectations of improving the functionality, usefulness, effectiveness, attractiveness, and efficiency of the app. Regarding functioning, they suggested adding physical exercises, no word limit in the free text boxes, and more short knowledge remarks during or at the end of the exercises. Guidance by a professional was seen as stimulation to perform the exercises. About the use of the app, they would have liked more customisation and the freedom to choose which exercise they wanted to perform:

> *Or that you have to take a physical exercise… …or have to do something crazy, maybe something like that. Even more variation, maybe that's still fun.* (Participant F11)

Qualitative Results: Usefulness for Bipolar Disorder

In addition to using Garton et al., (2012) 60 concepts of technology acceptance, we added one category (Usefulness for Bipolar Disorder) that came up during the interviews and the analysis process. This answered the question: Is the tested app suitable for people with BD? Overall, the participants found the app useful and recognised its application possibilities, especially during mild depressive episodes. One participant commented:

> *Yes, I think it's suitable for people who are bipolar, but it can be much more specific for if you are in a mania or if you are in depression. But I don't think it's the intention of this app, and I don't know. But if you're really deep in a depression, or you're deep in a mania, then I think you don't do those exercises.* (Participant F30)

Quantitative Results: Feasibility

After finishing the exercises, 21 participants (90%) rated one or more of the exercises. In total, 93 valuations were made (*mean* = 7.50; *SD* = 1.226, on a scale of 1–10). The exercises early in the intervention (1, 2, and 4) were rated lower than those that appeared later, with the lowest mean score given to for exercise two (active Listening). This was because the participants experienced difficulty performing the exercise because they needed a significant other to perform it with. Table 4 shows the descriptive statistics for all the exercises. To personalise the intervention, the participants had to choose between being guided by a professional or an expert by experience and from three types of notification messages. Seventeen participants (81%) chose guidance from the expert by experience. Five participants (24%) decided to have no notifications at all, eleven (52%) preferred Notification 1 ('Don't forget yourself, do the exercise.'), and five participants (24%) selected Notification 2 ('There is a positive psychology exercise waiting for you.'). An overview is given in table 5.

Table 4. Value of the exercises: descriptive statistics.

	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
1; Positive emotions (gratitude)	21	4	10	7.36	1.293
2; Positive relationships (active listening)	16	4	9	6.50	1.751
3; Resilience (three good things)	14	5	10	7.64	1.216
4; Strengths (discover your strengths)	12	3	9	7.50	1.567
5; Positive emotions (positive focus)	11	6	10	7.91	1.136
6; Positive relationships (expressing gratitude)	10	6	9	7.80	0.789
7; Resilience (getting stronger)	9	6	9	7.78	0.833
Total	**93**			**7.50**	**1.226**

Quantitative Results: Questionnaire Outcomes

Baseline scores on several outcome measures differed significantly between the intervention and control condition. The intervention group had numerically lower psychopathology scores (e.g. HADS, 5.92 vs. 9.12) and numerically higher positive psychology scores (e.g. MHC-SF, 45.54 vs. 32.18).

The within-group t-tests showed no significant changes in the intervention and control group on any of the outcome measurements, except for a significant decrease in

Table 5. Personalised elements of the interventions: frequencies.

Intervention type	Frequency	%
GHA[1]	1	4.8%
GHB[2]	4	19%
H1A[3]	2	9.5%
H1B[4]	9	42.9%
H2B[5]	5	23.8%
Total	21	100%

1: No alerts guided by the professional.
2: No alerts guided by the expert by experience.
3: Notification 1 guided by the professional.
4: Notification 1 guided by the expert by experience.
5: Notification 2 guided by the expert by experience.

dampening in the control group, as measured with the RPA ($p = .003$). Most within-group effect sizes for the intervention group were negligible to small (d = -0.18 – 0.43). For well-being, only the RPA showed medium to strong improvements in the intervention group (d = 0.56, 95% CI = 0.04 – 1.13, p = 0.068). The between-group ANCOVAs also failed to reveal any significant differences between the intervention and control groups at post-test (*p values* = 0.09–0.84).

The outcomes of the tests are summarised in Table 5.

Discussion and Conclusions

Principle Findings

This study investigated the acceptability of an OPPI designed for people with BD and the feasibility of conducting a larger trial. It also focused on exploring the potential psychopathology and well-being outcomes associated with the use of the OPPI.

Regarding the acceptability of the intervention, we found that 90% of the participants started the intervention, and 53% completed it. Unguided online interventions can lead to non-completion rates up to 74% (Richards & Richardson, 2012). Although in this study, the individual reasons for non-completion differed; technical problems, lack of technical support, and the intervention being unaccompanied were the main reasons for participants to stop using the app. Still, there was a relatively high number of full completers in our study, which could be attributed to several issues: first, we sent out notifications to remind the participant to perform the exercises; secondly, the content of the app is based on requirements of patients and professionals (Geerling et al., 2022);

Table 6. Between and within-group effects for the WELLBE BD-app: paired t-tests and ANCOVAs.

Outcomes	Pre T0	Post T1	Within-group changes			Between-subjects effects	
	Mean (Std. Deviation)	Mean (Std. Deviation)	t	*p*	Cohen's *d* (95% CI)	F	*p*
HADS intervention group	5.92 (4.96)	5.23 (4.83)	0.884	.41	0.24 (-0.32 to 0.78)	0.175	.68
HADS control group	9.12(6.17)	8.06 (5.11)	1.515	.15	0.37 (-0.13 to 0.85)		
ASRM intervention group	2.15 (1.99)	1.54 (3.02)	0.480	.56	0.17 (-0.39 to 0.71)	0.000	.099
ASRM control group	1.71 (3.06)	1.41 (1.91)	0.518	.61	0.13 (-0.35 to 0.60)		
QIDS intervention group	7.38 (4.27)	7.69 (5.79)	0.132	.76	-0.09 (0.63 to 0.46)	0.761	.39
QIDS control group	11.18 (7.21)	9.76 (6.94)	1.528	.15	0.37 (-0.13 to 0.86)		
MHC intervention group	45.54 (11.41)	43.54 (13.34)	0.769	.46	0.21 (-0.34 to 0.76)	0.043	.84
MHC control group	32.18 (14.35)	33.88 (13.99)	-0.734	47	-0.18 (-0.66 to 0.30)		
EQ5D intervention group	7.38 (2.14)	7.00 (1.92)	0.835	.42	0.23 (-0.32 to 0.78)	0.001	.34
EQ5D control group	8.71 (3.24)	8.18 (2.60)	0.919	.37	0.22 (-0.26 to 0.70)		
PANAS intervention group	36.46 (5.11)	34.69 (8.63)	0.850	.41	0.23 (-0.32 to 0.78)	0.169	.68
PANAS control group	31.76 (6.03)	32.47 (7.25)	-0.449	.66	-0.11 (-0.58 to 0.37)		
QPR intervention group	44.69 (7.01)	42.38 (9.22)	0.978	.35	0.27 (-0.29 to 0.82)	0.041	.84
QPR control group	34.82 (12.21)	38.24 (6.68)	-1.760	.09	-0.43 (-0.92 to 0.77)		
RPA intervention group	5.69 (3.40)	4.08 (2.72)	2.007	.068	0.56 (0.04 to 1.13)	0.251	.62
RPA control group	7.88 (6.29)	5.94 (2.72)	3.474	.003*	0.84 (0.28 to 1.36)		
SPWB intervention group	35.54 (3.10)	36.31 (4.15)	-0.805	.44	0.22 (-0.77 to 0.33)	1.433	.24
SPWB control group	33.71 (3.72)	33.76 (3.77)	-0.056	.96	-0.01 (-0.49 to 0.46)		
SCS.SF intervention group	37.00 (7.70)	36.69 (8.06)	0.176	.86	0.05 (-0.50 to 0.59)	0.755	.39
SCS.SF control group	31.53 (11.66)	34.24 (12.33)	-1.639	.12	0.40 (-0.87 to 0.10)		

Notes: HADS-A, Hospital Anxiety and Depression Scale; ASRM, Altman Self-Rating Mania scale; QIDS-SR, Quick Inventory Depressive Symptoms Self-Rating; MHC-SF, Mental Health Continuum Short Form; EQ5D, EuroQol 5 Dimensions; PANAS, Positive And Negative Affect Scale; QPR, Questionnaire Personal Recovery; RPA, Responses to Positive Affect Questionnaire; SPWB, Scales of Psychological Well-Being; SCS.SF, Self-Compassion Scale Short Form.

thirdly the participants could choose the person who guides them, throughout the intervention; and finally the participants received emails/calls when they didn't succeed the exercises. In a scoping review, Saleem et al. (2021) defined personalized feedback, guidance regarding content, interactivity with peers, reminders, and flexibility and usability as strategies to improve engagement. Even when participants are sceptical about online interventions completion rates aren't negatively influenced (Moritz et al., 2012).

The participants' average rating for the exercises was, with a 7.5 on a scale of 1–10, relatively high. Of the 93 valuations, 9.7% (9) scored five or lower (which was classed as insufficient). For 9.5% (2) of participants, this was a reason to stop the intervention. Surprisingly, 80% of the participants chose to be guided by the expert by experience, while in the developing phase of the app, this was equally divided (50% expert by experience /50% professional) (Geerling et al., 2022). The qualitative results showed that most participants were satisfied with the usability of the app, the design, and the personalisation possibilities in the settings. Most participants found using the app emotionally fulfilling and enjoyable. They reported an increase on positive feelings and emotions. Moreover, some participants reported a different, more positive view on their situation. This effect is appealing to the unmet needs in BD (Fortuna et al., 2019; Hajda et al., 2016; Maassen et al., 2018.). Improvements were suggested for the personalisation and customisation options, technical support options, and technical functioning, especially regarding the notifications and installation of the app. Comments were made about the possible adverse effects, being compelled to perform the exercises and some visual effects that need to be addressed in further development.

The second aim was to examine whether a full RCT with a similar design would be feasible. Of the 41 included participants, one withdrew from the study before the start due to personal reasons. Of the remaining 40 participants 30 (75%) completed the questionnaires after seven weeks (T1). There was a significant difference between the responses of the control group (84%) and the intervention group (62%). This was partly caused by participants who had left early in the intervention being excluded from the second measurement to avoid contaminating the intervention group data. The response rate was higher than in other publications (i.e. 44.8–52.7%; (Baruch, 1999; Baruch & Holtom, 2008; Yu & Cooper, 1983). Therefore, we can conclude that the design is feasible for an RCT.

Our secondary outcome refers to the applied questionnaires used to measure psychopathology and positive psychology and the results. Contrary to our expectations, this study did not find a significant pre-post difference between the control and intervention groups for well-being and psychopathology. Although we found a small effect size in the intervention group, this was too small to draw any conclusions, especially because of the small sample size. There was a difference between the intervention- and control group at baseline and post-test, but both groups improved. Sergeant report that distressed users of OPPIs have a better response to intervention than non-distressed participants (Sergeant & Mongrain, 2015). This could imply for the RCT that participants with more severe symptoms should be included.

Comparison with Previous Studies

We hypothesise that the high acceptance and value ratings of the app is due to early user involvement. This effect has also been found in previous studies; to meet the needs of the target group, user involvement is necessary at all stages of the development process (Kelders, Pots, Oskam, Bohlmeijer, & Van Gemert-Pijnen, 2013). The implementation of healthcare interventions depends on the acceptance of the intervention by both patients and clinicians (Diepeveen et al., 2013; Stok et al., 2016). During the intervention, we did not involve the attending clinicians of the participants since it was an unguided intervention. We operationalised 'acceptance' for our qualitative data using the 60 acceptability technology concepts and 10 acceptance topics proposed by (Garton et al., 2012). This enabled us to cluster the participants' quotes and develop a comprehensive overview of the qualitative results and is recommendable for comparable studies.

Despite a relatively high completion rate, still 47% of the participants did not succeed in the full completion of the intervention. Besides recommending improvements in technical functioning and support, one can question whether support during the intervention is necessary, and if so, by whom? Notably, 80% of the participants chose the expert by experience to accompany them. This suggests that peer support might have a role in the enrolment and further development of the intervention. Clinician contact during the course is associated with increased adherence and is one of the determinations of effectiveness (Hilvert-Bruce et al., 2012). Other studies have reported successful online interventions with peer support (Ali et al., 2015; Possemato et al., 2019). Most of the interventions offer peer-support via online groups or via chat sessions (Ali et al., 2015). In comparison with the only online module 'Thinking forward' for veterans with PTSD or combined with peer support (every 14 days during the intervention period of 24 weeks), the veterans reported in the peer-support group better outcome on quality of life, resiliency, and coping, and on PTSD-symptoms no difference in progression was found between the online- or peer-support group (Possemato et al., 2019). Moreover, it is important to involve clinicians in the implementation phase to increase adherence and completion rates (Stathopoulou et al., 2006). In the original development of the app, user involvement played a key role in the design and choice of content (Geerling et al., 2022). In accepting newly developed apps, user involvement and co-creation play an important role (Van Bruinessen et al., 2014). The participation of end users is the main element in user-centred designs, defined as 'an approach which views knowledge about users and their involvement in the design process as a central concern' (Preece et al., 2015).

The results of our study gave new input into improving the WELLBE BD-app, with suggestions such as having more variety in the exercises, adding physical exercises, having no word limit in the free text boxes, and having shorter knowledge remarks during or at the end of the exercises.

Participants in the study were in general positive about the app and were willing to participate in the intervention. The post-intervention response rate to the questionnaires was high (75%), indicating that the design of the app was feasible. Because the response rate in the control group was significantly higher than in the intervention group, we attempted to increase the intervention response rate by encouraging the non-completion group to fill out the questionnaires. It is questionable whether 11 questionnaires with a total of 101 questions are necessary to evaluate the effectiveness of the app. It has been suggested that long instruments can lead to boredom or confusion; therefore, the highest reliability coefficients have been reported for simple questionnaires (Shephard, 2003). Longer questionnaires lead to significantly lower response rates (Rolstad et al., 2011).

The outcomes of the pre and post-intervention questionnaires were not in line with our expectations and in contrast to previous studies that have suggested that people with BD can benefit from PPIs with a moderate to a large effect (Celano et al., 2020; Geerling et al., 2020; Kraiss et al., 2021). Our study differs from earlier studies since it is a digital health intervention instead of a physical group intervention; moreover, the intervention was unsupported by healthcare professionals. Previous studies have shown that interventions without encouragement or accompaniment had lower effect sizes and higher non-adherence and non-completion rates (Eysenbach, 2005; Hilvert-Bruce et al., 2012; Richards & Richardson, 2012). In addition, there was an unexplainable difference between the two groups at baseline, despite the randomized allocation of participants. When looking at the value given to the exercises in combination with the qualitative data, there was a high appreciation of the intervention. We hypothesise that the duration of the study may have been too short to measure effects and that newly developed skills, especially in the domain of positive psychology, will show their benefits later. Moreover, the intervention group had relatively low scores on psychopathology and higher scores on well-being outcomes, and therefore, further improvement is not easily accomplished.

Limitations and Further Research

Our study has some limitations, especially related to the generalisability of the results. The study was mainly a qualitative study with a relatively small number of participants. Specifically, at the recruitment stage, although we quantitatively randomised the participants based on voluntary participation, we cannot rule out that more engaged patients were more willing to participate in the study. Also, we limited the recruitment to one institute. These issues must be taken into account when designing a large RCT.

Another limitation of our study that could have affected the results is that participants who left early in the intervention were excluded from the second measurement. This means that we missed valuable data. The study could have been enriched if we had shared the outcomes in a focus group setting after the quantitative stage of the study. This may have clarified some of the unexpected findings.

Due to the study's feasibility design, the sample size was small; therefore, we could not draw firm conclusions about the secondary psychopathology and positive psychology outcomes.

Conclusions and Implications

The WELLBE BD-app, an OPPI for people with BD, proved to be acceptable for the target group in this study. The acceptance and valuation of the intervention and the separate exercises was high and promising for further development and enrolment in a larger cohort. It is recommended to improve technical functioning and technical support, to implement more options for personalisation during the use of the app, and to consider peer or professional guidance during the intervention. The study design also proved to be feasible for the target group, but the length and number of measurement questionnaires need careful consideration before the app is enrolled in a more extensive study. The large number of participants that chose the expert by experience instead of the professional to guide them within the app, needs further exploration. A specific question to be answered is whether peer support is the most promising way for guidance and motivational support to be provided in this intervention.

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CHAPTER 7

General discussion

General Discussion

In this chapter, the main findings of the studies presented earlier are discussed together with the current knowledge on positive psychology (PP) and bipolar disorder (BD), self-management in monitoring, and the impact of digitalisation on the treatment of BD. Next, we describe the strengths and limitations of the studies. This chapter concludes with implications for clinical practice and future research.

7.1 Main findings

The current thesis aimed to develop an internet application ('app') based on PP in collaboration with patients and professionals and to evaluate its acceptability and potential benefits for patients with BD. Furthermore, finding ways to improve self-management, i.e. monitoring compliance. We aimed to combine monitoring and well-being interventions in one mobile application (m-health) to achieve this aim. The main questions of this thesis were: (1) what is the state of the art of applying positive psychology interventions (PPIs) for BD? (2) What are the opinions of patients and professionals about online monitoring and PPIs for BD? (3) To co-creation an online mood monitoring and PPI digital intervention. (4) Is the developed intervention acceptable, and what are the effects of the intervention on well-being and psychopathology outcomes?

7.1.1 State of the art of PPIs in severe mental illness and health-related app use by patients with BD

In chapter 2, we performed a meta-analysis to assess the effects of PPIs on well-being and psychopathology in people with severe mental illness (SMI).

The 16 studies included in this meta-analysis revealed a significant moderate pre–post intervention effect on well-being and a significant large effect on psychopathology, showing that people with SMI can benefit from PPIs. However, PPIs are not more effective than other active psychological interventions. Previous meta-analyses have also shown that PPIs are effective in studies that included active control groups (Bolier et al., 2013; Chakhssi et al., 2018; Hendriks et al., 2020; Sin & Lyubomirsky, 2009; Weiss et al., 2016).

In chapter 3, we studied why patients diagnosed with BD start, continue, or discontinue health-related apps that support their self-management. Of the 41 participants, 44% used health-related apps, and 27% used those apps consistently. This is a higher usage rate than in the general population (20%) (Carroll et al., 2017). Furthermore, we found that the participants mainly used apps focused on physical activity, planning, and relaxation-related goals but not apps that are directly related to BD. People used apps when there was freedom of choice, user-friendliness, and trustworthiness, and they discontinued using them when the apps did not fit their individual needs, malfunctioned, or included too many adverts.

7.1.2 Co-creation of online mood monitoring and PPI digital intervention

We performed two connected studies in which we investigated the opinions of patients with BD and professionals about online mood monitoring (Chapter 4) and web-based PPIs (Chapter 5). We also assessed preferences on design, technical features, and options that facilitated their optimal use and implementation of mood monitoring.

Regarding mood monitoring, our findings showed that using the Life Chart Method (LCM) was preferred, along with options to personalise monitoring and strict privacy statements. Nicholas et al. (2015) revealed that there are almost no reliable and free downloadable apps for mood monitoring.

Regarding the expectations of PP, the participants underscored the potential benefits of PP in the personal recovery process. Positive emotions, resilience, positive relations, and strengths were highly valued in preferences for various PPIs. In contrast, self-compassion, optimism, and hope were less appreciated because of 'fear of compassion' (Gilbert, 2010) or that performing optimism and hope exercises may provoke symptoms of mania.

The strongest preferences for the design of an app were a calm design, the use of proper wording, and integration with mood monitoring (LCM).

The evaluation of the tested app revealed that 91% of the participants found it beneficial to perform the exercises. The valuation of the exercises was promising (7.35 on a scale of 1–10; median 7.5). Participants recommended further improving the app, especially addressing frequency and repeated exercises.

7.1.3 First evaluation of the acceptance and benefits of the developed digital intervention

The evaluation study described in Chapter 6 showed that the intervention was acceptable: 90% of the participants started the intervention, and 53% completed it. There were three main reasons for non-completion: technical problems, lack of technical support, and the fact that the intervention was self-guided and unaccompanied. The participants' average rating for the exercises was relatively high: 7.5 on a scale of 1–10. However, of the 93 participants, 9.7% scored five or lower, classified as insufficient. The qualitative results showed that most participants were satisfied with the usability of the app, its design, and the possibilities for personalisation in the settings. Most participants found that using the app was emotionally fulfilling and enjoyable. They reported an increase in positive feelings and emotions. However, we found no significant pre–post difference between the control and intervention groups for well-being and degree of psychopathology.

7.2 Application of positive psychology interventions in bipolar disorder

The results of our studies showed that BD warrants specific and careful application of PPIs and that existing PP exercises must be adjusted before applying them in patients with BD. In the next sections, several challenges for people with BD in applying positive psychology are addressed.

7.2.1 Fear for mania

In the development of the online PPI for BD, as described in Chapter 5, the fear of becoming manic when following a PPI was a major concern of the focus group members. They assumed that provoking positive feelings could induce or aggravate a (hypo)manic episode. This concern is also reported in other studies (Celano et al., 2020). Gruber et al. (2009) found that positive emotions, such as joy and amusement, could increase the severity of manic symptoms in patients with BD and that invoking compassion could decrease manic severity. Events enhancing strong personal growth, such as participating in a highly motivating workshop, also have been shown to induce manic symptoms (Proudfoot et al., 2012). On the other hand, positive rumination may lead to a decrease in manic symptoms (Li et al., 2017). Thus, the various aspects of PP seem to have different effects on the increase or decrease of manic symptoms.

Despite the fear of mania mentioned in the pilot test and the acceptability study (Chapter 6), we found no evidence to ground this fear, such as a relapse in mania during the intervention period. However, because this is a single feasibility study with a limited number of participants, we cannot draw the conclusion that PPIs do not provoke (hypo) mania. In the literature, only a few studies of PPIs and BD used mania measurement scales to evaluate elevated mood by using the Altman Self-Rating Mania Scale (ASRM) or the Young Mania Rating Scale (YMRS) (Altman et al., 1997; Young et al., 1978, 2004). Like our study, the two studies that did apply the ASRM or the YMRS did not find changes in the symptoms of mania (Kraiss et al., 2021; Painter et al., 2019). This suggests that PPIs do not induce an increase in symptoms of mania.

Nevertheless, it could still be argued that applying PPIs to patients who are already (hypo)manic may worsen these symptoms. Sleep disturbance, (recreational) use of stimulants, routine change, and falling in love are reported as important triggers of mania (Colom & Vieta, 2006; Proudfoot et al., 2012). The mentioned triggers are not specifically related to the goals of PPIs, like enhancing positive feelings. Still, it is not inconceivable that PPIs can affect the triggers of mania.

All in all, it is still somewhat premature to conclude that applying PPIs is without risks for inducing mania. Therefore it seems recommendable to apply PPIs, as a complementary intervention, in BD only in the later stage of the treatment, in euthymic or subsyndromal depressive episodes. Further research in this area is needed.

7.2.2 Fear of compassion

In the preferences for the PP exercises described in Chapter 5, we found that participants had a 'fear of compassion' and therefore valued exercises aimed at increasing compassion, optimism, and hope less positively. This seems contra-intuitive since these exercises are closely linked to unmet needs in people with BD, such as hope and increasing self-confidence (Goossens et al., 2007; Maassen et al., 2018). Fear of compassion (Gilbert, 2010) is closely linked to self-coldness, self-criticism, insecure attachment, depression, anxiety, and stress (Gilbert et al., 2011). Studies have shown that such traits are common in BD, e.g., women with BD are even more self-critical than controls (Rosenfarb et al., 1998). Stress and anxiety are closely related to symptoms of bipolar depression (Corry et al., 2013), and negative experiences during BD can contribute to high levels of self-criticism. Therefore, early interventions to decrease self-criticism are recommended (Nitzburg et al., 2016). Life satisfaction in BD seems to be related to self-compassion, which is significantly lower than in the controls (Dossing, 2016). The fear of compassion can also be related to early experiences in which people may have learned that positivity and happiness have negative consequences (Gilbert, 2010). It also can be argued that in BD, the fear of compassion is linked to the fear of mania, as described above. Moreover, it can be hypothesised that feelings of low self-esteem and self-criticism did not fit with feelings of compassion and, therefore, it could be difficult to embrace exercises that aimed to increase levels of compassion. It may be assumed that interventions that increase the level of self-compassion are indicated for people with BD.

We adjusted the application based on our findings, but do the above-described results justify a special approach for applying PPIs in BD? In schizophrenia, PPIs are adjusted to overcome problems of internalising feedback. Therefore, the therapeutic environment and clinical interactions are focussed equally on patients' strengths and skills in comparison with coping with symptomatology (Ahmed & Boisvert, 2006). Prudence is crucial when applying PPI in people with serious conditions like cancer to avoid the thoughts that 'cancer can be overcome by thinking positively, remaining optimistic, being mindful, and so on' (Macaskill, 2016, p8). In BD, the interventions are specially designed for the target group (Painter et al., 2019). Existing interventions such as 'This is my life' (Bohlmeijer & Hulsbergen, 2013) are customised on content and delivery to BD Geerling et al., 2022a; Kraiss et al., 2018), or they combine PPIs with previous work in patients with psychiatric illness (Celano et al., 2020). In addition, we can conclude that a certain adjustment is justified to fit PPIs with the target group and that the unaltered application of PPIs in BD could have adverse effects. A recent study revealed the importance of synchronisation between the top-down and bottom-up requirements of self-compassion interventions in cancer patients (Austin et al., 2022). In our development study, we used the same method that can be one of the reasons that we notice lower drop-out rates than in other studies. Therefore, comparable methods should be used when developing compassion interventions in BD.

7.2.3 PPIs and personal recovery in BD

There is a growing interest in the role of personal recovery (PR) in the treatment of BD. Recently the CHIME framework (Connectedness, Hope and optimism, Identity, Meaning in life and Empowerment) was adapted to the particular needs of people with BD (Jagfeld, Lobban, Marshall, & Jones, 2021; Leamy, Bird, Le Boutillier, Williams, & Slade, 2011). The expanded framework reflects all aspects of the CHIME but adds the concept of Tensions (balancing acceptance with ambition, openness about the illness and ambivalence about mania). The result is a new acronym: Purpose and meaning, Optimism and hope, Empowerment, Tensions, Identity and Connectedness (POETIC) (Jagfeld et al., 2021). The POETIC framework also reflects some of the unmet needs in BD, like: support with loneliness, grief counselling, acceptance, social isolation, coping with others, hope, expressing feelings and increasing self-confidence (Bauer et al., 2018; Fortuna et al., 2019; Goossens, Knoppert-Van Der Klein, Kroon, & Van Achterberg, 2007; Hajda et al., 2016; Maassen, Regeer, Regeer, Bunders, & Kupka, 2018).

In the recovery process, personal relationships, personal growth, self-acceptance, and resilience are mentioned as critical success factors (de Vos et al., 2018). These aspects can also be found in PP (Schueller & Parks, 2014). Although there are differences between PP and PR (see Chapter 1), they have more similarities in their approach to mental health. The two movements can reinforce one another (Resnick & Rosenheck, 2006). PP aims to research mechanisms and processes of optimal functioning of individuals, relations and societies and develop interventions that can enhance optimal functioning (Seligman & Csikszentmihalyi, 2000). Therefore, it can be a meaningful addition to the PR movement. Positive psychology interventions (PPIs) focus on improving positive feelings, behaviours or cognitions (Parks & Biswas-Diener, 2013; Seligman, Csikszentmihalyi, 2000; Sin & Lyubomirsky, 2009).

The qualitative results of the studies of the WELLBE BD app (Chapters 4 and 5) showed that PPIs lead to experiencing more positive feelings and that the use of the app was emotionally fulfilling. The participants thought that the use of the app can be especially beneficial during the recovery process of BD. Therewith, it seems that PPIs, as in the WELLBE BD app applied, in BD has the potential to fulfil some of the unmet needs

(Fortuna et al., 2019; Hajda et al., 2016; Maassen et al., 2018), but we didn´t studied that aspect. Further research is needed to establish how people with BD experienced PPIs and which meaning it has to their recovery process.

In our relatively small quantitative study, the data showed no significant effects on well-being and psychopathology. At the same time, other recent studies have reported significant effects of PPIs (Celano et al., 2020; Kraiss et al., 2021). Compared to the baseline characteristics of participants in the intervention groups in other studies, our participants had better scores on positive emotions (PANAS: 36.5 (Geerling) versus 18.5 (Celano), 28.4 (Kraiss), and on depression (QIDS: 7.38 (Geerling), 15.8 (Celano), 10.6 (Kraiss)), suggesting that a ceiling effect played a role in our study and may have restricted the potential for further improvement. This raises the question if someone can be 'too good' to benefit from PPIs. It seems that if the symptoms of psychopathology are low and the levels of well-being are high, progression is not straightforwardly achieved.

Other explanations for not finding significant improvement might be that we didn't study the differences between an individual approach (WELLBE BD) versus a group approach (Kraiss et al. 2021, Celano et al. 2020). Besides, the app wasn't integrated into the individuals' treatment process, which could also affect the results. Moreover, the absence of significant results on the outcome scale does not, per se, imply that participants do not perceive a benefit from PPIs, as our quantitative results seem to suggest. This could mean that a simple pre–post test is insufficient to measure meaningful results. A larger RCT on the WELLBE BD app must be performed to establish the findings and optimise how the app is accompaniment.

The unmet needs in BD and our outcomes suggest that interventions to promote well-being are justified in people with BD. When the beneficial components of PPIs are systematically integrated into mental health care, this could lead to a more sustainable model of mental health (Bohlmeijer & Westerhof, 2021). When applied, this model of sustainable mental health leads to higher levels of well-being, which can reduce the risk of relapse and enhance functioning in the recovery phases of mental disorders (Keyes et al., 2010; Lamers et al., 2015; Wood & Joseph, 2010). The studies in this thesis indicate that the moment of applying PPIs in the treatment is crucial. It needs to be fit to the individual recovery process, and people seem to benefit from PPIs in a euthymic or subsyndromal depressive mood.

7.3 Online monitoring in bipolar disorder: A different pathway?

Mood monitoring is an important intervention in BD. It provides patients with more insight into the course of the illness and facilitates early recognition and intervention (Gershon & Eidelman, 2015).

In the last two decades, numerous digital mood-monitoring applications for BD have been developed and tested, revealing that online mood monitoring is reliable during depressive episodes but not during mania (Faurholt-Jepsen et al., 2016). In clinical practice, the question is how digital technology relates to a traditional paper-and-pencil method. Our study's focus group meetings with patients and professionals revealed some interesting findings.

First, effective elements of a paper-and-pencil mood monitoring should be retained; ideally, any approach should move away from 'one size fits all' towards a personalised tool tailored to individual needs. In our study, there was a unanimous insight that the NIMH-developed Life Chart method (LCM) (Denicoff et al., 2000, 2002) was conditional for the monitoring app. The LCM has extensively been used in the Netherlands over the past 25 years, and was the preferred instrument for mood monitoring, even though the rates of adherence to it were not very high outside strict research settings. Up to 35% of the participants had missing LCM data during a one-year follow-up (Draisma et al., 2015). Second, we found that a personalised digital mood monitoring instrument can be constructed by adding elements like a direct link to the personal relapse prevention plan, adjustability in both settings and preferences to monitor mood-influencing factors and feedback options. This is consistent with earlier findings (Bos et al., 2020; van den Heuvel et al., 2018). Third, personalised feedback was frequently mentioned in our study and is one of the key components of engagement (Saleem et al., 2021). In addition, feedback in mood monitoring is often cited as a facilitator of adherence (Bos et al., 2020; 2021; Van Til et al., 2020).

Fourth, we found that timing also matters. Mood monitoring should be applied only when it fits into the patient's recovery process, which requires careful reconciliation between the patient, next of kin, and the clinician (Lysaker et al., 2014; van Bendegem et al., 2014). We proposed a pathway for online mood monitoring that optimises the application method and personalises the tool.

New technologies open the way to new horizons. The combination of smartphone-based monitoring and wearables, such as experience sampling measurements (ESMs), has been proven to raise self-awareness (Van Til et al., 2020). To maintain adherence, support and feedback from clinicians are recommended (Bos et al., 2020). Monitoring mood with activity-measurement apps on smartphones can be beneficial and has proven reliable (Melbye et al., 2021). Even forecasting mood episodes based on smartphone self-assessments is possible to some extent (Busk et al., 2020). Personalisation of the patient's needs, circumstances, and possibilities will be a main determination point in applying advanced mood monitoring. This means that patients have the lead in choosing which method or combination of methods of mood monitoring are applied.

7.4 Digitalisation in mental health treatment

It's not surprising that with the increase in internet use and smartphones in mental health care, technology is increasingly used. However, new technology-based interventions aren't easily adapted by patients and professionals, and implementation processes can be slow and painful (Chaudhry et al., 2006; May et al., 2011). The difficulties in acceptance originate from feelings of anxiety and insecurity and need reflection to overcome these challenges (Safi, Thiessen, & Schmailzl, 2018). Therefore, it seems justified to state that both patients and clinicians are crucial in developing and implementing new digital interventions.

The use of apps and increase of adherence by users.

In the study described in Chapter 3, 44% of participants used health-related apps, and only 27% used those apps consistently (Geerling et al., 2022b). This is consistent with previous findings in which engagement in using apps for a more extended period declined considerably (Carroll et al., 2017; Krebs & Duncan, 2015). We found that the main reasons for discontinuing the use of apps are content that does not fit personal needs, technical problems, and advertisements (Geerling et al., 2022b). This is in line with earlier research. O'Brien and Toms (2008) found that usability, negative affect, interruptions, disruptions, malfunctioning and lack of interest were reasons for disengagement. Studies of app use with chronic psychiatric disorders partly cover our results like motivation, customisation, interconnectivity, data inaccuracy, convenience and competitiveness (Anderson et al., 2016). When persuasive technologies, such as reduction, tunnelling, tailoring, personalisation, self-monitoring, simulation, and rehearsal, are applied, adherence can be improved (Oinas-Kukkonen & Harjumaa, 2008). This will be most successful when the appropriate principles are deployed at critical moments when nonadherence starts (Kelders & van Gemert-Pijnen, 2013).

Moreover, the involvement of clinicians in the implementation phase can help to increase adherence and completion rates (Stathopoulou et al., 2006), and involving patients, such as in co-creation, plays an essential role in accepting newly developed apps (Van Bruinessen et al., 2014).

Barriers in the uptake op digital interventions.

Besides involvement in development and implementation, several issues could hinder the acceptance of digital interventions in mental health. It has been shown that although health applications are widely available and most patients (90%) are interested in digital interventions (Ranney et al., 2012), only a minority of patients use such interventions for various reasons.

The first is the purpose of using an app. The apps that our participants used were mainly focused on physical activity, planning and relaxation purposes. The activities that they provided were related to the definition of self-management by Barlow et al. (2002). Physical activity is linked to a healthy lifestyle, and staying physically active can be helpful during a (mild) depressed episode. Apps that offer planning and structure daytime activities or apps that stimulate or improve relaxation and sleep are linked to interventions that enhance a person's social rhythm. These apps' purposes are not directly related to illnesses in general or to BD. Researchers have shown that people diagnosed with BD need apps that support work, social relations, finances and leisure management (Morton et al., 2017, 2021; Murnane et al., 2016; Nicholas, Fogarty, et al., 2017; Todd et al., 2013).

Second, free available apps are not sufficiently useful for people diagnosed with BD in terms of content, privacy policy, or source citation (Nicholas et al., 2015). Among the needs to improve mental health by using technology, access to care, integration/collaboration and education/awareness were most frequently mentioned (Nicholas, Huckvale et al., 2017).

Third, there is a lack of awareness of existing apps among both patients and clinicians (Morton et al., 2021). The uptake of e-health in mental health care, in general, is a complicated process (e.g. adapting, continuation, and techniques) with relatively low participant rates (Beentjes et al., 2018; Christensen et al., 2014).

The role of professionals

In addition to the involvement of users, the role of professionals is vital for a successful implementation in clinical practice. First, it is important to involve professionals in the development of technological interventions. Secondly, clinicians should put extra effort into promoting the use of apps to overcome the abovementioned obstacles. For instance, clinicians' input could help patients find proper applications. This process should occur in the triad between patients, next of kin and clinicians. In addition, we have to remember that a clinician's recommendation might not mean that the app is proper and 'good' for the patient (Neary & Schueller, 2018). An app evaluation model (the-app-evaluation-model) developed by the American Psychiatric Association is divided into five stages: (1) gathering background information; (2) determining risk, privacy and security; (3) evaluating evidence; (4) assessing ease of use; and (5) considering interoperability, can help to determine the quality of an app. But there are more suitable app rating instruments, such as the Mobile App Rating Scale (MARS) (Neary & Schueller, 2018).

If patients want to take optimal advantage of new apps, professionals must embrace digitalisation and adapt their treatment towards it. Therefore, it is important, above all, to change the attitudes of professionals. Digitalisation must be part of the conversation in the consulting room or consulting screen so that clinicians can help find personalised apps that fit the needs of their patients with BD.

7.5 Strengths and limitations

In this paragraph, the strengths and limitations of the studies in this thesis are divided into four sections: general methodical considerations, the state of the art of PPIs in severe mental illness and health-related app use, development of online mood monitoring and PPI digital intervention apps, and evaluation of the acceptance and benefits of the developed PP-app.

7.5.1 General methodical considerations

Recalling the main aim of this thesis, we must conclude that we have partially succeeded. We aimed to develop an app combining PPIs and an online monitoring tool (Chapters 4 and 5) to improve well-being and increase the monitoring compliance rate. However, due to the timeframe and extensive effort to develop both the monitoring tool and the PPI application, together with budget limitations and technical difficulties, we were unable to combine both functionalities in one app. Combining all the desired elements in one app requires an extensive process of development and user involvement. This may be part of a follow-up study. For now, we cannot evaluate the influence of PPIs on mood monitoring compliance in BD, which can be a topic for further research.

A strength of this dissertation is the use of a mixed method design in three of five studies (Chapters 3, 5, and 6). Such a design collects, analyses, and integratesualitative and quantitative data to achieve more conclusive results (Tashakkori & Creswell, 2007). Mixed methods have an advantage in answering more complex research questions, both exploratory and confirmatory (Teddlie & Tashakkori, 2009). When mixed methods research is used in developing interventions with stakeholders, critical areas are revealed that can help identify meaningful and acceptable solutions for all affected by the issue (Ivankova & Wingo, 2018). The results of evaluating the intervention (Chapter 6) underline the value of the mixed method. The qualitative results show the value of the intervention, while the quantitative results are less robust in terms of improvement.

7.5.2 State of the art of the effects of PPIs in patients with BD

Given the subject of this thesis, we intended to perform a systematic review or even a meta-analysis of the effects of PPIs on individuals with BD. However, a preliminary search in 2017 showed that there were not enough studies to perform a proper review. Therefore, we broadened our search to people with severe mental illness (SMI), revealing valuable outcomes. A further limitation is that for BD specifically, there was not enough data to perform a post hoc analysis on this subgroup.

A strength of our project was that we first conducted a meta-analysis conform to the PRISMA guidelines. By pooling and weighting the data, an estimated effect across studies could be given (Crowther & Lim, 2010).

7.5.3 Development of digital intervention

The studies described in Chapters 4 and 5 had some shared limitations. First, we limited our data gathering to focus groups even though the most reliable consensus of a group of experts is reached by performing a Delphi study (Okoli & Pawlowski, 2004). Therefore, we missed the opportunity to evaluate whether the outcomes of the focus groups are widely shared in the field. Second, selection bias may have arisen in recruiting professionals and patients due to voluntary participation from a network of highly specialised professionals (KenBiS) and patients from the Dutch advocacy organisation 'Plusminus'. It is conceivable that especially those interested in online interventions stepped forward to participate. This method was chosen to obtain input from more than one region of the Netherlands but raises the question of whether the participants sufficiently represent the target group. Nevertheless, we found that the participants were critical and had a broad array of opinions and views on the research topics. Based on the combination of advocacy members and patients treated in an outpatient clinic, we assume that our study is sufficiently representative and covers a sufficient range of opinions.

Besides the limitations, there are some strengths. A strength in the development studies is that we applied a framework to systematically involve users (patients and professionals). The roadmap from the Center for eHealth Research and Disease Management (CeHRes) enabled us to modify both interventions through all stages of the development process. It guaranteed the maximum involvement of all stakeholders (van Gemert-Pijnen et al., 2011), and our findings corroborated the results of Preece et al. (2015). The development of new interventions benefits from user involvement in all stages to meet the target group's needs (Kelders et al., 2013).

Focus group discussions are often used to gain an in-depth understanding of complex issues and to gather data from a selected group of individuals (Nyumba et al., 2018).

Therefore, it was an obvious method to choose for the development phase. A recent comprehensive scoping review on co-design involving people with severe mental illness resulted in 23 best practices (Schouten et al., 2022) divided into four overarching constructs: plan and structure the study, create and maintain a collaborative team, accommodate vulnerable participants; and strive for equal partnership (Schouten et al., 2022). Retrospectively, we can conclude that out of these 23 best practices, 18 were applied in the focus group discussions and were equally divided over the overarching constructs.

7.5.4 Evaluation

A major limitation is that we did not perform a full-scale randomised controlled trial (RCT) to evaluate the effects of the WELLBE BD app. The small sample size (appropriate for a feasibility study) made it impossible to draw firm conclusions about psychopathology and positive psychological outcomes. The single-centre recruitment is another limitation. A multi-centre design for the RCT is recommendable to generalise the findings. The participants who left early in the intervention were excluded from the second measurement, this limitation could have affected the results. Finally, due to a lack of resources, we also couldn’t perform an effect study on the developed mood monitoring application.

As strengths, we could argue that performing a feasibility and acceptability study before a more extensive RCT and combining quantitative and qualitative methods help improve the RCT's design (Orsmond & Cohn, 2015). The amount of data resources (questionnaires, in-depth interviews, data about app use, valuation of the exercises and drop-out reasons) could also be accounted as a strength of the evaluation process. Combining the different outcomes lead to data enrichment (Sedlakova et al., 2022).

7.6 Recommendations for the future and conclusion

In the final paragraph of the thesis, the recommendations for further research, clinical practice and patients will be described, followed by a conclusion.

7.6.1 Recommendations for future research

The first recommendation is to perform an RCT based on the acceptability and feasibility study results. The objectives are twofold. The first is to determine the effectiveness of the WELLBE BD app when applied on a larger scale. To ensure that user experiences are integrated in the study, it is recommendable to perform the study in a way that users and experts by experience are part of the research team. The second is to broaden the awareness of the effects of PPIs in BD in general because the evidence in that field is still limited. From the same perspective, it is advisable to enlarge and enrich the evidence on existing PPIs, like the group intervention ‘A good life with BD’ (Kraiss, ten Klooster, et al., 2018). This intervention has already been proven effective quantitatively. Still, there are no qualitative data, e.g. how the participants experience the interventions and how they might adapt new strategies of PP in their daily lives. A study proposal is already in preparation.

To reach the aim of integrating PPIs into the treatment for BD, researchers should address two major issues: the fear of becoming manic after performing PPIs and the fear of compassion. Concerning the first fear, research is needed to establish the risk of mania when applying PPIs in BD to add more evidence to make a more robust statement. We are planning to perform a quantitative study with a pre–post test, with adequate power to ground earlier findings. Concerning the fear of compassion, a qualitative study should be performed to gather broad information on the working mechanisms of PPIs in BD and if this differs from other target groups. In addition to that, possibly adequate ways can be found to adapt PPIs. The aim would be to increase compassion for people with BD, which is acceptable and contributes to self-compassion.

Finally, it is important to understand the implications of PPIs in BD for PR. We know that PP and PR are closely related, and we share the conviction that mental health is more than the absence of symptoms. The two movements can amplify each other (Resnick & Rosenheck, 2006). Among other factors, how PR is received is influenced by the extent of self-efficacy (SE). To measure SE, the Self-Efficacy for Personal Recovery Scale (SEPRS) was developed and validated (Villagonzalo et al., 2018). However, we do not know the effects of PPIs on self-efficacy. Low self-efficacy is a major impediment to self-management and, thus, optimal psychosocial functioning for people with BD (Lim et al., 2004). Therefore, it is useful to learn what effect PPIs can have on self-efficacy. At the time of writing, a quantitative study is being carried out. To establish how people with BD experienced PPIs and which meaning it has to their recovery process we are planning a qualitative study in which the 21 aspects of the POETIC-acronym (Jagfeld et al., 2021) will be used as topic list for the in-depth interviews.

7.6.2 Recommendations for clinical practice

The potential of PP as an approach to PR in BD contains some starting points for clinical practice and further development. First, the organisation of mental health care is the step forward from the theory of the two continua model and the model of sustainable mental health to clinical practice (Bohlmeijer & Westerhof, 2021; Westerhof & Keyes, 2010). In the Netherlands, some best practices already focus on a new way of delivering mental health, in which PR plays a dominant role (Van Os, Guloksuz, Vijn, Hafkenscheid, & Delespaul, 2019). While this is a courageous movement, on the downside, there could be a risk of limiting the use of existing evidence-based treatment options. Therefore, I would emphasise a merge of PP/PR, medical, psychological and psychosocial treatment in outpatient clinics for BD. The first step in this integration is suggested in the position paper of the Dutch chapter of the International Society of Bipolar Disorders (ISBD) (Geerling et al., 2022c)

Second, regarding the engagement and merger of PPI with PR concepts, clinicians and researchers should collaborate on projects to develop and implement new interventions and find ways to engage users (patients, next of kin and professionals). There is an excellent opportunity for PPIs to become an inevitable component in treating BD. In the POETIC acronym (Purpose and meaning, Optimism and hope, Empowerment, Tensions, Identity and Connectedness) lies the potential to shape new interventions for BD in which PP and PR come together and make it possible to increase levels of well-being in BD (Jagfeld et al., 2021).

Third, regarding digital mood monitoring, the focus groups showed that there could be major advantages in digital mood monitoring compared to pencil and paper methods. These include easy access by using smartphones, the flexibility of adding individual items and the possibility of linking to the relapse prevention plan. Using a validated instrument, such as the LCM, is conditional (Denicoff et al., 2000). The first steps to combine digital mood monitoring with a validated instrument have been taken. The results of our study were used as an initial concept in a digital life chart; the ILC (Inner Life Chart), as a component of a digital patient health environment (www.ivido.nl). This tool followed the recommendations in the consensus statement from the focus groups (Geerling et al., 2021). A study is in preparation to evaluate the first experiences of users. A major challenge will be implementation. In the first implementation tests, we discovered that, although embraced by patients and clinicians, the implementation has been less straightforward than expected.

Fourth, linked to the experiences mentioned above, the complicated uptake process of e-health in mental health care (e.g. adapting, continuation, techniques) leads to relatively low participant rates (Beentjes et al., 2018; Christensen et al., 2014). Although we found that clinicians (in several new digital applications) are enthusiastic, their uptake in daily practice is a complex step to take. Therefore, the most important step is to change professionals' attitudes. Digitalisation must be inevitable in treating BD in all stages of the recovery process to optimise self-management abilities and strive for an acceptable level of well-being. The search and use of health-related apps that fit the needs of individuals with BD must therefore be part of the conversation in the consulting room or consulting screen, but also in the kitchen around the 'teapot'.

7.6.3 Implications for patients

In the introduction, we met Lynn and Liam, a couple struggling with the consequences of BD after a severe mood episode. We became acquainted with the effects of being diagnosed with BD on Lynn as an individual and Liam as her beloved one.

What is the significance of this project for them? Does Lynn have any advantages from our findings? We believe she does. Our results can contribute to solving Lynn's unmet needs to retain a positive view of her life despite BD. Positive psychology can play an important role in the paradigm shift from the mere focus on illness and recovery from symptoms to a model in which sustainable health plays a dominant role. However, further research is needed to explore unmet needs and to develop interventions (both inside and outside mental health institutes). The aim is to promote a healthy life for those with a chronic disease like BD and to achieve posttraumatic growth after mood episodes.

7.6.4 Conclusion

The present era is dominated by rapid changes and uncertainties, such as climate change, economic problems, and a society that places increasingly high demands on people. In such circumstances, shaping an individual's life, especially someone with a serious mental health problem like BD, requires a high level of adaptation. This includes changes in lifestyle, finding a new balance in life, and the individual's strengths after a major disturbance, such as a mood episode or being diagnosed with BD. As a civilised society, we are obliged to care for those affected by mental disorders and help them find resilience and the courage to move forward. Although there is a tendency for a more balanced mental health system not only focusing on the disease but also on the strengths of individuals, our system is still largely 'illness driven', which means that evidence-based treatment options recommended in guidelines are not always applied in accordance with individual needs. There has been a long-existing call to personalise mental health care in BD (Leboyer & Kupfer, 2010). Hopefully, this thesis has made a small contribution to that change.

We conclude that in developing new digital interventions, systematic involvement of all end users in all stages of the process is essential to adapt the intervention fully and for successful implementation in clinical practice. Personalisation will be the key to successful (new) interventions in BD or mental health as a whole. Personalisation refers not only to design and user options but also to timing (when to apply) and content.

Furthermore, we conclude that positive psychology interventions (PPIs) can be a valuable addition to the treatment of bipolar disorder and can possible contribute to the integration of evidence based medicine and personal recovery in the treatment.

Based on theoretical evidence, we believe that PPIs can address some of the unmet needs in BD. The first experiences mentioned by the participants in our studies pointed in the same direction.

We conclude that we presented a way of digital mood monitoring for bipolar disorder that is suitable to be integrated into treatment programs and is based on evidence and on the requirements of patients and professionals.

Further research is necessary on several topics, including the working mechanisms of PPIs in bipolar disorder , the effect of the new digital mood monitoring, and how PPIs in bipolar disorder can tribute to personal recovery in terms of self-efficacy.

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CHAPTER 8

Summary

Bipolar disorder (BD) is a chronic condition with a cyclical and unpredictable course. A combination of pharmacological interventions and self-management strategies are crucial to effectively manage the disorder. Although regular monitoring of mood symptoms is an important component of self-management, many patients fail to consistently track their moods.

Despite the broad consensus on effective treatments for BD, patients have unmet healthcare needs essential to their personal recovery, such as finding meaning in life, developing self-confidence, learning to express their feelings and coping with unexpected situations. These needs are closely related to the dimensions of positive psychology (PP), which include goal orientation, personal growth, autonomy, environmental control, self-acceptance and positive relationships. PP is a relatively new field in psychology that focuses on improving positive feelings, behaviours and thoughts. By increasing resilience and reducing stress, PP interventions may possibly help prevent mood episode relapses and improve patient compliance with self-management strategies, such as mood monitoring.

Although the adoption of e-health is on the rise, it has not yet become a widespread practice in all mental health services. As the demand for online healthcare services increases, e-health offers a unique opportunity to improve and facilitate self-management of the disease and to offer interventions to increase well-being in a low-threshold and personalised manner.

This dissertation aims to enhance well-being and address some of the unmet needs of patients with BD by exploring ways to improve self-management, particularly mood monitoring compliance. To achieve this goal, we collaborated with BD patients and professionals to create an app rooted in PP before evaluating its acceptability and effectiveness. Specifically, we aimed to develop well-being and mood monitoring interventions together in one mobile application (m-health).

The Well-Being Bipolar Disorder (WELLBE BD) research project was divided into three distinct phases:

1) Assessing current knowledge of the effects of positive psychology interventions (PPIs) for individuals with severe mental illness (SMI) and conducting a survey on app usage by BD patients.
2) Collaboratively developing an online mood monitoring and digital PP intervention.
3) Conducting an initial assessment of the acceptability and benefits of the PP digital intervention.

The main research questions aimed to address:

State of the art

- What are the effects of PPIs in individuals with SMI based on existing studies?
- What is the rationale behind the use, continuation and discontinuation of health-related apps among patients diagnosed with BD, and how frequently are these apps used for self-management purposes?

Co-creation of an online mood monitoring and PPI digital intervention

- What are the opinions of BD patients and healthcare professionals regarding online mood monitoring, and what are their preferences for design, technical features and options that would facilitate optimal use and implementation?
- What are the opinions of BD patients and healthcare professionals regarding online PPIs, and can an app containing specifically designed PPIs for BD patients be developed and pilot-tested?

First evaluation of acceptance and benefits of the developed digital intervention

- Is the developed PP intervention application acceptable, and how is it valued by patients when used for an extended period?
- Is the study design feasible for implementing the app in a more extensive trial?

State-of-the-art PPIs in SMI and health-related app use by BD patients

In *Chapter 2*, we present an overview of the research in the field of PPIs for individuals with SMI. Although the original plan was to perform a systematic review of the application of PPIs in BD, we found limited research on this topic. Therefore, we expanded the search to encompass SMI. We conducted an exploratory meta-analysis of 16 studies to evaluate the impact of PPIs on well-being and psychopathology in individuals with SMI.

A small, non-significant, difference was observed between the intervention and control groups for both well-being and psychopathology (Hedge’s g, 0.16 vs -0.10) in the nine controlled studies. Across all studies, a moderate pre-post intervention effect was found to be significant for well-being, and a large effect was found to be significant for psychopathology (Hedge’s g, 0.40 vs -0.70), indicating that individuals with SMI do benefit from PPIs. These results are consistent with previous meta-analyses. The subgroup analysis revealed that PPIs are more effective in improving well-being in patients with major depressive disorder (MDD) compared to those with schizophrenia and other SMI diagnoses (such as BD). Group interventions appeared to be more effective than individual PPIs, and PPIs are more effective in decreasing psychopathology in patients with MDD compared to mixed samples. Due to the limited number of participants with BD, personality disorders and schizoaffective disorders (representing 4%, 11% and 2%, respectively), it was not possible to draw conclusions on the impact of PPIs on these SMI groups. However, the results indicated that individuals with SMIs do experience improved well-being and reduced psychopathology when using PPIs. To strengthen the evidence on the effectiveness of PPIs in SMIs, we recommend conducting adequately powered randomised controlled trials (RCTs) to further evaluate their impact.

Chapter 3 of this report explores the reasons why patients diagnosed with BD start, continue and discontinue using health-related apps to support their self-management. The study employed a mixed-methods design, with 41 participants diagnosed with BD participating in a quantitative survey, and 11 of these participants also taking part in an in-depth qualitative interview. Of the participants, 44% (*n* = 18*)* used health-related apps, with 27% (*n* = 11*)* using them consistently, which is a higher usage rate compared to the general population (35% used health-related apps vs 20% using them consistently). The results showed that participants primarily used apps that focused on physical activity, planning and relaxation goals, but none of these apps were directly related to their BD.

The qualitative part of this study focused on the rationale behind why those diagnosed with BD chose to start, continue and discontinue using health-related apps. Factors such as freedom of choice, user-friendliness and trustworthiness were important in determining whether an individual continued to use an app. On the other hand, a lack of personal relevance, technical issues and advertisements were common reasons for discontinuing app use. These findings highlight the importance of considering these factors when developing new apps to support self-management in BD. Cooperation between those diagnosed with BD and health professionals in designing and developing apps is crucial to ensure successful implementation and adoption.

Co-creation of online mood monitoring and PPI digital interventions

Chapter 4 details the first of a two-part study in which we identified the opinions of BD patients and professionals related to online mood monitoring. Our goal was to identify preferences on design, technical features and options facilitating optimal use and implementation of online mood monitoring. The study used a qualitative design, with three focus groups consisting of eight consumers and five professionals.

Among the participants, there was a consensus that the life chart method (LCM) was the preferred instrument for mood monitoring, with the understanding that it should only be applied when it fits in the recovery process. The focus group emphasised the importance of personalisation and customisation, not only in terms of design and options, but also to allow flexibility in using the digital LCM during the stages of BD when it most useful to them. Despite the potential benefits of digital monitoring, participants expressed concerns about privacy, particularly in regards to data exchange and access, and who specifically can see their life-chart. Therefore, vendors should provide a clear and transparent statement regarding data collection and access. Additionally, participants expressed concerns regarding the potential for social media misuse during mood episodes, especially (hypo)manic episodes. The study highlights the importance of involving stakeholders in defining the requirements for a smartphone-based mood-charting application. Personalisation, adjustability, privacy, a customisable graphical report and a direct connection to early intervention strategies are necessary requirements for a successful design. The findings from this value specification have been incorporated into this project's follow-up and served as the basis for developing the LCM as a component of a digital patient health environment (www.ivido.nl). A further study to evaluate these results is in preparation.

Chapter 5 concludes the diptych by exploring the perspectives of patients with BD and healthcare professionals on web-based PPIs for BD. A mixed-method design was used, combining focus group discussions, questionnaires, rapid prototyping and web-based feedback on a prototype from the participants. The goal was to gain insight into opinions on PPIs for BD and to develop and pilot-test a custom-designed app for patients with BD. The participants, despite having limited prior experience with PPIs, highlighted potential advantages such as monitoring positive feelings and reinforcing positive self-talk. They expressed the belief that PPIs could address some unmet needs in BD. These positive expectations underscore the potential of PPIs to aid in personal recovery and support the integration of these interventions into mental health care. This can enhance individuals' capacity for adaptation and foster a supportive environment for personal recovery.

Participants preferred exercises that focused on positive emotions and relationships, resilience and strengths, as opposed to those aimed at promoting self-compassion, optimism and hope. This was likely due to participants' concerns that these exercises could trigger symptoms of mania. Although "joy and amusement" are sometimes thought to be associated with more severe manic episodes, there is little evidence to support this belief. Existing studies have found no increase in manic symptoms in response to positive emotions, and additional research is being conducted to better understand this relationship. Given the previously outlined unmet needs in BD, it is unsurprising that evaluations for the exercises promoting self-compassion, optimism and hope were low. This can be attributed to the "fear of compassion", which is closely tied to self-criticism and depression. Negative experiences in BD can exacerbate the level of self-criticism. To address this, modifications to the exercises should be considered instead of removing these potential valuable tools.

Design preferences for the app included a calm aesthetic, appropriate language usage and integration with the LCM. The app evaluation results revealed that 91% (*n* = 12) of participants found the exercises to be beneficial and valued them highly on a scale of 1-10 (median 7.5). Recommendations for improvement included increasing the frequency and repetition of the exercises within the app.

First evaluation of the developed PP digital intervention's acceptance and benefits

In *Chapter 6*, we present the findings from the WELLBE BD app redevelopment, which were obtained from the analysis outlined in *Chapter 5*. We used a mixed-methods approach to study the app's acceptability and evaluate its suitability for implementation in a larger RCT. Furthermore, we explored the potential effects on mental health by randomly assigning 40 participants with BD into two groups: an intervention group and a control group, each with 20 participants. The study sample underwent a seven-week PP intervention. To measure acceptability, we conducted semi-structured interviews with intervention group members and collected log and questionnaire data to examine the app's actual usage and the perceived value of its exercises. Feasibility was determined by the number of participants who completed the intervention in both the intervention and control groups. The potential impact on mental health outcomes was measured using a comprehensive set of pre- and post-intervention questionnaires.

Regarding the intervention's acceptability, 90% (*n* = 18) of participants started the intervention and 53% (*n* = 11) completed it. The reasons for non-completion varied, with technical difficulties, and absence of technical support and personal accompaniment being the primary reasons for discontinuing app usage. The relatively high completion rate can be attributed to several factors, such as sending reminders, offering personalisation options, providing contact opportunities when exercises were not completed, and ensuring that the app's content was based on the requirements of both patients and professionals. The participants rated the exercises with an average score of 7.5 on a scale of 1 to 10, which was considered relatively high. However, out of 93 valuations, nine (9.7%) scored five or lower, which was deemed insufficient. For two participants (9.5%), this was cause for dropping out of the intervention. The qualitative results indicated that the majority of participants were satisfied with the app's usability, design and customisation options in the settings. Furthermore, the majority of participants found the app to be emotionally fulfilling and enjoyable, and reported an increase in positive emotions. The design was found to be feasible, indicated by 30 out of 40 (75%) participants completing the questionnaires after seven weeks (T1).

However, the length and number of measurement questionnaires should be carefully evaluated before incorporating the app into a larger study. The fact that a large number of participants chose an expert by experience rather than a professional as their guide within the app requires further investigation. No significant changes were observed in well-being and psychopathology between the control and intervention groups before and after the study. Although a small effect size was observed within the intervention group, it was not significant enough to draw any conclusions.

Conclusions

In the field of mental health, there is a shift towards a more holistic approach that places a greater emphasis on personal recovery. Personalization of care is one of the key-factors in this process. Hopefully, this thesis has made a small but meaningful contribution to this change. To effectively develop mental health digital interventions, it is necessary to involve of all end-users in every stage of the process. This will ensure that the intervention is fully adapted and successfully integrated into clinical practice. Personalisation will be the key to successful new interventions for BD and mental health as a whole. Personalisation encompasses not only design and user options, but also timing and content.

Furthermore, we conclude that PPIs can be a valuable addition to the treatment of BD and can potentially contribute to the integration of Evidence-Based Medicine (EBM) and PR. Theoretical evidence supports our belief that PPIs can address some of the unmet needs in BD. Furthermore, the anecdotal evidence from the participants in our studies pointed in the same direction.

We conclude that we have presented a method of digital mood monitoring for BD that is suitable for integration into treatment programmes and is based on evidence and on the requirements of patients and professionals.

Further research is necessary on several topics, including the working mechanisms of PPIs in bipolar disorder , the effect of the new digital mood monitoring, and how PPIs in bipolar disorder can tribute to personal recovery in terms of self-efficacy.

Dutch summary/Nederlandse samenvatting

De inzet van mobiele technologie ter bevordering van zelfmanagement en veerkracht bij een bipolaire stoornis

Inleiding

De bipolaire stoornis kenmerkt zich door depressieve, (hypo) manische en euthyme stemmingsepisoden en kent een chronisch en onvoorspelbaar beloop. De behandeling van mensen met een bipolaire stoornis kan worden onderverdeeld in drie stadia; acute-, voortgezette- en onderhoudsbehandeling waarbij in alle stadia van behandeling farmacotherapie en zelfmanagementinterventies belangrijke pijlers zijn. Mensen die gediagnosticeerd zijn met een bipolaire stoornis wordt geadviseerd om de invloed van de stemming op het functioneren te monitoren, om zo een beter zicht te krijgen op mogelijke voorspellers van een episode zodat door toepassen van vroeg signalering en -interventie sneller weer een euthyme stemming bereikt kan worden. Echter het volhouden van deze monitoring kost mensen veel moeite en is voor velen een dagelijks terugkerende confrontatie met de diagnose.

Ondanks het feit dat er brede consensus is over de behandeling, kennen mensen die gediagnosticeerd zijn met een bipolaire stoornis onvervulde zorgbehoeften. Deze onvervulde zorgbehoeften liggen grotendeels op het vlak van het persoonlijk herstel. Voorbeelden hiervan zijn; gebrek aan zingeving, het ontwikkelen van zelfvertrouwen, het leren uiten van gevoelens, het omgaan met onverwachte situaties, voor zichzelf opkomen en het functioneren in de sociale context. De geschetste behoeften komen deels overeen met dimensies uit de positieve psychologie zoals psychologisch en emotioneel welbevinden (doelgerichtheid, persoonlijke groei, autonomie, omgevingscontrole, zelfacceptatie en positieve relaties). Interventies die voortkomen uit de positieve psychologie zouden ingezet kunnen worden voor het vervullen van de geschetste zorgbehoeften. Hiermee zou het niveau van welbevinden en de veerkracht van mensen met een bipolaire stoornis vergroot kunnen worden. Daarmee zouden kunnen stressvolle gebeurtenissen beter opgevangen worden waarmee de frequentie, ernst of duur van een stemmingsepisode mogelijk zou kunnen afnemen.

Dit proefschrift heeft tot doel om een app te ontwikkelen op basis van positieve psychologie interventies voor mensen met een bipolaire stoornis. Daarnaast het ontwikkelen van een monitoringsapplicatie die goed aansluit bij de behoefte van patiënten. Beide applicaties worden ontwikkeld in co-creatie met patiënten en professionals.

Het WELLBE BD (Well-being Bipolar Disorder) project bestaat uit vijf onderzoeksprojecten die verdeeld zijn over drie fasen; 1) inventarisatie van kennis en de toepassingen van PPIs bij BS, 2) de ontwikkeling van de applicaties en 3) de eerste evaluatie van het gebruik van de applicatie. De belangrijkste bevindingen uit de verschillende onderzoeken worden hieronder kort weergegeven.

Deel 1 State of the art

Om zicht te krijgen de reeds vergaarde kennis op het gebied van het toepassen van positieve psychologie interventies (PPI's) bij mensen met een bipolaire stoornis hebben we een meta-analyse uitgevoerd (hoofdstuk 2). Vanwege de beperkte beschikbaarheid van relevante onderzoeksdata betreffende de toepassing van PPI's bij mensen met een bipolaire stoornis is de scoop van de meta-analyse verbreed naar mensen met ernstig psychiatrische aandoening (EPA).

Zestien onderzoeken werden geïncludeerd waarvan tien onderzoeken een controlegroep en zes onderzoeken pre-post design hanteerde. Er werd in de gecontroleerde studies een klein, niet significant, effect gevonden voor zowel de toename van welbevinden als voor de afname van psychopathologie (Hedge's g, 0,16 vs. -0,10). Als de effecten van alle onderzoeken bij elkaar genomen worden is er binnen de interventiegroepen een matig significant effect te zien voor welbevinden en een groot significant effect voor psychopathologie (Hedge's g, 0,40 vs. -0,70). Hieruit kunnen we concluderen dat mensen met een ernstige psychiatrische aandoening baat hebben bij het toepassen van PPI's maar de uitkomsten tonen niet aan dat PPI's effectiever zijn dan andere additionele therapieën in het vergroten van het welbevinden. Vervolgens zijn er subgroep analyses uitgevoerd. Deze laten zien dat PPI's effectiever zijn in het verbeteren van welbevinden, indien deze worden toegepast bij patiënten met een recidiverende depressieve stoornis in vergelijking met patiënten met schizofrenie. Omdat er relatief weinig participanten deelnamen met een bipolaire stoornis (4%), was het niet mogelijk om een uitspraak te doen over het effect bij deze doelgroep. Indien de PPI's in een groep worden aangeboden lijkt dit effectiever te zijn dan wanneer de interventie individueel plaatsvindt.

Deze meta-analyse kent een aantal beperkingen. De belangrijke is het geringe aantal deelnemers per onderzoek en de grote mate van diversiteit in de gehanteerde interventies en de vragenlijsten, waardoor de onderlinge vergelijking werd bemoeilijkt. Het is aan te bevelen om vervolgstudies uit te voeren om het bewijs van effectiviteit van PPI's bij deze doelgroep vast te stellen.

In hoofdstuk 3 is het onderzoek naar het gebruik van gezondheidsgerelateerde apps door mensen met een bipolair stoornis beschreven. In dit onderzoek is niet alleen gekeken naar de frequentie van het gebruik van apps en welke apps gebruikt werden, maar ook naar de redenen waarom mensen beginnen, doorgaan of stoppen met het gebruik van gezondheidsgerelateerde apps. Het onderzoek had een exploratief design waarbij gebruik gemaakt is van kwantitatieve en kwalitatieve onderzoeksmethoden. Eenenveertig personen namen deel aan het onderzoek waarvan 11 personen ook participeerden in een kwalitatief semigestructureerd interview.

Van de deelnemers gebruikten 44% gezondheidsgerelateerde apps waarvan 27% die apps ook consequent gebruikte voor zelfmanagementdoeleinden. Het merendeel van de deelnemers (72%) die apps hanteerden, gebruikten een of twee verschillende apps. De apps die gebruikt werden zijn veelal gericht op het uitvoeren van (fysieke) activiteiten, het plannen en bieden van structuur en het bevorderen van ontspanning. De deelnemers gebruikten geen apps die specifiek voor de bipolaire stoornis zijn ontworpen.

Het kwalitatieve deel van dit onderzoek richtte zich op de overwegingen die mensen hebben bij het starten, voortzetten en beëindigen van het gebruik van gezondheidsgerelateerde apps. Keuzevrijheid, gebruiksvriendelijkheid, een helder doel en betrouwbaarheid waren de belangrijkste factoren bij het gebruik van apps. Om te starten met het gebruik van apps is het als eerste van belang dat men weet heeft van het bestaan van een app, vervolgens dient het doel van de app duidelijk te zijn en is het van belang dat er (technische) support geboden wordt. Is men eenmaal gestart met het gebruik van de app dan zijn de mate van keuzevrijheid, de gebruiksvriendelijkheid en volledigheid van de app bepalend voor het continueren van het gebruik. Als redenen om te stoppen met het gebruik van een app werden genoemd: wanneer een app niet (meer) past bij de (zorg)behoefte van het individu, er technische storingen zijn of er (te veel) advertenties verschijnen.

De uitkomsten van dit onderzoek zijn gebruikt in de tweede fase van het project; de ontwikkeling van de apps.

Deel 2 de ontwikkeling van de PPI app en de monitoringsapp

In hoofdstuk 4 en 5 de ontwikkeling van twee apps is beschreven. In het eerste deel van het tweeluik is de uitkomst van het onderzoek naar de ontwikkeling van een online stemmingsmonitoring app voor mensen met een bipolaire stoornis weergegeven. Het betreft een kwalitatieve studie waarin met behulp van focusgroepen de meningen van mensen met een bipolaire stoornis en professionals zijn geïnventariseerd, waarna er gekomen is tot een gezamenlijk ontwerp voor een digitale monitoringstool.

Aan de focusgroepen namen acht patiënten en vijf professionals deel. De eerste stap in dit onderzoek was het inventariseren van de positieve en negatieve ervaringen van het gebruik van stemmingsmonitoring (zowel op papier als digitaal). Vervolgens is gekeken naar de positieve en negatieve aspecten van het digitaliseren van stemmingsmonitoring. De deelnemers hadden vooraf de verwachting dat een digitale versie hen meer overzicht zou bieden, gemakkelijker in gebruik zou zijn en beter beschikbaar was. Aan de andere kant waren er zorgen over privacy, zoals, het (nog) meer gebruik maken van je telefoon en toename van focus op de aandoening. In de eisen die aan de te ontwikkeling app gesteld werden valt op dat de deelnemers unaniem de voorkeur geven aan de Life-Chart Methode (LCM) als basis voor de app. Waarbij wel als restrictie wordt genoemd dat het inzetten van de app alleen dan moet plaatsvinden als het past in het herstelproces van de patiënt. Daarnaast is het van belang om maatwerk te leveren bijvoorbeeld door de app te personaliseren. Dit geldt niet alleen het ontwerp en opties van de app, maar ook voor het moment van gebruik. De deelnemers gaven aan het wenselijk te vinden om de app te kunnen gebruiken op de momenten waarop zij het zelf nuttig achtten. Naast gebruiksvriendelijkheid en betrouwbaarheid, is een directe koppeling met het signaleringplan en een instelbaar grafisch overzicht volgens de deelnemers randvoorwaardelijk om de app succesvol te laten zijn.

Naast de mogelijkheden, hebben de deelnemers ook zorgen over het gebruik van een app voor stemmingsmonitoring. Deze zorgen betreffen met name het privacy-aspect, vooral als het gaat over wie toegang tot de gegevens van de digitale life chart (DCL) hebben. Daarnaast zijn de deelnemers bang voor oneigenlijk gebruik (door henzelf) van social media, indien er via de DCL een directe link zou zijn. Deze angst geldt tijdens depressieve maar vooral tijdens (hypo)manische episode, waarbij ze vrezen achteraf spijt te zullen hebben van geposte berichten gedurende een episode.

De resultaten van het onderzoek geven aan dat het belangrijk is om alle eindgebruikers te betrekken bij het ontwerpen en ontwikkeling van een (monitoring) app. De resultaten uit dit onderzoek zijn gebruikt voor het ontwerpen van een digitale LCM (Inner Life Chart) als onderdeel van een digitale patiëntgezondheidsomgeving (PGO) (www.ivido.nl).

Het tweede deel van het tweeluik (hoofdstuk 5) geeft de resultaten weer van het onderzoek naar het ontwerp, de ontwikkeling en het testen van een app met positieve psychologie oefeningen voor mensen met een bipolaire stoornis. Het onderzoek is onderverdeeld in een kwantitatief en een kwalitatief deel om zo een zo goed mogelijk antwoord te kunnen geven op de onderzoeksvragen.

Bij de start van het onderzoek gaven de deelnemers aan weinig ervaring te hebben met positieve psychologie. Desgevraagd zagen ze wel mogelijke voordelen van het toepassen hiervan, zoals het monitoren van positieve gevoelens en positieve berichten aan jezelf geven. De deelnemers verwachten dat het gebruik van een app met PPI zou kunnen bijdragen aan het vervullen van een deel van de onvervulde zorgbehoeften.

Na deze eerste verkenning is gekeken waar de voorkeur lag van de deelnemers ten aanzien van de soorten oefeningen voor PPI's. Hieruit bleek dat oefeningen op de gebieden positieve emoties, veerkracht, positieve relaties en sterke kanten hoog gewaardeerd werden, terwijl oefeningen ter bevordering van zelfcompassie en optimisme en hoop lager gewaardeerd werden. Het onderzoek liet zien dat deze uitkomst (de voorkeur voor de soort oefening) beïnvloed werd door de angst voor een (hypo)manie. Ook bleek er bij de deelnemers de angst te bestaan om de oefeningen niet te kunnen volbrengen en om zichzelf compassievol te benaderen (ook bekend als angst voor compassie) en er was een aversie tegen bepaald woordgebruik waardoor oefeningen lager gewaardeerd werden. In het design hadden een rustige vormgeving, gebruik van goede bewoordingen en integratie met het LCM de voorkeur.

Op basis van de uitkomsten van dit onderzoek is de WELLBE BD app ontwikkeld en getest. Uit de eerste evaluatie van het gebruik van de WELLBE BD app bleek dat 91% van de deelnemers het nuttig vond om de oefeningen uit te voeren. De waardering van de oefeningen was eveneens veelbelovend (7,35 op een schaal van 1-10; mediaan 7,5). Er zijn aanbevelingen gedaan om de app te verbeteren (zoals verlagen van de frequentie van de oefeningen en het meerdere keren herhalen van dezelfde oefeningen in plaats van iedere dag een nieuwe oefening). De uitkomsten zijn gebruikt om de app te verbeteren alvorens deze breder getest is.

Deel 3 de evaluatie van de positieve psychologie app

In hoofdstuk 6 beschrijven we de bevindingen na de aanpassingen van de WELLBE BD-app, op basis van de uitkomsten van het onderzoek zoals beschreven in hoofdstuk 5. Om de onderzoeksvraag te beantwoorden werd gekozen voor een mixed method design. We onderzochten de mate van acceptatie van de WELLBE BD app en toetsten de haalbaarheid van het onderzoeksdesign. Daarnaast onderzochten we het gebruik en de waardering van de app en de effecten op welbevinden en psychopathologie. Veertig deelnemers hebben deel genomen aan het onderzoek die willekeurig aan de interventie- of de controlegroep werden toegewezen. De WELLBE BD app bestond uit een positieve psychologie interventie gedurende een periode van zeven weken, waarbij oefeningen uit een bestaande interventie ('Dit is jouw leven') werden gebruikt.

Om de acceptatie van de interventie te onderzoeken zijn semigestructureerde diepte-interviews gehouden met 11 deelnemers, werden loggegevens verzameld (bijvoorbeeld hoe vaak oefeningen gedaan waren) samen met de gegeven waardering van de oefeningen in de app. Negentig procent van de deelnemers is gestart met het gebruik van de app WELLBE BD. Van deze groep voltooide 53% de interventie. De redenen om op te stoppen met het gebruik van de app waren divers: technische problemen, gebrek aan technische ondersteuning en het feit dat de interventie niet werd begeleid, waren de belangrijkste. Het cijfer dat de deelnemers gaven aan de oefeningen was 7,5 op een schaal van 1 tot 10. Van de 93 waarderingen werd 9,7% met een vijf of lager gescoord (wat als onvoldoende werd aangemerkt). Voor 9,5% van de deelnemers was de (lage) waardering van de oefeningen de reden om te stoppen met het gebruik van de app. Uit de gehouden interviews bleek dat de meeste deelnemers tevreden waren over de gebruiksvriendelijkheid, het design en de personalisatiemogelijkheden van de app. De meeste deelnemers vonden het gebruik van de app plezierig en gaven aan dat het gebruik hen emotionele voldoening gaf. In lijn met deze bevindingen zagen we een toename van positieve gevoelens en emoties die gerapporteerd werden. De WELLBE BD app is daarmee als interventie voor de bipolaire stoornis acceptabel en zou kunnen bijdragen aan het vervullen van zorgbehoeften.

De haalbaarheid van het onderzoeksdesign werd bepaald door het aantal deelnemers uit zowel de interventie- als de controlegroep die het onderzoek wisten te voltooien. Van de 40 deelnemers vulde 30 deelnemers na 7 weken (75%) de vragenlijsten in. Dit responspercentage lijkt een bekrachtiging van de haalbaarheid van het design.

De effecten op welbevinden en psychopathologie werden gemeten met behulp van een uitgebreide set vragenlijsten voor- en na de interventie. Er werd geen significant pre-post verschil gevonden tussen de controle- en interventiegroep voor welbevinden en psychopathologie. Binnen de interventiegroep werd een klein effect vonden, maar dit verschil was niet significant.

Conclusie

Binnen de geestelijke gezondheidszorg is een paradigma verschuiving gaande van een stoornis georiënteerde zorg naar een model dat meer gericht is op een integratie met persoonlijk herstel. Personalisering van de zorg is hierbij een van de kernbegrippen. Hopelijk is dit proefschrift een kleine bijdrage aan dit veranderproces. Op basis van de resultaten van de verschillende onderzoeken van dit proefschrift kunnen een aantal gemeenschappelijke conclusies getrokken worden.

We concluderen dat het gedegen exploreren, ontwikkelen en ontwerpen van nieuwe interventies gebaat is bij betrokkenheid van alle eindgebruikers in alle fasen van het proces. Daarnaast is het aan te bevelen om gebruik te maken van een model dat het proces structureert.

Zowel op basis van reeds beschikbare als nieuwverworven kennis kunnen we vaststellen dat positieve psychologie interventies kunnen bijdragen aan het welbevinden van mensen met een bipolaire stoornis.

Tevens mogen we concluderen dat we een nieuw model voor digitale stemmingsmonitoring hebben ontwikkeld die gepersonaliseerd is en daarmee kan bijdragen aan een, op het individu toegesneden wijze van stemmingsmonitoring en vroeginterventie, die gebaseerd is op zowel empirisch bewijs als op de voorkeuren van eindgebruikers.

Verder onderzoek is aanbevelenswaardig op verschillende gebieden, waaronder; de werkingsmechanismen van PPI's bij bipolaire stoornis, het ervaren effect van de nieuwe digitale stemmingsmonitoring en hoe PPI's bij bipolaire stoornis kunnen bijdragen aan persoonlijk herstel in termen van zelfeffectiviteit.

We denken, met de uitvoering van het onderzoeksproject te hebben bijgedragen aan de ontwikkeling van de kennis op het gebied van positieve psychologie bij bipolaire stoornissen, handreikingen te hebben gedaan voor het bevorderen van zelfmanagement en bijdrage te hebben geleverd aan de (verdere) integratie van het herstelproces in de behandeling van de bipolaire stoornis.

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Curriculum Vitae

Bart Geerling is geboren op 6 februari 1969 in Grootegast.

Na het voltooien van de opleiding tot ziekenverzorgende in 1990, startte hij in 1991 de opleiding tot B-verpleegkundige bij Altrecht. Na enige jaren ervaring in de praktijk als senior verpleegkundige en een verhuizing naar het oosten van het land, begon hij in 2004 aan de opleiding tot verpleegkundig specialist ggz. Na zijn diplomering in 2007 werkte hij een aantal jaren als behandelaar/teamleider bedrijfsvoering binnen Adhesie/Dimence. Als teamleider van het Expertisecentrum Bipolaire Stoornissen van Dimence startte hij met de specialisatie in de bipolaire stoornis.

In 2011 behaalde het centrum onder leiding van Anja Stevens en Bart Geerling het keurmerk TOPGGz wat in 2016 en 2020 geprolongeerd werd. Daarnaast is ‘psychiatrie en zwangerschap’ zijn tweede specialisatie.

Vanaf 2019 is hij hoofd van het netwerk Dimence Bipolair en Dimence Psychiatrie & Zwangerschap, in deze functie is hij verantwoordelijk voor de zorginhoud, het onderzoek, innovatie en de deskundigheidsbevordering in het netwerk.

Bart is al meer dan 10 jaar actief in verschillende werkgroepen van het Kenniscentrum Bipolaire Stoornissen (KenBis) waaronder de werkgroep organisatie van zorg die zich inzet voor een toekomstbestendige visie op de zorg voor bipolaire stoornissen en de werkgroep vroegherkenning.

Vanaf 2015 tot 2023 was hij daarnaast ook bestuurslid van het Landelijk Kenniscentrum Zwangerschap en Psychiatrie (LKPZ) en is hij sinds 2020 lid van de taskforce Women Mental Health van de ISBD (International Society Bipolar Disorders).

Naast zijn reguliere taken in het werkveld is hij vanaf 2009 actief als (gast-) docent aan verschillende opleidingen. Ook binnen Dimence heeft hij tussen 2011 en 2018 een rol als waarnemend opleider VS-GGZ vervuld.

In 2017 startte hij het promotietraject ‘De inzet van mobiele technologie ter bevordering van zelfmanagement en veerkracht bij patiënten met een bipolaire stoornis (WELLBE-BD)’, onder begeleiding van Ernst Bohlmeijer, Ralph Kupka en Saskia Kelders.

Bart is getrouwd met Mirjam Stender en woont in Schalkhaar.

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(Poster) presentations (selection)

B. Geerling, De ontwikkeling van een positieve psychologie app voor mensen met een bipolaire stoornis. RGOc NSA symposium, 8 september 2022, Groningen.

B. Geerling, S.M. Kelders, A.W.M.M. Stevens, R.W. Kupka, E.T. Bohlmeijer, 'Developing an online positive psychology application for patients with bipolar disorder', EPA, 3-6 juni 2022 online posterpresentatie, European Psychiatry 65(S1):S409-S409, DOI:10.1192/j.eurpsy.2022.1039

B. Geerling, 'Bipolair in 2040', RGOc NSA symposium, De magie van de succesvolle behandeling, 24 september 2021, Puddingfabriek, Groningen

B. Geerling, J.T. Kraiss, S.M. Kelders, A.W.M.M. Stevens, R.W. Kupka, E.T. Bohlmeijer, The effect of Positive Psychology Interventions on well-being and psychopathology in patients with Severe Mental Illness; a meta-analysis, 21st Annual Conference of The International Society for Bipolar Disorders, Sydney maart 2019 (poster)

B. Geerling, S.M. Kelders, A.W.M.M. Stevens, R.W. Kupka, E.T. Bohlmeijer, Can consumers and professionals reach consensus? Focusing on: monitoring in Bipolar Disorder and adding Positive Psychology, 21st Annual Conference of The International Society for Bipolar Disorders, Sydney maart 2019 (poster)

B. Geerling, J.T. Kraiss, S. M. Kelders, A.W.M.M. Stevens, R.W. Kupka, E.T. Bohlmeijer, The effect of positive psychology interventions on well-being and psychopathology in patients with Severe Mental Illness: A systematic review and meta-analysis. APA 2018, New York, mei 2018 (poster).

B. Geerling, De inzet van apps bij de behandeling van bipolaire stoornissen, symposium ‘Stabiel en Dan?’ SCBS, 2 november 2017

B. Geerling, De inzet van mobiele technologie ter bevordering van zelfmanagement en veerkracht bij een bipolaire stoornis, Klinisch wetenschappelijke bijeenkomst, KenBis juni 2017

B. Geerling, Hoe 2.0 is de behandeling van de bipolaire stoornis, landelijk congres vs ggz, juni 2017.

Geerling B., De inzet van mobiele technologie ter bevordering van zelfmanagement en veerkracht bij patiënten met een bipolaire stoornis (WELLBE-BD), RGOc Nascholing stemmings- en angststoornissen NNNSA 30-9-2016

B. Geerling, H R. Trompetter, A.W.M.M. Stevens, R.W. Kupka, E.T. Bohlmeijer: Positive psychologial interventions for patients with bipolar disorder: what do we know? a systematic review. ISBD/ISAD Congres, Amsterdam, juli 2016 (poster)

Addendum: DEVELOPMENT AND IMPLEMENTATION OF E-HEALTH INTERVENTIONS TO IMPROVE SELF-MANAGEMENT AND WELLBEING IN PATIENTS WITH BIPOLAR DISORDER (WELLBE-BD)

Contributions per chapter:

Chapter 1: Introduction, an overview of the research field
Wrote chapter: Bart Geerling
Drafting or revision of the manuscript: Saskia Kelders, Ernst Bohlmeijer, Ralph Kupka, and Anja Stevens
Approval of the final version of the manuscript: all authors.

Chapter 2: The effect of positive psychology interventions on well-being and psychopathology in patients with severe mental illness: A systematic review and meta-analysis
Conception and design of the study: Jannis Kraiss, Bart Geerling, and Ernst Bohlmeijer
Conceived and designed the analysis: Jannis Kraiss and Bart Geerling
Collected the data: Jannis Kraiss and Bart Geerling
Analysis and/or interpretation of data: Jannis Kraiss and Bart Geerling
Performed the analysis: Jannis Kraiss and Bart Geerling
Wrote the paper: Bart Geerling, Jannis Kraiss
Drafting or revision of the manuscript: Saskia Kelders, Ernst Bohlmeijer, Ralph Kupka, and Anja Stevens
Approval of the final version of the manuscript: all authors.

Chapter 3: Why patients diagnosed with Bipolar Disorder start, continue or discontinue health-related apps supporting their selfmanagement: An exploratory mixed-method study
Conception and design of the study: Bart Geerling
Conceived and designed the analysis: Bart Geerling and Eline Lolkema
Collected the data: Eline Lolkema
Analysis and/or interpretation of data: Eline Lolkema and Bart Geerling
Performed the analysis: Eline Lolkema and Bart Geerling
Wrote the paper: Bart Geerling
Drafting or revision of the manuscript: Saskia Kelders, Ernst Bohlmeijer, Ralph Kupka, and Anja Stevens
Approval of the final version of the manuscript: all authors.
This study has been based on data collected and analysed by Eline Lolkema, student of applied Psychology, Saxion university of applied science, that were also used for conceiving her thesis: Gezondheidsapplicaties in de geestelijke gezondheidszorg, Een studie naar het applicatiegebruik van patiënten met een bipolaire stoornis (E. Lolkema, 2018, unpublished).

Chapter 4: How to make online mood-monitoring in bipolar patients a success? A qualitative exploration of requirements

Conception and design of the study: Bart Geerling and Saskia Kelders
Conceived and designed the analysis: Bart Geerling and Saskia Kelders
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Chapter 5: Developing an online positive psychology application for patients with bipolar disorder (Expectations of consumers and professionals turned into an intervention): Development study

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Chapter 6: Can digital positive psychology interventions improve the quality of life in bipolar disorder? Feasibility, acceptability and preliminary outcomes of a positive psychology application for people with bipolar disorder

Conception and design of the study; Bart Geerling, Peter ten Klooster, Saskia Kelders, Ernst Bohlmeijer, Ralph Kupka, and Anja Stevens
Conceived and designed the analysis: Peter ten Klooster and Bart Geerling
Collected the data: Jessica Visser and Bart Geerling
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Chapter 7: General discussion

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