The background of the entire page is decorated with approximately 15 ginkgo leaves. Most are a vibrant yellow, indicating they are dead or dormant. There are two leaves that are a deep green color, suggesting they are still alive. The leaves are scattered across the page in various orientations, some pointing towards the top, some towards the bottom, and some towards the sides. They have a characteristic fan shape with a long, thin petiole.

POSITIVE PSYCHOLOGY ONLINE

Using the Internet to promote
flourishing on a large scale

Linda Bolier

POSITIVE PSYCHOLOGY ONLINE
USING THE INTERNET TO PROMOTE FLOURISHING
ON A LARGE SCALE

Linda Bolier

2015

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POSITIVE PSYCHOLOGY ONLINE
USING THE INTERNET TO PROMOTE FLOURISHING
ON A LARGE SCALE

PROEFSCHRIFT

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“

The Ginkgo Biloba is one of the eldest trees in the world. It is regarded as a symbol of hope, wisdom and vitality.

Extreme examples of the ginkgo's tenacity may be seen in Hiroshima, Japan, where six trees growing between 1–2 km from the 1945 atom bomb explosion were among the few living things in the area to survive the blast. Although almost all other plants (and animals) in the area were destroyed, the ginkgos, though charred, survived and were soon healthy again. The trees are alive to this day.

”

Source: Wikipedia, The Free Encyclopedia

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1

General introduction

This chapter is partly based on:
Bolier, L., Walburg, A. J., Smit, F., Petrea, I., & Bohlmeijer, E. (2013). *WHO Policy Brief - How to promote well-being. Effective interventions and implementation in settings* (for World Health Organization, Copenhagen). Utrecht: Trimbos-instituut.

INTRODUCTION

In this thesis, a public health approach to enhance adult well-being through interventions that can be found on the Internet is studied. Devoting investment to the promotion of well-being might be a worthwhile endeavor in public mental health, in addition to an already more established problem-based preventive strategy. To explore this statement, we need to understand whether well-being is related to certain health benefits as well as the extent to which well-being is a moldable construct. Furthermore, evidence-based well-being interventions that could be disseminated on a large scale should be available. The thesis is divided in three parts, each addressing one goal. These are as follows:

- 1) To explore the impact of well-being on recovery and survival in people with physical illness;
- 2) To examine the overall effectiveness and potential of positive psychological interventions (PPIs) and online positive psychological interventions (oPPIs);
- 3) To study whether two newly developed oPPIs (Psyfit.nl – mental fitness online and Mentalvitality@work) have the capacity to enhance well-being in an effective and cost-effective way.

This chapter encompasses a general preface to the thesis. It begins with a short overview of positive psychology and various definitions of well-being. Next, a rationale for well-being promotion in general is set out: Why invest in well-being interventions? And is there a need for well-being interventions, based on epidemiological data? After that, we review the factors that determine well-being and that can be used as the ‘building blocks’ of PPIs. In particular, we focus on the use of online interventions in positive psychology: What is the potential synergy between positive psychology and Internet? Finally, an outline of the thesis will be presented.

POSITIVE PSYCHOLOGY

Over the past 15 years, a relatively new movement in psychology has gained ground: positive psychology. Positive psychology aims to achieve a scientific understanding of well-being and develop effective interventions in order to promote flourishing among individuals, families and communities (Seligman & Csikszentmihalyi, 2000). Positive psychology is the field of study that inspired our team to develop new interventions used in the studies reported in this thesis. Seligman and Csikszentmihalyi’s (2000) argued in their seminal article entitled ‘Positive psychology: An introduction’, published in a special issue of the *American Psychologist* that a negative bias prevailed in psychology research, where the main emphasis was on

negative emotions and the treatment of mental health problems and disorders (Seligman & Csikszentmihalyi, 2000). They argued not for a dismissal of this focus on negative states of mind, but for a more integrated understanding of human mental health, in which both positive and negative states would be acknowledged. Although the basic concepts of well-being, happiness and human flourishing have been studied for some decades (Diener, 1984; Maslow, 1968; Ryan & Deci, 2001; Veenhoven, 1988), Seligman & Csikszentmihalyi (2000) also noted a lack of evidence-based interventions to enhance well-being. Since then, a wide range of positive psychological interventions have been developed and the number of intervention studies has greatly increased. Positive psychology also embraces other traditions, such as mindfulness, reminiscence and life-review (Westerhof & Bohlmeijer, 2010). In addition, positive psychology has much in common with *mental health promotion*; all efforts in public mental health of which the main objective is to enhance positive mental health (Gudmundsdottir, 2011).

Perspectives on well-being

Three different perspectives on well-being can be distinguished in the literature. The first is subjective well-being: a cognitive appraisal of one's own life as a whole and an evaluation of emotional states (balance between positive and negative emotions) (Diener, 1984; Veenhoven, 2012). Subjective well-being is often classified under the headings of 'life satisfaction' and 'happiness'. The second perspective corresponds to the concept of psychological well-being. This concept builds on the work of Carol Ryff who was dissatisfied with the emphasis on subjective well-being and therefore focused on the optimal functioning of the individual (Ryff, 1989). In Ryff's view, psychological well-being is composed of six elements: self-acceptance, autonomy, environmental mastery, personal growth, purpose in life, and personal relations with others. The attainment of personal happiness is not the goal in life (as in subjective well-being), but rather self-actualization and meaning (Maslow, 1968). A third concept arose from the work of Corey Keyes, who called for the expansion of subjective and psychological well-being into a less self-centered definition of well-being (Keyes, 1998). In this model, social well-being is included (Keyes, 2007). Social well-being refers to the extent to which a person feels at home in society, trusts other people and makes sense of the world.

Together, the concepts of subjective, psychological and social well-being constitute the construct of 'positive mental health' (Keyes, 2007). In this construct, the definition of mental health drawn up by the World Health Organization is echoed (WHO, 2004):

Mental health is a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively, and is able to make a contribution to his or her community.

The concept of positive mental health also fits closely with a rather recently proposed definition of 'positive health' in which empowering people to take charge of their own health, in face of adversity, plays a central role: *Health is the ability to adapt and self-manage in the face of social, physical and emotional challenges* (Huber et al., 2011).

The three concepts of well-being above reflect the distinction proposed by Aristotle between eudaimonic and hedonistic well-being. Aristotle claimed that the *eudaimonic* approach to happiness is the true path in life (leading the 'good life', and aspiring to what is higher than us). This approach is again reflected in the concept of psychological and social well-being where the main focus is on meaning, personal growth and connectedness to society (Ryan & Deci, 2001; Ryff & Singer, 2008). In contrast, a *hedonistic* approach is based on chasing pleasure and avoidance of pain and should, according to Aristotle, not be sought for its own sake. Hedonistic well-being is mostly in accordance with the present construct of subjective well-being. There is, however, some debate on the distinctiveness of the two approaches, which may be part of a single umbrella construct of well-being (Kashdan, Biswas-Diener, & King, 2008; Waterman, 2008). Feeling good, or the presence of positive emotions, promotes positive functioning by building up individual and social resources (Fredrickson, 2003) and the relationship also works the other way around (for example see Borgonovi, 2008). It seems that eudaimonic and hedonistic well-being are highly related and intertwined.

In this thesis, we draw on elements of both the hedonistic and eudaimonic approach to well-being. In the meta-analysis on the relationship between well-being and physical health (Chapter 2), we designated subjective well-being (or emotional well-being) as an outcome. In the intervention reviews (Chapters 3 and 4) we set both subjective and psychological well-being as outcomes. The interventions developed as part of the studies reported in this thesis (Chapters 5 – 8) aim to enhance positive competences, personal growth, meaning in life and social connectedness ('functioning well', 'flourishing' or psychological well-being). At the same time, positive emotions and pleasure as per the hedonistic tradition may also be promoted ('feeling good' and life satisfaction). Just like Aristotle, we see such aspects as possible pleasant and welcome side effects of the interventions and they were therefore measured as such.

WHY ENHANCE WELL-BEING?

Why bother to try to make everybody happy? Or rather: to help people to flourish? This is an important question that must be answered before any attempt to intervene is initiated. There are three reasons why investment in well-being seems to be a legitimate action for society as a whole. Together, they constitute the rationale for the choice of creating an Internet intervention to promote well-being.

1. *Well-being leads to better outcomes and improved quality of life.*

Well-being appears to bring many personal and social benefits. There is compelling evidence that well-being is associated with a longer life and overall better physical health (Diener & Chan, 2011; Howell, Kern, & Lyubomirsky, 2007; Lyubomirsky, King, & Diener, 2005; Pressman & Cohen, 2005; Veenhoven, 2008). Also, there is some evidence that suggests well-being can play a role in the recovery and survival of physically ill patients, but the overall findings remain inconclusive (Diener & Chan, 2011). Furthermore, well-being is associated with prosocial behavior, such as undertaking volunteer work or giving informal care, and maintenance of high-quality relationships with family and friends (Howell et al., 2007). These positive outcomes in health and prosocial behavior have been established in both cross-sectional and longitudinal studies. Overall, longitudinal data are scarcer, but corroborate the results found in cross-sectional studies (Howell et al., 2007; Lyubomirsky et al., 2005). One of the key findings is that well-being is not only correlated with positive outcomes such as health and social success, but also predicts these positive outcomes. These longitudinal findings provide further evidence for a causal relationship between well-being and successful outcomes (Lyubomirsky et al., 2005). The relationships are mutually reinforcing, such that well-being leads to a desirable outcome in health or behavior, which subsequently leads to greater well-being, and so on. Thus, well-being can draw people into an upward spiral.

2. *Well-being contributes to the prevention and treatment of mental health symptoms and disorders.*

It is often assumed that psychopathology and well-being are two sides of the same coin, implying that successful treatment of the disorder will automatically lead to well-being. On this basis, most mental health efforts and research are focused on treating mental disorders and problems (Lamers, 2012). Over the past fifteen years, a shift towards integrating the focus on mental disorders with a focus on positive mental health has gained momentum (Seligman & Csikszentmihalyi, 2000). At the same time, there is a growing body of evidence that well-being and mental illness are, although correlated, to a certain extent, independent concepts and not just opposite poles of the same continuum (Keyes, 2005; Lamers, Westerhof, Bohlmeijer, ten Klooster, & Keyes, 2011; Weich et al., 2011). In addition, the available evidence suggests that well-being boosts resilience (the ability to bounce back after adversity) and reduces the risk of developing symptoms of a mental disorder later on (Keyes, Dhingra, & Simoes, 2010; Lamers, Westerhof, Glas, & Bohlmeijer, 2012; Wood & Joseph, 2010). For people with mental health problems, the presence of well-being can be beneficial, as it can increase quality of life and likelihood of recovery, and reduce the risk of relapse (Sin, Della Porta, & Lyubomirsky, 2011).

3. *Well-being-oriented interventions may be more easily accepted by the people who need them.*

Among the main obstacles in mental health service uptake worldwide are difficulties in reaching people in need of mental health services and a lack of opportunities to offer evidence-based interventions: the so-called 'mental health gap' (Kohn, Saxena, Levav, & Saraceno, 2004). Explanations for these problems include a shortage of resources (financial resources and qualified therapists) and a lack of public and personal awareness of the seriousness of mental disorders. In addition, stigma surrounding the formal use of mental health services may deter people in need from seeking help (Schomerus & Angermeyer, 2008). Delivering well-being interventions, in addition to problem-oriented interventions, could contribute to narrowing this 'mental health gap' by providing acceptable interventions for those who might otherwise fall through the net. Well-being interventions can be applied in both treatment (Parks, Schueller, & Tasimi, 2012), disease prevention, as in mental health promotion (Kobau et al., 2011). In practice, it may be easier to reach the general population, including people with diseases, who would like to improve their lives, to be happier or more resilient than to reach people who are looking for treatment for particular problems or diseases (Parks et al., 2012). Working on a positive goal is presumably less threatening and stigmatizing than working on depressive complaints. Also, many people with subclinical mental complaints (for example, subclinical depression) do not see themselves as a 'depressive person' (self-identification), but more as a person who needs more balance in life, or more well-being (Parks et al., 2012).

DO WE NEED WELL-BEING ENHANCEMENT?

How is well-being distributed in the Netherlands? A national study (Westerhof & Keyes, 2008) showed that approximately 65% of the Dutch population have poor or moderate levels of well-being (measured as positive mental health: combination of subjective, psychological and social well-being as defined by Keyes, 2005). The remaining 35% of the population can be described as 'flourishing', in other words, presenting a high level of well-being. In another major study from the European Social Survey, Netherlands was ranked 9th out of 22 European countries, with only 21% of the population described as flourishing (Huppert & So, 2013). By way of comparison, in Denmark, ranked as number one, 41%, or twice the proportion of people are in a flourishing state, compared with the Netherlands. The Netherlands scores rather low on competence (14/22), engagement (20/22), optimism (14/22) and positive relationships (14/22) and rather high on emotional stability (6/22) and positive emotions (8/22). We can conclude that a large group in the Netherlands (65 - 79%) are feeling out of sorts and may need a well-being intervention. Within this group, there are also people who suffer from mental health complaints, which put them at risk of developing

a full-blown disorder, along with people with full-blown mental disorders. These findings paint a somewhat different picture compared with certain international happiness studies, which repeatedly showed the Netherlands as one of the happiest nations on earth (Helliwell, Layard, & Sachs, 2013). However, in most of these studies, well-being is operationalized as 'life satisfaction' (only subjective well-being), whereas the study by Huppert and So (2013) shows that there is only a modest correlation (0.34) between life satisfaction and well-being when operationalized as flourishing. This finding seems to reflect the need to measure well-being as a multi-dimensional construct.

Several issues underscore the importance of investment in well-being. The financial crisis places a burden on many people, in terms of unemployment, job security and family instability due to financial problems (Arampatzi, Burger, & Veenhoven, 2014). Worldwide, a high percentage of people are living in poverty, which increases their vulnerability to poor mental health and well-being (Biswas-Diener & Patterson, 2011). In addition, life has become more complex for many people. The modern Western world functions on the basis of a demanding service and knowledge-based economy where we do more and more with our minds, instead of our hands. A 'healthy mind' has therefore become of paramount importance to a healthy economy (Weehuizen, 2008) and good coping skills, social skills and creative ability are indispensable assets. Along with a focus on changing life circumstances, well-being interventions can potentially assess and address factors that lead to positive outcomes in adverse circumstances (Biswas-Diener, 2011).

Another reason why we might be in need of well-being enhancement is the high prevalence of depression in the general population. As we have seen in the section on 'Why enhance well-being', higher levels of well-being can contribute to the prevention and treatment of common mental disorder symptoms (Keyes et al., 2010), in particular, depressive symptoms (Wood & Joseph, 2010). The average lifetime prevalence estimates for major depressive episodes is 15%, with 1 in 20 adults suffering from major depressive episodes at any given time (Bromet et al., 2011). In addition, subclinical or minor depression is a prevalent condition, which also has serious consequences in terms of reduced quality of life (Cuijpers & Smit, 2008). Approximately 16% of Dutch workers report stress at work and 11% experience signs of burn-out (Milczarek, Schneider, & Eusebio, 2009). These 'minor' conditions put affected individuals at greater risk of developing a full-blown mental disorder later on. Mental disorders and their subclinical counterparts not only place a burden on the individuals and their immediate environment, but also on society as a whole in terms of increased economic costs due to absenteeism, presenteeism and health care uptake (Smit et al., 2006).

DETERMINANTS OF WELL-BEING: BUILDING BLOCKS OF PPIS

As argued above, the enhancement of well-being carries the promise of many benefits. This begs the question as to how to actively enhance well-being. A good starting point is the identification of determinants that contribute to better well-being and are to some extent amenable to intervention. Evidence indicates that changing the things we do and the way we think can have the greatest impact (Lyubomirsky, Sheldon, & Schkade, 2005). Based on overviews of scientific literature (Aked, Marcs, Cordon, & Thompsom, 2009; Walburg, 2008) and frameworks for well-being (Rusk & Waters, 2014; Seligman, 2011), it appears that there is a range of factors that should constitute the 'building blocks' of a well-being intervention. The Psyfit - mental fitness online intervention, one of the interventions reported in this thesis, was developed on the basis of the following factors (Haverman et al., 2009):

Values and goals to build purpose in life. Well-being occurs when goals and behavior are in line with personal values. Values are deeply felt motives to pursue personal goals (Ryan & Deci, 2001). Setting values and goals gives life meaning and a sense of purpose. Purpose in life is a defining feature of mental health (Emmons, 2003). Indeed, the presence of a sense of purpose in life is positively associated with psychological well-being and negatively correlated with depressive symptoms (Pinquart, 2002).

Positive emotions. Positive emotions have value beyond merely feeling good. Positive emotions help broaden one's awareness and repertoire of action, which in turn helps to build up psychological, physical and social resources (Fredrickson, 2003). Such resources are built up over time and can lead to increased well-being and resilience (Tugade & Fredrickson, 2007). Thus, positive emotions can foster successful outcomes across a range of life domains.

Optimism and hope. Optimism and hope are viewed as cornerstones for well-being across many life domains. Optimism is a thought process and brings together positive thinking and a positive attitude toward life, even in the face of adversity (Seligman, 2002). Hope is the overall conviction that one's goals can be met through agency and planning (Snyder, 2000). Optimism and hope are significant markers for psychological resilience and shape the way an individual sees the world and copes with challenges (Nes & Segerstrom, 2006). In general, optimistic people can deal with stress more easily and bounce back more swiftly after experiencing adverse life events (Prati & Pietrantonio, 2009; Southwick, Vythilingam, & Charney, 2005). Gratitude, a feeling or attitude in acknowledgment of a positive experience or benefit that one has received, is a particular way to express an optimistic outlook on the world. It is positively related to well-being and experimental research has shown that it can be deliberately promoted (Emmons & McCullough, 2003; Wood, Froh, & Geraghty, 2010).

Positive relationships. The human being is a social being. Feeling close to, and valued by others is a fundamental human need (Tay & Diener, 2011). In general, happy people have stronger relationships than unhappy people (Diener & Seligman, 2002). Likewise, positive social relationships and social skills are associated with enhanced well-being, resilience and quality of life (Walsh, 2011). Increased social support has buffering effects on mental and physical illness and fosters adaptive coping strategies. It is positively linked with resilience (Jenkins et al., 2008; Southwick et al., 2005) and can contribute to growth after major negative life experiences (Prati & Pietrantonio, 2009).

Sharing well-being. Contribution to society, to the community or to people in the immediate environment is seen as a very important aspect of well-being (Kirkwood, Bond, May, MacKeith, & Teh, 2008). People taking up volunteering roles in society not only contribute to the well-being of the community, but also to their own well-being, perhaps mediated by increased purpose in life (Borgonovi, 2008; Greenfield & Marks, 2004).

Mindfulness. A mindful state (focused attention on the here and now and awareness of environment and the self) is associated with psychological well-being (Brown & Ryan 2003) and increased resilience after stress or trauma (Smith et al., 2011; Thompson, Arnkoff, & Glass, 2011). Furthermore, mindfulness can have preventive effects by reducing levels of stress, depression and anxiety (Grossman, Niemann, Schmidt, & Walach, 2004). The term 'savoring' is often mentioned in the context of positive psychology, and refers to conscious awareness and attention to pleasant experiences and positive emotions. The ability to savor is positively related to well-being and life-satisfaction (Bryant & Veroff, 2007; Quoidbach, Berry, Hansenne, & Mikolajczak, 2010).

Active and healthy lifestyle. Physical exercise is associated with increased resilience (Salmon, 2001; Southwick et al., 2005) and well-being (Biddle & Ekkekakis, 2005; Fox, 1999; Penedo & Dahn, 2005). Explanatory mechanisms can be physiological (producing hormones such as endorphins, neurotransmitters such as serotonin) and psychosocial (enhanced efficacy and coping, distraction from negative feelings and thoughts, social interaction when exercising together). A healthy diet (containing enough fruits, vegetables and fish and reducing excessive calories), also provides benefits for well-being and mental health, as well as facilitating relaxation and stress-management (Walsh, 2011).

ONLINE POSITIVE PSYCHOLOGY

So far, we have reviewed the possible benefits and manifestations of well-being interventions. Increased acceptance and empowerment can be identified as one of the possible advantages. Providing well-being interventions via the Internet may offer synergetic opportunities to reach

and involve many people. Based on the knowledge base in web-based design and the building blocks of positive psychological interventions, an intervention was created, called 'Psyfit.nl – Online mental fitness'. We provide a short rationale for using the Internet as a dissemination vehicle below.

Large-scale dissemination

First of all, Internet interventions, particularly automated self-help interventions, may be more affordable and available to many people, as opposed to face-to-face interventions, as there are no therapists involved, resulting in lower implementation costs (Muñoz, 2010). Internet interventions are highly accessible and can reach different target groups simultaneously, regardless of location, 24 hours a day, 7 days a week (Riper et al., 2007). Internet penetration is very high, currently standing at 34% on average worldwide, but with an average of 79% in North-America and 63% in Europe (Internetworldstats.com, May 2014). In total, almost 2 ½ billion people use the Internet worldwide. Therefore, online positive psychological interventions (oPPIs) may offer the most suitable and effective strategy for reaching large target groups (because of the presumed high acceptability of well-being interventions as noted previously under 'Why enhance well-being'). From a public mental health perspective, it is useful to reach large groups of people at the same time, as expressed in the 'population health approach' (Rose, 2008). According to this approach, greater benefits to overall public health can be expected when the bell curve of mental health in the human population is shifted a little to the healthy site. A relative slight increase in the level of well-being in a large proportion of the population may have a larger preventive effect on mental health than targeting the much smaller group of people already suffering (Huppert, 2009). In this way, online positive psychological interventions, even with small effect sizes, can have a major impact on well-being in the population, when both costs and benefits are weighed up. Moreover, the higher level of well-being could prevent the development of psychopathologies (Huppert, 2009).

For whom

Over the past 25 years, the Internet has become an increasingly normal part of people's lives. People search the Internet for all kinds of information, resources and programs, and use web-based applications, utilities and tools for their daily activities such as making calls, Internet banking, buying groceries or booking holidays. The Internet is also becoming the main source of health-related information. In the Dutch population, 83% of the population of 15 years and older search for health-related information via the Internet (van de Belt et al., 2013), which is higher than the figure of around 60% that searched online for health-related information in Saudi Arabia (AlGhamdi & Moussa, 2012) or in the USA, for example (Atkinson, Saperstein, & Pleis, 2009). Apart from a more long-standing interest in symptoms

and medical diagnosis, there seems to be a growing interest in information related to well-being and healthy lifestyle behaviors (Evers, 2006). Evidently, there is a large target group for online positive psychological interventions, extending to anyone with Internet access who is interested in the enhancement of well-being, health and resilience. In practice, it has been found that many people seeking well-being enhancing self-help tools and looking to improve their mood are presenting with sub-clinical depressive symptoms, or even symptoms at a more severe level (Parks, Della Porta, Pierce, Zilca, & Lyubomirsky, 2012). Online PPIs may be particularly suitable for these groups because they can counter depressive problems without the need to identify a particular disorder (Parks et al., 2012). Thus, the use of oPPIs can help to demedicalize common mental health problems and reduce diagnostic inflation (Dowrick & Frances, 2013). According to Muñoz (2010), people in need of mental health care can use online interventions in addition to other forms of care, for example while on waiting lists, during routine treatment as an adjunct intervention, and after treatment, in order to prevent relapse or recurrence. Embedding oPPIs in the healthcare system offers ample opportunities for the use of online positive interventions as they extend the health care system beyond treatment into health promotion and prevention (Wiederhold & Riva, 2012).

Empowerment and self-management

Online positive psychological interventions have the potential to become an engaging and empowering way for participants to take charge of their health and well-being. Internet interventions can stimulate self-management skills by using interactive and persuasive features (Fogg, 2003). The online program can itself motivate people to adopt and maintain the desired behavior and can therefore increase adherence to the program (Christensen, Griffiths, & Farrer, 2009; Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012). Furthermore, the Internet can promote social connection between people. 'Patient empowerment' is reflected in the 'Health 2.0' movement, which promotes collaboration between patients, their caregivers and professionals. The participant becomes an active and responsible partner in his/her own health and care pathway (Swan, 2009; van de Belt, Engelen, Berben, & Schoonhoven, 2010). Social media may become an important tool in this process: people support one another through Twitter, Facebook or in online support groups, thereby enhancing the impact of the intervention.

Effectiveness

In other fields of study, for example, in reducing depressive and anxiety problems (Andrews, Cuijpers, Craske, McEvoy, & Titov, 2010; Spek et al., 2007), problematic alcohol use (Riper et al., 2009), comorbid alcohol use and depression (Riper et al., 2014), smoking (Rooke, Thorsteinsson, Karpin, Copeland, & Allsop, 2010) and changing health behavior (Lustria et al., 2013), effectiveness of online interventions has been demonstrated meta-analytically and

cost-effectiveness has been assessed in individual and modeling studies (Lokkerbol et al., 2014; Smit et al., 2011). Effectiveness research on online positive psychological interventions is still in its infancy. A literature review on the effectiveness of oPPIs has shown mixed results (Mitchell, Vella-Brodrick, & Klein, 2010). Five randomized controlled trials were included in the review, of which three demonstrated enhanced well-being and three showed significant symptom reduction in favor of the intervention groups. Although the results of the present review are not unequivocal, they hold some promise that online positive psychological interventions can have the effect of promoting well-being and reducing depression symptoms.

OUTLINE

The central question, 'Is well-being enhancement online a worthwhile undertaking and potentially effective?' will be addressed in a set of studies carried out pursuant to the three main goals of this thesis:

The first goal 'To explore the impact of well-being on recovery and survival in the physically ill' is addressed in Chapter 2, a meta-analysis which examines well-being as a predictor for recovery and survival among people with diseases. Using a collection of longitudinal studies, this meta-analysis adds to the understanding of the benefits of well-being for our physical health.

The second goal 'To examine the overall effectiveness of positive psychological interventions and online positive psychological interventions' is addressed in Chapters 3 and 4. Chapter 3 summarizes the effectiveness of positive psychological interventions in the short-term and longer-term. A meta-analysis of a set of randomized controlled trials was conducted for that purpose. Furthermore, potential moderating variables, such as the duration of the intervention, recruitment methods and study quality, were examined. Chapter 4 sets out the rationale for using online interventions in positive psychology. Potential synergies between positive psychology and technology/the Internet, such as improved self-management and reaching many people at the same time (population health approach) are discussed and a literature review on the effectiveness of online positive psychological interventions is presented.

The third goal 'To study whether two online positive psychological interventions (Psyfit.nl – mental fitness online and Mentalvitality@work) have the capacity to enhance well-being in an effective and cost-effective way' is covered in Chapters 5 – 8. The first three chapters present the design and results of the randomized controlled trial, Psyfit – online mental fitness, the online well-being intervention. Participants were recruited from the general 'well-being seeking' population. Chapter 5 begins with a description of the design of the study. We

designed the study as a pragmatic randomized controlled trial with two arms, the intervention group and a wait-listed control group. Outcomes were measured at 2 and 6-month follow-up. In Chapter 6, the effectiveness of the intervention is examined, on the main outcome of well-being, and the secondary outcomes of depressive symptoms, anxiety, general health and vitality. Chapter 7 presents data on the cost-effectiveness of the intervention. In Chapter 8, the results of another study are presented: the Mentalvitality@work trial. To explore the potential of online well-being enhancement in the workplace, a cluster randomized controlled trial which examined the effects of a health surveillance system for positive mental health of nurses and allied health professionals in the workplace, was conducted. The intervention combined a questionnaire followed by personalized feedback and an offer of online interventions.

The thesis ends in Chapter 9 with a general discussion and conclusion of the key findings. Recommendations for future research and practice are also set out.

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Part One

**The impact of well-being on recovery and survival among
people with physical illnesses**

2

The impact of emotional well-being on long-term recovery and survival in physical illness: a meta-analysis

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ABSTRACT

This meta-analysis synthesized studies on emotional well-being as predictor of the prognosis of physical illness, while in addition evaluating the impact of putative moderators, namely constructs of well-being, health-related outcome, year of publication, follow-up time and methodological quality of the included studies. The search in reference lists and electronic databases (Medline and PsycInfo) identified 17 eligible studies examining the impact of general well-being, positive affect and life satisfaction on recovery and survival in physically ill patients. Meta-analytically combining these studies revealed a Likelihood Ratio of 1.14, indicating a small but significant effect. Higher levels of emotional well-being are beneficial for recovery and survival in physically ill patients. The findings show that emotional well-being predicts long-term prognosis of physical illness. This suggests that enhancement of emotional well-being may improve the prognosis of physical illness, which should be investigated by future research.

INTRODUCTION

This meta-analysis investigates emotional well-being as a predictor of the prognosis of physical illness. We define emotional well-being from a positive perspective, not as the mere absence of symptoms of psychopathology. Currently, most studies on the relation between mental and physical health investigated the presence or absence of psychopathology. These studies show that psychopathology is related to the course and severity of several physical diseases. For example, depression is associated with increased osteoporosis (Michelson et al., 1996), coronary heart disease (Glassman & Shapiro, 1998), diabetes complications (de Groot, Anderson, Freedland, Clouse, & Lustman, 2001), cancer incidence, progression (Spiegel & Giese-Davis, 2003) and cancer mortality (Satin, Linden, & Phillips, 2009), and anxiety may influence the development of coronary heart disease (Kubzansky & Kawachi, 2000).

By contrast, well-being may play an additional protective role in the course of physical diseases. After all, there is accumulating evidence that psychopathology and well-being are more than merely opposite poles of the same dimension (Huppert & Whittington, 2003; Keyes, 2005, 2007; Lamers, Westerhof, Bohlmeijer, ten Klooster, & Keyes, 2011; Watson & Tellegen, 1985), and both well-being and mental disorders may have independent impacts on physical health. To date, six reviews of the literature synthesized effects of well-being on physical health (Chida & Steptoe, 2008; Diener & Chan, 2011; Howell, Kern, & Lyubomirsky, 2007; Lyubomirsky, King, & Diener, 2005; Pressman & Cohen, 2005; Veenhoven, 2008). In general, the conclusions are favorable with well-being being positively associated to better health (Diener & Chan, 2011; Howell et al., 2007; Lyubomirsky et al., 2005), reduced risk of illness and injury (Pressman & Cohen, 2005), and lower mortality rates (Chida & Steptoe, 2008; Pressman & Cohen, 2005; Veenhoven, 2008). In samples of healthy people, the results of these studies clearly point towards the positive effects of well-being on physical health. However, results appear to be mixed in physically ill populations.

To illustrate, Howell et al. (2007) found positive effects of well-being on physical health for both healthy and diseased populations, although results differed across health outcomes. The findings suggest that well-being may enhance physical functioning in healthy adults and improve management of symptoms in diseased adults. For example, the likelihood of longevity increases for individuals with high well-being compared to those with low well-being, and this survival rate even increases 10% for individuals with chronic diseases who report high versus low well-being. The meta-analysis of Chida and Steptoe (2008) also shows protective effects of well-being on survival in diseased populations with renal failure and HIV. Even though Howell et al. (2007) and Chida and Steptoe (2008) show that well-being generally is related to better physical health in diseased adults, Diener and Chan (2011),

Pressman and Cohen (2005), and Veenhoven (2008) report otherwise. Diener and Chan (2011) conclude that findings with respect to diseased populations are mixed. Although Pressman and Cohen (2005) and Veenhoven (2008) state that there is too little consistency in the data to draw robust conclusions, both reviews suggest that there may be no effects or even adverse effects of well-being on physical health. In general, the pattern of research findings seems to point towards positive effects or no effects in relatively mildly diseased adults, where adherence to medication and behavioral factors such as physical exercise could play a role, and negative effects in severely diseased adults with high short-term mortality rates (Pressman & Cohen, 2005; Veenhoven, 2008).

In sum, the existing reviews produce inconsistent evidence with respect to well-being as a predictor of physical health in diseased populations. Conclusions across healthy and diseased populations differ, because the outcomes differ as well. In healthy individuals, the desirable health outcome is to stay healthy and to reduce mortality and the development of physical illness. Individuals with physical diseases already experience a diminished physical health, resulting in a different set of aims, such as decreasing symptom severity, preventing worsening of disease, and increasing survival rates.

Present study

This meta-analysis will focus on physically diseased patients, aiming to prospectively study the effects of emotional well-being on the prognosis of physical disease. The objective is to broadly investigate the prognosis, including survival, disease progress, recovery, and functional status. In addition, this systematic review will investigate emotional well-being, defined in the hedonic tradition of well-being research (Diener, Suh, Lucas, & Smith, 1999). In this research tradition, emotional well-being consists of an affective component, concentrating on positive emotions such as feelings of happiness, and a cognitive component, concentrating on evaluations of life such as life satisfaction. The previous literature reviews applied diverse definitions and terminology of well-being, investigating positive emotions (Pressman & Cohen, 2005; Veenhoven, 2008), positive emotions and positive dispositions such as optimism and sense of humor (Chida & Steptoe, 2008; Diener & Chan, 2011), or all positive psychological constructs (Howell et al., 2007). Moreover, several of these reviews included studies which measured quality of life by items on physical health and functioning (Howell et al., 2007). Other studies used positive affect adjectives such as active and energetic (Pressman & Cohen, 2005). These items might measure physical health instead of well-being. Thus to avoid confounding, this meta-analysis will employ a strict and narrow focus on emotional well-being, and in doing so will try to avoid contamination.

To further unravel the inconsistencies observed in reviewed studies, this systematic review will apply meta-analytic moderator analyses to evaluate how different constructs of well-

being, health-related outcome, year of publication, follow-up time and sample size introduce their own impact on outcome. Moreover, the methodological quality of the included studies will be assessed and added as a potential moderator, since effect sizes might be smaller in high-quality studies than in other studies (Cuijpers, van Straten, Bohlmeijer, Hollon, & Andersson, 2010).

In sum, this meta-analysis will synthesize evidence that is drawn from prospective studies on the relationship between emotional well-being and the prognosis of physical illness, in physically diseased samples across a range of health outcomes. In addition, our study will encompass quality assessment of the primary studies and we will employ meta-analytical techniques such as meta-regression and meta-analytic moderator analyses. The previous reviews of the literature (Chida & Steptoe, 2008; Diener & Chan, 2011; Howell et al., 2007; Lyubomirsky et al., 2005; Pressman & Cohen, 2005; Veenhoven, 2008) included several of these aims, but none of them combined all aspects into a single systematic literature review. Since the research field of positive psychology is growing rapidly, this review will also include several new studies on the relation between emotional well-being and the prognosis of physical illnesses.

METHOD

Selection of studies

Studies were included if they reported on emotional well-being or aspects of emotional well-being and on the prognosis of physical illness, aiming to evaluate the prospective effects of well-being on the prognosis. Studies were excluded when (1) the study design was not prospective; (2) emotional well-being was not measured (e.g., emotional well-being was measured otherwise than the presence of general well-being, positive affect and/or life satisfaction, emotional well-being was part of a composite index, or psychopathology was examined as indicator of well-being); (3) the study population was physically healthy, mentally disordered, or consisted of institutionalized elderly; (4) the paper included insufficient information for data extraction required for meta-analysis.

Search strategy

First, we searched the reference lists of the literature reviews of Chida and Steptoe (2008), Diener and Chan (2011), Howell et al. (2007), Lyubomirsky et al. (2005), Pressman and Cohen (2005), and Veenhoven (2008) for studies fitting the inclusion criteria. Second, a systematic search was performed in two electronic databases, Medline and PsycInfo, up to March 2011. The main search strategy was based on two key components: emotional well-being and prognosis of physical illness. Terms on both components were searched in title, abstract and

keywords. Emotional well-being included the following terms of which at least one had to be present: (well-being) or (wellbeing) or (happiness) or (happy) or (life satisfaction) or (positive affect) or (positive mood) or (positive emotion*). In addition, at least one term on prognosis of physical illness had to be present. With respect to prognosis, we were mainly interested in recovery outcomes, using terms as functional status, health, and survival. However, since recovery outcomes were not always explicitly mentioned, we also included search terms on recovery processes (recovery, rehabilitation, surgery, surgical, post-operative, postsurgical, morbidity, remission, convalescence), general terms of physical diseases (patient, disease, illness, pain, surviv*, mortality, injury, fracture, infarction) and terms on specific diseases (cancer, tumor, diabetes, arthritis, osteoarthritis, fibromyalgia, arthrosis, heart failure, angina, cardiac, cardiovascular, myocardial, coronary, thrombosis, stroke, cardiovascular accident, COPD, lung disease, bronchitis, aids, HIV). Only one of the search terms of prognosis of physical illness had to be present.

We searched for peer-reviewed studies in the English language with no limitations on the year in which the study was published. To minimize the presence of publication bias we also searched for dissertations. Furthermore, we cross-checked the reference lists of included studies for additional eligible studies. Potentially eligible studies were independently selected by two reviewers (SL and LB) in two phases. In the first phase, selection was based on title and abstract, and in the second phase on the full-text paper. All studies evaluated as potentially eligible by at least one of the reviewers in the first selection phase, were evaluated in the second selection phase. In the second phase, disagreements between both independent reviewers were resolved by consensus.

Information extraction

Our search revealed 17 eligible studies. The flow diagram of the study selection is shown in Fig. 1. Searching the reference lists of the literature reviews (Chida & Steptoe, 2008; Diener & Chan, 2011; Howell et al., 2007; Lyubomirsky et al., 2005; Pressman & Cohen, 2005; Veenhoven, 2008) and searching databases revealed in total 2,901 records. After exclusion (see Fig. 1), 17 studies were included in the meta-analysis. Of these studies, 6 studies were identified by searching the reference lists and 11 by the electronic search, thus adding new studies to the previous reviews.

Table 1 shows an overview of the included studies. All eligible studies were peer-reviewed articles. The study populations were diverse, including heart and vascular diseases ($n = 6$), cancer ($n = 1$), renal disease ($n = 1$), spinal cord injury ($n = 1$), HIV ($n = 1$), diabetes ($n = 1$), arthritis ($n = 1$), stroke ($n = 1$), hip fracture ($n = 1$), respiratory disorder ($n = 1$), general acute events, including stroke, hip fracture and heart attack ($n = 1$), and general medical patients ($n = 1$). The sample sizes ranged from 44 to 5,025 ($M = 749.7$; $SD = 1139.5$). Three

types of well-being constructs were extracted: general well-being ($n = 1$), positive affect ($n = 13$), and life satisfaction ($n = 3$). The studies measured general well-being using the WHO-5 well-being index ($n = 1$; Heun, Burkart, Maier, & Bech, 1999), positive affect using the subscale Positive affect of the Center for Epidemiological Studies Depression Scale ($n = 7$; Radloff, 1977), the subscale Positive affect of the Hospital Anxiety and Depression Scale ($n = 2$; Herrmann, 1997), the Mood Adjective Check List ($n = 2$; Nowlis, 1965), and the Global Mood Scale ($n = 2$; Denollet, 1993). Life satisfaction was measured by the Satisfaction With Life Scale ($n = 1$; Diener, Emmons, Larsen, & Griffin, 1985), the MOS short form general health survey ($n = 1$; Stewart, Hays, & Ware, 1988), and the Life Situation Questionnaire ($n = 1$; Krause, 1992).

The type of outcome measures included functional status ($n = 6$), health status ($n = 1$), and survival ($n = 10$). We combined functional status and health status as recovery outcomes. Functional status was measured by the Duke Activity Status Index ($n = 1$; Hlatky et al., 1989), (modified version of the) Katz's Activities of Daily Living scale ($n = 2$; Katz, Ford, Moskowitz, Jackson, & Jaffe, 1963), the Inpatient Rehabilitation Facilities-Patient Assessment Instrument ($n = 1$; Ottenbacher, Hsu, Granger, & Fiedler, 1996), the EuroQol (Euroqol group, 1990), and by measuring usual walking speed, rapid walking speed and chair stands ($n = 1$). Of the 10 studies measuring survival as outcome, 9 studies measured survival status (alive or deceased at follow-up) and 1 study measured survival time. The studies reported hazard ratios ($n = 6$), risk ratios ($n = 3$), odds ratios ($n = 4$), regression coefficients ($n = 3$) or means ($n = 1$). The follow-up time ranged from 3 months to 11 years with a mean of 4.47 years ($SD = 3.93$), and the papers were published between 1996 and 2009.

Information was extracted on study design, type of study population (e.g., cancer patients), sample size, type of well-being construct, type of outcome measures, and the study's outcome measure. For each paper, we extracted the relevant and most reliable outcome which was most completely adjusted for potential confounders, such that we obtained a single outcome per paper. For one study (Versteeg et al., 2009) we performed a meta-analysis to synthesize three odds ratios on mobility, self-care, and activities, into a single odds ratio. Moreover, we extracted the results based on baseline emotional well-being instead of change in emotional well-being over time. For one study (Moskowitz, 2003), the result based on multiple measurements of well-being was extracted, since the study did not report results based on baseline emotional well-being. When a paper included insufficient information for data extraction required for meta-analysis, we contacted the authors for additional information.

Quality assessment

Two reviewers (SL and LB) independently assessed methodological quality of the included studies, using a protocol based on the quality checklist for observational studies of Wong,

Cheung, & Hart (2008). We adapted the checklist to our study aims into a checklist consisting of five quality criteria on external validity, response rate, reliability, control for confounding demographic variables, and control for confounding health variables. For the studies on recovery we included an additional item on the objectiveness of the recovery measurements (i.e., self-report versus laboratory test). Each criterion was rated as 0 (study does not meet criterion) or 1 (study meets criterion). The interrater reliability was 89.1%. The overall quality of the study was assessed by dividing the total score by the total number of applicable items, resulting in a quality score between 0 and 1.00.

The quality of the studies ranged from 0.50 to 1.00 ($M = 0.74$; $SD = 0.17$). Three of the studies met all quality criteria. In ten studies the reliability of the scale measuring emotional well-being was not reported ($n = 1$) or Cronbach's alpha was lower than .60 ($n = 9$), mainly because well-being was measured by positive affect subscales from depression and anxiety questionnaires. The criterion assessing whether course of disease was measured objectively (i.e., no self-report), was only applicable for the studies measuring functional status or health status. Of these studies ($n = 7$), only one met this quality criterion.

Figure 1. Flow chart.

Meta-analysis

We used the software Comprehensive Meta Analysis (CMA) to meta-analytically combine study outcomes. For each study, we extracted the hazard ratio, risk ratio or odds ratio and its confidence intervals. Regression coefficients and means were converted to odds ratios using CMA. We combined the ratios, referring to the hazard ratios, risk ratios and odds ratios as likelihood ratios (LR). When necessary the ratio was inverted such that all LRs above 1 indicate a positive relationship of emotional well-being to the prognosis of physical illness. The meta-analysis included weighting of the study LRs by the inverse of the standard errors, based on the confidence intervals. With small studies tending to have wider confidence intervals and large studies to have narrow confidence intervals, the confidence interval reflects the precision of the LR. The LR is considered statistically significant if the confidence interval (95%) excludes the null value of 1.

A random-effects meta-analysis was performed, because of the heterogeneity across the studies. The random-effects method allows to assume that the studies are estimating different but related effects, thus relaxing the assumption that all studies are replicas. In addition, the random-effects model makes an adjustment to the study weights according to the extent of heterogeneity (Deeks, Higgins, & Altman, 2008), which translates into a broad 95% confidence interval around the pooled effect estimate.

We performed an overall analysis, as well as subgroup analyses and meta-regression analyses to identify potential moderators. In the subgroup analyses, we examined the effects of emotional well-being on the prognosis of physical illness separately for positive affect and for each measure of prognosis (survival; recovery). No subgroup analyses were performed on overall well-being and life satisfaction, since few studies measured these aspects of emotional well-being ($n = 1$ and 3 , respectively). The study population could not be split into more homogeneous subgroups because of its (too large) diversity. In the metaregression analyses, we evaluated the potentially confounding relationship of sample size, the quality of the studies, the follow-up length, and the publication year on the relationship of interest: the impact of emotional well-being on the prognosis of physical illness. To this end, we used an unrestricted maximum likelihood mixed effects regression. Moreover, we examined heterogeneity between the studies by using the Q-test, indicating the probability of heterogeneity, and the I^2 index, indicating the magnitude of the heterogeneity. An I^2 between 0 and 30% was considered as low, between 30 and 75% as moderate, and between 75 and 100% as high heterogeneity (Deeks et al., 2008).

Publication bias in the studies was evaluated using three indices: the funnel plot, the Egger's test of intercept and the Rosenberg fail-safe number. The funnel plot is a graph of effect size (LR) against sample size (N). When publication bias is absent, the observed studies

are expected to be distributed symmetrically around the pooled effect size. The Egger's test of intercept is a correlation between study precision (the inverse of the standard error) and the standardized effect (the effect size divided by its standard error). The fail-safe number indicates the number of nonsignificant unpublished studies needed to reduce the overall significant effect to non-significance (Sterne, Egger, & Moher, 2008). We used Rosenberg's (2005) weighted method for calculating fail-safe numbers, where studies with small variance are given higher weight than those with large variance. For the reporting of this meta-analysis, we applied PRISMA guidelines (Moher, Liberati, Tetzlaff, & Altman, 2009).

RESULTS

An overview of the 17 selected studies is presented in Table 1. The studies investigated the prospective relationship of general well-being, positive affect or life satisfaction to survival or recovery. None of the studies reported negative effects of emotional well-being on the prognosis of physical illness. The results of the 17 studies and the meta-analysis are presented in Fig. 2. Meta-analytically summarizing the effects across the studies revealed an overall likelihood ratio of 1.14 ($p < 0.001$), indicating a small but significant effect of emotional well-being on the course of physical disease. Since the studies were weighted, we also conducted a meta-analysis without the study of Konstam et al. (1996), which is an outlier in sample size ($n = 5,025$) as reflected by its narrow confidence interval. Meta-analytically combining the remaining 16 studies revealed a higher likelihood ratio of 1.18 ($p < .001$), indicating the positive relation of emotional well-being to recovery and survival is stronger when excluding the study with the highest weight. The 17 studies were heterogeneous as the variability of the effect sizes is larger than would be expected from sampling error alone. This high heterogeneity indicated that variability across the primary studies largely stems from systematic factors, such as the type of studied well-being, type of outcome or differences in methodological quality of the studies.

We performed two subgroup analyses to evaluate whether the effects differed for positive affect or course of disease outcomes. When examining the effects separately for positive affect, the 13 studies on positive affect revealed an LR of 1.22 ($p < .001$). Positive affect was significantly related to more survival and recovery. The distribution of effect sizes within studies on positive affect remained heterogeneous. Second, we performed a subgroup analysis on type of outcome. We split the studies in two groups, measuring recovery ($n = 7$) or survival ($n = 10$). Meta-analytically combining the studies on recovery and survival resulted in LRs of 1.39 ($p = .02$) and 1.11 ($p = .01$), respectively. Emotional well-being significantly predicted both survival and recovery later in time, with the strongest relation to recovery. Although the LR is higher for recovery, the confidence intervals show that the ratio for recovery is estimated with less precision than the ratio for survival. When taking type of

outcome into account as a moderator, the heterogeneity remained moderate to large within studies on recovery and survival.

Moreover, we evaluated quality of the studies, follow-up length, publication year, and sample size as moderators of the relation between emotional well-being and course of disease by performing three meta-regression analyses. Results of the meta-regression were insignificant for study quality ($B = -.56$; $p = .24$), follow-up length ($B = -.01$; $p = .53$), publication year ($B = .01$; $p = .59$), and for sample size ($B = -.00$; $p = .23$).

Finally, we evaluated publication bias. The funnel plot indicated asymmetry, since the studies are mainly concentrated on the right side of the plot. The Egger's test of intercept ($t = 4.41$; $df = 15$; $p < .001$) also suggests that bias exists. There is a significant correlation between study precision (the inverse of the standard error) and the standardized effect (the effect size divided by the standard error). Moreover, the fail-safe number indicated that 2.4 non-significant unpublished studies must be included in our random-effects model to reduce the

Figure 2. Forest plot

Table 1. Descriptives of the studies on emotional well-being as predictor of the course of physical disease

Study	Quality ¹	Follow-up (years)	Participants	Predictive measure ²	Outcome measure ³	Results Likelihood ratio (95% confidence interval)	Conclusion ⁴
Birket-Smith et al. (2009)	1.00	6	Chronic heart disease (N = 85)	Well-being (WHO-5)	Survival	1.024 (1.005 – 1.042)	+
Brown et al. (2003)	0.80	10	Cancer (N = 205)	Positive affect (MACL)	Survival	0.990 (0.938 – 1.045)	0
Brummett et al. (2009)	0.67	3	Coronary artery disease, age 60+ (N = 948)	Positive affect (CES-D)	Functional status (DASI)	1.609 (1.039 – 2.492)	+
Denollet et al. (2008)	0.80	2	Coronary artery disease (N = 874)	Positive affect (HADS)	Survival	2.550 (1.479 – 4.397)	+
Fisher et al. (2004)	0.67	2	Arthritis, age 65+ (N = 937)	Positive affect (CES-D)	Functional status (ADL)	1.099 (1.024 – 1.181)	+
Fredman et al. (2006)	0.50	2	Hip fracture, age 65+ (N = 432)	Positive affect (CES-D)	Functional status: Usual and rapid walking speed, chair stands	2.700 (1.096 – 6.654)	0
Kimmel et al. (1998)	1.00	4	Hemodialysis patients (N = 295)	Life satisfaction (SWLS)	Survival	1.205 (0.960 – 1.513)	0
Konstam et al. (1996)	0.80	3	Congestive heart failure (N = 5025)	Life satisfaction (MOS)	Survival	0.949 (0.899 – 1.001)	0
Krause et al. (1997)	1.00	11	Spinal cord injury (N = 330)	Life satisfaction (LSQ)	Survival	1.990 (1.373 – 2.885)	+
Moskowitz (2003)	0.60	10.8	HIV+ patients (N = 407)	Positive affect (CES-D)	Survival	1.163 (1.042 – 1.299)	+
Moskowitz et al. (2008)	0.80	10	Diabetic patients (N = 715)	Positive affect (CES-D)	Survival	1.111 (0.962 – 1.284)	0
Olofson et al. (2009)	0.60	8	Chronic alveolar hypoventilation (N = 44)	Positive affect (MACL)	Survival	1.961 (0.901 – 4.167)	0

Ostir et al. (2002)	0.50	1	Acute events (stroke, heart attack or hip fracture), age 65+ (N = 240)	Positive affect (CES-D)	Functional status (ADL)	2.700 (1.096 – 6.653)	+
Ostir et al. (2008)	0.50	0.25	Stroke, age 55+ (N = 823)	Positive affect (CES-D)	Functional status (IRF-PAI)	4.241 (0.939 – 19.151)	0
Pelle et al. (2009)	0.83	1	Chronic heart failure (N = 276)	Positive affect (GMS)	Health status (HCS)	0.865 (0.603 – 1.241)	0
Scherer and Hermann-Lingen (2009)	0.80	1	Patients of the general medical ward (N = 575)	Positive affect (HADS; 1 item on enjoyment)	Survival	1.400 (1.016 – 1.930)	+
Versteeg et al. (2009)	0.83	1	Coronary artery disease (N = 533)	Positive affect (GMS)	Functional status (EQ5D mobility)	1.031 (0.649 – 1.667)	0

¹Range from 0.00 (low quality) to 1.00 (high quality), based on external validity, response rate, reliability, control for confounding demographic variables, control for confounding health variables, and objectiveness of the recovery outcomes (not applicable for studies on survival).

²Zung = Zung self-rating depression scale (SDS subscale well-being); WHO = WHO-5 well-being index; MACL = Mood Adjective Check list; HADS = Hospital Anxiety and Depression Scale (subscale positive affect); SWLS = Satisfaction with Life Scale; MOS = MOS short form general health survey; LSQ = Life Situation Questionnaire (subscale); CES-D = Center for Epidemiologic Studies Depression Scale (subscale positive affect); GMS = Global Mood Scale.

³DASI = Duke Activity Status Inventory; ADL = Activities of Daily Living Scale; IRF-PAI = Inpatient Rehabilitation Facilities - Patient Assessment Instrument (subscale motor ratings); HCS = Health Complaints Scale (subscale cardiac symptoms); EQ5D = EuroQol-5D.

⁴ + = positive effect ($p \leq .05$); 0 = no effect ($p > .05$); - = negative effect ($p \leq .05$).

overall significant effect to non-significance. The funnel plot, Egger's test of intercept and fail-safe number indicated the presence of publication bias. To gain insight in the grey literature, we searched the electronic databases for eligible dissertations. Three dissertations were eligible (Caron, 1997; Hamilton, 1996; Ostir, 2001), but excluded because the studies were already included in the meta-analysis (Ostir, 2001) or data required for meta-analysis were unavailable despite contacting the authors for additional information (Caron, 1997; Hamilton, 1996). These three dissertations reported positive effects in the dissertation abstract, showing positive effects of well-being on course of disease in unpublished studies. Furthermore, given the novelty of the focus on positive well-being in relation to physical health, it is unlikely that many studies with negative findings are unreported (Diener & Chan, 2011). However, we have to interpret the results in our meta-analysis carefully, since effects of well-being on course of disease might be overestimated.

DISCUSSION

Main findings

This meta-analysis synthesized studies on emotional well-being as predictor of the prognosis of physical illness, while in addition evaluating the impact of putative moderators such as type of outcome. Although previous literature reviews included several of these study aims (Lyubomirsky et al., 2005; Pressman & Cohen, 2005; Howell et al., 2007; Chida & Steptoe, 2008; Veenhoven, 2008; Diener & Chan, 2011), this is the first study to our knowledge that combines all aspects into a single review. Our literature search identified 17 eligible papers, of which nine new studies in addition to the studies included in earlier reviews. This shows that the research field on the relation of positive well-being to physical health is growing rapidly.

Meta-analytically combining these studies showed that positive emotional well-being is favorably related to the prognosis of physical illness. Patients with higher baseline levels of emotional well-being have better recovery and survival rates than patients with low levels of emotional well-being. Although the effect is small, it is remarkable that emotional well-being at baseline has significant effects on physical health later in time, since the average follow-up is approximately after 4 years. The effect size of the relation between emotional well-being and course of disease is even similar for studies with short and long follow-ups.

Subgroup analyses indicated that emotional well-being is related to both survival and recovery. Moreover, positive affect is beneficial. Positive affect may influence immune and cardiovascular systems directly by activating the autonomic nervous system and the Hypothalamic-Pituitary-Adrenal axis (HPA) thus buffering the impact of stress. Positive affect has also an indirect favorable effect by increasing health behavior and engagement in social

networks (Pressman & Cohen, 2005; Howell et al., 2007). There were not enough studies to conduct a subgroup analysis on life satisfaction (3 studies) and well-being (1 study).

Recommendations for future research

It is important for future research to take into account that the impact of emotional well-being on course of disease might differ across health outcomes, well-being measures, and study populations. As suggested in previous literature reviews, effects might also differ across diseases (Chida and Steptoe, 2008). In addition, Pressman and Cohen (2005) and Veenhoven (2008) state that well-being has beneficial effects in relatively mildly diseased adults and negative effects in severely diseased adults. For our future understanding of the role of well-being in disease progression, it is highly relevant whether well-being has similar effects in various disease populations. Unfortunately, the study populations in the current meta-analysis were too diverse to further investigate effects across diseases.

Moreover, other population characteristics could play a role in the relation between emotional well-being and course of disease. Pressman and Cohen (2005) found that positive affect was associated with lower mortality rates, mainly in older community-residing adults. They suggest that the association is possibly stronger in older participants. This meta-analysis could not unravel the effects of age and health outcome, since the studies on survival included patients of all ages, whereas studies on recovery more often included only older patients. Additionally, results could differ across gender. Brummett et al. (2009) and Fisher et al. (2004) found that effects of well-being on recovery were stronger for males than for females. In the current meta-analysis, the patient populations were too diverse to examine differential effects across well-being and outcome measures, diseases, age and gender, but we recommend investigating these aspects in future research.

Strengths and limitations

One of the strengths of this systematic review is the focus on emotional well-being as the presence of well-being, positive affect, or life satisfaction. We investigated positive psychological aspects, whereas previous reviews also included studies on quality of life which use items on physical functioning and health. The focus on other aspects than emotional well-being was our main criterion for exclusion of studies. Aspects as vitality, energy, and optimism might indirectly measure health (Pressman & Cohen, 2005). In addition, we included control for baseline health status as a quality criterion, which was present in 14 of the 17 included studies.

Most studies used subscales from depression scales to measure positive affect. For example, both the Hospital Anxiety and Depression Scale (HADS) and the Center for Epidemiologic Studies Depression Scale (CES-D) include a subscale on positive affect. However, these

questionnaires are designed to screen for depressive symptoms rather than to measure positive affect, resulting in low subscale reliability (Penninx, 2000). Additional studies need to be conducted, using reliable questionnaires which are designed to measure well-being, such as the Positive and Negative Affect Scales (PANAS; Watson & Tellegen, 1988) and Mental Health Continuum-Short Form (MHC-SF; Lamers et al., 2011).

Although most studies used depression scales to measure aspects of positive well-being, few studies included negative aspects of mental health such as psychopathology and negative affect as a confounding variable, to evaluate the unique effects of emotional well-being. Studies that did evaluate the unique effects of positive emotional well-being report positive results, such as Brummett et al. (2009).

In addition, the results from our meta-analysis have to be interpreted carefully. First, the studies used different covariates varying from baseline health characteristics to demographic characteristics such as gender and age, making the studies diverse. The high heterogeneity confirmed that the variability across the studies was larger than would be expected from sampling error alone. Although study quality, in which control for baseline health status and for demographics were used as quality criteria, was not related to the effect size of the study, we have to take the high variability and diversity in covariates across studies into account. Moreover, the results have to be interpreted carefully because of potential publication bias. The effects of emotional well-being on recovery and survival might be overestimated.

Conclusion and implications

Emotional well-being predicts long-term prognosis of physical illness. Higher levels of emotional well-being are beneficial for recovery and survival rates in physically diseased patients. Although the effects are small, the findings are important. Recovery and survival are highly relevant outcomes. Moreover, since physical diseases such as coronary heart disease and cancer are highly prevalent, small effects of emotional well-being on prognosis of physical illness have a large impact in the population. In addition, several psychological interventions are effective in enhancing well-being, such as Acceptance and Commitment Therapy (Fledderus, Bohlmeijer, Smit, & Westerhof, 2010) and well-being therapy (Fava, Rafanelli, Cazzaro, Conti, & Grandi, 1998). By the enhancement of well-being, these interventions might also improve recovery and survival in physical illness. Future research should investigate effects of psychological interventions on the prognosis of physical illness.

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Part two

**Effectiveness and potential of general and online positive
psychological interventions**

3

Positive psychological interventions: a meta-analysis of randomized controlled studies

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ABSTRACT

Background. The use of positive psychological interventions may be considered as a complementary strategy in mental health promotion and treatment. The present article constitutes a meta-analytical study of the effectiveness of positive psychology interventions for the general public and for individuals with specific psychosocial problems.

Methods. We conducted a systematic literature search using PubMed, PsychInfo, the Cochrane register, and manual searches. Forty articles, describing 39 studies, totaling 6,139 participants, met the criteria for inclusion. The outcome measures used were subjective well-being, psychological well-being and depression. Positive psychology interventions included self-help interventions, group training and individual therapy.

Results. The standardized mean difference was 0.34 for subjective well-being, 0.20 for psychological well-being and 0.23 for depression indicating small effects for positive psychology interventions. At follow-up from three to six months, effect sizes are small, but still significant for subjective well-being and psychological well-being, indicating that effects are fairly sustainable. Heterogeneity was rather high, due to the wide diversity of the studies included. Several variables moderated the impact on depression: Interventions were more effective if they were of longer duration, if recruitment was conducted via referral or hospital, if interventions were delivered to people with certain psychosocial problems and on an individual basis, and if the study design was of low quality. Moreover, indications for publication bias were found, and the quality of the studies varied considerably.

Conclusions. The results of this meta-analysis show that positive psychology interventions can be effective in the enhancement of subjective well-being and psychological well-being, as well as in helping to reduce depressive symptoms. Additional high-quality peer-reviewed studies in diverse (clinical) populations are needed to strengthen the evidence-base for positive psychology interventions.

BACKGROUND

Over the past few decades, many psychological treatments have been developed for common mental problems and disorders such as depression and anxiety. Effectiveness has been established for cognitive behavioral therapy^{1,2}, problem-solving therapy³ and interpersonal therapy⁴. Preventive and early interventions, such as the Coping with Depression course⁵, the Don't Panic course⁶ and Living Life to the Full^{7,8} are also available. The existing evidence shows that the mental health care system has traditionally focused more on treatment of mental disorders than on prevention. However, it is recognized that mental health is more than just the absence of mental illness, as expressed in the World Health Organization's definition of mental health:

Mental health is a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively, and is able to make a contribution to his or her community⁹.

Under this definition well-being and positive functioning are core elements of mental health. It underscores that people can be free of mental illness and at the same time be unhappy and exhibit a high level of dysfunction in daily life¹⁰. Likewise, people with mental disorders, can be happy by coping well with their illness and enjoy a satisfactory quality of life¹¹. Subjective well-being refers to a cognitive and/or affective appraisal of one's own life as a whole¹². Psychological well-being focuses on the optimal functioning of the individual and includes concepts such as mastery, hope and purpose in life^{13,14}. The benefits of well-being are recorded both in cross-sectional and longitudinal research and include improved productivity at work, having more meaningful relationships and less health care uptake^{15,16}. Well-being is also positively associated with better physical health¹⁷⁻¹⁹. It is possible that this association is mediated by a healthy lifestyle and a healthier immune system, which buffers the adverse influence of stress²⁰. In addition, the available evidence suggests that well-being reduces the risk of developing mental symptoms and disorders^{21,22} and helps reduce mortality risks in people with physical disease²³.

Seligman and Csikszentmihaly's (2000) pioneered these principles of positive psychology in their well-known article entitled 'Positive psychology: An introduction', published in a special issue of the American Psychologist. They argued that a negative bias prevailed in psychology research, where the main focus was on negative emotions and treating mental health problems and disorders²⁴. Although the basic concepts of well-being, happiness and human flourishing have been studied for some decades^{12,25-27}, there was a lack of evidence-based interventions²⁴. Since the publication of Seligman and Csikszentmihaly's seminal article, the positive psychology movement has grown rapidly. The ever-expanding International Positive

Psychology Association is among the most extensive research networks in the world²⁸ and many clinicians and coaches embrace the body of thought that positive psychology has to offer.

Consequently, the number of evaluation studies has greatly increased over the past decade. Many of these studies demonstrated the efficacy of positive psychology interventions such as counting your blessings^{29,30}, practicing kindness³¹, setting personal goals^{32,33}, expressing gratitude^{30,34} and using personal strengths³⁰ to enhance well-being, and, in some cases, to alleviate depressive symptoms³⁰. Many of these interventions are delivered in a self-help format. Sin and Lyubomirsky (2009) conducted a meta-analytical review of the evidence for the effectiveness of positive psychology interventions (PPIs). Their results show that PPIs can indeed be effective in enhancing well-being ($r = 0.29$, standardized mean difference Cohen's $d = 0.61$) and help to reduce depressive symptom levels in clinical populations ($r = 0.31$, Cohen's $d = 0.65$). However, this meta-analysis had some important limitations. First, the meta-analysis included both randomized studies and quasi-experimental studies. Second, study quality was not addressed as a potential effect moderator. In recent meta-analyses, it has been shown that the treatment effects of psychotherapy have been overestimated in lower quality studies^{35,36}. The lack of clarity in the inclusion criteria constitutes a third limitation. Intervention studies, although related to positive psychology but not strictly developed within this new framework (e.g. mindfulness, life-review) were included in the meta-analysis. However, inclusion of these studies reduces the robustness of the results for pure positive psychology interventions.

Present study

The aim of the present study is to conduct a meta-analysis of the effects of specific positive psychology interventions in the general public and in people with specific psychosocial problems. Subjective well-being, psychological well-being and depressive symptoms were the outcome measures. Potential variables moderating the effectiveness of the interventions, such as intervention type, duration and quality of the research design, were also examined. This study will add to the existing literature and the above meta-analytical review³⁷ by 1) only including randomized controlled studies, 2) taking the methodological quality of the primary studies into account, 3) including the most recent studies (2009 – 2012), 4) analyzing not only post-test effects but also long-term effects at follow up, and 5) applying clear inclusion criteria for the type of interventions and study design.

METHOD

Search strategy

A systematic literature search was carried out in PsychInfo, PubMed and the Cochrane Central Register of Controlled Trials, covering the period from 1998 (the start of the positive psychology movement) to November 2012. The search strategy was based on two key components: there should be a) a specific positive psychology intervention, and b) an outcome evaluation. The following MeSH terms and text words were used: “well-being” or “happiness” or “happy*”, “optimism”, “positive psychology” in combination with “intervention”, “treatment”, “therapy” and “prevention”. This was combined with terms related to outcome research: “effect*”, or “effic*”, or “outcome*”, or “evaluat*”. We also cross-checked the references from the studies retrieved, the earlier meta-analysis of Sin & Lyubomirsky (2009) and two other reviews of positive psychological interventions^{38,39}. The search was restricted to peer-reviewed studies in the English language.

Selection of studies

Two reviewers (LB and MH) independently selected potentially eligible studies in two phases. At the first phase, selection was based on title and abstract, and at the second phase on the full-text article. All studies identified as potentially eligible by at least one of the reviewers during the first selection phase, were re-assessed at the second selection phase. During the second phase, disagreements between the reviewers were resolved by consensus. The inter-rater reliability (kappa) was 0.90.

The inclusion criteria were as follows:

- Examination of the effects of a positive psychology intervention. A positive psychology intervention (PPI) was defined in accordance with Sin and Lyubomirsky’s (2009) article as a psychological intervention (training, exercise, therapy) primarily aimed at raising positive feelings, positive cognitions or positive behavior as opposed to interventions aiming to reduce symptoms, problems or disorders. The intervention should have been explicitly developed in line with the theoretical tradition of positive psychology (usually reported in the introduction section of an article).
- Randomization of the study subjects (randomizing individuals, not groups) and the presence of a comparator condition (no intervention, placebo, care as usual).
- Publication in a peer-reviewed journal.
- At least one of the following are measured as outcomes: well-being (subjective well-being and/or psychological well-being) or depression (diagnosis or symptoms).

- Sufficient statistics are reported to enable the calculation of standardized effect sizes.

If necessary, authors were contacted for supplementary data. We excluded studies that involved physical exercises aimed at the improvement of well-being, as well as mindfulness or meditation interventions, forgiveness therapy, life-review and reminiscence interventions. Furthermore, well-being interventions in diseased populations not explicitly grounded in positive psychology theory ('coping with disease courses') were excluded. Apart from being beyond the scope of this meta-analysis, extensive meta-analyses have already been published for these types of intervention⁴⁰⁻⁴². This does not imply that these interventions do not have positive effects on well-being, a point which will be elaborated on in the discussion section of this paper.

Data extraction

Data extraction and study quality assessment were performed by one reviewer (LB) and independently checked by a second reviewer (MH). Disagreements were resolved by consensus. Data were collected on design, intervention characteristics, target group, recruitment methods, delivery mode, number of sessions, attrition rates, control group, outcome measures and effect sizes (post-test and at follow up of at least 3 months). The primary outcomes in our meta-analysis were subjective well-being (SWB), psychological well-being (PWB) and depressive symptoms/depression.

The methodological quality of the included studies was assessed using a short scale of six criteria tailored to those studies and based on criteria established by the Cochrane collaboration⁴³: 1) Adequacy of randomization concealment, 2) Blinding of subjects to the condition (blinding of assessors was not applicable in most cases), 3) Baseline comparability: were study groups comparable at the beginning of the study and was this explicitly assessed? (Or were adjustments made to correct for baseline imbalance using appropriate covariates), 4) Power analysis: is there an adequate power analysis and/or are there at least 50 participants in the analysis?, 5) Completeness of follow up data: clear attrition analysis and loss to follow up < 50%, 6) Handling of missing data: the use of intention-to-treat analysis (as opposed to a completers-only analysis). Each criterion was rated as 0 (study does not meet criterion) or 1 (study meets criterion). The inter-rater reliability (kappa) was 0.91. The quality of a study was assessed as high when five or six criteria were met, medium when three or four criteria were met, and low when zero, one or two criteria were met. Along with a summary score, the aspects relating to quality were also considered individually, as results based on composite quality scales can be equivocal⁴⁴. Table 1 shows the quality assessment for each study. The quality of the studies was scored from 1 to 5 ($M = 2.56$; $SD = 1.25$). Twenty studies were rated as low, 18 were of medium quality and one study was of high quality. None of the studies met all quality criteria. The average number of participants

Table 1. Quality assessment per study

Study	1	2	3	4	5	6	Total
Abbott 2009 ⁷⁸	0	0	1	1	0	1	3
Boehm 2011 ⁷³	0	1	1	1	0	1	4
Buchanan 2010 ⁵⁶	0	0	0	1	0	0	1
Burton 2004 ⁶⁴	0	1	1	1	1	0	4
Cheavens 2006 ⁷⁶	0	0	1	0	1	0	2
Emmons 2006 study 1 ²⁹	0	1	0	1	0	0	2
Emmons 2006 study 3 ²⁹	0	1	0	1	0	0	2
Fava 1998 ⁸²	0	1	0	0	1	0	2
Fava 2005 ⁸³	0	1	0	0	0	0	1
Feldman 2012 ⁶⁰	0	0	0	1	0	0	1
Frieswijk 2005 ⁷⁷	0	0	0	1	0	0	1
Gander 2012 ⁷⁴	0	1	1	1	0	0	3
Goldstein 2007 ⁸⁴	0	0	0	1	0	0	1
Grant 2009 ⁷⁹	0	0	0	0	0	0	0
Grant 2012 ⁸²	1	1	1	1	0	0	4
Green 2006 ³³	0	0	0	1	1	0	2
Hurley 2012 ⁶¹	0	0	1	1	0	0	2
King 2001 ⁶⁶	0	1	0	0	1	0	2
Kremers 2006 ⁵⁷	0	0	1	1	1	0	3
Layous 2012 ⁷⁵	0	1	1	1	0	0	3
Lichter 1980 study 2 ⁸⁰	0	0	0	0	1	0	1
Luthans 2008 ⁶⁵	1	1	1	1	0	0	4
Luthans 2010 study 1 ⁷²	0	1	1	1	1	0	4
Lyubomirsky 2006 study 2 ⁵⁸	0	1	1	1	1	0	4
Lyubomirsky 2011 ⁶⁷	0	1	1	1	0	0	3
Martinez 2010 ⁶⁸	0	1	1	1	1	0	4
Mitchell 2009 ⁶⁹	1	1	1	1	0	1	5
Page 2012 ⁶²	1	0	1	0	0	0	2
Peters 2010 ⁷⁰	0	1	1	1	1	0	4
Quoidbach 2009 ⁵⁹	1	0	1	0	0	0	2
Schueller 2012 ⁶³	1	0	1	1	0	0	3
Seligman 2005 ³⁰	0	1	1	1	1	0	4
Seligman 2006 study 1 ⁵¹	0	0	1	0	0	0	1
Seligman 2006 study 2 ⁵¹	0	1	1	0	1	0	3
Shapira 2010 ⁵⁵ ; Mongrain 2011 ⁵³ ; Sergeant 2011 ⁵⁴ ; Mongrain 2012 ⁵²	1	1	1	1	0	0	4
Sheldon 2002 ³²	0	1	1	1	1	0	4
Sheldon 2006 ³⁴	0	1	1	0	0	0	2
Spence 2007 ⁸¹	0	0	1	0	0	0	1
Wing 2006 ⁷¹	0	1	0	1	0	0	2
<i>Total</i>	<i>7</i>	<i>23</i>	<i>26</i>	<i>27</i>	<i>14</i>	<i>3</i>	<i>100</i>

Index:

- 1 = Randomization concealment
- 2 = Blinding of subjects
- 3 = Baseline comparability
- 4 = Power analysis or N $\geq$ 50
- 5 = Completeness of follow up data
- 6 = Intention-to-treat analysis

in the analysis was rather high (17 out of 39 studies scored positive on this criterion), although none of the studies reported an adequate power analysis. Also, baseline comparability was frequently reported (26/39 studies). On the other hand, independence in the randomization procedure was seldom reported (7/39 studies) and an intention-to-treat analysis was rarely conducted (3/39 studies).

Meta-analysis

In a meta-analysis, the effects found in the primary studies are converted into a standardized effect size, which is no longer placed on the original measurement scale, and can therefore be compared with measures from other scales. For each study, we calculated effect sizes (Cohen's d) by subtracting the average score of the experimental group (M_e) from the average score of the control group (M_c), and dividing the result by the pooled standard deviations of both groups. This was done at post-test because randomization usually results in comparable groups across conditions at baseline. However, if baseline differences on outcome variables did exist despite the randomization, d 's were calculated on the basis of pre- post-test differences: by calculating the standardized pre- post change score for the experimental group (d_e) and the control group (d_c) and subsequently calculating their difference as $\Delta d = d_e - d_c$. For example, an effect size of 0.5 indicates that the mean of the experimental group is half a standard unit (standard deviation) larger than the mean of the control group. From a clinical perspective, effect sizes of 0.56 – 1.2 can be interpreted as large, while effect sizes of 0.33 – 0.55 are of medium size, and effects of 0 – 0.32 are small⁴⁵.

In the calculation of effect sizes for depression, we used instruments that explicitly measure depression (e.g. the Beck Depression Inventory, or the Center for Epidemiological Studies Depression Scale). For subjective and psychological well-being, we also used instruments related to the construct of well-being (such as positive affect for SWB and hope for PWB). If more than one measure was used for SWB, PWB or depression, the mean of the effect sizes was calculated, so that each study outcome had one effect size. If more than one experimental group was compared with a control condition in a particular study, the number of subjects in the control groups was evenly divided across the experimental groups so that each subject was used only once in the meta-analysis.

To calculate pooled mean effect sizes, we used Comprehensive Meta-Analysis (CMA, Version 2.2.064). Due to the diversity of studies and populations, a common effect size was not assumed and we expected considerable heterogeneity. Therefore, it was decided a priori to use the 'random effects model'. Effect sizes may differ under this model, not only because of random error within studies (as in the fixed effects model), but also as a result of true variation in effect sizes between studies. The outcomes of the random effects model are

conservative in that their 95% Confidence Intervals (CIs) are often broad, thus reducing the likelihood of type-II errors.

We tested for the presence of heterogeneity with two indicators. First, we calculated the Q-statistic. A significant Q rejects the null-hypothesis of homogeneity and indicates that the true effect size probably does vary from study to study. Second, the I^2 -statistic was calculated. This is a percentage indicating the study-to-study dispersion due to real differences, over and above random sampling error. A value of 0% indicates an absence of dispersion, and larger values show increasing levels of heterogeneity where 25% can be considered as low, 50% as moderate and 75% as a high level of heterogeneity⁴⁶.

Owing to the expected high level of heterogeneity, all studies were taken into account. Outliers were considered, but not automatically removed from the meta-analysis. The procedure of removing outliers which are outside the confidence interval of the pooled effect size is advised when a common effect size is assumed. However, in our meta-analysis, high dispersion was expected and therefore only the exclusion of Cohen's $d > 2.5$ from the final sample was planned.

Subgroup analyses were performed by testing differences in Cohen's d 's between subgroups. Six potential moderators were determined based on previous research and the characteristics of the investigated interventions and studies: 1) Self-selected sample/not self-selected: did the participants know that the aim of the intervention was to make them feel better?; 2) Duration: less than four weeks, four to eight weeks, or more than eight weeks; 3) Type of intervention: self-help, group intervention, or individual therapy; 4) Recruitment method: community (in a community center, local newspapers), internet, by referral/hospital, at university; 5) Psychosocial problems (Yes/none): was the data based on a group with certain psychosocial problems or was the study open to everyone?; 6) Quality rating: low (score 1 or 2), medium (score 3 or 4) or high (score 5 or 6). The impact of the duration and quality ratings was also assessed using meta-regression.

Results of meta-analysis may be biased due to the fact that studies with non-significant or negative results are less likely to be published in peer-reviewed journals⁴⁷. In order to address this issue, we used three indices: funnel plots, the Orwin's fail-safe number and the Trim and Fill method. A funnel plot is a graph of effect size against study size. When publication bias is absent, the observed studies are expected to be distributed symmetrically around the pooled effect size. The Orwin's fail-safe number indicates the number of non-significant unpublished studies needed to reduce the overall significant effect to non-significance (according to a self-stated criterium)⁴⁸. The effect size can be considered to be robust if the number of studies required to reduce the overall effect size to a non-significant level exceeds

$5K + 10$, where K is the number of studies included. If asymmetry is found in the funnel plot, the Trim and Fill method adjusts the pooled effect size for the outcomes of missing studies⁴⁹. Imputing missing studies restores the symmetry in the funnel plot and an adjusted effect size can be calculated.

For the reporting of the results of this meta-analysis, we applied Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines⁵⁰.

RESULTS

Description of studies

The selection process is illustrated in Figure 1. First, 5,335 titles were retrieved from databases and 55 titles were identified through searching the reference list accompanying the meta-analysis by Sin and Lyubomirsky (2009)³⁷ as well as two other literature reviews of positive psychological interventions^{38,39}. After reviewing the titles and abstracts and removing duplicates, 84 articles were identified as being potentially eligible for inclusion in our study. Of these 84 articles, 40 articles in which 39 studies were described, met our inclusion criteria (of these, 17 articles describing 19 studies were also included in the meta-analysis by Sin and Lyubomirsky, 2009). In two articles^{29,51} two studies were described, and one study⁵²⁻⁵⁵ was published in four articles.

The characteristics of the studies included are described in Table 2. The studies evaluated 6,139 subjects, 4,043 in PPI groups and 2,096 in control groups. Ten studies compared a PPI with a no-intervention control group^{29,51,56-63}, 17 studies compared a PPI with a placebo intervention^{29,30,32,34,52-55,64-75}, seven studies with a waiting list control group^{33,76-81} and five studies with another active intervention (care as usual)^{51,82-85}. A minority of seven studies^{51,57,76,77,82,83} applied inclusion criteria to target a specific group with psychosocial problems such as depression and anxiety symptoms. Half of the studies, 19 in total, recruited the subjects (not necessarily students) through university^{29,32,34,51,56,58-61,64-68,70,72,75,80,85}. In seven studies subjects were recruited in the community^{33,57,71,73,76,77,81}, in four studies by referral from a practitioner or hospital^{29,51,82,83}, in three studies in an organization^{62,78,79} and six studies recruited through the internet^{30,52-55,63,69,74,84}. Twenty-eight studies measured subjective well-being, 20 studied psychological well-being and 14 studied depressive symptoms. Half of the studies (20) were aimed at adult populations^{29,30,33,51-56,62,63,65,69,71,73,74,76,78,79,81-84}. A substantial number of studies (17) were aimed at college students^{29,32,34,51,58-61,64,66-68,70,72,75,80,85} and two studies were aimed at older subjects^{57,77}. In most studies (26) the PPI was delivered in the form of self-help^{29,30,34,52-56,58,59,61,63-71,73-75,77,78,80,84,85}. Eight studies used group PPIs^{32,33,51,57,60,62,72,76} and five used individual PPIs^{51,79,81-83}. Intensity varied considerably across studies, ranging from a short one-day exercise⁷⁰ and a two-week self-help intervention⁶⁵ to intensive therapy^{51,82,83} and coaching^{33,81}.

Figure 1. Flow diagram

Table 2. Characteristics of randomized controlled trials examining the effects of positive psychology interventions

Author	Intervention	Session (number), duration	Mean age (range or SD)	Delivery	Recruitment	Self-selection	Psychosocial problems / inclusion criteria	Control Group	N analyzed (post-test)	Attrition rate, % (post-test)	Outcome measures	Follow-up (min, 3 months)
Abbott 2009 ³⁸	ResilienceOnline	7, 10w	43	Self help	Organization	Self-selected	None	Waiting list	Ne=26 Nc=27	41.5%	PWB: AHI DEP: DASS-21	-
Boehm 2011 ⁷³	Optimism and gratitude exercise	6, 6w	35.6 (11.4)	Self help	Community	Self-selected	None	Placebo	Ne=146 Nc=74	?	SWB: SWLS	-
Buchanan 2010 ⁴⁶	Doing acts of kindness	10, 10d	26 (18-60)	Self help	University	Self-selected	None	No intervention	Ne=28 Nc=28	0% (? nt)	SWB: SWLS	-
Burton 2004 ⁴⁴	Writing about positive experiences	3, 3d	18.6 (0.95)	Self help	University	Not self-selected	None	Placebo	Ne=48 Nc=42	0%	SWB: PA	-
Cheavens 2006 ⁹⁸	Hope therapy	8, 8w	49 (32-64)	Group	Community	Self-selected	Inclusion criteria unclear	Waiting list	Ne=17 Nc=15	12% 22% T: 18%	PWB: SHS DEP: CES-D	-
Emmons 2006 study 1 ²⁹	Practising gratitude by counting one's blessings	10, 10w	U (students)	Self help	University	Not self-selected	None	Placebo	Ne=65 Nc=67	T: 4%	SWB: Life as a whole, upcoming week, PA	-
Emmons 2006 study 3 ²⁹	Practising gratitude by counting one's blessings	21, 3w	49 (22-77)	Self help	Referral/hospital	Not self-selected	None	No intervention	Ne=33 Nc=32	0% (? nt)	SWB: Life as a whole, upcoming week, PA (self-report and observed)	-
Fava 1998 ⁹²	Well-being therapy	8, 16w	28.4 (6.5)	Individual	Referral/hospital	Self-selected	Diagnosis of MDD or AD, successful response to treatment	TAU	Ne=10 Nc=10	0%	PWB: RPWB DEP: CID, SQ subscale	-
Fava 2005 ⁹³	Well-being therapy	8, 16w	41.9 (12)	Individual	Referral/hospital	Self-selected	Diagnosis of GAD	TAU	Ne=8 Nc=8	20%	PWB: RPWB DEP: CID, SQ subscale	1 yr (not in study)
Feldman 2012 ²⁰	Hopeful goal-directed thinking	1, 1d	18.7 (18-22)	Group	University	Self-selected	None	No intervention	Ne=37 Nc=29	24.7%	PWB: GSHS; PIL	-
Frieswijk 2005 ⁷⁷	Self-management positive bibliotherapy	5, 10w	72.9 (6.2)	Self help	Community	Self-selected	Slightly or moderately frail (>=65 GFI)	Waiting list	Ne=79 Nc=66	18.4% 10.4% T: 14.3%	SWB: SPF-IL PWB: MS	6 m
Gander 2012 ⁷⁴	9 exercises: gratitude visit three times, three letters, strengths, three funny things, social exercises	7, 1w 14, 2w	44.9 (10.07)	Self help	Internet, magazine	Self-selected	None	Placebo	Ne=559 Nc=63	74%	PWB: AHI DEP: CES-D	6m
Goldstein 2007 ⁹⁴	Cultivating sacred moments	15, 3w	(22-44)	Self help	Internet	Self-selected	None	TAU	Ne=35 Nc=38	14.6% 9.5% T: 12.0%	SWB: SWLS PWB: RPWB	-
Grant 2009 ⁷⁹	Executive coaching	6, 8-10w	49.8	Group and individual	Organization	Self-selected	None	Waiting list	Ne=21 Nc=20	18%	DEP: DASS-21	-
Grant 2012 ⁸⁵	Solution-focused coaching	1, 1d	20.5 (5.4)	Self help	University	Self-selected	None	TAU	Ne=117 Nc=108	0% (? nt)	SWB: PA	-
Green 2006 ⁹³	Life coaching and attainment of goals	10, 10w	42.7 (18-60)	Group	Community	Self-selected	None	Waiting list	Ne=25 Nc=25	10.7% 10.7% T: 10.7%	SWB: SWLS, PA PWB: RPWB, SHS	-
Hurley 2012 ²¹	Savoring the moment	14, 2w	19.5 (2.06)	Group / Self help	University	Not self-selected	None	No intervention	Ne=94 Nc=99	37.7% 39.6% T: 38.7%	SWB: PA DEP: BDI	-
King 2001 ¹⁴⁶	Writing about best possible selves	4, 4d	21 (18-42)	Self help	University	Not self-selected	None	Placebo	Ne=19 Nc=16	0%	SWB: PA	-
Kremers 2006 ⁹⁷	Self-management positive group course	6, 6w	64.3 (7)	Group	Community	Self-selected	Single and lonely	No intervention	Ne=46 Nc=73	17.0% 7.6% T: 16.2%	SWB: SPF-IL	6 m
Layous 2012 ²⁶	Best possible selves exercise	4, 4w	19.1 (1.8)	Self help Group	University	Not self-selected	None	Placebo	Ne=80 Nc=37	?	SWB: PA PWB: NS	-
Lichter 1980 study 2 ²⁰	Rehearsal of positive statements	14, 2w	U (students)	Individual	University	Not self-selected	None	Waiting list	Ne=25 Nc=23	0% (? nt)	SWB: AF1 DEP: BDI	-

Luthans 2008 ⁶⁵	Online well-being program (PsyCap)	2, 2w	32.2	Self help	University	Self-selected	None	Placebo	Ne=187 Nc=177	6.0% 4.8% T: 5.5%	PWB-PCQ	-
Luthans 2010 study 1 ⁷²	PsyCap training	1, 2h	21.1 (2.66)	Group	University	Not self-selected	None	Placebo	Ne=153 Nc=89	0%	PCQ	-
Lyubomirsky 2006 study 2 ⁶⁶	Thinking about positive life experiences	3, 3d	19.5 (2.6)	Self help	University	Not self-selected	None	No intervention	Ne=26 Nc=36	0%	SWB-SWLS, PA	-
Lyubomirsky 2011 ⁶⁷	Expressing optimism or gratitude	8, 8w	19.7 (18.46)	Self help	University	Self-selected	None	Placebo	Ne=218 Nc=101	T: 10.1%	SWB-PLA, SWLS, SHS(2)	6 m
Martinez 2010 ⁶⁸	Practising gratitude by counting one's blessings	14, 2w	20.7 (1.5)	Self help	University	Not self-selected	None	Placebo	Ne=41 Nc=34	34.0%	SWB-PA, GA (self-report and observed)	-
Mitchell 2009 ⁶⁹	Online intervention Use your strengths in a new way	3, 3w	37 (18.62)	Self help	Internet	Self-selected	None	Placebo	Ne=48 Nc=54	64.6% 57.4% T: 60.8%	SWB-PWI-A, SWLS, PA, PWB-OTH	3 m
Page 2012 ⁷²	Working for Wellness Program	6, 6w		Group	Organization	Self-selected	None	No intervention	Ne=13 Nc=10	58.1% 66.7% T: 62.3%	DEP-DASS-21 SWB-SWLS, PA, PWB-SPWB	6 month
Peters 2010 ⁷⁰	Positive future thinking	1, 1d	39.7 (10.0)	Self help	University	Not self-selected	None	Placebo	Ne=44 Nc=38	0%	SWB-PA	-
Quoidbach 2009 ⁶⁹	Projecting a positive self in the future	14, 2w	29.7 (21.50)	Self help	University	Not self-selected	None	No intervention	Ne=15 Nc=57	T: 49.5%	SWB-SHS(2)	-
Schueler 2012 ⁶⁸	Package of 2, 4 or 6 positive psychology exercises (active-constructive responding, gratitude visit, life summary, three good things, savoring, strengths)	14, 2w 28, 4w 42, 6w	42.4 (12.1)	Self help	Internet	Self-selected	None	No intervention	Ne=457 Nc=204	54.7% 42.5% T: 55.4%	DEP-CES-D	-
Seligman 2005 ⁷⁰	Strengths exercises (2), gratitude (1), positive thinking (2)	7, 1w	64%	Self help	Internet	Self-selected	None	Placebo	Ne=341 Nc=70	T: 28.8%	PWB-SHI DEP-CES-D	6 m
Seligman 2006 study 1 ⁶¹	Group positive psychotherapy	6, 6w		Group	University	Self-selected	Mild to moderate depressive symptoms (BDI 10-24)	No intervention	Ne=14 Nc=20	26.3% 4.8% T: 15.0%	SWB-SWLS DEP-BDI	3, 6 (in study), 12 m
Seligman 2006 study 2 ⁶¹	Individual positive psychotherapy	14, 12w	U (adults)	Individual	Referral/hospital	Self-selected	Clinical diagnosis of MDD	TAU	Ne=11 Nc=9	15.4% 40.0% T: 28.6%	SWB-SWLS PWB-PPTI DEP-HRSD_ZSRS	-
Shapira 2010 ⁶⁶ ; Mongrain 2011 ⁷¹ ; Sergeant 2011 ⁶⁴ ; Mongrain 2012 ⁷²	Three good things, signature strengths, self-compassion, optimism, compassionate action, gratitude intervention	7, 1w	34 (11.8)	Self help	Internet	Self-selected	None	Placebo	Ne=804 Nc=138	75%	PWB-SHI DEP-CES-D	3 (in study), 6 m
Sheldon 2002 ⁷²	Goal-training program	2, 2w	U (students)	Group	University	Not self-selected	None	Placebo	Ne=36 Nc=42	T: 13.3%	SWB-PA PWB-RPWB	-
Sheldon 2006 ⁷⁴	Gratitude or visualizing positive self	14, 2w	U (students)	Self help	University	Not self-selected	None	Placebo	Ne=44 Nc=24	T: 6.0%	SWB-PA	-
Spence 2007 ⁶¹	Life coaching and attainment of goals	10, 10w	38.6	Individual	Community	Self-selected	None	Waiting list	Ne=20 Nc=17	4.8% 15.0% T: 9.8%	SWB-SWLS, PA PWB-RPWB	-
Wing 2006 ⁷¹	Positive writing	3, 3d	40.3 (18.79)	Self help	Community	Self-selected	None	Placebo	Ne=58 Nc=55	6.3%	SWB-SWLS	-

Abbreviations. U = Unknown; Ne = Number of subjects in experimental group; Nc = Number of subjects in control group; T = Total; nr = Not reported; MDD = Major Depressive Disorder; AD = Anxiety Disorder; GAD = Generalized Anxiety Disorder; AHL = Authentic Happiness Inventory; EASQ = Expanded Attributional Style Questionnaire; GFI = Groningen Frailty Indicator; SWLS = Satisfaction with Life Scales; PA = Positive Affect; SHS = State Hope Scale; PIL = Purpose in Life Test; CES-D = Center for Epidemiological Studies Depression Scale; SQ = Kellner's Symptom Questionnaire; CID = Clinical Interview for Depression; RPWB = Ryff's Scales of Psychological Well-being; MHC-SF = Mental Health Continuum-Short Form; HS = Hope Affect; SHS(2) = Subjective Happiness Scale; GA = Global Appraisals of subjective well-being; PWI-A = Personal Well-being Index for Adults; OTH = Orientations To Happiness; DASS-21 = Depression, Anxiety and Stress Scales; WB6 = 6 well-being questions; SHI = Steen Happiness Index; PPTI = Positive Psychotherapy Inventory; HRSD = Hamilton Rating Scale for Depression; ZSRS = Zung Self-Rating Scale; LSI-A = Life Satisfaction Index-A; GDS = Geriatric Depression Scale; GSIS = Goal-Specific Hope Scale; NS = Needs Satisfaction

Post-test effects

The random effect model showed that the PPIs were effective for all three outcomes. Results are presented in Table 3. The effect sizes of the individual studies at post-test are plotted in Figures 2, 3 and 4.

A composite moderate and statistically significant effect size (Cohen's d) was observed for subjective well-being $d = 0.34$ (95% CI [0.22, 0.45], $p < .01$). For psychological well-being, Cohen's d was 0.20 (95% CI [0.09, 0.30], $p < .01$) and for depression $d = 0.23$ (95% CI [0.09, 0.38], $p < .01$), which can be considered as small.

Heterogeneity was moderate for subjective well-being ($I^2 = 49.5\%$) and depression ($I^2 = 47.0\%$), and low for psychological well-being ($I^2 = 29.0\%$). Effect sizes ranged from -0.09 ⁶⁶ to 1.30 ⁶⁴ for subjective well-being, -0.06 ⁷⁸ to 2.4 ⁸³ for psychological well-being and -0.17 ⁶⁹ to 1.75 ⁸³ for depression.

Table 3. Main effects

Outcome measures	n	N	Studies	Cohen's d (95% CI)	Heterogeneity	Test for overall effect
<i>Post-test</i>						
Subjective well-being	28	Ne=1449 Nc=1265	[29,32-34,51,56-59,61,62,64,66-71,73,75,77,79-81,84,85]	0.34 (0.22 – 0.45)	Q=53.5, df=27, $T^2=0.04$ ($p < .01$); $I^2=49.5\%$	Z=5.82 ($p < .01$)
Psychological well-being	20	Ne=2511 Nc=977	[29,30,32,33,51-55,55,60,62,65,69,74-77,81-84]	0.20 (0.09 – 0.30)	Q=26.8, df=19, $T^2=0.01$ ($p=0.11$); $I^2=29.0\%$	Z=3.65 ($p < .01$)
Depression	14	Ne=2435 Nc=760	[30,51-55,55,61,63,69,74,76,80,82,83]	0.23 (0.09 – 0.38)	Q=24.5, df=13, $T^2=0.03$ ($p=0.03$); $I^2=47.0\%$	Z=3.21 ($p < .01$)
<i>Follow-up</i>						
Subjective well-being	6	Ne=329 Nc=298	[51,57,62,67,69,77]	0.22 (0.05 – 0.38)	Q=5.05, df=5, $T^2=0.00$ ($p=0.41$); $I^2=1.1\%$	Z=2.61 ($p < .01$)
Psychological well-being	6	Ne=1830 Nc=417	[30,52-55,55,62,69,74,77]	0.16 (0.02 – 0.30)	Q=6.8, df=5, $T^2=0.01$ ($p=0.24$); $I^2=26.0\%$	Z=2.20 ($p=.03$)
Depression	5	Ne=1765 Nc=343	[30,51-55,69,74]	0.17 (-0.06 – 0.39)	Q=11.1, df=4, $T^2=0.04$ ($p=0.03$); $I^2=63.9\%$	Z=1.44 ($p=.15$)

n = Number of studies, N = Number of subjects, Ne = Number of subjects in experimental group; Nc = Number of subjects in control group

Removing outliers reduced effect sizes for all three outcomes: 0.26 (95% CI [0.18, 0.33], $Z=6.43$, $p<.01$) for subjective well-being (Burton & King, 2004 and Peters et al., 2010 removed)^{64,70}, 0.17 (95% CI [0.09, 0.25], $Z=4.18$, $p<.01$) for psychological well-being (Fava et al. (2005) removed)⁸³ and 0.18 (95% CI [0.07, 0.28], $Z=3.33$, $p<.01$) for depression (Fava, 2005 and Seligman, 2006 study 2, removed)^{51,83}. Removing the outliers reduced heterogeneity substantially (to a non-significant level).

Subjective well-being

Meta Analysis

Figure 2. Post-test effects of positive psychology interventions on subjective well-being

Psychological well-being

Meta Analysis

Figure 3. Post-test effects of positive psychology interventions on psychological well-being

Depression

Meta Analysis

Figure 4. Post-test effects of positive psychology interventions on depressive symptoms

Follow-up effects

Ten studies examined follow-up effects after at least three months and up to 12 months (Table 3). For the purposes of interpretation, we used only those studies examining effects from three to six months (short-term follow-up), thus excluding Fava et al. (2005)⁸³ which had a follow-up at one year. The random-effects model demonstrated small but significant effects in comparison with the control groups for subjective well-being (Cohen's d 0.22, 95% CI [0.05, 0.38], $p < .01$) and for psychological well-being (0.16, 95% CI [0.02, 0.30], $p = .03$). The effect was not significant for depression (0.17, 95% CI [-0.06, 0.39], $p = .15$). Heterogeneity was low for subjective well-being ($I^2 = 1.1\%$) and psychological well-being ($I^2 = 26.0\%$), and high for depression ($I^2 = 63.9\%$).

Subgroup analyses

Subgroup analyses are presented in Table 4. We looked at self-selection, duration of the intervention, type of intervention, recruitment method, application of inclusion criteria related to certain psychosocial problems, and quality rating.

Table 4. Moderator effects: subgroup analysis (post-test)

Outcome measure	Criteria	Subgroup (study)	n	Cohen's d (95% CI)	Test for subgroup differences
Subjective well-being	Self-selection	Self-selected	15	0.29 (0.18 – 0.39)***	Q=0.64, df=1 (p=.43)
		Not self-selected	13	0.38 (0.17 – 0.60)**	
	Duration	<=4 weeks	17	0.35 (0.18 – 0.52)***	Q=1.84, df=2 (p=.91) Slope=0.01, Z=0.14 (p=.89)
		<=8 weeks	6	0.24 (0.10 - 0.39)**	
		>8 weeks	5	0.43 (0.17 – 0.68)**	
	Type	Self help	20	0.33 (0.20 – 0.46)***	Q=0.20, df=2 (p=.91)
		Group	5	0.38 (0.03 – 0.73)*	
		Individual	3	0.41 (0.01 – 0.81)*	
	Recruitment	Community	6	0.29 (0.11 – 0.48)**	Q=5.36, df=4 (p=.25)
		Internet	2	0.06 (-0.24 – 0.35)ns	
Referral/hospital		2	0.51 (0.08 – 0.95)*		
Psychological well-being		University	16	0.36 (0.19 – 0.53)***	Q=0.10, df=1 (p=.76)
		Organization	2	0.62 (0.11-1.12)*	
	Psychosocial problems	Specific psychosocial problems	4	0.31 (0.09 – 0.52)**	
		None	24	0.35 (0.22 – 0.48)***	
	Quality rating	Low (1-2)	16	0.29 (0.17 – 0.40)***	Q=2.41, df=2 (p=.30) Slope=-0.00, Z=0.08 (p=.94)
		Medium (3-4)	11	0.40 (0.19 – 0.61)***	
		High (5-6)	1	0.05 (-0.34 – 0.44)ns	
	Self-selection	Self-selected	15	0.18 (0.05 – 0.30)**	Q=0.32, df=1 (P=.57)
		Not self-selected	5	0.25 (0.04-0.46) *	
		<=4 weeks	11	0.16 (0.07 – 0.25)***	
Duration	<=8 weeks	2	0.35 (-0.20 – 0.89)ns	Q=1.91, df=2 (p=.39) Slope=0.05, Z=0.95 (p=.34)	
	>8 weeks	7	0.41 (0.03 – 0.79)*		
	Type	Self help	10		0.14 (0.05 – 0.23)**
Recruitment		Group	6	0.26 (0.08 – 0.44)**	Q=3.76, df=2 (p=.15)
		Individual	4	0.81 (-0.01 – 1.63)ns	
		Community	4	0.20 (-0.03 – 0.44)ns	
		Internet	5	0.09 (-0.03 – 0.21)ns	
		Referral/hospital	4	0.91 (0.24 – 1.57)**	
		University	5	0.22 (0.08 – 0.35)**	

Depression	Psychosocial problems	Organization	2	0.18 (-0.43 – 0.78)ns	
		Specific psychosocial problems	5	0.59 (0.00 – 1.18)*	Q=1.93, df=1 (p=.17)
		None	15	0.17 (0.08 – 0.25)***	
	Quality rating	Low (1-2)	10	0.32 (0.07 – 0.58)*	Q=1.86, df=2 (p=.40)
		Medium (3-4)	9	0.15 (0.06 – 0.24)**	Slope=-0.01, Z=-0.45 (p=.66)
		High (5-6)	1	0.29 (-0.11 – 0.68)ns	
	Self-selection	Self-selected	12	0.20 (0.05 – 0.36)*	Q=1.73, df=1 (p=.19)
		Not self-selected	2	0.41 (0.15 – 0.66)**	
	Duration	<=4 weeks	7	0.15 (0.02 – 0.28)*	Q=4.86, df=2 (p=.09)
		<=8 weeks	2	0.47 (-0.02 – 0.97)ns	Slope=0.20, Z=2.32 (p=.02)
		>8 weeks	5	0.68 (0.15 – 1.21)*	
	Type	Self help	8	0.15 (0.03 – 0.27)*	Q=6.99, df=2 (p=.03)
		Group	2	0.47 (-0.02 – 0.97)ns	
		Individual	4	0.88 (0.29 – 1.47)**	
	Recruitment	Community	1	0.48 (-0.23 – 1.18)ns	Q=15.76, df=4 (p<.01)
		Internet	5	0.11 (-0.02 – 0.23)ns	
		Referral/hospital	3	1.14 (0.55 – 1.73)***	
		University	3	0.41 (0.17 – 0.65)**	
		Organization	2	0.22 (-0.18 – 0.63)ns	
	Psychosocial problems	Specific psychosocial problems	5	0.78 (0.35 – 1.21)***	Q=7.65, df=1 (p=.01)
		None	9	0.16 (0.05 – 0.27)**	
	Quality rating	Low (1-2)	7	0.47 (0.26 – 0.67)***	Q=10.14, df=2 (p=.01)
		Medium (3-4)	6	0.15 (0.00 – 0.30)*	Slope=-0.10, Z=-2.26 (p=.02)
		High (5-6)	1	-0.17 (-0.56 – 0.22)ns	

* p<0.05; ** p<0.01; *** p<0.001; ns = non-significant

n = Number of studies

For depression, five out of six subgroups of studies resulted in significantly higher effect sizes. Higher effect sizes were found for 1) interventions of a longer duration (only in the meta regression analysis), 2) individual interventions, 3) studies involving referral from a health care practitioner or hospital, 4) studies which applied inclusion criteria based on psychosocial problems and 5) lower quality studies. For subjective well-being and psychological well-being, there were no significant differences between subgroups, although for the latter there was a recognizable trend in the same direction and on the same moderators, except for quality rating.

Twenty-six out of 39 studies were self-help interventions for which we conducted a separate subgroup analysis. However, there was little diversity within the self-help subgroup: only six studies examined intensive self-help for longer than four weeks, self-help was offered to people with specific psychosocial problems in only one study and more than half of the self-help studies ($n=14$) recruited their participants via university. Consequently, there were no significant differences between subgroups for self-help interventions.

Publication bias

Indications for publication bias were found for all outcome measures, but to a lesser extent for subjective well-being. Funnel plots were asymmetrically distributed in such a way that the smaller studies often showed the more positive results (in other words, there is a certain lack of small insignificant studies). Orwin's fail-safe numbers based on a criterium effect size of 0.10 for subjective well-being (59), psychological well-being (16) and depression (13) were lower than required (respectively 150, 110 and 80). Egger's regression intercept also suggests that publication bias exists for psychological well-being (intercept=1.18, $t=2.26$, $df=18$, $p=.04$) and depression (intercept=1.45, $t=2.26$, $df=12$, $p=.03$), but not for subjective well-being (intercept=1.20, $t=1.55$, $df=26$, $p=0.13$). The mean effect sizes of psychological well-being and depression were therefore recalculated by imputing missing studies using the Trim and Fill method. For psychological well-being, three studies were imputed and the effect size was adjusted to 0.16 (95% CI 0.03-0.29). For depression, five studies were imputed and the adjusted effect size was 0.16 (95% CI 0.00-0.32).

DISCUSSION

Main findings

This meta-analysis synthesized effectiveness studies on positive psychology interventions. Following a systematic literature search, 40 articles describing 39 studies were included. Results showed that positive psychology interventions significantly enhance subjective and psychological well-being and reduce depressive symptoms. Effect sizes were in the

small to moderate range. The mean effect size on subjective well-being was 0.34, 0.20 on psychological well-being, and 0.23 on depression. Effect sizes varied a great deal between studies, ranging from below 0 (indicating a negative effect) to 2.4 (indicating a very large effect). Moreover, at follow-up from three to six months, small but still significant effects were found for subjective well-being and psychological well-being, indicating that effects were partly sustained over time. These follow-up results should be treated with caution because of the small number of studies and the high attrition rates at follow-up.

Remarkably, effect sizes in the current meta-analysis are around 0.3 points lower than the effect sizes in the meta-analysis by Sin and Lyubomirsky (2009)³⁷. We included a different set of studies in which the design quality was assured using randomized controlled trials only. Effectiveness research in psychotherapy shows that effect sizes are relatively small in high-quality studies compared with low-quality studies³⁵ and this might also be true for positive psychology interventions. In addition, we applied stricter inclusion criteria than those used by Sin and Lyubomirsky (2009) and therefore did not include studies on any related areas such as mindfulness and life review therapy. These types of interventions stem from long-standing independent research traditions for which effectiveness has already been established in several meta-analyses^{40,41}. Also, the most recent studies were included. This might explain the overestimation of effect sizes in the meta-analysis by Sin and Lyubomirsky (2009).

Several characteristics of the study moderated the effect on depressive symptoms. Larger effects were found in interventions with a longer duration, in individual interventions (compared with self-help), when the interventions were offered to people with certain psychosocial problems and when recruitment was carried out via referral from a health care professional or hospital. Quality rating also moderated the effect on depression: the higher the quality, the smaller the effect. Interestingly, these characteristics did not significantly moderate subjective well-being and psychological well-being. However, there was a trend in the moderation of psychological well-being that was the same as that observed in the studies which included depression as an outcome. In general, effectiveness was increased when interventions were offered over a longer period, face-to-face on an individual basis in people experiencing psychosocial problems and when participants were recruited via the health care system.

Although it is clear that more intensive and face-to-face interventions generate larger effects, the effects of short-term self-help interventions are small but significant. From a public health perspective, self-help interventions can serve as cost-effective mental health promotion tools to reach large target groups which may not otherwise be reached⁸⁶⁻⁸⁸. Even interventions presenting small effect sizes can in theory have a major impact on populations' well-being when many people are reached⁸⁹. The majority of positive psychology interventions (in

our study 26 out of 39 studies) are already delivered in a self-help format, sometimes in conjunction with face-to-face instruction and support. Apparently, self-help suits the goals of positive psychology very well and it would be very interesting to learn more about how to improve the effectiveness of PPI self-help interventions. However, a separate subgroup analysis on the self-help subgroup revealed no significant differences in the present meta-analysis. There was very little variation in the subgroups as regards population, duration of the intervention and recruitment method. As a result, this analysis does not give firm indications on how to improve the effectiveness of self-help interventions. It is possible that self-help could be enhanced by offering interventions to people with specific psychosocial problems, increasing the intensity of the intervention and embedding the interventions in the health care system. However, more studies in diverse populations, settings and with varying intensity are needed before we can begin to derive recommendations from this type of meta-analysis. Other research gives several additional indications on how to boost the efficacy of self-help interventions. Adherence tends to be quite low in self-help interventions^{90,91} and therefore, enhancing adherence could be a major factor in improving effectiveness. Self-help often takes a 'one size fits all' approach, which may not be appropriate for a large group of people who will, as a consequence, not fully adhere to the intervention. Personalization and tailoring self-help interventions to individual needs⁹² as well interactive support⁹³ might contribute to increased adherence and likewise improved effectiveness of (internet) self-help interventions.

Study limitations

This study has several limitations. First, the quality of the studies was not high, and no study met all of our quality criteria. For example, the randomization procedure was unclear in many studies. Also, most studies conducted completers-only analysis, as opposed to intention-to-treat analysis. This could have seriously biased the results³⁵. However, the low quality of the studies could have been overstated as the criteria were scored conservatively: we gave a negative score when a criterion was not reported. Even so, more high-quality randomized-controlled trials are needed to enable more robust conclusions about the effects of PPIs. Second, different types of interventions are lumped together as positive psychology interventions, despite the strict inclusion criteria we applied. As expected, we found a rather high level of heterogeneity. In the future, it might be wise and meaningful to conduct meta-analyses that are restricted to specific types of interventions, for example gratitude interventions, strengths-based interventions and well-being therapy, just as has already been carried out with, for example, mindfulness and life review. In the present meta-analysis, studies on these specific interventions were too small and too diverse to allow for a subgroup-analysis. Third, the exclusion of non peer-reviewed articles and grey literature could have led to bias, and possibly also to the publication bias we found in our study. Fourth, although

we included a relatively large number of studies in the meta-analysis, the number of studies in some subgroups was still small. Again, more randomized-controlled trials are needed to draw firmer conclusions. Sixth, the study of positive education is an emerging field in positive psychology⁹⁴⁻⁹⁸ but school-based interventions were excluded from our meta-analysis due to the strict application of the inclusion criteria (only studies with randomization at individual level were included).

CONCLUSION

This meta-analysis demonstrates that positive psychology interventions can be effective in the enhancement of subjective and psychological well-being and may help to reduce depressive symptom levels. Results indicate that the effects are partly sustained at short-term follow-up. Although effect sizes are smaller in our meta-analysis, these results can be seen as a confirmation of the earlier meta-analysis by Sin and Lyubomirsky (2009). Interpretation of our findings should take account of the limitations discussed above and the indications for publication bias.

Implications for practice

In mental health care PPIs can be used in conjunction with problem-based preventive interventions and treatment. This combination of interventions might be appropriate when clients are in remission; positive psychology interventions may then be used to strengthen psychological and social recourses, build up resilience and prepare for normal life again. On the basis of the moderator analysis, we would recommend the delivery of interventions over a longer period (at least four weeks and preferably eight weeks or longer) and on an individual basis. Practitioners can tailor their treatment strategy to the needs and preferences of a client and can use positive psychology exercises in combination with other evidence-based interventions that have a positive approach and aim to enhance well-being, such as mindfulness interventions⁴⁰, Acceptance and Commitment Therapy^{7,99}, forgiveness interventions⁴², behavioral-activation¹⁰⁰ and reminiscence^{41,101}.

In the context of public health, positive psychology interventions can be used as preventive, easily accessible and non-stigmatizing tools. They can potentially be used in two ways: 1) in mental health promotion (e.g. leaflets distributed for free at community centers, (mental) health internet portals containing psycho-education), and 2) as a first step in a stepped care approach. In the stepped care model, clients start with a low-intensity intervention if possible, preferably a self-directed intervention. These interventions can be either guided by a professional or unguided, and are increasingly delivered over the internet. Clinical outcomes can be monitored and people can be provided with more intensive forms of treatment, or referred to specialized care, if the first-step intervention does not result in the

desired outcome¹⁰².

Recommendations for research

Regarding the research agenda, there is a need for more high-quality studies, and more studies in diverse (clinical) populations and diverse intervention formats to know what works for whom. Standards for reporting studies should also be given more attention, for example by reporting randomized controlled trials according to the CONSORT statement¹⁰³. In addition, we encourage researchers to publish in peer-reviewed journals, even when the sample sizes are small or when there is a null finding of no effect, as this is likely to reduce the publication bias in positive psychology. Furthermore, most studies are conducted in North America. Therefore, replications are needed in other countries and cultures because some positive psychology concepts may require adaptation to other cultures and outlooks (e.g. see Martinez et al., 2010)⁶⁸. Last but not least, we strongly recommend conducting cost-effectiveness studies aiming to establish the societal and public health impact of positive psychology interventions. This type of information is likely to help policy makers decide whether positive psychology interventions offer good value for money and should therefore be placed on the mental health agenda for the 21st century.

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4

Online positive psychological interventions: state of the art and future directions

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ABSTRACT

Many people make use of the Internet and new technologies, such as mobile apps and social media. Using these resources to disseminate positive psychology interventions offer opportunities for positive psychology to achieve its main goal: to make people flourish. Online interventions can be highly engaging and persuasive, thereby supporting behavioral change and subsequently promoting people's well-being and resilience. This chapter outlines several aspects and applications of online positive psychological interventions. The benefits of online positive psychological interventions and challenges for research and development are addressed. Also, a literature review was conducted on their effectiveness. Already many online positive psychological interventions are available, however, more high-quality research is needed to strengthen their evidence-base.

INTRODUCTION

Since the founding of positive psychology in 1998, positive psychological interventions (PPIs) have advanced considerably. Many interventions have demonstrated efficacy to increase well-being and decrease depressive symptoms (Sin & Lyubomirsky, 2009; Bolier, Haverman, et al., 2013). PPIs can benefit already happy individuals looking to become happier, and also have a role in the whole spectrum of mental health interventions, from mental health promotion to prevention, and treatment (Barry, 2001).

In 2011, Martin Seligman, one of the founders of positive psychology, launched the 'Flourish 51' initiative that set an ambitious goal: by the year 2051, 51 percent of the people of the world will be flourishing (Seligman, 2011). This challenge is addressed to health professionals, government leaders, and every person who wishes to improve well-being.

Reaching the Flourish 51 goal requires considerable work. Even if effective methods to increase well-being exist, simply reaching 51 percent of the world population is a major obstacle. Relatedly, the so-called 'mental health gap' refers to the many individuals in need of mental health services lacking access to quality interventions (Kohn, Saxena, Levav, & Saraceno, 2004). Explanations for this gap include limited resources (e.g., money, therapists) and a lack of awareness and recognition of the seriousness of mental disorders. This health gap extends to people with subclinical symptoms, who rarely receive help for such distress; for example, subclinical depressive symptoms are highly prevalent and still lead to serious individual impairment, loss in productivity, and increased health care uptake (Cuijpers & Smit, 2008). Delivering positive psychological interventions could contribute to the Flourish 51 goal and help narrow the mental health gap. People with stress, anxiety, depression, and those simply looking to increase their well-being may be easier reached with a well-being approach as opposed to a problem-focused approach (Parks, Schueller, & Tasimi, 2013). People may be more attracted to these kinds of interventions, as they identify more with the well-being message.

In addition, in order to close the health gap and allow people to flourish, we need to design interventions that are 'non-consumable' (Muñoz, 2010). 'Non-consumable' interventions are those that can be used repeatedly to benefit more people without being used up (e.g., therapists' time, medication). Given the capability of repeated use, 'non-consumable' interventions, such as self-help, are particularly applicable outside the boundaries of the traditional local health care systems. Many PPIs are already delivered in self-help formats (Sin & Lyubomirsky, 2009; Bolier, Haverman, et al., 2013).

New information and communication technologies (ICT) and the World Wide Web offer

an excellent platform to disseminate 'non-consumable' self-help well-being interventions. Worldwide Internet penetration currently stands at 34%, but is much higher in North America (79%) and Europe (63%; Internet World Stats, 2012). In total, more than two billion people use the Internet with access continuing to rise in both the developed and developing countries.

The use of technology and the Internet can also help to increase engagement in positive self-help interventions. Even if people read self-help books, sustained benefit requires translating the acquired knowledge into practice. Devoting the time and effort necessary for sustainable behavioral change often requires some external support. New technologies can potentially increase engagement and translation into real life by leveraging features that create intrinsic rewards and social connectivity (McGonigal, 2011). By expanding access and increasing engagement, new technologies and delivery of interventions via the Internet suit the goals of positive psychology and the Flourish 51 initiative

This chapter will address the following questions: what are online positive psychological interventions (oPPIs)? Who uses oPPIs? What are the benefits disseminating PPIs via the Internet? What oPPIs are currently available and what do we know about their effectiveness? What are the future challenges for oPPIs?

WHAT ARE ONLINE POSITIVE PSYCHOLOGICAL INTERVENTIONS?

Definition of online interventions

In this chapter we focus on online interventions offered directly to users. Ritterband and colleagues (2003) define online interventions as: "Interventions typically focused on behavioral issues, with the goal of instituting behavior change and subsequent symptom improvement. They are usually self-paced, interactive and tailored to the user, and they make use of the multimedia format offered by the Internet" (pg. 527). Given the growing dissemination of interventions in mediums beyond just the Internet (e.g., mobile applications, virtual reality, sensors) other terms have been offered (i.e., behavioral intervention technologies, 'BITs'; Mohr, Burns, Schueller, Clarke, & Klinkman, 2013). In this article, however, we use 'online interventions', because this term is (still) adopted more widely.

Online interventions differ on several features (see Ritterband et al., 2003; Proudfoot et al., 2011) including:

1. *Hardware.* Online interventions are offered and accessed via personal computers, tablets (e.g. an iPad), and/or mobile phones.
2. *Professional support.* Interventions vary from self-help with no support, e-mail or telephone support, to adjunct interventions integrated for use within face-to-face interventions.

3. *Program interactivity.* High levels of interactivity help engage people. Online interventions can achieve this through self-tests and feedback, interactive exercises, SMS or e-mail reminders, chat sessions, or games and gaming elements.
4. *Multimedia channels.* The number and type vary widely across interventions (e.g. Animations, videos, audio podcasts, images and 3D virtual reality).
5. *Length and flexibility.* Online interventions span simple, one-time exercises, highly structured extended programs, and highly personalized interventions.
6. *Sharing opportunities.* Consistent with trends in Web 2.0, online interventions increasingly allow for sharing of ideas, emotions and social support. Social media channels, such as Twitter and Facebook, are gaining in importance in online interventions and empower their participants through interaction with others.

Online positive psychological interventions

In the context of positive psychology, oPPIs expand on definitions of online interventions by including 'improvement of well-being and resilience' in addition to 'symptom improvement' (Mitchell, Vella-Brodrick, & Klein, 2010). The use of online interventions began during early evaluation of positive psychology interventions aimed to increase well-being in the general population (Seligman, Steen, Park & Peterson, 2005).

Since then, a vibrant movement in positive psychology is aimed at using opportunities provided by technology and the Internet to support people's flourishing. These include 'positive computing' or "The study and development of information and communication technology that is consciously designed to support people's psychological flourishing in a way that honors individuals' and communities' different ideas about the good life" (Sander, 2011, pg. 311) and 'positive technology' or "The use of technology to improve the quality of our personal experience with the goal of increasing wellness, and generating strengths and resilience in individuals, organizations, and society" (Botella et al., 2012, pg. 78).

oPPIs align with both these movements. Positive computing and technology look further than just adding another theme (well-being) to the range of online intervention themes (such as depression, alcohol et cetera). It aims to improve human experience and engage people to reach their targets in real life, which is clearly aligned with the goals of positive psychology.

For whom?

Many people use the Internet for health-related purposes. Besides the long-standing interest in symptoms and medical diagnosis, there is a growing interest in information related to well-being and healthy lifestyle behaviors (Evers, 2006). Relatedly, a large target group for oPPIs

exists, including anyone with Internet access who is interested in the enhancement of well-being, health and resilience. Although, one might expect that many of these people would be free of psychiatric symptoms, it has been found that many of the people seeking self-help to improve their well-being have sub-clinical to even rather severe depressive symptoms (Parks, Della Porta, Pierce, Zilca, & Lyubomirsky, 2012).

If oPPIs are effective at reducing sub-clinical or clinical levels of distress, they may be a helpful complement to existing mental health resources. Muñoz (2010) offers several examples of how online interventions can be used in addition to other forms of health care for individuals in need, including while on waiting lists for other interventions, as an adjunct intervention during routine care, and after treatment, in order to prevent relapse or recurrence. Furthermore, oPPIs might be used as preventive interventions, to avoid the need for later treatment (Wiederhold & Riva, 2012). Thus, oPPIs provide options across whole spectrum of mental health interventions, from health promotion and prevention to cure and care (Barry, 2001).

POSSIBLE BENEFITS OF ONLINE POSITIVE PSYCHOLOGICAL INTERVENTIONS

Self-management/Empowerment

oPPIs can engage and empower participants to take charge of their own health and well-being. oPPIs stimulate self-management skills by providing participants with tools to guide their behavior, thoughts, and interactions (see also section entitled 'Persuasion' below). Participants can even get support and/or information from other participants, who provide expertise based on their own experiences. The Health 2.0 movement emphasizes 'patient empowerment' by promoting a collaborative approach between patients, caregivers, and professionals. In this approach, the participant is an active and responsible partner in his/her own health and care pathway (Van de Belt, Engelen, Berben, & Schoonhoven, 2010; Swan, 2009). Social media, such as Facebook and Twitter, can be a valuable tool in promoting collaboration and support.

Population Strategy by High Scalability

Automated self-help interventions are, at least in terms of their potential, highly scalable as the world-wide web has significant population penetration. A 'population strategy' views health and well-being as an issue for populations as well as for individuals (Rose, 1992). It proposes that greater benefits to overall public health can be expected with small boosts in mean levels of health within the population. For positive psychology, a small increase in population well-being may have a larger promoting and preventive effect than treating the small group of people already suffering of mental illness (Huppert, 2009). In this way,

interventions with small effect sizes but that reach large groups can still have a major impact on populations' well-being, especially when costs are low. oPPIs meet these criteria as they are low cost, empowering and easily accessible.

EFFECTIVENESS OF ONLINE POSITIVE PSYCHOLOGICAL INTERVENTIONS

Example of online positive psychological interventions

In the boxes, we present a non-exhaustive selection of oPPIs. These interventions provide examples of existing programs that are appealing and engaging. Although, some lack empirical support (i.e., randomized controlled trials).

Case 1: Psyfit.nl (The Netherlands, Trimbos Institute). Psyfit (www.psyfit.nl) is an online unguided self-help intervention that aims to enhance well-being and reduce depressive symptoms. Designed for the general population, it can also be used within a stepped care approach (i.e., offering minimal care first and more intensive care if warranted) for the prevention and treatment of depression. Participants tailor the intervention program to meet their personal needs and monitor their progress through self-administered tests. The program consists of six modules with 4 lessons each. The modules are (1) mission and goals, (2) positive feelings, (3) positive relationships, (4) living in the moment, (5) optimistic thinking, and (6) mastering your life (Bolier, Kramer, et al., 2013). This program is also discussed in the literature review of randomized controlled trials.

Case 2: The Happiness Coach (Belgium, ISW Limits & Christelijke Mutualiteit). Based on Psyfit, the happiness coach was developed in Belgium (gelukscoach.plukjegeluk.be) as a comprehensive intervention and part of a broader, 'Seize your happiness,' campaign. The program uses the metaphor of people traveling along a subway and provides a railway map to guide people to their preferred happiness strategies. It includes information, advice, and interactive exercises aimed to change behavior. In one year more than 10,000 people registered for this program (Vansteenkoven, 2011).

Case 3: Live Happy iPhone app (USA, Signal Patterns). In 2008, Signal Patterns launched the Live Happy iPhone app as the first mobile application in positive psychology based on empirically-based principles. The content drew on the comprehensive work of Sonja Lyubomirsky and contained key elements from her book 'The How of Happiness' (Lyubomirsky, 2008) and well-known positive psychological exercises, such as savoring the day, doing kind things and a gratitude journal. In an Experience Sampling Methodology study, mood and happiness improved significantly following use of one or more of the exercises (Parks et al., 2012), demonstrating the effectiveness of these interventions in naturalistic settings.

Online positive psychological interventions, a review of randomized controlled studies

Several meta-analyses demonstrate the efficacy of online interventions for a wide range of problems including depression and anxiety (Spek et al., 2007) and problematic alcohol use (Riper et al., 2009). In positive psychology, however, results have been less conclusive. A review of online positive psychological interventions identified five studies with three demonstrating improved well-being and three yielding significant decreases in depressive symptoms (Mitchell et al., 2010).

As research on online interventions is accumulating rapidly, we present an updated review to provide a more current overview of the evidence. We used Mitchell et al.'s (2010) study as a starting point and included additional studies retrieved using the following search terms in PsycINFO and PubMed: well-being, happiness, positive psychology, e-health, Internet, intervention, effectiveness, and efficacy. We consulted international colleagues for additional studies that may have been missed. The main inclusion criterion was an examination of the effects of an oPPI using a randomized research design. We used the term 'online' broadly and included interventions that used recruitment procedures and plain instructions via the Internet or e-mail (even if they contained no interactive features which is a hallmark of online interventions).

In total, eleven studies were found, ten of which measure well-being and one measured only depressive symptoms (see Table 1: Characteristics of studies). Seven of the ten studies measuring well-being found significant increases (Bolier, Kramer, et al., 2013; Gander et al., 2012; Layous, Nelson, & Lyubomirsky, 2013; Luthans, Avey, & Patera, 2008; Mitchell, Stanimirovic, Klein, & Vella-Brodick, 2009; Seligman et al., 2005; Shapira & Mongrain, 2010). Furthermore, of the eight studies measuring depression, five found significant decreases in symptoms (Bolier, Kramer, et al., 2013; Gander et al., 2012; Parks-Sheiner, 2009; Seligman et al., 2005; Shapira & Mongrain, 2010). For significant findings, effect sizes were mostly small. However, given that these interventions were often self-help in nature, this is in line with the results of a previous meta-analytic reviews of PPIs that found that self-help interventions were typically associated with small effect sizes as opposed to the medium to large effects produced by more intensive face-to-face interventions (Sin & Lyubomirsky, 2009; Bolier, Haverman, et al., 2013).

Three studies found no significant effects on well-being (Abbott, Klein, Hamilton, & Rosenthal, 2009; Goldstein, 2007; Parks-Sheiner, 2009). It is difficult to explain the findings by Abbott et al. (2009) and Parks-Sheiner (2009). Adherence and motivational factors may have played a role in the results achieved by the online programs, which were both fairly demanding. The non-significant result in the study of Goldstein (2007) is more easily explained, as the comparison condition was care-as-usual and both conditions resulted in improvements.

Based on this result, oPPIs could be considered as an acceptable alternative intervention, especially when available resources might be able to provide only online interventions rather than other care. Three studies indicated no significant improvement on depression levels compared to the control group (Mitchell et al., 2009; Abbott et al., 2009; Schueller & Parks, 2012). In the studies of Mitchell et al. (2009) and Abbott et al. (2009), lack of significant findings might be due to low levels of depressive symptom levels at baseline providing little room for improvement.

More than half of the interventions in the studies were single component interventions (Gander et al., 2012; Goldstein, 2007; Layous et al., 2013; Mitchell et al., 2009; Seligman et al., 2005; Shapira & Mongrain, 2010). The others were comprehensive multi-component interventions (Abbott et al., 2009; Bolier, Kramer, et al., 2013; Luthans et al., 2008; Parks-Sheiner, 2009; Schueller & Parks, 2012). Based on the available data, no clear conclusion can be drawn as to which type of intervention is more effective, as both produced some studies with significant results and others with non-significant differences. Results from Schueller and Parks (2012) suggest that more exercises and content might not lead to increased benefits, as the 2-exercise and 4-exercise condition were more effective compared to the 6-exercise condition. More experimental studies that vary intensity, variety, and duration could provide more evidence to guide the question of single exercises vs. extended programs.

Seligman et al. (2005) found the strongest effects for the 'Three good things' and 'Using your strengths in a new way' exercises (sustained effects on well-being and depression after 6 months). Notably, however, these effects were only partly replicated in the later study of Gander et al. (2012) in which effects were marginal, and a study by Mongrain and Anselmo-Matthews (2012) which found only effects on well-being but not depression for these interventions.

It is important to underscore the limitations of these evaluations. Many trials had high drop-out rates, a common problem in online trials (Eysenbach, 2005). Although, four of the eleven studies conducted intention-to-treat analysis (Abbott et al., 2009; Parks-Sheiner, 2009; Bolier, Kramer, et al., 2013; Mitchell et al., 2009) that attempt to address drop-out and reduce bias by including every participant in the analysis, the other studies conducted only a completers-only analysis, which includes those who complete all questionnaires. A completers-only analysis biases the results and limits the generalizability when factors (e.g., motivation, personality, disorder) correspond to differential dropout.

In conclusion, some empirical data supports the hypothesis that online positive psychological interventions can effectively enhance well-being and reduce depressive symptoms, in the short and long-term. However, effects for online programs appear to be smaller than offline

programs indicating an 'effectiveness gap' (Mitchell et al., 2010). Only one study directly compared an online and offline intervention, showing no differences between them (Layous et al., 2013). Despite this preliminary evidence, more research is needed to extend the current body of evidence. Future studies should also address more nuanced questions including examining mediation and moderation to determine what works and for whom.

Table 1. Characteristics of studies on the effectiveness of online positive psychological interventions

Study	Intervention	Session (number), duration	Population	Outcome measures	Control group	N analyzed	Attrition rate	ITT (Y)/CO	Time points	Results	Cohen's d (pooled)
Abbott, 2008	ResilienceOnline, program to enhance resilience	7, 10w	Working adults	PWB: AHI DEP: DASS-21, WHOQOL-BREF	Waiting list	Ne=26 Nc=27	41.5%	Y	Pre, Post	No significant differences between groups on well-being, depression, anxiety, stress or quality of life	-0.06 (PWB) 0.11 (DEP)
Bolier, 2013	Psyfit, online well-being self-help program to improve mental fitness	4, 4w	Adult population (moderately depressed)	PWB: MHC-SF DEP: CES-D	Waiting list	Ne=143 Nc=141	24.6% at post 37.3% at 6 months	Y	Pre, Post, 6m	Significant improvement in PWB and reduction in depressive symptoms at post test, for depression still significant at follow up.	0.27 (PWB) 0.36 (DEP) (Post) 0.01 (PWB) 0.35 (DEP) (6m)
Gander, 2012	9 exercises: gratitude visit, 4 good things (1 and 2 weeks), strengths, 3 funny things, social exercises	7, 1w 14, 2w	Adult sample	PWB: AHI DEP: CES-D	Placebo (Early memories)	Ne=559 Nc=63	74%	N	Pre, Post, 1m, 3m, 6m	Significant improvement in PWB for all exercises (except 3 good things over 2 weeks) at at least one time period. Significant reduction of depression in 5 out of 9 exercises (not in the three good things). Largest effects for signature strengths and 3 funny things.	0.10 (PWB) -0.05 (DEP) (Post) 0.27 (PWB) -0.07 (DEP) (6m)
Goldstein, 2007	E-mail program Cultivating sacred moments	15, 3w	Adult sample	SWB: SWS PWB: RPWB	Treatment as usual (therapeutic writing)	Ne=35 Nc=38	12%	N	Post, 6w	No differences between groups. Both conditions showed significant positive effects for SWB and three out of six areas in PWB. Effects were partly sustained at follow up.	0.06 (SWB) -0.02 (PWB) (Post)
Layous, 2013	Best possible selves exercise	4, 4w	Students	SWB: PA PWB: NS	Placebo (Neutral writing)	Ne=31 Nc=38	Unknown	N	Pre, Post	Significant improvement in SWB, non-significant improvement in PWB. Online format just as effective as in-person format.	0.56 (SWB) 0.24 (PWB) (Post)
Luthans, 2008	Online well-being program (PsyCap)	2, 2w	Working adults	PWB: PCQ	Placebo (Decision-making exercise)	Ne = 187 Nc = 177	5.5%	N	Pre, Post	PWB (PsyCap) significantly increased	0.23 (PWB)
Mitchell, 2009	Use your strengths in a new way Online	3, 3w	Adult community sample	SWB: PWI-A, SWS: PA PWB: OTH DEP: DASS-21	Placebo (Information only) Treatment as usual (Problem solving)	Ne = 48 Nc = 54	69.9% at post 83.1% at 3 months	Y	Pre, Post, 3m	Significant increase in cognitive component of SWB (as measured with the PWI-A, not with the SWS), and not for the affective component. No significant decrease in mental symptoms	0.07 (SWB, PWI-A: 0.20) 0.01 (PWB) - pleasure scale: 0.13) 0.06 (DEP) (Post)
Parks, 2009 (unpublished)	Online Positive Psychotherapy	42, 6w	Mild to moderately depressed adults	SWB: SWS, PANAS DEP: CES-D	Waiting list	Ne = 125 Nc = 142 (3m)	47.6% at post	Y	Pre, Post, 1m, 3m	Significant decrease in 3 month follow-up in depressive symptoms in PPT group, but no significant improvement in the PPT group for well-being, (significant deterioration of well-being in the control group)	0.21 (DEP) 0.07 (SWB: SWS) -0.50 (SWB: PA) (3m)

Schueler, 2012	Group PPT: package of 2, 4 or 6 positive psychology exercises (active-constructive responding, gratitude visit, life summary, three good things, savoring, strengths)	14, 2w 28, 4w 42, 6w	Mild to moderately depressed adults	DEP: CES-D	No intervention	Ne=457 Nc=204	55.4%	N	Pre, every week during 6 weeks	Significantly fewer depressive symptoms in both the 2-exercise condition and the 4-exercise condition in comparison to the 6-exercise condition. No significant difference (only numerically) with the control group	0.14 (DEP, 2 exercises) 0.16 (DEP, 4 exercises) 0.02 (DEP, 6 exercises)
Seligman, 2005	Strengths exercises (2), gratitude (1), positive thinking (2), send by e-mail	7, 1w	Adult sample (moderately depressed)	PWB: SHI DEP: CES-D	Placebo (earliest memories)	Ne = 341 Nc = 70	28.8%	N	Pre, Post, 1m, 3m, 6m	PWB and DEP: At 6 month follow-up significant effects for Three good things and Using signature strengths. At 1 month post-test significant effect for Gratitude visit.	0.01 (PWB) 0.17 (DEP) (Post) 0.06 (PWB) 0.14 (DEP) (6m)
Shapira 2010; Mongrain 2011; Sergeant 2011; Mongrain 2012	Three good things, signature strengths, self-compassion, optimism, compassionate action, gratitude intervention	7, 1w	Adult community sample (moderately depressed)	PWB: SHI DEP: CES-D	Placebo (earliest memories)	Ne = 118 Nc = 70	25% at post 75% at 6 m	N	Pre, Post, 1m, 3m, 6m	Significant increases in well-being and decreases in depression up to 3-6 months. On the whole, the effects on well-being are smaller than for depression	0.11 (PWB) 0.25 (DEP) (Post) 0.14 (PWB) 0.36 (DEP) (3m)

Abbreviations - SHI = Steen Happiness Index; CES-D = Centre for Epidemiological Studies – Depression scale; SWLS = Satisfaction With Life Scale; PANAS = Positive And Negative Affect Scale; PWI-A = Personal Well-being Index; MHC- SF; Mental Health Continuum – Short Form; PCQ; PsyCap Questionnaire; OTH = Orientations to Happiness; WHOQOL-BREF = World Health Organization Quality of Life – Brief Version; DASS-21 = Depression Anxiety Stress Scale; SWB = Subjective Well-being; PWB = Psychological Well-being; DEP = Depression; PA = Positive Affect; NS = Need satisfaction; w = week; m = month; ITT = Intention-to-treat analysis; CO = Completers Only analysis

THE FUTURE OF ONLINE POSITIVE PSYCHOLOGICAL INTERVENTIONS

Research to date shows that Internet dissemination of positive psychological interventions holds promise for mental health and well-being. However, actual large scale delivery and uptake of oPPIs lags this potential. Addressing several questions, however, could help realize this potential such as: what is necessary to make oPPIs work in the real world? Can alternative research designs (e.g., besides randomized clinical trials) inform development and implementation? What innovations have to be made to keep up with new technologies? In this part of this chapter we explore some of the ways in which oPPIs could address these issues in the future.

Persuasion

Improving well-being is a dynamic and active process. People have to take action and change their behavior, cognitions and attitudes to reach this goal. Lyubomirsky et al. (2011) conclude that increasing well-being requires effective positive psychology exercises, motivation and continuous effort devoted to the interventions, and an individual 'fit' with the personality, motives, strengths and needs of the person completing the intervention (see also Schueller, this volume). Persuasive elements in oPPIs can promote adherence and improve effectiveness by helping people stay involved. Technical design elements within an online intervention can arouse and prolong motivation for sustained behavioral change even in the absence of professional support (Fogg, 2003). A systematic review suggested that persuasive elements in interventions explain a substantial amount of the variance in adherence and intervention effectiveness (Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012). Therefore, it is recommended that oPPI designs learn from the literature on persuasive design, especially because the examination of persuasive elements in oPPIs is still scarce. Following the Persuasive System Design-model (Oinas-Kukkonen & Harjumaa, 2012), designers are advised to consider for example:

- *Tailoring content* and instructions to the participants' needs, interests, strengths profiles or personality. Some empirical evidence shows that tailoring positive psychology exercises can indeed effectively enhance intervention engagement and adherence (Schueller, 2010; 2011).
- *Prompts and reminders*: messages or brief feedback via e-mail, SMS or social media. Prompts can be automated but can also be tailored to the specific needs of a participant. This can lead to a greater exposure and therefore a more effective intervention (Fry & Neff, 2009; Crutzen et al., 2011).
- *Goal setting and action planning*: the opportunity to set goals and to make an action

plan through a website has a significant effect on desired behavior and may lead to prolonged exposure to the intervention (Webb, Joseph, Yardley, & Michie, 2010).

- *Serious gaming and storytelling.* Video games can attract and maintain attention and offer an opportunity for positive psychology to make exercises challenging and fun (Baranowski, Buday, Thompson, & Baranowski, 2008). They link very closely to the aims of positive psychology because (many) people inherently enjoy the activity of playing, and the gaming experience can be applied to change real life behavior (McGonigal, 2011).
- *Self-monitoring.* Self-screening and monitoring of personal well-being status can actively support the achievement of goals. Online questionnaires can support this, but a more convenient option is to monitor using mobile apps that might even be able to collect data passively.
- *Social support and sharing.* Social influence is a powerful persuasive strategy to motivate people. Online interventions can facilitate learning by demonstrating the behavior of others (social learning) and can shape behavior by providing comparisons to one's past performance or the performance of others (social comparison). Online based social platforms (e.g., peer groups) can facilitate sharing of experiences and supporting change (Swan, 2009). Social networks, such as Facebook and Twitter, can also be used in online interventions to bring people together and disseminate ideas and interventions (Swan, 2009; McGonigal, 2011). Positive psychology exercises (i.e., three good things) have already been set up as a Facebook application (Munson, Lauterbach, Newman, & Resnick, 2010).

Quality standards for interventions

Although qualified positive psychology professionals, researchers, organizations, and institutions develop online interventions, commercial developers also create these sites. Multiple contributors advance the development of oPPIs and may promote interdisciplinary collaboration between positive psychology professionals, technologists, and commercial developers to create novel applications of positive psychological theory. However, to protect consumers, the merits of these interventions need to be addressed. A quality seal for oPPIs could help consumers choose from the many interventions that populate the web. Although international quality standards for online interventions have not yet been developed, a certifying instrument and quality seal has been developed in the Netherlands for this purpose (Fischer, Nabitz, & Riper, 2010). A collaborative project between the Trimbos Institute and the health care agencies for the Ministry of Health provides potential participants with a comprehensive review of the quality of online interventions. Each intervention undergoes

a systematic quality evaluation. Furthermore, participants can review the interventions themselves by completing an online rating questionnaire. Interventions that promote well-being or resilience will be part of this evaluation process. The Beacon website is a similar initiative that provides a database of Internet and mobile interventions along with a summary of the research evidence intended for a lay audience (Christensen et al., 2010).

A quality system for oPPIs should at least cover four main criteria:

1. *User friendliness*: This criterion includes items such as usability, contact possibilities and quality of service, and the professionalism of the design (look and feel).
2. *Effectiveness (Evidence based)*: This aspect emphasizes the importance of the research basis for the program and evidence of its benefits.
3. *Transparency*: The developer of an online intervention should provide full access to information about the organization behind the intervention, the developers, the costs involved, possible contraindications, objectives of the program, amount of time a participant is expected to use the intervention in order to get positive results, and privacy issues.
4. *Technical aspects and security*: The organization responsible for the intervention should guarantee the availability of the program (uptime), scalability and security in terms of data protection, software updates, installation of security patches and back-up.

Quality standards for research designs

The real world impact of online interventions is sometimes questioned because of the disparity between the positive effects found in RCTs, and the outcomes produced when disseminated in naturalistic settings or to widespread audiences. Although RCTs are needed to establish efficacy of online positive psychological interventions, other forms of research are necessary to ensure a good fit between the technology, the participants and the dissemination context. Traditional RCTs alone are insufficient to keep up with the rapid pace at which technology develops and thus oPPIs evolve. Van Gemert-Pijnen et al. (2011) propose a holistic framework for the design, evaluation and implementation of online interventions that is useful for researchers, developers, and marketers of oPPIs. The framework recommends a mixed-method approach, combining both qualitative and quantitative methods. In the early stages of development, formative evaluation aims to improve the product through a cyclic, iterative design process. This process should involve the relevant stakeholders (end-users, professionals who are going to work with the product, health-care providers, etc.). Important elements during this development stage include testing prototypes, assessing usability, and conducting a requirements analysis to facilitate subsequent up scaling. Process evaluations,

including small-scale pilot testing of initial prototypes, can identify considerations or problems for future implementation and dissemination. Summative evaluation is necessary after developing the intervention. This includes addressing the benefits to well-being and actual use of the intervention and may involve conducting a RCT.

Evaluating online intervention trials involve specific challenges and issues (Proudfoot et al., 2011). For example, as previously mentioned, poor adherence and high drop-outs are typical of online trials (Eysenbach, 2005), and also in positive psychology (e.g. Mongrain & Anselmo-Matthews, 2012; Bolier, Kramer, et al., 2013). In RCTs it is justly recommended to conduct an analysis of everyone included in the trial, regardless of drop-out status (intention-to-treat analysis, ITT). As a sensitivity analysis, we recommend conducting completers-only analyses as well to better understand of the characteristics of the subpopulation that did not drop-out and the effects of the intervention for this group. Another critical issue is to evaluate not just well-being outcomes, but adherence, or the actual use of the intervention as well. This can be assessed via analyzing web statistics: log files, login times and unique webpage viewing, if technological features are created to capture this data. Use data may link to outcomes or provide additional information useful for subsequent development and refinement of oPPIs. Perceived usefulness of the program assessed using participant satisfaction rates should also contribute to the evaluation process (Danaher & Seeley, 2009).

Creating a business model

In order to facilitate the upscaling of oPPIs to the mass market it is crucial that they are developed on the basis of a sustainable business model. This model should define how the intervention will generate revenue for the continued maintenance, hosting and updating, along with an implementation strategy. Implementation must ensure that the oPPI will achieve its full potential under real-world conditions and circumstances (Van Limburg et al., 2011). For most oPPIs, it is unlikely that they will be covered through insurance as they are wellness-based and not illness-based. To make them accessible to the general public, the developer should carefully consider the balance between the needed revenue stream and affordability for the user.

Another possibility for oPPIs to generate revenue would be to provide 'the software of the program as a service' (SAAS) to stakeholders such as health care institutions, hospitals, schools, and companies. They could integrate the information, tools and modules into their websites to add value to their products and services by providing oPPIs to clients and/or workers. Costs could be paid for with the funds generated from the licenses.

Co-creation also has the potential to contribute to the development of a sustainable model for oPPIs, by leveraging resources from different stakeholders to keep the cost low for

each individual. For example, cooperation may be possible with a hosting provider, an ICT company or with a university in exchange for research data.

CONCLUSION

The available literature shows that the field of online interventions provides positive psychology researchers and practitioners with many opportunities to develop enjoyable, engaging and scalable interventions. Preliminary evidence suggests that some oPPIs can effectively enhance well-being and reduce depressive symptoms. However, the mixed findings within the small number of studies suggests that much remains to be learned about which oPPIs are effective and what are their effective ingredients. Researchers and practitioners interested in oPPIs should learn from related fields and integrate principles of persuasive technology design to enhance the use and efficacy of these interventions. oPPIs need to take full advantage of the technological medium to be highly interactive, personalized, and supportive of the intrinsic motivation of participants. In addition, researchers and developers should consider how the development and evaluation differ for online interventions in comparison to their offline counterparts.

Not only do new technologies offer a convenient way of delivering established interventions, it can also have a profound impact on how we shape our lives and how we relate to one another. Sanders (2011) describes the process of 'democratization' of positive psychology through the use of new technologies: knowledge becomes available to a greater number of people, and they can use it in accordance with their own values to make their lives happier and more meaningful. The general public can use oPPIs without professional guidance to enhance their well-being and lead more fulfilling lives. Policymakers, companies, psychologists, and practitioners can provide these resources as stand-alone interventions, as first line treatments in stepped care programs, or as supplements to face-to-face, traditional interventions. The challenge we are faced with is to develop interventions that are based on research of the highest possible quality, the most up-to-date knowledge, and novel uses of emerging technology to make a true contribution to human flourishing.

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Part three

**Effectiveness and cost-effectiveness of two online positive
psychological interventions:**

Psyfit.nl and Mentalvitality@work

5

An Internet-based intervention to promote mental fitness in mildly depressed adults: design of a randomized controlled trial

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ABSTRACT

Background. Investing in mental well-being is considered a supplement to current mental health service delivery in which the treatment and prevention of mental disorders are core components. It may be possible for people to enhance their well-being by boosting their “mental fitness.”

Objective. Psyfit, an online, multi-component, fully automated self-help intervention, was developed with the aim of improving well-being and reducing depressive symptoms. The efficacy and cost-effectiveness of this intervention will be examined in a randomized controlled trial.

Methods. In this two-armed randomized controlled trial, a total of 290 participants will be assigned to use Psyfit (experimental condition) or to a 6-month waiting list (control condition). Adults with mild to moderate depressive symptoms interested in improving their mental fitness will be recruited from the general population through advertisements on the Internet and in newspapers. Online measurements by self-assessment will be made prior to randomization (pre-test), 2 months after baseline (post-test), and 6 months after baseline (follow-up).

Results. The primary outcome is well-being. Secondary outcomes are depressive symptoms, general health, vitality, and economic costs. Analysis will be conducted in accordance with the intention-to-treat principle.

Conclusions. This study will examine the efficacy and cost-effectiveness of an online intervention that aims to promote well-being in people with elevated levels of depressive symptoms. If shown to be effective, the intervention could prove to be an affordable and widely accessible intervention to improve well-being in the general population.

Trial Registration. The study is registered with the Netherlands Trial Register, part of the Dutch Cochrane Centre (NTR2126).

INTRODUCTION

Depression, anxiety disorders, and alcohol dependency are highly prevalent mental disorders (Alonso et al., 2004a; Bijl, Ravelli, & van Zessen, 1998) and among the 10 disorders with the greatest disease burden (WHO, 2004). These disorders are associated with reduced quality of life (Alonso et al., 2004b) and high economic costs due to productivity losses and high levels of health service uptake (Smit et al., 2006). In addition, many more people suffer from poor well-being (Keyes, 2007), subclinical depression (Cuijpers & Smit, 2008), and stress at work (Milczarek, Schneider, & Eusebio, 2009) putting them at greater risk of developing a mental disorder later on. In the current dynamic and innovative knowledge- and service-driven economy, more people are faced with mentally demanding jobs. This places unique demands on people's emotional, social, and cognitive capacities (Walburg, 2008; Weehuizen, 2008). Countries are challenged by the adverse consequences stemming from these demanding circumstances, such as burnout, absenteeism, and subsequent economic costs. Therefore, it is important to reach people at an early stage when the development of a full-blown mental disorder might still be prevented. So far, preventive interventions developed for this reason focus mainly on the prevention of mental health problems and disorders, and less on the improvement of well-being (Beddington et al., 2008).

The World Health Organization (WHO) defines mental health as “a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively, and is able to make a contribution to his or her community.” This definition of mental health represents a paradigm shift from focusing on the narrow medical constructs of illness and disease only, to embracing well-being as well (WHO, 2005).

The WHO definition also underscores the notion that mental health is not merely the absence of mental illness. Well-being and mental illness, although correlated, are independent concepts and not just opposites on a single continuum. People presenting with low levels of well-being have similarly poor psychosocial outcomes as people suffering from mental illness (Keyes, 2005). Likewise, people with mental disorders are capable of experiencing well-being, to some degree (Bergsma, ten Have, Veenhoven, & De Graaf, 2011). In general, people with high levels of well-being are physically healthier, live longer, are more productive at work, and use less health care (Keyes & Grzywacz, 2005; Veenhoven, 2006). Longitudinal and experimental evidence suggests that positive affect and well-being may generate these desirable outcomes (Lyubomirsky, King, & Diener, 2005). The available evidence suggests that the enhancement of well-being might be a valuable public health strategy in mental health promotion.

With this positive approach to mental health in mind, we developed an Internet-based self-

help intervention ("Psyfit") aimed at the promotion of well-being. Below, we elaborate on the public health rationale for this type of intervention, including the definition of well-being, the relevance of the Internet as an implementation vehicle, and the use of positive psychology interventions as a starting point.

Definition of well-being

There are three different types, or concepts, of well-being. The first is subjective well-being, which is a cognitive and/or affective appraisal of one's own life as a whole and seeking a balance between positive and negative emotions (Diener, 1984). The second is the concept of psychological well-being. This concept builds on the work of Carol Ryff who was dissatisfied with the emphasis on subjective well-being and focused more on the optimal functioning of the individual (Ryff, 1989). In Ryff's view, psychological well-being contains six elements: self-acceptance, autonomy, environmental mastery, personal growth, purpose in life, and personal relations with others. According to this view, the attainment of personal happiness is not the goal in life, but rather self-actualization and meaning. The third concept arose from the work of Corey Keyes who called for a broader and less self-centered orientation towards well-being and for the expansion of subjective and psychological well-being to include social well-being; in other words, a complete state model of mental health (Keyes, 2007). Social well-being refers to the extent to which a person feels at home in society, trusts other people, and makes sense out of the world. The WHO's definition is clearly rooted in this perspective.

Using the Internet: eHealth

The promotion of well-being requires the delivery of effective and accessible interventions aimed at sustainable behavioral change. The Internet might offer the opportunity to reach this goal. Using persuasive technology techniques, programs designed to change attitudes and behaviors can be made for computers, game systems, and mobile devices (Fogg, 2003) so that they are highly engaging and enjoyable at the same time. Internet interventions are defined as highly structured; self- or semi self-guided; founded on evidence-based, face-to-face interventions; tailored to provide follow-up and feedback; personalized to the user; interactive; and enhanced by animation, audio, or video technology (if possible) (Ritterband et al., 2003).

eMental Health interventions can vary from plain information, tailored advice, single exercises, and interactive self-help programs to structured online therapies with or without guidance from a therapist. The major advantages of eMental Health are that Internet interventions can be offered on a broad scale, they are able to engage hard-to-reach people, and they can reduce therapists' time (ie, reduce costs) (Smit & Riper, 2008).

In the field of Internet interventions, the efficacy of interventions aimed at the reduction of

depressive symptoms or anxiety has been demonstrated meta-analytically (Spek et al., 2007a). The majority of these programs are based on cognitive behavioral therapy (Spek et al., 2007b) and problem-solving therapy (van Straten, Cuijpers, & Smits, 2008; Warmerdam, van Straten, Twisk, Riper, & Cuijpers, 2008).

Positive psychology interventions

The positive psychology movement has developed many interventions that focus on flourishing and positive functioning. These include counting one's blessings (Emmons & McCullough, 2003; Seligman, Steen, Park, & Peterson, 2005; Sheldon & Lyubomirsky, 2006), practicing kindness (Lyubomirsky, Sheldon, & Schkade, 2005; Otake, Shimai, Tanaka-Matsumi, Otsui, & Fredrickson, 2006), setting personal goals (Green, Oades, & Grant, 2006; Sheldon, Kasser, Smith, & Share, 2002; Spence & Grant, 2007), expressing gratitude (Seligman et al., 2005; Sheldon & Lyubomirsky, 2006), and using personal strengths (Seligman et al., 2005). A comprehensive meta-analysis of 51 positive psychology interventions has demonstrated moderate effect sizes for enhancing well-being and reducing depressive symptoms (Sin & Lyubomirsky, 2009).

However, experimental research on well-being interventions offered over the Internet is still scarce and the results are mixed. A randomized controlled trial with 2 separate interventions (working with your strengths and problem solving) and a placebo control group showed mixed results (Mitchell, Stanimirovic, Klein, & Vella-Brodrick, 2009). Well-being was improved, but there was not a significant impact on mental illness. In another trial (Seligman et al., 2005), the Internet was used for the recruitment of participants and the collection of data. The single exercises (using signature strengths in a new way and recapitulating three good things) enhanced well-being and reduced depressive symptoms for up to 3 months. Also, "writing and reading a gratitude letter" was effective, but only in the short term. However, a more critical look at the interventions reveals that these exercises were not truly Internet-based interventions as described in the previously cited definition by Ritterband et al. (2003) because the interventions were neither interactive nor personalized. Another two randomized controlled trials examined the effects of multi-component interventions (Abbott, Klein, Hamilton, & Rosenthal, 2009; Parks-Sheiner, 2009). In a workplace setting, an intervention called "Resilience Online" did not demonstrate any significant effects (Abbott et al., 2009). In another study using an online version of positive psychotherapy, depressive symptoms were significantly reduced, but there was no improvement in subjective well-being (Parks-Sheiner, 2009).

The current study

The aim of this study is to evaluate the efficacy and cost-effectiveness of Psyfit, an online well-being program (www.psyfit.nl). The study will add to the existing literature by testing a multi-component and flexible Internet-based intervention to promote well-being. To date, the research in this area is limited to either single interventions focusing on one well-being exercise at a time (Seligman et al., 2005; Mitchell et al., 2009) or to multiple protocol-based interventions (Abbott et al., 2009; Parks-Sheiner, 2009). In these studies, participants in the intervention groups are allocated to an inflexible intervention, although most people would prefer to choose what they need and feel up to doing (Bergsma, 2007; Lyubomirsky et al., 2005). For this reason, Psyfit offers a choice of different interventions that participants can tailor themselves.

The primary objective of this study is to evaluate the effectiveness of the Psyfit intervention in comparison to a waiting list control group. We hypothesize that the intervention group will demonstrate a significant increase in well-being and a reduction in depressive symptoms at post-test and follow-up compared to the control group. Secondary study objectives are to conduct an economic evaluation and to examine if particular subgroups benefit differently (ie, more or less) than others from the intervention.

METHODS

Study design

This study is designed as a randomized trial with two parallel groups. In the experimental condition, participants will receive 2 months free access to Psyfit. In the control condition, participants will be put on a waiting list for 6 months before they are offered access to Psyfit. The study is designed to compare the efficacy and cost-effectiveness of Psyfit relative to the waiting list control condition. A secondary objective is to examine whether certain groups (eg, based on depressive symptoms, gender, and education level) benefit differently from the intervention. Participants in both conditions will have unrestricted access to professional help, if needed. The study protocol, interventions, participant information, and informed consent procedure have been approved by the Dutch Medical Ethics Committee for Mental Health Care (METIGG), under registration number 9218.

Inclusion and exclusion criteria

The participant group is defined as everyone willing to improve their “mental fitness.”

Participants will be included if they: (1) are 21 years or older; (2) present with very mild to moderate depressive symptoms with a score between 10-24 on the Center for Epidemiological Studies Depression Scale (CES-D); (3) have moderate or low levels of well-being as measured

with the Mental Health Continuum-Short Form (MHC-SF); (4) have access to a computer and the Internet; and (5) have sufficient knowledge of the Dutch language. The CES-D (Haringsma, Engels, Beekman, & Spinhoven, 2004) and MHC-SF (Keyes, Shmotkin, & Ryff, 2002; Westerhof & Keyes, 2008) inclusion and exclusion scores are based on established cut-off points.

People with serious depressive symptoms (CES-D score ≥ 25) or active suicidal thoughts or plans (determined from the Web Screening Questionnaire (Donker, van Straten, Marks, & Cuijpers, 2010)) will be excluded from this study. Those who fail to meet these selection criteria will be notified by email and will be advised to contact their general practitioner if their depressive symptoms exceed the threshold limit. In cases of suicidal ideation, people will be urgently referred to the national online suicide-prevention platform for help.

Recruitment

Participants will be recruited through banners on Internet websites related to mental health and well-being. In addition, advertisements will be placed in newspapers and monthly magazines on health-related topics.

The recruitment message for the study is formulated positively (ie, not with a focus on symptoms and problems): “Would you like to increase your mental fitness? Would you like to feel better? Improve your mental fitness and participate in our study of an online self-help program, Psyfit.” The analogy is made with physical fitness: “There are certain lifestyle behaviors you could adopt that can make you feel mentally fit.” Preliminary focus group research has shown that people with minor mental health problems, those experiencing stress, or those who just “don’t feel good” are attracted by the “mental fitness” message (Notenboom & Van Male, 2008).

The advertisements will include the website address where people can register for Psyfit (www.psyfit.nl). This website contains complete information about the study and a demonstration video of the intervention. Those interested in participating can leave their name and email address. The email and Internet Protocol (IP) addresses will be checked for multiple registrations. Following this, prospective participants will receive an email with additional information about the study and a link to the online informed consent form and online questionnaire.

Randomization

The online randomization procedure will be carried out at the individual level. After returning the informed consent form and completing the baseline questionnaire, people who meet the inclusion criteria will be randomly allocated to the experimental group (Psyfit) or to the

waiting list and they will be notified by email. Randomization will be stratified by gender, education, and severity of symptoms based on CES-D scores (scores between 10-15 and 16-24). A computer program will allocate participants using a generated randomization list. Block randomization in blocks of two will be performed to ensure equal distribution of participants across conditions.

Intervention group: Psyfit

Psyfit is offered as an online and fully automated self-help intervention without active support from a therapist (see Figure 1 in Chapter 6 for a screenshot of the intervention). Participants tailor their own intervention program to their personal needs and measure their progress by several self-tests. In addition, they can discuss their experiences in an online community accessed via Psyfit.

The content of the well-being program, Psyfit, is based on an extensive literature review (Walburg, 2008). Elements in the intervention originate from positive psychology (Seligman et al., 2005; Sin & Lyubomirsky, 2009), mindfulness (Grossman, Niemann, Schmidt, & Walach, 2004), cognitive behavioral therapy (Riper & Kramer, 2007), and problem-solving therapy (Cuijpers, 2005).

Psyfit consists of six modules, each containing a 4-week program:

1. Mission and goals (living from a deeply felt mission and personal values);
2. Positive feelings (positive thinking and working on your positive affect);
3. Positive relations (connection with other people and your environment);
4. Living in the moment (consciously living and enjoying);
5. Thinking and feeling (change negative thinking patterns, optimistic thinking); and
6. Master your life (managing personal energy, stress, and problems).

In theory, each module is likely to have impact on well-being. During the study, the Psyfit website is accessible only to the participants in the experimental group. An email will be sent to each participant assigned to Psyfit with a personal username and password. From the moment the participant logs on, a 2-month free access to the intervention is activated. If a participant doesn't log on, a reminder email with the log-on codes will be sent after one week and, if necessary, after two weeks and again after three weeks. Participants are allowed to use the program at any time they want during the trial period. Participants are advised to choose and finish at least one module during the intervention period. During each

4-week module, participants receive background information on the specific subject, view short films, and receive a weekly assignment that they are expected to complete during that week. On average, this takes 20 to 30 minutes each day.

Participants are free to use all other functionalities offered in Psyfit and can always choose to start a new module. For an overview of functionalities, see Textbox 1.

Textbox 1. Functionalities in Psyfit

General self-test to assess individual well-being level beforehand and after 2 months.

A personal plan in which the participant can reflect on his or her goals, motives, and pitfalls.

A “mood meter” for monitoring changes in the mood of the participant. The outcomes are presented in a graph.

Automatic email service twice a week with reminders, tips, and advice.

Online community for sharing experiences and peer-to-peer support.

Contact form: participants can ask questions and receive feedback from a psychologist via email. If required, the participant is referred to professional care. Technical assistance is also provided.

“My Psyfit”: the participant can download and print out a personal PDF blueprint of the intervention with all the modules, exercises, and progress measurements completed.

Videos: each module starts with a video showing a Dutch expert explaining the relevance of this particular module.

Module self-tests: each module starts and ends with a short self-test to see if the particular skill has improved.

The participant can work through the intervention independently (self-help) but can fill in a contact form with a question if necessary. Psyfit could be likened to a toolbox from which people can “pick and mix” whatever they like and need. The web statistics module will systematically track and trace the actions of each participant, such as the number of log-on times, the time spent on the website, and the modules chosen. This enables adherence to the intervention to be examined.

Control group

Participants in the control condition are placed on a waiting list for 6 months. After a 6-month follow-up assessment, they will receive their personal user name and password for Psyfit.

Assessments

The primary outcome measure is well-being. Secondary outcome measures include depressive symptoms, general health and vitality, and economic costs (as measured by health care use, days of absence, inefficient job performance, and work productivity). For an

overview of outcomes and instruments, see Table 1.

Measurements will be taken at baseline (pre-test), directly after the intervention (post-test, 2 months after baseline), and 6 months later (follow-up). All measurements are self-report measures and will be administered via email with a link to the questionnaire on the Internet.

High dropout rates are a characteristic feature of online trials and can be as high as 50% (Christensen, Griffiths, & Farrer, 2009). Therefore, email reminders and rewards (eg, raffle of six iPods and vouchers) for filling in the questionnaires will be used. It is expected that this will lead to a lower attrition rate.

Table 1. Questionnaires and assessment times

Questionnaire ^a	Measurement	T0 Pre-test	T1 Post-test ^b	T2 Follow-up ^c
MHC-SF	Well-being/positive mental health	X	X	X
WHO-5	Well-being	X	X	X
CES-D	Symptoms of depression	X	X	X
MOS SF-36 subscales	Vitality and general health	X	X	X
TIC-P and PRODISQ	Health service uptake and production losses	X	X	X
CSQ-8	Client satisfaction		X	
Demographics	Age, gender, education, marital status, job status	X		

^a all questionnaires are discussed within Instruments section

^b 2 months after T0

^c 6 months after T0

Instruments

Well-being and positive mental health

Well-being will be assessed with two questionnaires measuring different concepts. The Mental Health Continuum-Short Form (MHC-SF) (Keyes, 2002) is a 14-item self-report questionnaire that categorizes measures of well-being as “languishing,” “moderate,” or “flourishing.” Participants rate the items on a 6-point scale from 0 (never) to 5 (every day). The MHC-SF measures subjective well-being as well as psychological and social well-being. These aspects are all addressed in Psyfit; therefore, this questionnaire was chosen. The MHC-SF has shown good internal consistency ($> .80$) and discriminant validity (Lamers, Westerhof, Bohlmeijer, ten Klooster, & Keyes, 2011).

The WHO-Five Well-being Index (WHO-5) contains 5 positively formulated items on mental health (Bech, 2004). Participants are asked to rate the items using a 6-point scale ranging from 0 (never) to 5 (all of the time). The WHO-5 has been validated in different populations (Bech, 2004) and is useful as a screening instrument for depression (Henkel et al., 2003). It

was chosen as a measurement instrument because of its brevity and the concurrent validity with depression.

Depressive symptoms

Depressive symptoms will be measured by the Dutch version of the Center for Epidemiological Studies Depression Scale, the CES-D (Radloff, 2009). The CES-D is a 20-item self-rating scale with item scores ranging from 0 to 3 (higher scores indicating more depression), and a total score from 0 to 60. The CES-D has acceptable reliability and validity with a cut-off score of 16 for mild depressive symptoms (Haringsma et al., 2004) and a cut-off score of 25 for severe depressive symptoms (Beekman et al., 1997). When applied via the Internet, the CES-D appears to be a reliable and valid instrument (Donker et al., 2010).

Vitality and general health

Two quality of life related constructs, “vitality” and “general physical health” will be measured with two scales from the Medical Outcomes Study Short Form-36 (MOS SF-36) (Ware, Jr. & Sherbourne, 1992). The vitality subscale contains 4 items which are rated on a 4-point scale ranging from 1 (all the time) to 6 (never). The “perception of general health” subscale consists of 5 items which are rated on a 5-point Likert scale (1 = “exactly right” to 5 = “exactly wrong”). The MOS SF-36 has demonstrated good reliability and validity (Brazier et al., 1992).

Economic costs

The economic evaluation will be conducted from a societal perspective. It includes utilization costs of any type of health care and medicines (direct medical costs), costs incurred by the participants for travel and parking (direct non-medical costs), and costs due to production losses (indirect non-medical costs) (Hakkaart-van Roijen, Tan, & Bouwmans, 2010; Hakkaart-van Roijen, van Straten, & Donker, 2002). All costs will be expressed in Euro (€) on an annual per capita basis for the reference year 2010. Data on direct medical and non-medical costs are obtained by using the Dutch Cost Questionnaire for Psychiatry (TIC-P) (Hakkaart-van Roijen et al., 2002). Six items from the Productivity and Disease Questionnaire (PRODISQ) will be used to measure indirect non-medical costs (Koopmanschap, 2005) stemming from productivity losses due to days of absence and presenteeism/inefficient job performance.

Other variables

Participant satisfaction with the intervention will be measured with an adapted Dutch version of the Client Satisfaction Questionnaire-short form (CSQ-8) (de Brey, 1983; Nguyen, Attkisson, & Stegner, 1983). The internal consistency of this scale in the Dutch population is very high (Cronbach alpha = .93). The 8-item self-report questionnaire has a scale ranging from 1 to 4 and a total score range from 8 to 32.

Furthermore, participants will be asked about important life events and whether they are currently receiving treatment from a mental health specialist.

Sample size

Depressive symptoms and well-being are used as a starting point for the power calculation. We aim to be able to show differences between Psyfit and the waiting list control condition with a standardized effect size (Cohen's d) of 0.33 or larger. A standardized effect of 0.33 can be considered as the lower limit of a moderate clinical effect (Lipsey, 1993) and is based on a meta-analysis of well-being intervention research (Sin & Lyubomirsky, 2009) and a recent randomized controlled trial (Mitchell et al., 2009). To demonstrate this effect, and assuming an alpha of 0.05 and a statistical power (1-Beta) of 80%, we need 145 participants in each condition; therefore, we need 290 participants in total for the trial.

Analysis

Results will be reported according to the Consolidated Standards of Reporting Trials (CONSORT) statement regarding eHealth (Altman, 1996; Eysenbach, 2011). We will adhere to the intention-to-treat (ITT) principle, which means all participants who have been randomized will be included in the analyses. Missing data at T1 and T2 will be imputed using the expectation-maximization (EM) method, as implemented in Statistical Package for the Social Sciences (SPSS) Missing Value Analysis. The program imputes missing values by maximum likelihood estimation using the observed data in an iterative process (Dempster, Laird, & Rubin, 1977). In online trials dropout is to be expected, and sometimes a large amount of missing data has to be estimated. Although ITT analysis is the approach of choice according to the CONSORT statement, there may also be pitfalls, such as when the missing-at-random assumption is not plausible and the results of the analysis are subsequently biased (Sterne et al., 2009). Therefore, a completers-only analysis and a per-protocol analysis will be conducted in addition (sensitivity analysis). Reasons for dropout in the study will be checked at random by telephone follow-up (dropout analysis).

To examine differences between the two conditions, we will use multiple regression analyses with the clinical outcomes on continuous measures (MHC-SF, WHO-5, CES-D, and the vitality and general health scales from MOS SF-36) as dependent variables and an intervention-control group dummy as predictor variable. We will compute standardized effect sizes (Cohen's d). Cohen's d is computed by subtracting the mean post-test intervention score from the mean post-test control group score and dividing the difference by the pooled standard deviation (Cohen, 1988).

Moderator analyses will be conducted to examine which groups benefit more (or less) from the intervention by regressing the outcomes on independent variables such as gender,

education, mild/moderate depressive symptoms, the treatment dummy, and the interaction with the treatment dummy and the selected independent variables.

The economic evaluation will be conducted from a societal perspective, thus including the intervention costs (ie, Psyfit), the costs of health care uptake (TIC-P), the participants' out-of-pocket costs for obtaining health care (TIC-P), and the economic costs due to productivity losses in paid work (PRODISQ). The incremental cost-effectiveness ratio (ICER) will be calculated. Uncertainty in the ICER will be captured using a bootstrap approach, producing a scatter of simulated ICERs over the ICER-plane and by drawing an ICER acceptability curve of the likelihood that Psyfit is more cost-effective for a range of willingness-to-pay (WTP) ceilings.

All analyses will be conducted using two-sided tests and alphas of .05. For this purpose, the most recent version of the SPSS software will be used.

DISCUSSION

This online trial will examine whether an Internet-based self-help intervention for the enhancement of well-being is effective in terms of clinical outcomes and economic costs. A second objective is to examine whether certain groups benefit more or less from the intervention. The enhancement of well-being on a large scale may contribute to public mental health by resulting in better health, fewer mental disorders, and enhanced quality of life on a population level (Beddington et al., 2008; Veenhoven, 2004).

This study has several *a priori* limitations. First, dropout may occur in either of the two groups. To examine any selectiveness, we will conduct dropout analysis and a telephone survey for examining reasons for dropout. Moreover, we will conduct intention-to-treat analyses in which missing values are replaced by their most likely estimates. Second, we will only use self-report questionnaires, not formal diagnostic instruments, to establish diagnoses. Therefore, we will not know whether participants meet the criteria for a Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) diagnosis so results about prevention of mental disorders will not be available. We opted for self-rating because the intervention should be easily accessible and highly applicable because of its public nature. We don't want to scare people off by intensive diagnostic procedures. A third limitation of this study concerns the use of questionnaires that are not (yet) validated for online purposes. Psychometric properties of online assessments may differ from their paper-and-pencil counterparts (Buchanan, 2002). On the other hand, the CES-D (Donker et al., 2010) and the MHC-SF (Lamers et al., 2011), which are used in this study, have been proven to be reliable and valid instruments even if used on the Internet. Finally, the open recruitment strategy may attract certain groups, for

example, more higher-educated people or more spiritually engaged and higher-motivated people. Therefore, care must be taken in generalizing the results.

Our study also has several strengths. It is likely to add to the existing literature because it is—at least to our knowledge—the first evaluation of an online flexible and multiple-component intervention aimed at the improvement of well-being to include people with mild depressive symptoms. As such, we will be able to draw conclusions about the potential impact of such an intervention on mental health. Although the recruitment procedure could be a weakness as previously mentioned, at the same time it creates the opportunity to strengthen external validity (real world implementation potential) by analyzing which target groups are attracted by the “open access” and positively formulated recruitment strategy.

Online interactive programs may attract large numbers of people, therefore, even small or moderate effect sizes can have an impact on population health. If proven to be effective, Psyfit may be an affordable instrument that can be distributed on a large scale to enhance population well-being.

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6

An Internet-based intervention to promote mental fitness for mildly depressed adults: results of a randomized controlled trial

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ABSTRACT

Background. Depression is a worldwide problem warranting global solutions to tackle it. Enhancing well-being has benefits in its own right and could be a good strategy for preventing depression. Providing well-being interventions via the Internet may have synergetic effects.

Objective. Psyfit (“mental fitness online”) is a fully automated self-help intervention aimed at improving well-being based on positive psychology. This study examines the clinical effects of this intervention. *Methods.* We conducted a 2-armed randomized controlled trial that compared the effects of access to Psyfit for 2 months ($n=143$) to a waiting-list control condition ($n=141$). Mild to moderately depressed adults in the general population seeking self-help were recruited. Primary outcome was well-being measured by Mental Health Continuum-Short Form (MHC-SF) and WHO Well-being Index (WHO-5); secondary outcomes were depressive symptoms, anxiety, vitality, and general health measured by Center for Epidemiological Studies Depression Scale (CES-D), Hospital Anxiety and Depression Scale Anxiety subscale (HADS-A), and Medical Outcomes Study-Short Form (MOS-SF) vitality and general health subscales, respectively. Online measurements were taken at baseline, 2 months, and 6 months after baseline.

Results. The dropout rate was 37.8% in the Psyfit group and 22.7% in the control group. At 2-month follow-up, Psyfit tended to be more effective in enhancing well-being (nonsignificantly for MHC-SF: Cohen's $d=0.27$, $P=.06$; significantly for WHO-5: Cohen's $d=0.31$, $P=.01$), compared to the waiting-list control group. For the secondary outcomes, small but significant effects were found for general health (Cohen's $d=0.14$, $P=.01$), vitality ($d=0.22$, $P=.02$), anxiety symptoms (Cohen's $d=0.32$, $P=.001$), and depressive symptoms (Cohen's $d=0.36$, $P=.02$). At 6-month follow-up, there were no significant effects on well-being (MHC-SF: Cohen's $d=0.01$, $P=.90$; WHO-5: Cohen's $d=0.26$, $P=.11$), whereas depressive symptoms (Cohen's $d=0.35$, $P=.02$) and anxiety symptoms (Cohen's $d=0.35$, $P=.001$) were still significantly reduced compared to the control group. There was no clear dose–response relationship between adherence and effectiveness, although some significant differences appeared across most outcomes in favor of those completing at least 1 lesson in the intervention.

Conclusions. This study shows that an online well-being intervention can effectively enhance well-being (at least in the short-term and for 1 well-being measure) and can help to reduce anxiety and depression symptoms. Further research should focus on increasing adherence and motivation, reaching and serving lower-educated people, and widening the target group to include people with different levels of depressive symptoms.

Trial Registration: Netherlands Trial Register (NTR) number: NTR2126

INTRODUCTION

Relevance of well-being

Depression is a highly prevalent problem worldwide (Bromet et al., 2011), which underscores the global urgency of tackling this mental illness (WHO, 2002). The average lifetime prevalence estimates of major depressive episodes is 15%, with 1 in 20 people suffering from this illness at any given time (Bromet et al., 2011). In addition, many more people present subclinical depressive symptoms, putting them at greater risk of going on to develop a full-blown mental disorder (Cuijpers & Smit, 2008). The enhancement of well-being may be just as important in dealing with poor mental health as treating the symptoms of depression (Keyes, 2007). Ample studies show that the level of well-being is a predictor of psychopathology, independent of the influence of negative affect (Keyes, Dhingra, & Simoes, 2010; Wood & Joseph, 2010). The presence of well-being is also beneficial in its own right. Well-being is associated with a healthier and longer life (Howell, Kern, & Lyubomirsky, 2007; Pressman & Cohen, 2005), prosocial behavior, and maintenance of high-quality relationships with family and friends (Howell et al., 2007). Thus, well-being may play a role both in supporting health and human functioning and in reducing symptoms of mental illness.

Three different types of well-being have been identified in various studies. Subjective well-being refers to positive affect and/or life satisfaction (Veenhoven, 2012), psychological well-being refers to the level of positive functioning, containing constructs such as meaning in life, goal setting, and mastery (Ryff, 1989), and social well-being contains constructs such as the level of social integration and social contribution (Keyes, 1998).

Positive psychology

In the emerging field of positive psychology, interventions aimed at flourishing and positive functioning are being developed and evaluated. These interventions focus on individual competencies and strengths, rather than on mental symptoms and disorders (Seligman & Csikszentmihalyi, 2000). Examples of interventions are “counting your blessings” (Seligman, Steen, Park, & Peterson, 2005), “practicing kindness” (Otake, Shimai, Tanaka-Matsumi, Otsui, & Fredrickson, 2006), “expressing gratitude” (Seligman et al., 2005; Sheldon & Lyubomirsky, 2006), and “using your personal strengths” (Seligman et al., 2005). Positive psychology also embraces other like-minded traditions, such as mindfulness (Brown & Ryan, 2003) and life review (Bohlmeijer, Roemer, Cuijpers, & Smit, 2007).

Evidence of the effectiveness of positive psychological interventions was reviewed in 2 meta-analyses showing that these interventions enhance well-being and reduce depressive symptoms (Bolier et al., 2013; Sin & Lyubomirsky, 2009). In addition, positive psychological interventions may reach people who are otherwise more difficult to connect with. People

presenting subclinical depression or other problems, such as stress and anxiety, may find a well-being approach more appealing than a problem-oriented approach (Parks, Schueller, & Tasimi, 2012). One of the main obstacles worldwide in mental health care is to reach people in need of treatment or prevention with good quality interventions (Kohn, Saxena, Levav, & Saraceno, 2004). By their inherent appeal, positive psychological interventions may help to narrow this mental health gap.

Combining positive psychological interventions and the Internet

Providing positive psychological interventions via the Internet may offer synergetic opportunities. The effectiveness of online problem-based interventions (eg, in reducing depressive symptoms or anxiety (Spek et al., 2007) or problematic alcohol use (Riper et al., 2009)) has been demonstrated meta-analytically. Internet interventions, especially self-help interventions, may be more affordable and accessible for many people as opposed to face-to-face interventions (Muñoz, 2010). Therefore, online positive psychological interventions may offer the most suitable and effective strategy for reaching large target groups. To date, a literature review of the effectiveness of online positive psychological interventions has shown mixed results (Mitchell, Vella-Brodrick, & Klein, 2010). In this review, 5 randomized controlled trials were included (Abbott, Klein, Hamilton, & Rosenthal, 2009; Mitchell, Stanimirovic, Klein, & Vella-Brodrick, 2009; Parks-Sheiner, 2009; Seligman et al., 2005; Shapira & Mongrain, 2010), of which 3 demonstrated enhanced well-being (Mitchell et al., 2009; Seligman et al., 2005; Shapira & Mongrain, 2010) and 3 showed significant symptom reduction (Parks-Sheiner, 2009; Seligman et al., 2005; Shapira & Mongrain, 2010). The authors concluded that there is still an “effectiveness gap between offline and online formats” in positive psychological interventions (Mitchell et al., 2010). In more recent studies of online positive psychological interventions, mixed results were also found. In a comprehensive study by Gander et al. (2012), 9 online positive psychological interventions were compared to a placebo exercise. Significant improvement in psychological well-being was found for 8 exercises, but not at all time points, and 5 of 9 exercises reduced depressive symptoms (Gander, Proyer, Ruch, & Wyss, 2012). In the study of Layous et al. (2013) the online variant of the “best possible selves” exercise was just as effective as the face-to-face variant, and more effective than the placebo intervention (Layous, Nelson, & Lyubomirsky, 2013). Schueller and Parks (2012) showed that it might not always be effective to provide more exercises and content because a 2-exercise and a 4-exercise condition were more effective than the 6-exercise condition (Schueller & Parks, 2012).

One of the reasons for a gap between face-to-face and online interventions could be the low adherence rates (Christensen, Griffiths, & Farrer, 2009; Mitchell et al., 2010). Adherence may be related to effectiveness such that the more people adhere to an intervention, the larger

the effect sizes are (Donkin et al., 2011; Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012). This supposed relationship needs further clarification in online positive psychological interventions (Mitchell et al., 2010).

Current study

The primary goal of the current study was to examine the effectiveness of Psyfit, an online positive psychological intervention, in comparison with a waiting-list control group. This study distinguishes itself from former experimental research, which was limited to single-component interventions (Mitchell et al., 2009; Seligman et al., 2005; Shapira & Mongrain, 2010) or longer multiple and fixed-sequential interventions (Abbott et al., 2009; Parks-Sheiner, 2009; Schueller & Parks, 2012), in focusing on a multicomponent, flexible, online intervention. The intervention resembles a toolbox where people can pick and mix their personal training program. From self-determination theory, it can be reasoned that this idea would promote autonomy in the participant, leading to more intrinsic motivation to follow the program (Ryan & Deci, 2006). Indeed, experimental studies show that most people are better off with a tailored positive psychological intervention shaped to their personal preferences and needs (Lyubomirsky, Dickerhoof, Boehm, & Sheldon, 2011; Schueller, 2011).

We hypothesized that the online positive psychological intervention group would demonstrate a significant increase in well-being and a reduction in depressive and anxiety symptoms at 2- and 6-month follow-ups as compared to the control group. The second goal of the study was to examine the role of adherence. We hypothesized that the more people adhered to the intervention, the larger the effects would be. A third goal was to examine whether particular subgroups benefit more or less than others from the intervention (less vs more depressive symptoms at baseline, higher- vs lower-educated people, men vs women, older vs younger people). Because of the broad nature of the intervention, it was hypothesized that each of the subgroups was served equally well.

METHODS

Study design

We conducted a randomized controlled trial (NTR2126) of the online positive psychological intervention Psyfit as compared to a waiting-list control group. Online measurements were measured at baseline, 2 months, and 6 months after starting the intervention. Details of the study design and the intervention are reported more extensively in the study protocol that was published previously (Bolier et al., 2012), but a summary is presented subsequently. The study was approved by the Dutch Medical Ethics Committee for Mental Health Care (registration number 9218).

Intervention

Psyfit is an online self-help intervention, without support from a therapist. Psyfit aims to enhance well-being by stimulating personal growth and positive functioning. A parallel goal is to reduce depressive and anxiety symptoms. The intervention is based on positive psychological principles and addresses strengths and personal competencies rather than mental problems and deficiencies. It incorporates evidence-based exercises based on positive psychology and elements stemming from mindfulness, cognitive behavioral therapy, and problem-solving therapy (Walburg, 2008). In Psyfits' communication message, an analogy is made with physical fitness. Similar to the saying "an apple a day keeps the doctor away," Psyfit encourages people to complete their daily mental fitness training.

There are 6 modules in Psyfit, each containing a 4-lesson program: (1) personal mission statement and setting your goals, (2) positive emotions, (3) positive relations, (4) mindfulness, (5) optimistic thinking, and (6) mastering your life. Each week, the lesson consisted of psycho-education and a practical exercise. At the end of the week, participants received an email notifying them that the next lesson could be started. Participants could start or finish modules as they wished, as long as they were in sequence.

Participants allocated to the intervention group received an email with a personal username and password. After logging in, 2-month access to Psyfit was activated. Participants were advised to complete at least 1 module during the intervention period. Each module is a separate module on its own and may, in theory, improve well-being.

Control group

Participants in the control group were told they were on a waiting list for 6 months before they received their login codes for Psyfit. A waiting-list control group is ethically acceptable when there is no immediate risk or treatment indication (Mohr et al., 2009), thus fitting the preventive nature of this study. Participants in the control group had unrestricted access to professional help, if needed.

Participants

Participants were recruited from the adult well-being-seeking population in the Netherlands in March and April 2010. The recruitment message was formulated positively (not with a focus on symptoms and problems): "Would you like to increase your mental fitness? Improve your mental fitness and participate in our study of an online self-help program." Banners and advertisements were placed in free newspapers and on Facebook. Interested people registered at the Psyfit website (Figure 1, www.psyfit.nl) and subsequently received an email with information on the study and a link to the online consent form and baseline questionnaire. Adult participants (21 years and older) were included when informed consent was obtained

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and if they presented mild to moderate depressive symptoms as represented by a score of 10-24 on the Center for Epidemiologic Studies Depression Scale (CES-D) (Haringsma, Engels, Beekman, & Spinhoven, 2004) and a languishing or moderate level of well-being as measured with the Mental Health Continuum-Short Form (MHC-SF) in which the levels languishing, moderate, and flourishing can be distinguished (Lamers, Westerhof, Bohlmeijer, ten Klooster, & Keyes, 2011). Furthermore, they had to have access to a computer and Internet and have sufficient knowledge of the Dutch language. Participants with serious depressive symptoms (CES-D score ≥ 25) or active suicidal thoughts or plans (question from the Web Screening Questionnaire (Donker, van, Marks, & Cuijpers, 2009)) were excluded. Those meeting any of these exclusion criteria were advised to seek professional help. Those scoring too high on well-being according to the inclusion criteria were excluded, but were invited to do Psyfit after the study. Participants in both the experimental and control group had unlimited access to professional help, such as primary care and psychological support.

Randomization

Randomization took place after baseline measurement and was carried out by using a computer-generated randomization list in blocks of 2, stratified by gender, education (higher/lower), and depression symptom level (CES-D scores 10-15 and 16-24).

Outcomes and instruments

The primary outcome measure was well-being. This was assessed with 2 questionnaires: the MHC-SF which measures positive mental health in terms of subjective, psychological, and social well-being (Lamers et al., 2011), and the World Health Organization 5-item Well-Being Index (WHO-5) (Bech, Olsen, Kjoller, & Rasmussen, 2003; Henkel et al., 2003), a short measure of overall well-being. Secondary outcomes were depressive symptoms, as measured with the CES-D (Haringsma et al., 2004; Radloff, 2009); anxiety symptoms, as measured with the Hospital Anxiety and Depression Scale, Anxiety subscale (HADS-A) (Spinhoven, Ormel, Sloekers, & Kempen, 1997); and general health and vitality, as measured with 2 subscales from the Medical Outcomes Study 36-Item Short Form (MOS SF-36) (Ware & Sherbourne, 1992). All measurement instruments were self-reported and administered via email with a link to the questionnaire on the Internet. The instruments have been shown to have satisfactory reliability and validity (also see the protocol article for elaboration) (Bolier et al., 2012). Participant satisfaction was measured using the 8-item Client Satisfaction Questionnaire short form (CSQ-8) (de Brey, 1983).

During the trial, usage data from the Web application containing log files were gathered, which enabled monitoring of intervention adherence.

Analyses

Analyses were conducted following the intention-to-treat (ITT) principle. Accordingly, all participants were analyzed in the group to which they were allocated. Missing data at 2-month and 6-month follow-ups were imputed using the estimation maximization (EM) method in SPSS version 19 (IBM Corp, Armonk, NY, USA). Reporting of the results follows the guidelines of the Consolidated Standards of Reporting Trials (CONSORT) eHealth checklist (Eysenbach, 2011). We applied unpaired *t* tests and logistic regression analyses to examine possible baseline differences between dropouts and nondropouts. A chi-square test (χ^2) was used to determine possible differential loss to follow-up between experimental group and control group. Dropout was defined as completing the baseline and 2-month follow-up questionnaire, but not the 6-month follow-up questionnaire, or completing the baseline questionnaire, but neither of the follow-up questionnaires.

The effectiveness of Psyfit was examined by regression analyses. We used the clinical outcomes on continuous measures (MHC-SF, WHO-5, CES-D, HADS-A, and subscales of the MOS SF-36) as dependent variables for the 2- and 6-month follow-ups separately. The intervention dummy and the baseline measurements of the corresponding outcome variables were used as independent variables.

The size of the effect was estimated by using Cohen's *d*. Cohen's *d* is calculated as the difference between 2 means divided by the pooled standard deviation. A Cohen's *d* of 0.5 indicates that the mean of the intervention group is half a standard deviation larger than the mean of the control group. Cohen's *d* from 0.56 to 1.2 is a large effect size, 0.33 to 0.55 is moderate, and 0 to 0.32 is considered small (Lipsey & Wilson, 1993). We calculated effect sizes (baseline to 2- and 6-month follow-ups, respectively) of each condition separately, and after that calculated the difference between experimental group and control group (Δd). As a sensitivity analysis, a completers-only analysis was conducted as well.

To examine the role of adherence, a dose–response relationship was analyzed. Five separate groups were made up of participants adhering to 0, 1, 2, 3, or 4 lessons from any module. Differences between these groups and a possible linear relation (time $\times$ group interaction) were investigated by means of a repeated measures ANOVA analysis. The levels of adherence were used as independent variables and the clinical outcomes at 2- and 6-month follow-ups as repeated measures. An unpaired *t* test was used to examine the difference between hardly adhered (adhered to 0 or 1 lesson) and at least some adherence (adhered to 2–4 lessons).

Finally, a moderator analysis was conducted to determine whether certain subgroups (men vs women; education level higher vs lower; mild vs moderate depressive symptoms: CES-D

score ≤ 16 or > 16 ; younger/older age group: ≤ 45 years or > 45 years) benefited more or less from the intervention. This was done by regressing the outcome variable on the independent group variables, the condition dummy, and the interaction between subgroup and condition dummy while controlling for the baseline measurement.

For all analyses, we used 2-sided tests with a significance level of $P < .05$. We only used $P < .10$ for the adherence analysis because of the reduced number of participants and lower power.

RESULTS

Flow of participants

Figure 2 shows the flow of participants. A total of 845 persons were interested in participating in the study and registered with the website. After giving informed consent and filling out the online screening form and baseline questionnaire, 284 people were included in the study (33.6%). Participants were randomly assigned to the intervention ($n=143$) or the waiting-list control group ($n=141$).

Participant characteristics

The demographic characteristics and baseline scores of the participants are shown in Table 1. The mean age of participants was 43.2 years (SD 11.8) and most were female (226/284, 79.6%). Participants were mostly highly educated (208/284, 73.2%) and most had paid employment (214/284, 75.4%). The mean CES-D depression score at baseline was slightly above the cut-off score of 16 (mean 16.80, SD 4.13) indicating a clinically relevant level of depressive symptoms (Radloff, 2009), and the MHC-SF score was below the Dutch national mean of 3.98 (mean 3.47, SD 0.63) (Lamers et al., 2011).

Attrition

The response rate was 75.4% (214/284) at 2-month follow-up and 69.7% (198/284) at 6-month follow-up. The response rate was significantly higher in the control group compared to the Psyfit group at 2-month follow-up (84.4% vs 66.4%; $\chi^2_1 = 12.3$, $P < .001$) and 6-month follow-up (77.3% vs 62.2%; $\chi^2_1 = 7.6$, $P = .01$).

Tested at $P < .05$, dropout analysis revealed that there were several significant differences between dropouts and completers. Those who dropped out were more likely to be living in a dorm or with their parents ($\chi^2_2 = 9.9$, $P = .002$) and be of younger age ($\chi^2_1 = 4.2$, $P = .04$). No significant differences emerged between dropouts and completers regarding baseline symptoms. Examination of the interaction showed that dropouts in the control group scored significantly lower than dropouts in the Psyfit group on the MOS SF-36 general health subscale, indicating poorer health for dropouts in the control group ($F_{1,280} = 6.48$, $P = .01$).

Table 1. Baseline characteristics

	Psyfit (n=143)	Control group (n=141)	All (N=284)
Age mean, (Sd)	43.5 (11.7)	42.8 (11.9)	43.2 (11.8)
<i>Age in categories (%)</i>			
21-34 years	36 (25.2)	37 (26.2)	73 (25.7)
35-64 years	100 (69.9)	101 (71.6)	201 (70.8)
65-100 years	7 (4.9)	3 (2.1)	10 (3.5)
Female, n (%)	114 (79.7)	112 (79.4)	226 (79.6)
Major negative life event Yes, n (%)	80 (55.9)	73 (51.8)	153 (53.9)
<i>Education (%)</i>			
Lower (up to high school and middle-level applied education)	39 (27.3)	37 (26.2)	76 (26.8)
High (academic/ professional)	104 (72.7)	104 (73.8)	208 (73.2)
<i>Daily activities</i>			
Paid employment	106 (74.1)	108 (76.6)	214 (75.4)
Unemployed / unable to work	20 (14.0)	10 (7.1)	30 (10.6)
Other (student, at home, retired)	17 (11.9)	23 (16.3)	40 (14.1)
<i>Living situation, n (%)</i>			
With partner, with or without children	92 (64.3)	84 (59.6)	176 (62.0)
No partner, with or without children	45 (31.5)	48 (34.0)	93 (32.7)
Other (students' home or parents)	6 (4.2)	9 (6.4)	15 (5.3)
<i>Test scores, mean (Sd)</i>			
MHC-SF well-being	3.45 (0.62)	3.50 (0.63)	3.47 (0.63)
WHO-5 well-being	10.81 (4.31)	11.52 (4.38)	11.17 (4.35)
CES-D depression	16.91 (4.16)	16.67 (4.11)	16.80 (4.13)
HADS-A anxiety	6.55 (2.86)	6.53 (2.96)	6.54 (2.91)
MOS SF subscale general health	18.57 (3.51)	17.95 (3.61)	18.26 (3.57)
MOS SF subscale vitality	14.46 (3.16)	14.62 (2.83)	14.54 (3.00)

Effects of the intervention

Table 2 presents the means and standard deviations for the outcome measures at 2- and 6-month follow-ups plus effect sizes and the results of the regression analysis in the EM imputed ITT sample. In Figure 3, the results of Psyfit on the MHC-SF, WHO-5, and CES-D are depicted. From baseline to the 2-month follow-up, well-being (the main outcome measure) as measured with the MHC-SF was higher although this did not meet statistical significance ($\beta = 0.09$, $P=.06$). A significant effect on the other well-being measure, the WHO-5, was found ($\beta = 0.12$, $P=.01$). Between-group effects fell within the small range (MHC-SF: $d=0.27$; WHO-5: $d=0.31$). With regard to the secondary outcome measures, the intervention group showed a significant decline at 2-month follow-up in both depressive symptoms ($\beta = -0.13$, $P=.02$) and anxiety ($\beta = -0.15$, $P=.001$), and a significant improvement in both self-reported health ($\beta = 0.09$, $P=.01$) and vitality ($\beta = 0.12$, $P=.02$) versus the control group. Effect sizes were)

Figure 2. Participants' flow through the study

Table 2. Effects of Psyfit, intention-to-treat analysis

Measures		Psyfit (n=143)			Control group (n=141)			Linear regression analysis			
		Mean	Sd	d	Mean	Sd	d	β	t	P value	Δd
MHC-SF	Baseline	3.45	0.62		3.50	0.63					
	2-month	3.92	0.71	0.71	3.82	0.82	0.44	0.09	1.88	.06	0.27
	6-month	3.88	0.79	0.61	3.90	0.71	0.60	0.01	0.13	.90	0.01
WHO-5	Baseline	10.81	4.31		11.52	4.38					
	2-month	12.75	4.47	0.44	12.12	4.63	0.13	0.12	2.47	.01	0.31
	6-month	12.92	4.77	0.47	12.45	4.61	0.21	0.09	1.61	.11	0.26
CES-D	Baseline	16.91	4.16		16.67	4.12					
	2-month	13.67	6.69	0.57	15.39	7.64	0.21	-0.13	-2.33	.02	0.36
	6-month	13.06	7.55	0.63	14.94	7.48	0.28	-0.13	-2.38	.02	0.35
HADS-A	Baseline	6.55	2.86		6.53	2.96					
	2-month	5.75	2.90	0.28	6.64	3.08	-0.04	-0.15	-3.29	.00	0.32
	6-month	5.65	3.39	0.29	6.70	2.98	-0.06	-0.17	-3.38	.00	0.35
MOS SF health	Baseline	18.57	3.51		17.95	3.61					
	2-month	19.21	3.16	0.19	18.11	3.50	0.05	0.09	2.72	.01	0.14
	6-month	18.65	3.41	0.02	18.20	3.51	0.07	0.00	-0.7	.95	-0.05
MOS SF vitality	Baseline	14.46	3.16		14.62	2.83					
	2-month	15.74	3.09	0.41	15.14	2.76	0.19	0.12	2.33	.02	0.22
	6-month	15.70	3.57	0.37	15.20	3.01	0.20	0.09	1.70	.09	0.17

small (MOS SF general health: $d=0.14$; MOS SF vitality: $d=0.22$; HADS-A: $d=0.32$) to medium (CES-D: $d=0.36$). At 6-month follow-up, results were sustained for anxiety ($\beta = -0.17$, $P=.001$) and depressive symptoms ($\beta = -0.13$, $P=.02$), presenting medium effect sizes (both $d=0.35$), but were no longer significant for well-being, health, and vitality.

The same trends in effects emerged in the completers-only analysis: positive effects for all outcomes at 2-month follow-up and sustained effects for anxiety and depressive symptoms at 6-month follow-up (Table 3). However, the effect of well-being at 2-month follow-up as measured with the MHC-SF was not significant in the completers-only analysis ($\beta = 0.08$, $P=.14$, $d=0.19$) nor were there significant effects for depressive symptoms at 6-month follow-up ($\beta = -0.10$, $P=.14$, $d=0.26$). Vitality was improved at 2-month follow-up, but this did not meet statistical significance ($\beta = 0.11$, $P=.06$, $d=0.19$).

Figure 3. Depicted scores at baseline, 2-month and 6-month follow-up for the MHC-SF, WHO-5 and CES-D (ITT sample)

Table 3. Effects of Psyfit, completers only analysis

Measures		Psyfit (n=95 2-month, n = 89 6-month)			Control group (n=119 2-month, n=109 6-month)			Linear regression analysis			
		Mean	Sd	d	Mean	Sd	d	β	T	P value	Δd
MHC-SF	Baseline	3.52	0.63		3.51	0.63					
	2-month	3.95	0.81	0.59	3.81	0.85	0.40	0.08	1.50	0.136	0.19
	Baseline	3.51	0.61		3.50	0.64					
WHO-5	6-month	3.89	0.84	0.52	3.91	0.76	0.58	-0.20	-0.32	0.749	-0.06
	Baseline	11.27	4.45		11.45	4.32					
	2-month	12.98	5.11	0.36	11.97	4.78	0.11	0.11	1.98	0.049	0.25
CES-D	Baseline	11.07	4.37		11.58	4.45					
	6-month	12.72	5.44	0.33	12.59	4.84	0.22	0.04	0.57	0.571	0.11
	Baseline	16.57	4.12		16.55	4.18					
HADS-A	2-month	13.35	7.97	0.51	15.58	8.11	0.16	-0.14	-2.12	0.035	0.35
	Baseline	17.04	4.14		16.66	4.00					
	6-month	13.35	8.64	0.54	14.87	8.04	0.28	-0.10	-1.50	0.135	0.26
MOS SF health	Baseline	6.27	2.83		6.52	3.03					
	2-month	5.49	3.18	0.26	6.68	3.24	-0.05	-0.16	-2.89	0.004	0.31
	Baseline	6.28	2.78		6.57	2.95					
MOS SF vitality	6-month	5.55	3.78	0.22	6.69	3.23	-0.04	-0.14	-2.24	0.027	0.26
	Baseline	18.66	3.50		17.97	3.66					
	2-month	19.40	3.31	0.22	18.09	3.61	0.03	0.11	2.59	0.010	0.19
MOS SF vitality	Baseline	18.39	3.40		18.39	3.35					
	6-month	18.57	3.58	0.05	18.61	3.36	0.07	-0.01	-0.11	0.913	-0.02
	Baseline	14.67	3.17		14.66	2.82					
	2-month	15.80	3.39	0.34	15.09	2.86	0.15	0.11	1.88	0.062	0.19
	Baseline	14.37	3.29		14.80	2.83					
	6-month	15.53	3.99	0.32	15.39	3.15	0.20	0.048	0.74	0.463	0.12

Adherence

On average, 1.39 modules were started (SD 1.45). Most participants (74/143, 51.7%) started 1 module (mode and median). Participants most often enrolled in the positive emotions module (51/143, 35.7%), before personal mission statement and setting your goals (44/143, 30.8%), mindfulness (31/143, 21.7%), and optimistic thinking (29/143, 20.3%). Positive relations (22/143, 15.4%) and mastering your life (22/143, 15.4%) were the least popular modules.

In Table 4, different adherence grades and their effect sizes are shown for the experimental group (ITT sample). Adherence was defined as completing zero (31/143, 21.7%), 1 (46/143, 32.6%), 2 (24/143, 16.8%), 3 (29/143, 20.3%), or 4 lessons (13/143, 9.1%) from 1 or more modules. In plots, there is no clear dose–response relationship (the more adherence, the

Table 4. Adherence grades and effect sizes. ITT sample (experimental group, Cohen's d pre- post), Repeated Measures analysis

		Less than one lesson (n = 31)		One lesson (n = 46)		Two lessons (n = 24)		Three lessons (n = 29)		At least four lessons (n = 13)		Repeated Measures, df = 8	
Measures		Mean (Sd)	d	Mean (Sd)	d	Mean (Sd)	d	Mean (Sd)	d	Mean (Sd)	d	time	time *
MHC-SF	Baseline	3.46 (0.60)		3.46 (0.70)		3.17 (0.58)		3.52 (0.52)		3.69 (0.62)		F = 34.20	F = 1.72
	2-month	3.84 (0.61)	0.63	3.90 (0.64)	0.66	4.05 (0.81)	1.25	3.92 (0.68)	0.66	3.99 (1.04)	0.36	P < .001	P = .09
	6-month	3.74 (0.69)	0.43	3.87 (0.79)	0.55	3.98 (0.78)	1.18	3.94 (0.76)	0.65	3.91 (1.09)	0.25		
WHO-5	Baseline	10.00 (3.59)		11.74 (4.22)		9.75 (5.33)		10.41 (4.45)		12.31 (3.22)		F = 18.06	F = 0.95
	2-month	12.00 (3.21)	0.59	12.83 (4.01)	0.26	13.34 (6.24)	0.62	12.09 (4.01)	0.40	14.69 (5.60)	0.52	P < .001	P = .48
	6-month	11.56 (3.91)	0.42	13.28 (4.76)	0.34	13.29 (5.48)	0.65	12.80 (4.93)	0.51	14.55 (4.86)	0.54		
CES-D	Baseline	17.71 (4.19)		16.28 (3.71)		17.58 (4.74)		17.41 (4.33)		14.92 (3.73)		F = 30.00	F = 0.99
	2-month	15.21 (6.21)	0.47	13.73 (5.77)	0.53	13.99 (9.74)	0.47	13.61 (6.77)	0.67	9.31 (5.92)	1.13	P < .001	P = .44
	6-month	14.06 (6.51)	0.67	14.42 (7.67)	0.31	12.16 (8.56)	0.78	12.03 (7.94)	0.84	9.85 (5.90)	1.03		
HADS-A	Baseline	6.90 (2.53)		6.52 (2.96)		7.04 (3.21)		6.00 (3.11)		6.15 (2.03)		F = 9.20	F = 0.53
	2-month	6.28 (2.47)	0.25	6.22 (2.88)	0.10	5.58 (3.62)	0.35	4.71 (2.58)	0.45	5.00 (2.80)	0.47	P < .001	P = .83
	6-month	6.16 (3.19)	0.26	6.01 (3.37)	0.16	6.08 (4.00)	0.26	4.62 (2.94)	0.46	4.61 (3.40)	0.55		
MOS SF health	Baseline	18.52 (2.74)		18.46 (3.82)		19.00 (3.95)		19.14 (3.55)		17.00 (3.06)		F = 14.29	F = 2.16
	2-month	18.98 (2.74)	0.17	19.05 (3.14)	0.17	19.47 (4.05)	0.12	19.48 (2.80)	0.11	19.31 (3.43)	0.71	P < .001	P = .03
	6-month	17.82 (2.81)	-0.25	19.07 (3.29)	0.17	18.88 (4.41)	-0.03	19.06 (3.30)	0.02	17.85 (3.34)	0.27		
MOS SF vitality	Baseline	14.03 (2.77)		15.04 (3.17)		13.96 (3.97)		14.00 (2.87)		15.38 (2.84)		F = 13.53	F = 1.75
	2-month	15.20 (2.16)	0.48	15.83 (3.29)	0.24	16.83 (3.81)	0.74	15.21 (2.82)	0.43	15.85 (3.24)	0.16	P < .001	P = .09
	6-month	15.03 (2.77)	0.36	15.90 (3.64)	0.25	15.85 (4.23)	0.46	16.01 (3.67)	0.61	15.62 (3.91)	0.07		

larger the effect size) recognizable. Tested at $P < .10$, repeated measures analysis showed significant effects for the MHC-SF at both 2- and 6-month follow-ups after completing 2 lessons ($F_{8,274} = 1.72$, $P = .09$, Cohen's d pre-post 1.25 and 1.18). Significant effects were found for the MOS-SF general health subscale at 2-month follow-up after completing 4

lessons ($F_{8,274} = 2.16$, $P = .03$, Cohen's d pre-post 0.71) and for the MOS-SF vitality subscale at 2-month follow-up after adhering to 2 lessons ($F_{8,274} = 1.75$, $P = .09$, Cohen's d pre-post 0.74). When examining hardly any adherence (completing ≤ 1 lesson) versus at least some adherence (completing ≥ 2 lessons), 2 comparisons appeared to be significant (not presented in Table 4). The effect sizes of the HADS-A anxiety scale at 2-month follow-up ($d = 0.16$ vs $d = 0.43$, $t_{141} = 2.24$, $P = .03$) and of the CES-D depression scale at 6-month follow-up ($d = 0.47$ vs $d = 0.87$, $t_{141} = 1.84$, $P = .07$) were significantly higher for the at least some adherence group compared to those who completed 1 lesson or less.

Participant satisfaction

Results regarding participant satisfaction are based on the completers sample (93/95 filled in the satisfaction questionnaire). Regarding participant satisfaction, 40 of 93 participants (43.0%) in the experimental group expressed satisfaction with Psyfit. The other 57.0% (53/93) were indifferent and/or dissatisfied. In the questionnaire, we were unable to separate the indifferent and the dissatisfied categories. Psyfit was found to be somewhat helpful in dealing with problems by 47.3% of the participants (44/93). Almost 70% (65/93) of the participants would recommend Psyfit to friends, and 66.7% (62/93) would do Psyfit (again), if needed. Adherence was positively related to satisfaction rate ($\chi^2_3 = 15.0$, $P = .02$).

Subgroup effects

A moderator analysis with well-being (MHC-SF and WHO-5) and depression (CES-D) as dependent variables was conducted to explore which subgroups benefited more or less from the intervention. The only significant result was found for education level on the WHO-5 well-being measure at 6-month follow-up ($d = 0.46$ for higher-educated participants vs $d = -0.20$ for lower-educated participants; $F_{1,280} = 6.23$, $P = .01$). Other nonsignificant trends for educational level were found on WHO-5 well-being at 2-month follow-up ($d = 0.42$ vs $d = 0.02$; $F_{1,280} = 3.60$, $P = .06$) and on the CES-D at 6-month follow-up ($d = 0.58$ vs $d = -0.13$, $F_{1,280} = 3.66$, $P = .06$), suggesting that higher-educated people profited more from the intervention than lower-educated people on these measures. For age, a nonsignificant trend was found on the CES-D at 6-month follow-up ($d = 0.61$ for participants older than 45 years vs $d = 0.09$ for younger participants, $F_{1,280} = 3.62$, $P = .06$), suggesting that the older group benefited more from Psyfit. For the other 2 potential moderators, gender and depression status, no significant or relevant interaction effects were found.

DISCUSSION

Principal results

This randomized controlled trial examined the efficacy of an online self-help course aimed at promoting mental fitness and subsequent well-being. The results at 2-month follow-up show that intervention group participants made a significant improvement in the level of overall well-being on one measure (WHO-5) than participants in the waiting-list control group and a nonsignificant improvement on the other well-being measure (MHC-SF). Furthermore, general health and vitality level were significantly enhanced, and depression and anxiety symptoms were reduced in comparison to the waiting-list control group. At 6-month follow-up, effects were maintained for depression and anxiety. All effects were in the small to medium range. Adherence analysis revealed no clear dose–response effect, although some larger effects appeared for people receiving at least a minimal part of the intervention. For well-being (only WHO-5) and depression, somewhat larger effects were found for higher-educated and older participants.

Comparison with previous work

The effects of taking part in Psyfit are comparable with effects of similar positive psychological interventions in self-help format with regard to well-being (0.14–0.33 in a meta-analysis at immediate follow-up), but appear to be larger for depression on average (0.15 in the same meta-analysis) (Bolier et al., 2013). When compared with separate studies of other online positive self-help interventions, the effect sizes at immediate follow-up in the current study are quite similar, and higher in some cases. For example, in the Seligman et al. (2005) study, exercises that worked well had effect sizes of 0.23 for well-being and 0.14–0.28 for depression. In the study of Shapira and Mongrain (2010), effect sizes of 0.03–0.18 were found for well-being and 0.09–0.30 for depression. Mitchell et al. (2009) found effect sizes ranging from 0.05 to 0.29 for well-being and an effect size of –0.17 for depression. At longer-term follow-up, effect sizes of the current study were comparable or higher for depression (up to 0.33 for Seligman et al. (2005), 0.42 for Shapira and Mongrain (2010), and –0.04 for Mitchell et al. (2009), and lower for well-being (up to 0.28 for Seligman et al. (2005), up to 0.30 for Shapira and Mongrain (2010), and up to 0.33 for Mitchell et al. (2009)).

Adherence and acceptability

More than three-quarters (78.3%) of the participants in the intervention group completed at least 1 lesson in Psyfit. The personal mission statement and setting your goals module and the positive emotions module were the most popular modules, each chosen by one-third of the total sample. This can be considered a satisfactory adherence rate in general because it is comparable with, or higher than, adherence rates in other online self-help interventions

(Christensen et al., 2009). However, from a practical point of view, it is questionable whether this adherence rate deserves our endorsement because less than 10% fully adhered to 1 module (consisting of 4 lessons). The group who completed at least 1 lesson showed slightly larger effect sizes than the whole group analysis, indicating that following the self-help course could predict effect size to some extent, but these results were not convincing. The explanation for this is not immediately clear. Dose-response effects (the more adherence, the larger the effects) have been established in several online trials of mental health promotion (Donkin et al., 2011). On the other hand, not every trial demonstrated such an adherence effect (van der Zanden, Kramer, Gerrits, & Cuijpers, 2012), which is comparable to our results. Unfortunately, we collected no information on the reasons for quitting (or not even starting) the intervention. One possible explanation is that nonparticipants/dropouts felt disappointed, or not capable of proceeding with the intervention. We did determine that adherence rate was positively related to satisfaction rate. Alternatively, it could be argued that people stopped because they felt better and were no longer in need of help, which could explain the modest effects of adherence, implying that the nonadhering participants were doing better as well.

Still, the question of how to increase the engagement and adherence for this type of intervention is important. It is likely that by increasing adherence, people could benefit more. The incorporation of persuasive and gaming elements into an intervention may hold considerable promise because such elements may raise client satisfaction and can encourage participants to stick to the intervention (Fogg, 2003; Kelders et al., 2012; Lehto & Oinas-Kukkonen, 2011). Less than half (approximately 40%) of participants were satisfied with Psyfit, although a larger percentage (approximately 65%) would recommend the program to a friend or would do it again if needed. Persuasive elements may help to arouse and prolong participant motivation, which may ultimately contribute to sustainable behavioral change (Fogg, 2003). Although Psyfit already contains some engaging and motivating elements, such as email reminding and self-monitoring instruments, other persuasive functionalities could be added to make it a truly interactive and personalized device, such as tailored feedback and action planning. In addition, minimal guidance (eg, telephone/email contact or coaching supervision) is worth considering because this may increase adherence and effectiveness. There is some experimental evidence showing that tailoring positive psychological exercises to needs and preferences can indeed effectively enhance intervention engagement and adherence (Schueller, 2011), although preference for a certain well-being activity appears to be not enough to guarantee intervention effectiveness (Parks, Della Porta, Pierce, Zilca, & Lyubomirsky, 2012). For this reason, it seems warranted to ensure a good person-activity fit; a kind of diagnosis to determine which well-being enhancing exercise suits the participant best (Lyubomirsky et al., 2011). Features of the intervention (dosage and variety) as well

as personal aspects, such as motivation and efficacy beliefs, should be taken into account (Lyubomirsky & Layous, 2013). Lastly, it has been found that lower-educated groups often lack the more sophisticated Internet skills that are needed to participate in an online intervention (van Deursen & van Dijk, 2011). Increasing those skills in these groups might contribute to improved adherence and better performance in online interventions such as Psyfit.

Population approach

A relatively slight increase in the overall level of health in a sizeable part of the population may have a larger preventive effect than targeting only the much smaller group of people who are already ill (Huppert, 2009; Rose, 2008). This principle may apply even more for mental health and well-being because stigma surrounding the formal use of mental health services may deter people in need from seeking help (Schomerus & Angermeyer, 2008). Considering that many people can be reached by Psyfit in a nonstigmatized way and in a relatively short length of time, even the small effect sizes that were demonstrated in this trial may contribute to an important improvement in population mental health. On the other hand, this trial only included a specific target group of people presenting mild to moderate depressive symptoms, which affects generalizability to the larger population. In a naturalistic study, it has been found that people seeking self-help interventions to improve well-being either show rather severe depression scores or hardly any signs of depression (Parks et al., 2012), whereas the present study targeted people with mild depressive symptoms. It would be insightful to examine if Psyfit is also effective in these other groups in a way that could be generalized to a larger population.

Limitations

A number of limitations in this study have to be recognized. First, there was a rather high attrition rate and differential dropout between the intervention arms. Although not an uncommon phenomenon in online trials (Eysenbach, 2005), the dropout may have affected the results in a way that is not easy to predict. Thus, the results of our trial should be considered with caution. Second, the intervention used in this study was designed like a toolbox from which people could pick and mix their own personalized program. This can be considered a strength because it enables participants to tailor their own program, which is a unique feature of the intervention. However, it may also be considered a weakness because no reliable statements can be given about the comparative effectiveness of modules and other effective elements of the intervention. Third, we did not measure motivational level, self-efficacy, or readiness to change as is constructed, for example, in the Stages of Change theory (Prochaska & DiClemente, 1992). Therefore, we could not examine whether the more motivated and better-equipped people adhered better to the intervention and accordingly

benefited more. Fourth, the study used a waiting-list control group. This means there was no blinding of participants and possible placebo effects could not be established. Fifth, the CSQ-8 (de Brey, 1983) contains ambiguous reply categories. As a result, some of the satisfaction rates were difficult to interpret. For further research, we recommend that these categories be adapted to an unambiguous Likert scale, for example. Sixth, the effect sizes that were found were mostly in the small range. The study was powered to detect medium-sized effects (Bolier et al., 2012) and may, therefore, be underpowered to detect these small changes (eg, the nonsignificant finding for well-being/MHC-SF at 2-month follow-up) and subgroup effects.

Conclusion and recommendations for practice and research

To the best of our knowledge, this is the first study of an online positive psychological intervention with a flexible multicomponent format to demonstrate both small, significant effects on well-being (for one of the measures) and on symptoms of mental disorder. Regarding the implications for public health, Psyfit could be used as an open and highly accessible mental health promotion tool, disseminated by relevant lifestyle and health-related websites and Internet forums, or referred to by health care professionals.

Regarding the future research agenda for online positive psychological interventions, emphasis should be placed on (1) increasing adherence and motivation by using persuasive design and/or providing minimal support, (2) determining what works best for whom and ensure a good person–activity fit, (3) serving lower-educated people better, and (4) considering the use of other control groups to overcome the limitations of a waiting-list control group. The target group could be expanded to present more variety in the depressive symptom spectrum. This will likely help to strengthen the generalizability of these results to a larger group of people.

One of the strengths of this study was the uncomplicated recruitment of participants (845 interested people within a 5-week timeframe), whereas in other randomized controlled trials of online health interventions recruitment can be a serious challenge (Murray et al., 2009). As such, Psyfit and other online positive psychological interventions can be regarded as positive technology, a recently proposed concept that refers to the use of technology for improving the quality of personal experience by fostering positive emotions, self-empowerment, and social connectedness (Riva, Baños, Botella, Wiederhold, & Gaggioli, 2012). These technologies have the potential to evolve further and become available to many more people. As nonstigmatizing and nonmedicalized tools to address the promotion of mental health and subsequent prevention of depression, they contain the promise of a sustained positive effect on health care and society.

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7

Cost-effectiveness of online positive psychology: randomized controlled trial

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ABSTRACT

As yet, no evidence is available about the cost-effectiveness of positive psychological interventions. When offered via the Internet, these interventions may be particularly cost-effective, because they are highly scalable and do not rely on scant resources such as therapists' time. Alongside a randomized controlled trial of an online positive psychological intervention, a health-economic evaluation was conducted. Mild to moderately depressed adults seeking self-help and recruited in the general population were randomly assigned to the intervention group ($n = 143$) and a waitlisted usual care group ($n = 141$).

Improved clinical outcomes were achieved in the intervention group (at least for depression) at higher costs. When outliers (the top 2.5%, $n = 5$ in intervention group, $n = 2$ in control group) were removed, cost-effectiveness was increased considerably. For positive psychology, economic evaluations may be a means to nudge policy decision-makers towards placing positive psychological interventions on the health agenda.

INTRODUCTION

Major depressive disorder is one of the leading contributors to the global burden of disease by causing disabilities and reduced quality of life (Vos et al., 2012). In addition to the human cost of depression, such as sad mood, isolation from significant others and an inability to enjoy life, high economic costs are involved. The annual per person costs are €5,009, amounting to €311 million per one million people in the age bracket of 18 - 65 years (Smit et al., 2006). A study based on data from 28 European countries estimated that around 1% of gross domestic income is lost due to depression. Around one-third of these costs are direct medical costs, while absenteeism and premature mortality account for the other two-thirds (Sobocki, Jonsson, Angst, & Rehnberg, 2006). Promoting population health and preventing depression may not only be justifiable in its own right, but may also be associated with economic benefits.

For the prevention of depression, investing in well-being on a public level might be just as important as treating (subclinical) symptoms in individuals (Keyes, 2007). In a population-wide health promotion approach the wider 'not yet ill' population would be targeted with well-being interventions as a preventive inoculation against psychopathology (Rose, 2008; Huppert, 2009). This population-wide health promotion approach could be relevant for positive psychological self-help interventions, particularly when offered online (Bolier & Martin Abello, 2013). Online positive psychological interventions (oPPIs) have the potential to be highly accessible and scalable, reaching different kinds of populations. Moreover, they are, in theory, low-cost interventions, empowering people to manage their own well-being and thereby saving valuable time for professional therapists.

There is some preliminary evidence that oPPIs may impact on well-being and depression, however, these effects appear to be smaller than offline positive psychological interventions (Mitchell, Vella-Brodrick, & Klein, 2010). In addition to clinical evidence regarding the efficacy of oPPIs, information about their cost-effectiveness may also help policy makers decide whether these interventions offer good value for money and should therefore be placed on the health agenda (Drummond, Sculper, Torrance, O'Brien, & Stoddart, 2005). However, oPPIs have not yet been evaluated from a health-economic perspective. One might expect these interventions to be cost-effective alternatives to their face-to-face counterparts since the online self-help format does not rely on scant resources. Moreover, well-being promotion, whether in online or offline format, is likely a cost-saving initiative in its own right, since the presence of well-being is related to enhanced work productivity and reduced healthcare costs (Keyes & Grzywacz, 2005).

Current study

A randomized controlled trial was conducted to examine the effectiveness of Psyfit (www.psyfit.nl), an online mental fitness self-help program, which is based on positive psychology principles. The main findings of this trial have been published elsewhere (Bolier et al., 2013). Alongside the RCT, a cost-effectiveness study was conducted from a societal perspective. This is the most common perspective used in economic evaluations, which captures all costs, no matter who incurs the costs. We used this perspective because decisions regarding positive psychological interventions should be made in the interest of the general public, and not be confined to the (economic) gains of one institution or sector. We hypothesized that doing Psyfit would lead to improved well-being and reduced depressive symptoms, against cost savings.

METHODS

Design

The study was designed as a randomized controlled trial in two parallel groups. Participants were randomized across two conditions: Psyfit and a waitlisted care-as-usual group. Online measurements were taken at baseline, 2 months and 6 months after starting the intervention. The study design, the intervention, and the clinical findings are reported in detail elsewhere (Bolier et al., 2013; Bolier et al., 2012). The study was approved by the Dutch Medical Ethics Committee for Mental Health Care, under registration number 9218, and was registered with the Netherlands Trial Register, part of the Dutch Cochrane Centre (NTR2126).

Participants and procedure

Participants were recruited from the general population via advertisements in free newspapers and banners on Facebook. The recruitment message was: "Would you like to increase your mental fitness? Improve your mental fitness with an online program". In this way a self-selected 'well-being seeking' sample was recruited. People could enrol at www.psyfit.nl. Next, they received an e-mail with information on the study and were directed to the informed consent form and baseline questionnaire. To be included, applicants had to be over 21 years of age, have access to a computer and the Internet and be fluent in the Dutch language. Furthermore, they had to present mild to moderate depressive symptoms (score 10-24 on the CES-D) (Haringsma, Engels, Beekman, & Spinhoven, 2004) and a languishing or moderate level of well-being (as measured with the MHC-SF) (Lamers, Westerhof, Bohlmeijer, Ten Klooster, & Keyes, 2011). Participants were excluded when presenting severe depressive symptoms (CES-D ≥ 25) and/or active suicidal thoughts or plans (question from the Web Screening Questionnaire) (Donker, Van Straten, Marks, & Cuijpers, 2009). Those meeting the exclusion criteria were advised to seek professional help (general practitioner and/

or the national suicide platform 113online.nl). Randomization took place after baseline measurement and was carried out using a computer generated randomization list in blocks of two, stratified by gender, education (high/lower) and depression symptom level (CES-D scores 10-15 and 16-24).

Intervention

Psyfit is an online self-help intervention, fully-automated and without support from a therapist. The intervention aims to enhance well-being by fostering positive emotions and stimulate positive functioning. A parallel goal is to reduce depressive symptoms. The intervention is based on principles derived from positive psychology and focuses on positive experiences, strengths and personal competencies rather than mental problems and deficiencies. It incorporates evidence-based exercises based on positive psychology, in addition to elements stemming from mindfulness, cognitive behavioral therapy and problem-solving therapy (Walburg, 2008).

There are six modules in Psyfit: 1) Personal mission statement and setting your goals, 2) Positive emotions, 3) Positive relations, 4) Mindfulness, 5) Optimistic thinking and 6) Mastering your life. One module contains four lessons. Each week, one lesson consisted of psychoeducation and a practical exercise, thus a participant can finish a module in one month. At the end of the week, participants received an email notifying them that the next lesson could be started. Participants could start or finish modules as they wished, as long as they were in sequence. Other functionalities in Psyfit include several self-tests to monitor progress, videos showing Dutch experts, a personal action plan and an online community to share experiences among its participants.

Participants allocated to the intervention group received an email with a personal username and password. After logging in, two-month access to Psyfit was activated. Participants were advised to complete at least one module during the intervention period.

Waitlisted care-as-usual group

Participants in the control group were told they were on a waiting list for 6 months before they received their login codes for Psyfit. They were free to seek professional help (care-as-usual), if needed.

Clinical measures

The primary clinical outcome was well-being, as measured with a brief measure of positive well-being, the WHO Well-being Index (WHO-5). The WHO-5 contains five positively formulated items on mental health. The WHO-5 has been validated in different populations (Henkel et al., 2003) and has shown high reliability (Cronbach's α of .84) (Bech, Olssen,

Kjoller, & Rasmussen, 2003) WHO-5 scores vary between 0 and 25 with higher scores indicating better well-being. The secondary clinical outcome was depression, as measured with the Dutch version of the Center for Epidemiological Studies Depression Scale, the CES-D (Radloff, 2009). The CES-D is a 20-item self-rating scale with item scores ranging from 0 to 3 (higher scores indicating more depression), and a total score from 0 to 60. The Dutch translation has demonstrated good reliability (Cronbach's α between .79 and .92) and validity (Bouma, Ranchor, Sandeman, & Van Sonderen, 1995).

Resource use measures

This study studied the cost-effectiveness of Psyfit from a societal perspective. This means that, according to standard economic evaluation procedures, all the costs related to the intervention were included: health service use, participants' out-of-pocket expenses and the costs due to productivity losses in paid work (Drummond et al., 2005). These data were collected using the Trimbos and Institute of Medical Technology Assessment Questionnaire for Costs for Psychiatry (TIC-P) (Hakkaart-van Roijen, Van Straten, & Donker, 2002) for two periods: the month prior to randomization and the month prior to the 6-month follow-up. There are indications that the TIC-P has satisfactory construct validity and is a reliable instrument to measure medical consumption and production losses in people with mild to moderate mental health problems (Bouwman et al., 2013). Costs can be categorized as direct or indirect costs. Direct costs include medical and non-medical costs. Indirect costs encompass productivity losses.

Direct costs: costs of health services

Direct medical costs are those related to the healthcare system and include healthcare uptake costs, from both formal and informal health service providers, as well as medication. The costs of these health care services were calculated by multiplying the number of health care units by their standard cost price as reported in the Dutch guidelines for health economic evaluations for the reference year 2009 (Hakkaart-van Roijen, Tan & Bouwman, 2010) (see Table 1 for an overview of the health service types and their costs). The costs of medication (antidepressants, sedatives and benzodiazepines) were calculated as the cost price per standard daily dose as reported in the Dutch Pharmacotherapeutical Compass (Broekhuijsen, Danz, Van Oppenraay & Veurink, 2013), multiplied by the number of prescription days plus the pharmacist's dispensing costs of €14 per prescription.

Direct non-medical costs included travelling and parking expenses while visiting a health service provider. These costs were valued at €0.20 per kilometre and €3 per hour parking time. Furthermore, the loss of leisure time for participating in Psyfit was incorporated and valued at €12.50 per hour.

Table 1. Direct medical and direct non-medical costs by health service type

Health service type	Direct Medical Costs (in 2009 €)		Direct Non-Medical Costs (in 2009 €)	
	Unit	Unit cost price ^a	km, hrs(h) ^b	Unit cost price ^c
General practitioner	Contact	28	1.1, 1h	15.72
Company doctor ^d	Contact	28	17.6, 0.5h	9.77
Social worker	Contact	65	5, 2h	29
Private practice psychotherapist, psychiatrist	Contact	90 ^e	7, 2h	29.4
Alcohol and drug consultant (CAD)	Contact	171	10 ^f , 3h	42.5
Regional mental health service ^g	Contact	171	5, 3h	41.5
Physiotherapist	Contact	36	2.2, 2h	28.44
Mental hospital	Contact	173	7, 3h	41.9
Medical specialist General Hospital	Contact	64	7, 3h	41.9
Medical specialist University Hospital	Contact	129	7, 4h	54.4
Alternative treatment ^h	Contact	50.7	5, 1h	16.5
Home care	Hour	35	NA	NA
Informal care (family, friends, self help) ⁱ	Hour	12.5	NA	NA

^a Integral unit cost prices (cf. Hakkaart-van Roijen et al., 2010).

^b Based on average distances (in special tariff taxi and public transport zones) and travel + waiting + treatment times (in hrs) for receiving treatment (cf. Hakkaart-van Roijen et al., 2010).

^c Costs = $(0.2 * \text{km}) + 3 + (12.5 * \text{hrs})$. With €0.2 = cost per km; €3 = 1h parking time; €12.5 = 1h time (cf. Hakkaart-van Roijen et al., 2010).

^d No parking costs assumed.

^e Own calculation, valued as average of private practice psychologist, psychotherapist, and psychiatrist (cf. Hakkaart-van Roijen et al., 2010).

^f Assumed as CAD were more dispersed than regional mental health services.

^g Psychologist and psychiatrist GGZ.

^h Own calculation, valued as average of homoeopath and acupuncturist (cf. Hakkaart-van Roijen et al., 2010).

ⁱ Valued as domestic help (cf. Hakkaart-van Roijen et al., 2010).

Notes: NA, not applicable.

Intervention costs

In estimating the per-participant intervention costs, the average time spent on the intervention was valued at €12.50 per hour (leisure time value) for an average of 4 hours per participant over the 4-week intervention period (based on the adherence rate in Bolier et al., 2013). In addition, working time spent answering questions and the moderation of a forum were included for an average of 3 days a month over the course of the intervention (at €700/day).

Further costs were related to website maintenance, which amounted to €6,000 and €4,500 per annum for upgrading and hosting the website respectively. Recruitment costs were included as well, which amounted to €10,000.

Relying on data from a Dutch adult population survey (Westerhof & Keyes, 2008), 65% of the adult population's well-being is under pressure to a greater or lesser extent (languishing or moderate well-being, $N=8,355,972$). Taking a conservative approach, it was assumed that 10% would search for online help, of whom a final 1% would engage in the online self-help intervention. This resulted in estimated usage by 8,356 participants per year. Based on the above assumptions and data, the per-participant intervention costs were estimated to be €55 as a lump sum.

Indirect costs: production losses

The costs stemming from production losses in paid work were calculated on the basis of the number of days absent from work (absenteeism), plus the number of days spent at work with reduced efficiency (presenteeism). Parameters were age, class and gender (See costs in Table 6.1 in Hakkaart-van Roijen et al., 2010, which were indexed to the year 2009).

Analysis

For the cost-effectiveness analysis, data from baseline to 6-month follow-up were used.

Analysis of clinical outcomes

The analysis of the clinical outcomes was performed according to the intention-to-treat (ITT) principle, which follows the guidelines of the Consolidated Standards of Reporting Trials (Altman, 1996). Missing data at follow-up were imputed using the expectation maximization algorithm (EM) in the Statistical Package for the Social Sciences, version 19. EM is a single imputation method that replaces missing values in the dataset with estimates. The method contains two steps: In the expectation step, a value is estimated based on the available data and dispersion. In the maximization step, a fitting value is calculated based on the restructured dataset. This is an iterative process, until the most accurate estimation is reached. In a comparison of different imputation methods, EM imputation led to acceptable results, as opposed to last-observation-carried forward (Blankers, Koeter, & Schippers, 2010).

For both the well-being and depressive symptoms outcomes, clinically relevant changes were determined. For the WHO-5, Jacobson and Truax's algorithm for reliable and clinically relevant change was calculated (Jacobson & Truax, 1991), which turned out to be 5.91 points improvement on the raw scale. In addition, we decided that the participant had to score 13 points or higher (below 13 is an indication for depression (Bech, 2004)). For the CES-D,

participants needed to score below the clinical cut-off score of 16 and improve at least 5 points, which is an accepted indication for clinically relevant change in CES-D depression (Beekman et al., 2002). Due to our included target group, participants who scored already below the cut-off score of 16 (10-15) needed to fulfil only the 5-points change criterion, whereas the participants presenting with moderate symptoms (16-24) had to fulfil both criteria. Participants were dichotomised according to these criteria into treatment responders and non-responders.

Cost-effectiveness analysis

The cost-effectiveness analysis was likewise conducted according to the ITT principle. The mean total and annualised costs for each of the conditions were calculated at baseline and follow-up (the monthly costs were multiplied by 12 months). The incremental costs were calculated as the between-group difference at post-test.

Incremental costs and incremental effects were used to calculate the incremental cost-effectiveness ratio (ICER) as $(C1 - C0)/(E1 - E0)$, where C is the average annualised per-participant cost and E is the proportion of treatment responders in the experimental (1) and control condition (0). The ICER of each outcome describes the incremental costs for gaining one additional intervention response, and was calculated for both well-being and depression.

Stochastic uncertainty in the ICER was captured using a non-parametric bootstrap approach (with 2,500 replications), producing a scatter of simulated ICERs. This cost-effectiveness plane represents a decision matrix, with differences in costs on the vertical axis and differences in health effects on the horizontal axis. If the dots appear mainly in the South-East quadrant of the plane, health gains are obtained for lower costs, resulting in an acceptable intervention from a cost-effectiveness perspective. Dots appearing in the North-West quadrant correspond to diminished health for increased costs, which means that the intervention is unacceptable in comparison to usual care. In the two other quadrants, higher or lower cost levels have to be weighed against greater or lesser effectiveness.

For decision-making purposes, a cost-effectiveness acceptability curve was produced when higher costs had to be weighed against greater effects. This curve represents the probability that the intervention is cost-effective relative to the control condition for one case for a range of willingness-to-pay (WTP) ceilings (€0 – €100,000) for gaining one additional treatment responder.

Sensitivity analyses

Several sensitivity analyses were conducted. First, to determine the robustness of the results, the analyses were repeated for a scenario in which the intervention costs were assumed to be

larger (€150 instead of €55), as this might be the case in another setting or country. Second, because it was found that the costs were driven by a few outliers, a separate analysis was conducted. In this separate analysis, the top 2.5% of the outliers with costs in excess of €45,000 were removed: $n = 2$ in the usual care group, and $n = 5$ in the Psyfit group. Third, a complete case analysis was conducted to check whether results were maintained examining those people who filled in all questionnaires. Fourth, the complete case analysis was also done under the outlier scenario.

RESULTS

Flow of participants

After screening for eligibility, 284 of the 845 people that were interested in the study, were included (See Figure 2 of Chapter 6 for flow of participants through the study). Attrition rate was 24.6% (70/284) at 2-month follow-up and 30.3% (86/284) at 6-month follow-up. Attrition rate was significantly higher in the Psyfit group, as compared to the control group. There were no significant differences between dropouts and completers regarding baseline symptoms. However, those who dropped out seemed to be of younger age ($\chi^2_1 = 4.2$, $p = .04$) compared to people who filled in all questionnaires.

Participants' characteristics

The mean age of participants was 43.2 years and most were female (226/284, 80%) and highly educated (208/284, 73%). The majority had paid employment (214/284, 75%). The mean score on the WHO-5 at baseline was 11.17 (Sd 4.35) and on the CES-D 16.80 (Sd 4.13), indicating a challenged level of well-being and a slightly elevated level of depressive symptoms. At baseline, mean per-participant annualized total costs were €5282 in the Psyfit group and €5966 in the control group (Table 2). There were no clinically or economically relevant differences at baseline between the study groups, indicating that randomisation had resulted in comparable groups.

Effects

After 6 months, the number of participants showing clinically significant change for the WHO-5 was 25 (17.5%) in the Psyfit group as compared to 15 in the control group (10.6%) ($\chi^2_1 = 2.75$, $p = 0.10$). The difference in effectiveness was $0.175 - 0.106 = 0.07$. For the CES-D, clinically significant change was observed in 64 participants in the Psyfit group (44.8%) versus 42 participants in the control group (29.8%) ($\chi^2_1 = 6.80$, $p = 0.01$). The difference in effectiveness was $0.448 - 0.298 = 0.15$.

These results were comparable with the results that were found on the continuous measures

(table 3): From baseline to 6-month follow-up well-being as measured with the WHO-5 was not-significantly higher in the Psyfit group ($\beta = 0.09$, $p = .11$, Cohen's $d = 0.26$), and depressive symptoms were significantly reduced ($\beta = -0.13$, $p = .02$, Cohen's $d = 0.35$).

Table 2. Annual per capita costs by condition and time

	€, 2009 ^a			
	baseline	(SD)	6-m follow-up	(SD)
<i>Care as Usual condition (N=141)</i>				
Direct medical costs ^b	1187	(2187)	1037	(1646)
Direct non-medical costs	497	(821)	387	(556)
Absenteeism ^c	2625	9118	2257	8118
Presenteeism	1657	2997	1736	3123
Intervention costs	NA		NA	
Total costs	5966	(10202)	5417	(9070)
<i>Online self-help condition (N=143)</i>				
Direct medical costs	1316	(1855)	1307	(1788)
Direct non-medical costs	484	(699)	457	(639)
Absenteeism	1608	5856	3067	10195
Presenteeism	1874	3599	2001	4046
Intervention costs	NA		55	(0.0)
Total costs	5282	(8021)	6888	(12746)

^a Mean costs based on a monthly basis (cf. Hakkaart-van Roijen et al., 2010).

^b Including medication

^c Presenteeism, Absenteeism all relate to production losses (indirect costs)

Notes: Total costs are the sum of the other cost components. Differences in the totals are due to rounding. NA, not applicable.

Cost-effectiveness

Table 2 presents the direct, indirect and total annualised costs based on imputed data. Table 4 contains the cost-effectiveness analysis (Total sample). At 6-month follow up, the average total annualised per-participant costs were €6,888 in the experimental group and €5,417 in the control group, hence. Hence, the incremental costs were €6,888 - €5,417 = €1,471. The majority of the costs stem from production losses at paid work.

Table 3. Effects of Psyfit on the continuous measures

		Psyfit			Waiting list			Linear regression analysis		
Measures		Mean	Sd	d	Mean	Sd	d	β	P value	Δd
WHO-5	Baseline	10.81	4.31		11.52	4.38				
	6-month	12.92	4.77	0.47	12.45	4.61	0.21	0.09	.11	0.26
CES-D	Baseline	16.91	4.16		16.67	4.12				
	6-month	13.06	7.55	0.63	14.94	7.48	0.28	-0.13	.02	0.35

For WHO-5 well-being (see Figure 1), the ICER is $1,471 / 0.07 = 21,319$, which implies additional costs of €21,319 for gaining one treatment response. On the cost-effectiveness plane, the majority of the simulated ICERs (73%) occur in the North-East quadrant. This indicates that with a probability of 73%, a health gain is produced by applying the intervention, but at additional costs. The other ratios show up in the South-East quadrant (18%, indicating health gains at lower costs), in the North-West quadrant (7% indicating negative effects at higher costs), and in the South-West quadrant (2% indicating negative effects, with cost savings). The incremental cost-effectiveness acceptability curve shows that when there is no willingness to pay, there is a 23% probability that the intervention is more cost-effective than care-as-usual. When the willingness to pay for a favourable treatment response is €10,000, €20,000 or €30,000 this probability rises to 34%, 47% and 61%, respectively.

For CES-D depression (see Figure 2), the ICER is $€1,471 / 0.15 = €9,807$ per treatment responder. Again, most ICERs (79%) are located in the North-East quadrant, showing that there is a large probability that health gains are obtained for additional costs. There is a 19% probability that the intervention is effective with cost savings (the South-East quadrant) and a 2% probability that the intervention is ineffective at higher costs (North-West quadrant). In

Table 4. Cost-effectiveness analysis and sensitivity analysis

	Total sample		Alternative scenarios							
	WHO-5	CES-D	A		B		C		D	
	WHO-5	CES-D	WHO-5	CES-D	WHO-5	CES-D	WHO-5	CES-D	WHO-5	CES-D
Costs ¹	1,471	1,471	1,565	1,565	463	463	2,276	2,276	-205	-205
Effect	0.07	0.15	0.07	0.15	0.07	0.15	0.04	0.16	0.05	0.18
ICER, €	21,319	9,807	22,681	10,433	6,431	3,087	53,993	13,871	-4,068	-1,166
<i>Distribution in the ce plane</i>										
- 1 st quadrant (n-e)	73	79	73	79	51	54	66	84	31	39
- 2 nd quadrant (inferior: n-w)	7	2	8	2	6	2	19	1	9	1
- 3 th quadrant (s-w)	2	0	2	0	5	1	3	0	12	1
- 4 th quadrant (dominant, s-e)	18	19	18	18	39	44	12	15	48	60
<i>WTP ceiling, %</i>										
€0	23	22	22	22	44	47	18	18	60	62
€10,000	34	47	33	47	68	82	22	39	69	90
€20,000	47	71	47	70	80	90	32	63	74	96
€30,000	61	83	60	84	84	95	40	78	77	98

¹ Costs per 'disease-free' year at 2009 prices

ICER = Incremental Cost Effectiveness Ratio

Scenario A = Intervention costs raised to €150

Scenario B = Outliers 2.5% from the top excluded (2 excluded in usual care group and 5 excluded in Psyfit group)

Scenario C = Completers sample (N = 109 usual care group, N = 89 Psyfit)

Scenario D = Completers sample, outliers excluded (N = 107 usual care group, N = 84 Psyfit)

terms of acceptability, there is a 22% probability that the intervention is more effective than care-as-usual when there is no WTP. When the willingness to pay for a favourable treatment response is €10,000, €20,000 or €30,000 this probability increases to 47%, 71% and 83%, respectively.

Figure 1. WHO-5 Cost-effectiveness plane and acceptability curve

Figure 2. CES-D Cost-effectiveness plane and acceptability curve

DISCUSSION

Main findings

The aim of this randomized controlled trial was to examine whether an oPPI to enhance mental fitness and reduce depressive symptomatology would be cost-effective. The proportion of participants that showed clinically relevant change on the main outcome well-being was (not significantly) higher in the intervention group: 17.5% in the intervention group as compared to 10.6% in the care-as-usual group. For depression, clinical change occurred in 44.8% of the participants in the intervention group and in 29.8% of the participants in the

control group. Although Psyfit was demonstrated to be more effective than the usual care group, at least for depression, this economic evaluation indicates that the intervention is not cost-effective from a societal point of view. The better effects are obtained for substantially higher costs (€21,319 and €9,807 per treatment responder on well-being and depression, respectively). Under the hypothetical scenario that there is no willingness to pay for treatment response, there is a 22% probability that the intervention is more cost-effective than usual care. In general, there is at least some willingness to pay for a health gain, but it remains to be seen if the WTP would be as high as close to €10,000 for a clinically significant reduction in depressive symptomatology plus a less pronounced increase in well-being. The majority of the costs stem from production losses. Sensitivity analyses with a hypothetical increase in intervention costs and in the complete case sample attested to the robustness of these findings. However, when the top 2.5% high-cost outliers were removed (7 outliers), the cost-effectiveness of Psyfit looked more favourable for both well-being and depression, especially in the complete case sample.

From a health-economic point of view, Psyfit has not produced large benefits in the overall sample. This result is not consistent with the growing body of evidence that Internet-based interventions can be cost-effective, as demonstrated for example in the case of cognitive behavioral therapy via the Internet to treat depression, social phobia or panic disorder (Hedman, Ljotsson, & Lindefors, 2012). What might have caused the limited cost-effectiveness? The major cost-driver for the intervention group was obviously not the intervention costs of €55, but it appeared that participants in the intervention group generated more productivity losses as compared with the participants in the usual care group. In particular, the costs for absenteeism were higher in the intervention group. This was a puzzling finding since there was no indication of loss of health and vitality in the intervention group (Bolier et al., 2013). A possible explanation could be that through gaining increased awareness of their stress, people in the intervention group took sick leave more frequently by way of prevention and in the context of better self-management. Whether this is really the case is unknown, since we did not ask why they reported themselves sick. We could also speculate that having followed the intervention, people might adhere more tenaciously to their personal life goals and values, discovering in the process that their job wasn't the most important thing in life. This may have increased their willingness to report sick more often or for longer periods of time.

A closer look at the data revealed that there was no difference between the *number* of people that became sick listed in the intervention group compared to the control group. However, there was a small minority of participants in the intervention group that lost many working days, thus increasing total absenteeism. When we removed some of these outliers (top 2.5%) in both the intervention group (n=5) and the usual care group (n=2), cost-effectiveness

increased substantially. Minus the outliers, and at a WTP of €0, the intervention has a probability of 44-47% of being cost-effective; with a WTP of €10,000 this probability rises to 68-82%. Whether Psyfit is cost-effective or not, is ultimately up to the judgement of the decision makers. Much depends on the willingness to pay and, it appears, on the impact of outliers.

Limitations

Several limitations of this study need to be recognized. First, the outcomes of this cost-effectiveness analysis seem to be affected by a limited number of outliers. This will likely cause insecurity in the decision-making process. Second, there was a rather high attrition rate in this trial and in addition selective dropout. Although not an uncommon phenomenon in online interventions (Eysenbach, 2005), the procedure for handling the missing data may not have been entirely successful in eliminating this bias. Third, the costs and effects were examined in a relatively short time-span of 6 months. Consequently, we do not know how the cost-effectiveness would have been over the longer term. Fourth, we used a waitlisted usual care group and therefore we could not blind participants to the condition to which they were assigned. Even though this is the case for most randomized trials of psychological interventions, it may have distorted the outcomes. Fifth, we did not consider changes in the costs in the domestic realm, while it is common in economic evaluations to value these as well (Drummond et al., 2005). Sixth, participants in the trial were a self-selected sample of mainly highly educated women. To generalize results to the wider population of mildly depressed people, more men and lower educated people have to be reached, perhaps by adapting the recruitment method and/or intervention. Because of these limitations, the results of this study should be considered with caution.

Recommendations and future directions

What could positive psychology learn from economic evaluations in general and from this CEA study in particular? In general, CEA can evaluate the economic costs and benefits associated with the clinical outcomes of positive psychological interventions. Clearly, decision makers would be more likely to consider interventions that not only improve health outcomes, but are also affordable economically, thus offering good value for money. If the cost-effectiveness of positive psychological interventions would be established, this could encourage investment in the implementation of these interventions from stakeholders such as companies, schools and municipalities. Positive psychology can learn from CEAs and other economic evaluations in the medical field, by using the same standards for designing, conducting and reporting health economic evaluations (Drummond et al., 2005; Husereau et al., 2013). In addition, it may make sense for positive psychology to look beyond the medical model, because the interventions tend to have broad impacts – often extending beyond well-

being and symptom reduction. In the current study we looked mainly at illness-based cost drivers and thus we may not have captured all benefits. Assessing the cost-effectiveness of public health interventions, which Psyfit is considered to be, requires a broad perspective on intersectoral costs and consequences (Weatherly et al., 2009). As we know, enhanced well-being is related to many positive outcomes for the individual and for society (Lyubomirsky, King, & Diener, 2005). It would be interesting to establish what the cost-savings would be, for example, of greater creativity, innovation or enhanced prosocial behavior. In addition to CEAs, other types of economic evaluations can be applied, such as a cost-benefit analysis (CBA) in which monetary value is linked to the outcomes, or a cost-consequence analysis (CCA), which allows decision makers to select components and health benefits that are most relevant to their perspective and needs.

The current study sets a first example of how a CEA in positive psychology can be designed and conducted. The results raise questions on how to improve the cost-effectiveness of the intervention. As we have seen, removing outliers sheds another light on the results. Also, there could be other conditions under which the intervention might be more effective and cost-effective as well. In the 6-month follow-up, which data was used for the cost-effectiveness analysis, depressive symptoms were still significantly reduced, but the raised well-being level was no longer maintained. The adherence rate in Psyfit was rather low; although a large part (112/143, 78%) followed at least one lesson in a module, less than 10% (13/143) finished the intervention according to the protocol (Bolier et al., 2013). If adherence could be enhanced, the effectiveness might well improve, as other research has shown (Donkin et al., 2011). In positive psychology interventions, it is imperative to establish a good 'person-activity fit', thereby connecting the intervention to the needs and preferences of the user (Lyubomirsky, Dickerhoof, Boehm, & Sheldon, 2011). To maintain an elevated level of well-being, an ongoing effort in doing the exercises might be needed, as people may have a tendency to return to their personal 'set-point' level of well-being (Sheldon & Lyubomirsky, 2006). Although Psyfit already contains some engaging and motivating elements, such as self-monitoring and a free choice of modules, the effectiveness and subsequent cost-effectiveness of Psyfit and other oPPIs in general could be improved by incorporating more persuasive elements, such as personalized feedback and tailoring of the intervention needs and preferences (Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012). Another way to boost the (cost-)effectiveness of Psyfit and other oPPIs would be to identify who benefits most from the intervention and whether there are certain subgroups for whom Psyfit is counterproductive. In that way, interventions can be targeted and/or tailored to these particular groups. Lastly, it might be wise to pay attention in the intervention to well-being and mental health complaints in relation to work-related issues, in order to deal with the diminished productivity in the intervention group.

Conclusion

To the best of our knowledge, this is the first study to examine the health economic consequences of a positive psychological intervention. In the cost-effectiveness analysis, improved clinical outcomes were achieved (at least for depression), though at higher costs. In conclusion, we recommend looking for ways to increase the cost-effectiveness of Psyfit, for example by increasing adherence and longer term effectiveness, or by targeting the intervention to particular subgroups for whom the intervention works best. Replications of this study are needed. For positive psychology in general, we recommend considering the possibilities of economic evaluations alongside randomized trials, as they may help (online) positive psychological interventions to gain a firm foothold on the public health agenda for the 21st century.

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8

Workplace mental health promotion online to enhance well-being of nurses and allied health professionals: a cluster-randomized controlled trial

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ABSTRACT

Objective. Well-being is an important prerequisite for the mental health and work functioning of nurses and allied health professionals. The objective of this study was to examine the effectiveness of a workers' health surveillance (WHS) module that offers screening, tailored feedback and online interventions targeting positive mental health and mental health complaints. WHS is a strategy at the workplace to implement preventive action by identifying and treating health complaints.

Methods. All wards of one hospital were randomized, and all nurses and allied health professionals working in these wards ($N = 1140$) were invited to participate in either the Online Intervention group (OI) or the Waitlisted control group (WL). Primary outcome was positive mental health (Mental Health Continuum — Short Form, MHC-SF); secondary outcomes were work engagement (Utrecht Work Engagement Scale, UWES), a specific well-being measure (WHO-5 Well-being Index) and mental health symptoms (Brief Symptom Inventory, BSI). Online self-report measurements were conducted at baseline, and after three and six months.

Results. Participation rate for the intervention at baseline was 32% ($NOI = 178$; $NWL = 188$). The intervention significantly enhanced positive mental health, in comparison to the control group ($F = 3.46$, $p = 0.03$). Cohen's d was 0.37 at post-test and 0.28 at follow-up, which can be considered as a moderate effect and a small effect respectively. In particular, psychological well-being (a subscale on the MHC-SF) was enhanced (Cohen's d 0.43 at post-test and 0.50 at follow-up). No significant or relevant differences between groups on secondary outcomes were found. The uptake and compliance of the online interventions was very low (28/178, 16% logged in; 9/178, 5% started with one or more modules within an intervention).

Conclusion. We can conclude that the intervention was capable of enhancing positive mental health. However, due to a high attrition rate, especially in the intervention group, this result should be considered with caution. Improvement of the screening instrument, more use of persuasive technology within the interventions and individual guidance to support engagement and compliance may be recommended.

INTRODUCTION

Many nurses suffer from mental health problems. A cross-sectional study reports a twice as high prevalence rate of depression in nurses as compared to the prevalence rate in the normal adult population (Letvak, Ruhm, & McCoy, 2012). This state of affairs not only concerns themselves, but could also seriously affect their work productivity and functioning (Letvak et al., 2012). Impaired mental health in nurses is associated with medication errors, near misses, patient safety and patient satisfaction (Gärtner, Nieuwenhuijsen, van Dijk, & Sluiter, 2010). Therefore, early detection of mental health complaints or reduced work functioning is essential for the quality of nursing care (Gärtner, Nieuwenhuijsen, van Dijk, & Sluiter, 2012).

A focus on well-being

A focus on symptoms and impaired work functioning may not be sufficient to enhance the mental health of nurses. The mental health care system has traditionally focused more on the treatment of mental disorders and symptoms than on the promotion of well-being (Seligman & Csikszentmihalyi, 2000). However, it is widely recognized that mental health is more than just the absence of mental illness, as is stated in the World Health Organization's definition of mental health (WHO, 2004):

Mental health is a state of well-being in which the individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively, and is able to make a contribution to his or her community.

According to this definition, well-being and well-functioning are core elements of mental health. Recently, these elements are captured into a dynamic concept of health in which empowering people to take charge of their own health, in face of adversity, plays a central role: *Health is the ability to adapt and self-manage in the face of social, physical and emotional challenges* (Huber et al., 2011). This might be a highly applicable concept for nurses and allied health professionals, such as physiotherapists and radiotherapists, as working in this area can have a serious impact on mental well-being and resilience. This impact is due to high workload, time pressure and coping with human suffering and pain (McCann et al., 2013). The self-management capacity of a nurse to cope with the challenges at work and restore one's sense of well-being might determine to a certain extent their mental health.

The benefits of well-being on people's functioning are recorded both in cross-sectional and longitudinal research. They include improved productivity at work, better physical health and as a consequence less health care uptake, and having more meaningful relationships (Howell, Kern, & Lyubomirsky, 2007; Keyes & Grzywacz, 2005). In addition, the available

evidence suggests that well-being reduces the risk of developing mental health complaints and disorders at a later point in time (Wood & Joseph, 2010). In this sense, well-being acts as a protective factor for mental health and healthy functioning. Three different types of well-being have been identified in various studies. Subjective well-being refers to positive affect and/or life satisfaction (Diener, 1984). Psychological well-being refers to the level of positive functioning containing constructs such as meaning in life, goal setting, and mastery (Ryff, 1989). Social well-being contains constructs such as the level of social integration and social contribution, together with subjective and psychological well-being forming the construct of 'positive mental health' (Keyes, 2002).

Well-being in the nursing profession

In the context of work, a considerable amount of research has been conducted on the well-being related construct of *work engagement*, a positive, fulfilling, work related state of mind that is characterized by vigour, dedication and absorption (Bakker, 2011). For nurses and allied health professionals, promoting well-being strengthens work commitment and performance (Kanste, 2011; Sun, Zhao, Yang, & Fan, 2012). Nursing could be regarded as highly demanding work, both emotionally and physically, and therefore training programs to enhance work engagement and to strengthen personal resources seem warranted (Chou, Hecker, & Martin, 2012). Likewise for society, keeping our health care workforce mentally fit is of crucial importance. The need for health care workers is growing, as the population is ageing at a rapid pace. In the meantime the health care workforce is ageing at a similar rate. In the Netherlands, only 27% of the nurses predict they will be able to work until they reach retirement age, because of high work pressure and low work engagement (Maurits, De Veer, & Francke, 2012). This raises serious questions about the sustainability of health care in the long run (Lokkerbol & Smit, 2013). All in all, it seems important to promote mental health at the workplace (Czabala, Charzynska, & Mroziak, 2011) and to foster well-being and work engagement among nurses and other health professionals in particular (Jenaro, Flores, Orgaz, & Cruz, 2011).

Workers' health surveillance

One strategy for prevention in the workplace involves workers' health surveillance (WHS), a system to detect work-related detrimental health effects at an early stage, in order to enable timely interventions (Koh & Aw, 2003). In occupational healthcare, WHS is an important feature. In the Netherlands, it is a mandatory action for employers to allow their employees to do such a check-up that is aimed at preventing or reducing the risks that the work poses for the employee health. In the Netherlands, it has three aims: 1) to prevent the onset, recurrence, or worsening of work-related diseases, 2) to monitor and promote work-related health and work functioning, and 3) to monitor and improve sustained employability (NVAB,

2013). Although both the International Labour Organization and the Dutch guideline for occupational physicians prescribes supplementing WHS as an important part of surveillance (ILO, 1998; NVAB, 2013), not all workplaces have implemented this system and those who do usually don't follow the screening up with adequate interventions.

Enhancing WHS with automated individual feedback and an offer of online interventions targeting well-being and mental health of nurses and allied health professionals is a new way to conform to this regulation and has not been reported before, as far as we know. Providing feedback and online interventions may offer a suitable and effective strategy for reaching a large target group in the workplace. In particular, online *self-help* interventions are potentially more affordable and accessible for many people, as opposed to face-to-face interventions which use up resources such as therapists' time (Muñoz, 2010). People can use self-help interventions at their convenience, at their own pace and in the privacy of their own homes.

The current study

The primary objective of the current study is to examine the effectiveness of a workers' health surveillance module combined with personalized feedback and an offer of online interventions (OI) on the well-being, work engagement and mental health of nurses and allied health professionals, compared to a waitlisted control group (WL). The study targets the effectiveness of the whole WHS module, including the screening, feedback and offer of online interventions. In theory, this WHS module could enable a large part of a working population to be reached with online interventions, thereby contributing to public mental health. The current study is part of a larger trial which includes a third study arm (invitation for a consultation with an occupational physician for the positively screened workers: OP group) (Gärtner et al., 2011). These results are published elsewhere (Gärtner, Nieuwenhuijsen, Ketelaar, van Dijk, & Sluiter, 2013). Former published results can be summarized as follows: Regarding work functioning, the OI group was not more effective compared to the WL (Ketelaar et al., 2013a), although non-inferior to the OP group (Ketelaar et al., 2013b). Also, no significant effects were found on work-related stress and work-related fatigue for the OI group in comparison to the WL (Ketelaar et al., 2013a) and the OI group was not effective from a health economic perspective (Noben et al., 2014). Workers in the OP group showed less work functioning impairments in comparison to the WL (Gärtner et al., 2013) and produced this response against lesser costs (Noben et al., 2014).

We hypothesized that the OI group would demonstrate a significant increase in well-being and work engagement, as well as significant symptom reduction at three months and six months follow-up, compared to the WL. The online interventions offered in the WHS-module are all self-help interventions. Most have proved to be effective in separate trials on a range of clinical outcomes such as depression (Spek et al., 2008; Warmerdam, van, Twisk, Riper,

& Cuijpers, 2008), well-being (Bolier et al., 2013), and risky drinking (Riper et al., 2008). The workplace was a new setting for the implementation of these interventions.

METHODS

Study design

The study is a cluster-randomized controlled trial in which the effectiveness of a WHS module, followed by tailored feedback and an offer of online interventions, is compared to a waitlisted no-intervention control group. The study was carried out in one large academic medical centre in the Netherlands. The randomization process took place at ward level, using a computer software program (Nquery Advisor), which generated a randomization list in blocks of three. This was performed by one researcher (KN) who was not involved in the practical recruitment of employees. The randomization took place before the recruitment and consent phase and can therefore be considered as a pre-randomization procedure (Schellings et al., 2009). Furthermore, an incomplete-double-consent design was applied, meaning that individuals were only informed about their own group (Schellings, Kessels, ter, Knottnerus, & Sturmans, 2006). Online measurements by self-assessment were conducted at baseline (March 2011), at three months and six months after baseline. At all times, the participants in both conditions retained unrestricted access to professional help, if so required. The study design and procedures of the whole trial with three arms (OI group, OP group and WL) are reported in detail elsewhere (Gärtner et al., 2011). The Medical Ethics Committee of the Academic Medical Center Amsterdam approved this study. The trial registration number of the study is NTR2786 (Dutch Trial Register: <http://www.trialregister.nl>).

Participants

The study population for this study consisted of nurses and allied health professionals, such as physiotherapists and radiotherapists ($n = 1140$). Because of the preventive nature of the intervention, participants were only included if they were not on sick leave for more than two weeks at baseline. In order to reach adequate statistical power, 210 participants in each group were required (see Gärtner et al., 2011 for the power calculation).

Procedure

First, all 1140 employees who worked in the wards that were randomized to the OI or the WL received a letter at their home address containing detailed information on study procedure and privacy assurance issues. After that, they received an invitation via their work e-mail containing information on the study, a link to the online questionnaire, and a log-in name and password. Before they could start the questionnaire, participants had to give their informed consent online. In the six weeks after sending the invitation, three reminders were sent to

those employees that had not yet completed the questionnaire.

Intervention group

Participants in the intervention group completed online screening on the following aspects: impaired work functioning, distress, work-related fatigue, risky drinking behavior, depression, anxiety and posttraumatic stress. The screening questions also partly served as a baseline measurement for this study (Gärtner et al., 2011). Immediately after filling in the questionnaire, they received personalized feedback, which was automatically generated using a programmed algorithm, on their screen and by e-mail.

Based on the personal screening results, participants were offered a tailored choice of online interventions and personalized advice, the participant could visit the website of the online intervention and log in. For example, if a participant scored above the cut-off point for case identification of depression (≥ 0.42) on the Brief Symptom Inventory (de Beurs & Zitman, 2006), an online intervention to prevent and treat depression was offered. If participants scored above 5 for men and 4 for women on the 3-item (AUDIT-C, the Alcohol Use Disorders Identification Test (Gual, Segura, Contel, Heather, & Colom, 2002), an online intervention to reduce risky drinking was offered. Participants who screened positive on impaired work functioning (regardless of mental health status) received an online educational leaflet on how to improve their work functioning. In the case of negative screening on all mental health complaints, participants were invited to follow an online course to promote well-being and mental fitness (Psyfit). Thus, the system provided both mental health promotion and indicated prevention efforts. Participants could be screened positive on different aspects and therefore could be offered a choice of different interventions at the same time. When screened positive, a minimum of two interventions was offered, depending on the number of complaints. If only one complaint was detected, the well-being intervention, Psyfit, was the second option (with a non-binding advice to follow the complaint-related intervention). From self-determination theory it can be reasoned that the opportunity to choose an intervention that fits the preference and need of its user would promote autonomy and subsequently lead to more engagement to follow the program (Ryan & Deci, 2006).

The following online interventions were used in our study:

1. *Psyfit*, a course aimed at enhancing well-being and mental fitness, based on principles stemming from positive psychology, cognitive behavioral therapy and mindfulness (Bolier et al., 2013). Participant can choose one (or more) 4-week module(s), out of 6 modules;
2. *Colour Your Life*, aimed at tackling (subclinical) depressive symptoms and based on

cognitive behavioral therapy (Spek et al., 2008; Warmerdam et al., 2008). The course consists of 8 weekly 30-minute sessions and one booster session;

3. *Strong at work*, aimed at reducing work stress and how to cope with it. This online self-help course is not yet tested on effectiveness itself, but is based on evidence-based principles of occupational stress management and cognitive behavioral therapy (Richardson & Rothstein, 2008). The course contains 8 weekly 30-minute lessons and one booster session after 12 weeks;
4. *Don't Panic Online*, aimed at reducing panic symptoms in subclinical and mild cases of panic disorder, based on cognitive behavioral therapy (van Ballegooijen et al., 2013). There are six 30 minute sessions which can be completed in 8 weeks;
5. *Drinking Less*, aimed at the reduction of risky drinking (Riper et al., 2008). The course is based on motivational, cognitive behavioral and self-control training principles. Participants are encouraged to use the program for a minimum of 6 weeks (for example for 10 minutes a day).

Control group

Participants in the control condition filled in the screener as a baseline measurement as well. After the six-month follow-up assessment they received the same offer as the online group: personalized feedback and a matched offer of self-help interventions.

Outcomes and instruments

Positive mental health was the primary outcome in this article; work engagement, well-being, and depression and anxiety symptoms were the secondary outcomes.

Positive mental health

The Mental Health Continuum-Short Form (MHC-SF) is a 14-item self-report questionnaire measuring positive mental health (Keyes, 2002). It contains subscales on subjective well-being as well as psychological and social well-being. Participants rated the items on a 6-point scale from 0 (never) to 5 (every day). The average score in a Dutch representative population sample was 2.98 (Sd = 0.85) (Lamers, Westerhof, Bohlmeijer, ten Klooster, & Keyes, 2011). The MHC-SF has shown good internal consistency (Cronbach's alpha > 0.80) and discriminant validity (Lamers et al., 2011). In our study, Cronbach's alpha was 0.93.

Work engagement

The Utrecht Work Engagement Scale (UWES-9, short-form) measures engagement at the workplace (Schaufeli, Bakker, & Salanova, 2006). It is a 9-item scale, and items are scored

on a 7-point rating scale (0 = never, 6 = always). The scale contains three subscales: vigour, dedication and absorption. The mean score in a large group ($N = 9,679$) of different populations was 3.82 ($Sd = 1.10$). Cronbach's alpha of the UWES-9 varied between 0.85 and 0.92 across 10 different countries, including the Netherlands (Schaufeli et al., 2006). In our study, Cronbach's alpha was 0.94.

Well-being

The WHO-5 well-being scale contains five positively formulated items on subjective well-being. Participants were asked to rate the items using a 6-point scale (0 = never, 5 = all of the time). The total score is multiplied by 4, adding up to a possible maximum score of 100. The mean score of the WHO-5 in general population studies is around 70 (Bech, 2004). The WHO-5 has been validated in different populations with good internal consistency (Cronbach's alpha 0.84) (Bech, 2004; Henkel et al., 2003). In our study, Cronbach's alpha was 0.91.

Mental complaints: anxiety and depression

Anxiety and depression symptoms were measured with the corresponding subscales of the Brief Symptom Inventory (BSI). Each subscale has six items with a 5-point response scale (0 = not at all; 4 = extremely). Cronbach's alphas are 0.87 for both scales (de Beurs & Zitman, 2006). In our study, Cronbach's alphas were 0.84 for BSI Depression and 0.80 for BSI Anxiety respectively.

Analyses

The analyses were performed in the total sample of participants. Analyses were conducted following the intention-to-treat (ITT) principle, hence all participants were analysed in the group to which they were allocated. Reporting of the results follows the guidelines of the Consolidated Standards of Reporting Trials (CONSORT statement) (Altman, 1996).

Attrition

We applied t-tests and logistic regression analysis to examine possible baseline differences between drop-outs and non drop-outs, as well as differential drop-out between online group and control group. A drop-out was defined as completing the baseline and three month follow-up questionnaire, but not the six month follow-up questionnaire; or completing the baseline questionnaire, but none of the follow-up questionnaires. If there were outcomes or demographical aspects that had a statistically significant effect on drop-out, they were included in the effect analyses as a covariate.

Effects

The effectiveness of the intervention was examined by analysing the differences over time through applying Linear Mixed Models (LMM). If the assumption of a normal distribution of residuals was not met, a log-transformation was used for the LMM, and the median and range were also used to describe the outcome. Otherwise, only the mean and standard deviation were used to describe the outcome. The main effects of *group* and *time*, and the interaction *group*time* were included as fixed effects in the model. *Hospital Ward* (the cluster level) and *ward*subject* (the individual level) were included as random effects. However, if the cluster did not have a statistically significant effect, it was excluded from the model. The main interest concerned the interaction effect of *group*time* (interpreted as the difference in change scores over time between the online and control group). LMM includes incomplete cases in the analysis and employs restricted maximum-likelihood estimation to calculate parameter estimates. LMM assumes that missing data occurred randomly.

In addition, for continuous measures the size of the effect was estimated calculating Cohen's *d*, using the estimated values from the LMM analysis. Cohen's *d* was calculated as the difference between two means divided by the pooled standard deviation. A Cohen's *d* of 0.5 indicates that the mean of the intervention group is half a standard deviation larger than the mean of the control group. Values of *d* from 0.56 to 1.2 can be assumed to be large, 0.33 to 0.55 are moderate and 0 to 0.32 are considered small (Lipsey & Wilson, 1993).

All analyses were conducted using two-sided tests and alphas of 0.05. The analyses were carried out using the Statistical Package for the Social Sciences (SPSS), version 19.]

RESULTS

Flow of participants

Figure 1 shows the flow of participants. A total of 58 hospital wards were randomized across the two study arms in this article. Of the 1,140 employees, 423 (37.1%) started the baseline questionnaire. Of those, 178 in the online group and 188 in the control group completed the baseline questionnaire and were eligible for participation in the trial (*n* = 366 in total). This is the sample that is used for the intention-to-treat analysis. In the online group 28 participants (15.7%) logged in at least once into one or more online interventions. Nine participants (5.1%) started one of more of the modules within the online interventions (six started with *Psyfit* and three with *Color your life*), which means the other 19 participants merely logged in and did not start any of the intervention modules. More results of the track-and-trace data of the online interventions can be found in the process evaluation (Ketelaar et al., 2013c). 108 participants (60.7%) in the online group and 50 (26.6%) participants in the control group were lost to follow up.

Figure 1. Flow of participants through the trial

Background characteristics

The demographic characteristics and scores on the outcomes at baseline are shown in Table 1. The mean age of participants was 40 years. Participants in the online group were on average younger (38) than those in the control group (42). Most participants were female (79.8%), were employed as a nurse (71.9%) and had a partner (75.2%). More than 80% of the participants screened positive on impaired work functioning and/or mental health. In the control group this positively screened group was larger (85.6%) than in the online group (78.1%). With regard to baseline characteristics of the outcomes, positive mental health and work engagement scores (3.32 and 4.37 respectively for the total group) were above the mean in the general population; the WHO-5 well-being score (63.8) was below average .

Attrition analysis

There were significantly more drop-outs in the online group compared to controls (61% vs. 27%, $\chi^2 = 43.28$, $p < 0.01$). Loss to follow-up was therefore not entirely random.

Tested at $p < 0.05$, drop-out analysis reveals that regarding background characteristics at baseline, age predicted drop-out ($\chi^2 = 4.54$, $p = 0.10$; Beta = 0.79, $p = 0.03$): the younger the participant, the more likely that the participant had dropped out. In addition, regarding

Table 1. Baseline characteristics of the online group and control group

	Control group (n = 188)	Online group (n = 178)	All (n = 366)
Women, n (%)	145 (77.1)	147 (82.6)	292 (79.8)
Age (mean, Sd)	42 (11.4)	38 (12.1)	40 (11.9)
<i>Civil status</i>			
Partner, yes, n (%)	141 (75.4)	132 (75.0)	273 (75.2)
Divorced, yes, n (%)	9 (4.8)	4 (2.3)	13 (3.6)
Foreign background, yes, n (%)	25 (13.3)	23 (12.9)	48 (13.1)
<i>Occupation</i>			
Nurses, n (%)	134 (71.3)	129 (72.5)	263 (71.9)
Surgery assistant, n (%)	5 (2.7)	0 (0.0)	5 (1.4)
Nurse practitioners, n (%)	22 (11.7)	11 (6.2)	33 (9.0)
Allied health professionals, n (%)	27 (14.4)	38 (21.3)	65 (17.8)
Work experience in years, mean (Sd)	11 (10.2)	10 (9.9)	11 (10.1)
<i>Impaired mental health</i>			
One or more mental health complaints, n (%)	119 (63.3)	109 (61.2)	228 (62.3)
Depression, above cut-off, n (%)	45 (23.9)	44 (24.7)	89 (24.3)
Anxiety, above cut-off, n (%)	30 (16.0)	32 (18.0)	62 (16.9)
Positively screened mental health complaints and/or impaired work functioning, n (%)	161 (85.6)	139 (78.1)	300 (82.0)

the outcomes, those who did drop out showed lower work engagement as measured with the UWES-9 ($t_{363} = 2.46$, $p = 0.01$; $\text{Beta} = -0.22$, $p = 0.07$) at baseline. There were no significant interaction differences for these characteristics between the online group and control group (no differential drop-out for young participants and/or participants with low work engagement).

Effects

The estimated effects according to the LMM-analysis are presented in Table 2. Because the random effect of ward (cluster effect) was not significant in the analyses, it was excluded from the LMM model.

Both the online group and the control group improved over time regarding positive mental health ($F = 8.30$, $p < 0.01$), well-being ($F = 11.02$, $p < 0.01$) and anxiety symptoms ($F = 4.33$, $p = 0.01$), with the largest improvements occurring between baseline and three months follow-up.

Considering the interaction effect of group*time, the primary outcome - positive mental health - was significantly enhanced in the OI group, in comparison to the control group ($F = 3.46$, $p = 0.03$, Cohen's $d = 0.37$ three months follow-up, 0.28 six months follow-up). The effect stems for a large part from the subscale psychological well-being (Cohen's $d = 0.43$ at post-test and 0.50 at follow-up, $F = 5.35$, $p = .01$). Furthermore, there was a significant effect on work engagement in the OI group ($F = 3.44$, $p = 0.03$, Cohen's $d = 0.25$ three months follow-up, 0.15 six months follow-up), but this seemed to be mainly due to a small deterioration in the control group, rather than an enhancement in the OI group. The interaction effects on well-being, depression and anxiety symptoms were non-significant.

Table 2. Estimated effects on and analysis of primary and secondary outcomes at baseline, 3 and 6 months follow-up (n = 366)

Outcome	Time Online group (n = 178)				Control group (n = 188)				Cohen's LMM analyses			
		Relative frequency above cut-off (%)	Mean (Sd)	Median (range)	Cohen's d	Relative frequency above cut-off (%)	Mean (Sd)	Median (range)	Cohen's d	Δd	Group	Time
Positive mental health (MHC-SF, 0-5)	B		3.39 (0.66)				3.25 (0.74)				F = 4.72 p = 0.03	F = 8.30 p = 0.00
	3m		3.68 (0.66)		0.44		3.30 (0.74)		0.07	0.37		
	6m		3.65 (0.66)		0.39		3.33 (0.74)		0.11	0.28		
-Subscale MHC-SF Subjective well-being (0-5)	B		3.81 (0.63)				3.73 (0.66)				F = 0.73 p = 0.40	F = 3.19 p = 0.04
	3m		3.97 (0.63)		0.25		3.80 (0.66)		0.11	0.14		
	6m		3.97 (0.63)		0.25		3.79 (0.66)		0.09	0.16		
-Subscale MHC-SF Psychological well-being (0-5)	B		3.62 (0.63)				3.49 (0.78)				F = 5.49 p = 0.02	F = 7.18 p = 0.00
	3m		3.91 (0.63)		0.46		3.51 (0.78)		0.03	0.43		
	6m		3.96 (0.63)		0.54		3.52 (0.78)		0.04	0.50		
-Subscale MHC-SF Social Well-being (0-5)	B		2.86 (0.80)				2.68 (0.84)				F = 4.05 p = 0.05	F = 7.08 p = 0.00
	3m		3.22 (0.80)		0.45		2.76 (0.84)		0.10	0.35		
	6m		3.11 (0.80)		0.31		2.83 (0.84)		0.18	0.13		

Well-being (WHO-5, 0-100)	B		63.7 (13.6)		63.8 (15.0)		F = 0.01 p = 0.92	F = 11.02 p = 0.00	F = 0.94 p = 0.39
	3m		70.1 (13.6)	0.47	67.3(15.0)	0.24	0.23		
	6m		67.8(13.6)	0.30	67.9(15.0)	0.28	0.02		
Work engagement (UWES-9, 0-6)	B		4.36 (0.99)		4.37 (0.99)		F = 0.02 p = 0.90	F = 0.71 p = 0.50	F = 3.44 p = 0.03
	3m		4.45 (0.99)	0.09	4.21 (0.99)	-0.16	0.25		
	6m		4.46 (0.99)	0.10	4.32 (0.99)	-0.05	0.15		
Depression (BSI, 0-4)	B	37/178 (20.8%)	0.31 (0.32)	0.19 (0.07-1.82)	0.30 (0.35) 0.18 (0.04 - 2.41)		F = 0.03 p = 0.85	F = 2.93 p = 0.06	F = 1.54 p = 0.22
	3m	32/178 (18.0%)	0.24 (0.32)	0.12 (0.00 - 1.75)	0.26 (0.35) 0.15 (0.00 - 2.38)	0.11	0.11		
	6m	30/178 (16.9%)	0.22 (0.32)	0.10 (-0.02 - 1.73)	0.29 (0.35) 0.18 (0.03 - 2.41)	0.03	0.25		
Anxiety (BSI, 0-4)	B	25/178 (14.0%)	0.21 (0.24)	0.14 (0.05 - 2.01)	0.25 (0.32) 0.16 (0.05 - 2.02)		F = 0.62 p = 0.43	F = 4.33 p = 0.01	F = 0.03 p = 0.97
	3m	19/178 (10.7%)	0.16 (0.24)	0.09 (0.00 - 1.96)	0.19 (0.32) 0.10 (0.00 - 1.97)	0.22	-0.01		
	6m	20/178 (11.2%)	0.17 (0.24)	0.10 (0.01 - 1.97)	0.22 (0.32) 0.12 (0.02 - 1.99)	0.13	0.04		

DISCUSSION

Main findings

In this study, the WHS module including screening, personalized feedback and an offer of online interventions effectively enhanced positive mental health as measured with the MHC-SF for nurses and allied health professionals, and in particular psychological well-being, in comparison to a waitlisted control group. The effect can be considered as medium-sized at three month follow-up and small at six month follow-up for positive mental health in general and medium-sized at both time-points for the subscale psychological well-being. For work engagement a small positive effect was found, which might be due to a small deterioration in the control group. No significant differences between groups were found for well-being as measured with the WHO-5, depression or anxiety.

Comparison to other work and interpretation

In comparison to the randomized controlled trials examining the effects of the separate online interventions (Warmerdam et al., 2008; Spek et al., 2008; Riper et al., 2008; Bolier et al., 2013) which were used in the WHS, the effects in our study were smaller, did not occur across the entire range of outcomes and/or were sustained to a lesser extent. For example, for the Colour Your Life program medium-sized effects were found in previous studies for both depression (Warmerdam et al., 2008; Spek et al., 2008) and anxiety (Warmerdam et al., 2008) at three and six months follow-up. Likewise, the Psyfit program has been shown to be effective on a range of positive outcomes, and also reduced depressive and anxiety symptoms at follow-up (Bolier et al., 2013). The results in the current study are somewhat comparable to the findings in the 'Don't Panic Online' RCT which suffered from low adherence and a high drop-out rate as well (van Ballegooijen et al., 2013).

What could have caused this difference in effect? A look at the track-and-trace data of the interventions shows that adherence to the offered online interventions was very low (Ketelaar et al., 2013c). Adherence - the extent to which people follow the protocol in the intervention as intended - can be an important predictor of intervention effectiveness (Donkin et al., 2011; Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012). Indeed, this seems to be also the case in the OP group (Ketelaar et al., 2013b): A post hoc analysis revealed that going to the preventive consultation of the occupational physician resulted in a larger effect at post-test ($d = 0.50$, medium sized effect) than screening and feedback alone ($d = 0.34$, small effect).

Regarding the OI group, sixteen percent (28 out of 178 participants) logged in at least once to one or more online interventions, but only nine participants (5%) followed an intervention to some extent, which means that the participant has started with one or more modules within an intervention. Because of the very low adherence rate, a post hoc analysis on the relationship

between adherence and effect was not possible. The adherence rate is different from other trials of separate online interventions, in which more than 75% of the participants adhered to an intervention to at least some extent (Spek et al., 2008; Bolier et al., 2013). Because of a lack of participants in the online interventions as well as low adherence, it is more likely that the actual process of screening and personalized feedback caused the effect rather than the online interventions themselves, perhaps by raising a sense of awareness and relevance (see for example Boon, Risselada, Huiberts, Riper, & Smit, 2011).

The low adherence rate could be related to the study population, which was different from the populations in the trials of the separate online interventions (Bolier et al., 2013b; Warmerdam et al., 2008; Spek et al., 2008). In these studies, people were purposely recruited in order to follow a program to reduce depression or enhance well-being. Participants in these trials could thus be regarded as a self-selected and probably more motivated sample. In our study, participants received the online feedback after filling in the screening questionnaire, but there was no explicit help-seeking initiated by themselves. In addition, more than 80% screened positive on mental health complaints and/or impaired work functioning, which might be due to low specificity in the screening instrument. Although it is known that hospital-employed nurses have higher rates of mental health problems than the general norm (Letvak et al., 2012), it could be argued that people did not follow the advice to participate in an online intervention because their complaints were not to the extent that they felt they needed help or an intervention. Likewise, many of the positively screened people received an offer of more than one intervention. We hypothesized that people would be strengthened in their autonomy when they have multiple options. However, the 'too-much-choice effect' could actually have lowered their motivation to start with and follow an intervention (Scheibehenne, Greifeneder, & Todd, 2010). A final issue that could have caused the low adherence rate is the lack of personal contact in the interventions, as they are all fully automated self-help interventions. This may conflict with the social nature and personality of many nurses that is characterized by empathy and the urge to care for others (Eley, Eley, Bertello, & Rogers-Clark, 2012). For depression, the use of personal guidance in online interventions is related to enhanced effectiveness (Andersson & Cuijpers, 2009).

Another salient finding is the significant effect on psychological well-being as measured with the subscale of the MHC-SF, and not on subjective well-being (as measured with another subscale of the MHC-SF and the WHO-5). Apparently, the effect that was found meant more of an improvement in positive functioning (e.g. better relationships, more meaning), as opposed to higher positive affect or cognitive appraisal of life. It might be that the actions and functioning of a person would change first after following an intervention and that it precedes the better feeling. A better feeling (subjective well-being), and a reduction in depressive and anxiety symptoms would require a sustained effort, which was not supported by the current

intervention. We do not know why there was a small deterioration in the WL control group regarding work engagement. There might be some changes in the organizational context such as changes in job demands at the wards in the WL group which might have affected the work engagement of the nurses (Schaufeli, Bakker, & Van Rhenen, 2009), but this is speculation because we did not measure these aspects.

Limitations

A number of limitations in this study have to be recognized. First, the number of participants required for adequate statistical power was not fully achieved. This may have contributed to the non-significance of effects. Second, there was a high attrition rate in this study, and in addition, differential drop-out between the study groups. Although this is not uncommon in online trials (Eysenbach, 2005), this may have produced bias in a direction that is not easy to predict. Third, the adherence rate was very low, which has already been mentioned as a possible predictor for the lower than expected results.

Conclusion and recommendations for practice and research

This study shows that a preventive workers' health surveillance program consisting of online screening, personalized feedback and a personalized offer of online self-help interventions is capable of enhancing positive mental health, and in particular psychological well-being, at three and six month follow-up. The effect should be considered with caution as there was a large attrition rate and other outcomes failed to reach statistical significance.

Potentially, the implementation of this WHS program could address positive mental health/well-being, work engagement and mental health complaints in nurses and allied health professionals, which are important elements for their work functioning and their own work enjoyment. By reaching a large group of employees at the same time, the WHS module could have a significant impact on occupational and thereby public mental health. The program could be part of a population health approach in which a large part of a certain population has to be reached for prevention purposes, in addition to the smaller already diseased population (Rose, 2008). However, based on the results of our study, widespread implementation is not yet warranted and the system should be improved first. The lack of participants and low adherence raise questions about the acceptability of online interventions to nurses and allied health professionals. Engaging nurses in the interventions may require human contact with a coach or occupational physician. This 'blended' work model should be further developed and investigated. Also, the role of persuasive technology and gaming elements requires attention in the future research agenda, as these elements can encourage a participant to begin and stick to an online intervention (Kelders et al., 2012). As regards to the screening system (which can be considered now as highly sensitive, but probably less

specific), the optimal balance between sensitivity and specificity should be determined with the help of an ROC curve (receiving operating characteristics) (DeLong, DeLong, & Clarke-Pearson, 1988), in such a way that symptom profiles are matched better with the needs and preferences of the participants.

We adopted an individual approach to enhance the mental health of nurses and allied health professionals, and based on the results of our study, made some recommendations to refine and improve the WHS module. However, in order to establish a climate for work engagement and well-being in an organization, there has to be just as much focus on organizational factors and job resources, such as management styles and workload, as there is on personal resources (Bakker, 2011; Czabala et al., 2011). When nurses and allied health professionals feel that their organization provides support and involvement, and also nurtures their psychological needs, they will be more likely to function well and invest their time and energy in their patients and the organization (Bakker, 2011). Embedding the WHS module within an integral organizational strategy may help to contribute to the success of this preventive mental health program.

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9

General discussion

INTRODUCTION

In a population health approach it is assumed that substantial health gains can be achieved by reaching many people at low risk, instead of or in addition to approaching the few at high risk or who are already ill (Rose, 2008). Extrapolating this idea to well-being enhancement offers opportunities to improve mental and physical health, social relationships and creativity in society at large (Huppert, 2009). The aims of the present thesis were as follows: 1) To further explore whether health benefits can be expected as a result of enhanced well-being; 2) Whether well-being can be enhanced through intervention; and 3) In particular, whether evidence-based well-being interventions that could be disseminated on a large scale via the Internet are available. The central research questions will be summarized in this discussion section, alongside a general discussion of important issues that arose during the execution of the studies. First, a summary of the main findings is presented, in line with the three main goals described in the introduction to this thesis. Second, the strengths and limitations of the studies are analyzed, as the results must be interpreted in light of these considerations. Finally, five issues are highlighted that offer avenues for future research and practice in both general and online positive psychological interventions (PPIs and oPPIs).

KEY FINDINGS

- 1) What is the impact of well-being on recovery and survival in people who are physically ill?

Well-being has a small predictive effect on recovery and survival for people with physical diseases.

A meta-analysis was conducted which synthesized studies that focused on the prognostic value of subjective well-being (positive affect, life satisfaction) on physical recovery and survival in patients with physical diseases (Chapter 2). Results showed a small but significant effect; a higher level of emotional well-being predicted a higher probability of both recovery and survival. The effect was strongest for recovery from illness. Several variables (quality of the studies, follow-up time, publication year and sample size) were included as moderators, but these analyses revealed no particular subgroup effects. Previous reviews and meta-analyses showed inconsistent results for the impact of well-being on physical outcomes. Both Chida and Steptoe (2008) and Howell (2007) found positive effects for well-being on physical health in diseased populations. However, Pressman and Cohen (2005), Diener and Chan (2011) and Veenhoven (2008) found mixed results presenting no effects or sometimes even adverse effects of well-being on recovery or survival in populations with severe diseases. The positive results in the current meta-analysis offer more solid grounds for the premise that well-being acts as an independent building block for physical health in people who already

have a disease, since nine new studies were included compared with previous reviews. Nonetheless, caution must be exercised because effects were very small and there were indications for publication bias. Also, much remains to be learned about the predictive value of well-being on recovery and survival across various diseases and severity levels.

2) What is the overall effectiveness and potential of general and online positive psychological interventions?

Well-being can be enhanced through positive psychological interventions.

Well-being can be effectively enhanced through interventions, as a second meta-analysis in the present thesis has shown. Chapter 3 describes the second meta-analysis conducted to examine the effectiveness of positive psychological interventions on well-being and depressive symptoms. PPIs significantly enhanced subjective well-being and psychological well-being and helped to reduce depressive symptoms compared with controls (waitlist, placebo and no intervention). All effect sizes could be described as small. Effects were maintained at three to six months follow-up for subjective well-being and psychological well-being. For depression, interventions were more effective for interventions of a longer duration, interventions delivered to people with particular psychosocial problems, and for interventions in a face-to-face format. The quality of the study also moderated the effect on depression: the lower the quality, the higher the effect, an interaction effect that has also been found in other meta-analyses e.g. (Cuijpers, van Straten, Bohlmeijer, Hollon, & Andersson, 2010). Overall, the quality of the study designs was quite low. Also, indications for publication bias were found. The effect sizes in our meta-analysis were interestingly enough approximately 0.3 points lower than in the meta-analysis by Sin and Lyubomirsky (2009), which found medium-sized effects for positive psychology interventions on well-being and depressive symptoms. This could be due to the strict application of inclusion criteria, which excluded quasi-experimental designs and related interventions, such as mindfulness and life review.

The Internet can be used as an effective vehicle to disseminate positive psychological interventions.

In Chapter 4, written for a handbook of positive psychological interventions, an overview of the possibilities for using the Internet for the dissemination of positive psychological interventions is presented. In this chapter, the potential benefits of online positive psychological interventions, such as high scalability and potential for self-management, are discussed. The results of a literature review examining the effectiveness of these interventions are also presented. So far, the evidence suggests that oPPIs are effective in enhancing well-being and reducing depressive symptoms. However, results for the effects were mixed insofar as some interventions, but not all, helped to enhance well-being and reduce depressive

symptoms. Many of the interventions reviewed were offered in a simple e-mail-instruction format: the extent to which persuasive technologies (such as tailoring, personalization, and reminders) were used in the interventions was limited.

3) Can Psyfit.nl and Mentalvitality@work enhance well-being in both an effective and cost-effective way?

Psyfit.nl is effective in enhancing well-being and reducing depressive and anxiety symptoms.

Based on the results of the meta-analysis (Chapter 3), qualitative literature research (Walburg, 2008) and focus group research (Notenboom & Van Male, 2008), we developed an online intervention, Psyfit – mental fitness online – designed to enhance well-being in the general population. We conducted a randomized controlled trial to examine the effectiveness of the intervention on a mildly depressed sample (Chapter 5 and 6). Psyfit was found to be effective in helping participants enhance their well-being, vitality and general health and in reducing anxiety and depressive symptoms. Effects were maintained at 6-month follow-up for depression and anxiety. Unlike other randomized controlled trials in which recruitment can be a real challenge (Morgan, Jorm, & Mackinnon, 2013; Treweek et al., 2010), recruitment went smoothly and quickly: Within five weeks over 800 people had expressed their interest in participating in the study, of which $n = 284$ were included in the trial.

Cost-effectiveness of the Psyfit.nl seems limited or at least, is not well understood.

Online interventions have been shown to be cost-effective alternatives for their face-to-face counterparts (Hedman et al., 2014). In Chapter 7, a cost-effectiveness study of Psyfit is described, which was conducted as a secondary analysis in the randomized controlled trial (Chapter 5 and 6). To our knowledge, this cost-effectiveness study was the first economic evaluation of a positive psychological intervention. Results indicated that improved clinical outcomes were achieved, but at substantially higher costs in comparison with the waitlisted usual care group. It was difficult to explain these results, in light of the clinical improvements and overall low costs of the intervention. One possible explanation for the finding that the intervention was not cost-effective is that by using the intervention, participants became more aware of their stress levels and value system, resulting in more frequent reports of illness (which was the biggest cost driver), as a preventive measure. However, a closer look at the data reveals that the number of people who became sick-listed did not differ between the groups, which runs counter to this explanation. In the Psyfit group, a small number of participants were responsible for a large share of the costs. The costs fell considerably and cost-effectiveness was improved when these outliers were removed ($n = 5$ in Psyfit group and $n = 2$ in control group). We can therefore conclude that the extent to which Psyfit is

cost-effective is unclear. Cost-effectiveness also depends on the amount of money society is willing to pay (Willingness-To-Pay) for a favorable intervention response.

MentalVitality@work is effective in enhancing well-being, but not in reducing depressive and anxiety symptoms.

Psyfit was part of a prevention package for online interventions (with Color Your Life, Don't Panic Online, Drinking Less and Strong at Work) that was used in a large cluster-randomized controlled trial, the MentalVitality@Work study (Chapter 8). The package was offered as a follow-up to an online assessment with automated feedback in an organizational context: to all nurses and allied health professionals in a large hospital in the Netherlands. At the three and six month follow-ups, the intervention was found to significantly enhance well-being, in comparison with the waitlisted control group. No significant differences were found in relation to symptoms of depression and anxiety. The uptake of the online interventions was very low.

STRENGTHS AND LIMITATIONS

The results of our studies should be interpreted in light of their strengths and limitations. In this section, we will acknowledge the general and most relevant limitations.

First, the quality of the research designs in the meta-analysis of positive psychology interventions and the review of online positive psychology interventions was in general quite low. Low quality intervention studies tend to show higher effect sizes (Cuijpers et al., 2010). Although we drew the conclusion that these interventions show promise in terms of their capacity to enhance well-being and reduce mental health complaints, the results should be interpreted with caution.

Second, in the meta-analysis of PPIs (Chapter 3), we included studies that examined interventions primarily aimed at raising positive feelings, cognitions or behavior (following Sin & Lyubomirsky, 2009), and that clearly fell within the theoretical tradition of positive psychology. However, there is no academic consensus on the definition of positive psychological interventions. It could be argued that our definition, and therefore our study inclusion process, was too tight, as we excluded well-known interventions such as mindfulness-based stress reduction and reminiscence interventions. Such interventions could easily be placed in the field of positive psychology. On the other hand, these interventions are based on other research traditions from the 1970s and 1980s and onwards, and have already been extensively and reviewed, including in meta-analyses (Chiesa & Serretti, 2009; Pinquart & Forstmeier, 2012). In an article that has followed our meta-analysis (Schueller, Kashdan, & Parks, 2014), it was argued that the scope of the review was indeed too narrowly defined. In our response, we explained that the scope and selection of studies was a conscious and

reasoned choice based on our definition of the PPIs described above and the inclusion strategy (Bolier et al., 2014). Furthermore, it might be wise to conduct meta-analyses on the different types of PPIs, such as gratitude interventions or strengths-based interventions, as heterogeneity was high in our meta-analysis, despite the strict inclusion criteria. Moreover, we proposed that a meta-analysis covering all types of positive psychological interventions, as Schueller et al. suggested, could be conducted through a joint effort by positive psychology researchers, as such a project might be beyond the capacities of one research group.

Third, in the Psyfit trial, a self-selected, and as a result, likely a rather motivated sample participated in the intervention. Highly educated women were overrepresented in the study. Therefore, the results cannot be generalized to the total population of people with mild depression. Missing out on certain groups, such as men and people with lower education, is a very common phenomenon in Internet-based intervention trials (Kelders, 2012). This is unfortunate, because people with a lower educational background face additional challenges to their resilience when a negative life event occurs. They tend to suffer more after adverse events, for example after experiencing a divorce or physical disability, because they have less resources available to them such as cognitive ability or good social status (Mandemakers, 2011). Such challenges may give rise to an additional unmet need for intervention.

Fourth, in both randomized controlled trials (Psyfit and MentalVitality@Work), there were rather high attrition rates. Although this is a regular, and maybe even a natural feature of online unguided intervention trials (Eysenbach, 2005), it may have biased our results in an unpredictable manner. We endeavored to prevent bias to the greatest extent possible by carrying out intention-to-treat analyses, imputing the data and/or sensitivity analyses.

Fifth, adherence to the protocol in the positive psychological interventions is quite low, especially in the MentalVitality@Work studies. In that study, only 5 percent of the participants followed an online intervention to some degree, meaning that 95% read the feedback text, but did not act upon the tailored advice. In the Psyfit trial, over three-quarters of the participating sample completed at least one lesson, but only 9 percent adhered to the full intended protocol (adhering to at least one module). Many online interventions, especially unguided interventions, are characterized by low intervention adherence, i.e., the extent to which people follow the protocol in the intervention as intended (Eysenbach, 2005; Kelders, 2012).

Sixth, as we have focused on end outcomes such as well-being and depression, mediating variables, such as self-efficacy and mastery which might predict adherence to the intervention and effects, were not measured. The research question as to *whether* Psyfit and MentalVitality@Work are effective, has been answered. However, the question of *how*

the interventions work (mechanisms of change), has not yet been answered, and provides grounds for future research.

Seventh, non-specific factors might have contributed to significant effects in both intervention trials. It is known that non-specific factors (for example, the competence of the therapist) contribute significantly to intervention outcomes (Chatoor & Kurpnick, 2001). In online intervention research, it could be the case that mere exposure to an offer of a trustworthy online intervention and the expectation on the part of the participant that the program will boost their mental fitness, could have caused the significant effects.

Eighth, the online interventions are presented as interventions for individuals, whereas a public health approach would require an integrated strategy including social and environmental factors (WHO, 2005). For example, the MentalVitality@Work study took place in a large hospital in the Netherlands. To raise the level of well-being among employees, a focus on organizational factors, such as workload, organizational culture and leadership style is required, alongside factors at individual-level (Bakker, 2011).

Despite the limitations, the studies presented in this thesis also display some important strengths. In this thesis, one of the first steps has been taken to summarize and combine research on both positive psychology and technology (collated in the concept of 'positive technology' (Riva, Banos, Botella, Wiederhold, & Gaggioli, 2012). Technology offers an important opportunity for positive psychology to broaden its reach, raise levels of engagement with interventions and incorporate interventions into existing health care structures. This can be achieved in a highly cost-effective manner, because online positive psychological interventions, especially fully automated interventions, involve very little of either professionals' and patients' resources. To determine the validity of this assumption, a cost-effectiveness analysis was conducted on the Psyfit trial. This may be identified as a second major strength of this thesis, even in the context of its puzzling findings, as this is the first economic evaluation of a positive psychological intervention.

Another strength of the thesis is that in the meta-analysis of positive psychological interventions, only randomized controlled trials were included. With this procedure, a certain level of quality of the interventions was assured. However, the quality of the included study designs was not high. The quality of an individual study was weighted against its effect. Based on this mediator analysis, we drew the conclusion that higher quality studies showed smaller effects, at least for depression.

The study design quality can also be considered as a strength of the Psyfit trial and the Mentalvitality@work trial. Quality standards for conducting randomized controlled trials based on Cochrane criteria were applied, such as publishing the research protocols beforehand,

power analyses, intention-to-treat analyses and adequate random concealment. By applying these criteria, a certain level of quality in the studies was assured.

CONSIDERATIONS AND FUTURE RECOMMENDATIONS FOR RESEARCH AND PRACTICE

The studies covered in this thesis yielded useful insights on the research questions. Despite the limitations, there are enough strengths and starting points to warrant further development and research to explore the potential of general and online positive psychological interventions. In this part of the discussion, five issues will be addressed in order to strengthen the research field and to ensure that general and online positive psychological interventions have a real impact. The following points are based on the findings of the studies, their strengths and limitations.

1. Improve and expand *research methods* in general and online positive psychology
2. Design a *population approach*
3. *Empowerment*, from buzzword to real substance
4. *Adherence* and *real-life behavioral change*
5. No impact without *implementation*

1. Improve and expand research methods in general and online positive psychology

In the discussion of the findings of the studies in this thesis, we already anticipated that intervention research designs should be *improved* and *expanded* in positive psychology.

Improvement

The findings of the meta-analysis in Chapter 3 provide grounds for the conclusion that study designs need to be *improved*, as the quality of the design of the included studies was quite low in general and was also a predictor for study effect (in a negative way). We hope that this finding will encourage researchers in positive psychology to adopt rigorous standards for their research designs, thereby improving the quality of intervention research. The regular guidelines for conducting RCTs established in the CONSORT statement apply equally to positive psychological interventions (Altman, 1996). Quality of RCTs conducted in positive psychology could be improved, for example by applying adequate randomization procedures, power analyses to calculate appropriate sample sizes and intention-to-treat analyses (next to completers-only and per-protocol analyses as sensitivity analyses). In addition, in order to ensure proper interpretation of the results, the analysis of results should

not only contain a test of significance (Null Hypothesis Significance Testing), but also an effect size or clinically relevant change. In psychology in general, there is also a need to publish more research protocols before the study starts, as per standard practice in medical sciences (Chambers, 2014). The application of this procedure in positive psychology is likely to increase the chance that studies with 0-findings will be published, thereby contributing to the reduction of publication bias found in the meta-analysis.

As mentioned previously, there were high attrition rates in the Psyfit.nl trial, and in particular, in the Mentalvitality@work trial, especially in the intervention groups. The online nature of both trials (all questionnaires filled in online and no required personal contact between the researchers and participants, plus the fully-automated self-help interventions) could have contributed to this phenomenon. The non-use of interventions and high drop-outs are a typical and perhaps even natural feature of online trials (Eysenbach, 2005; Murray et al., 2009), including in positive psychology (Mitchell, Stanimirovic, Klein, & Vella-Brodrick, 2009; Mongrain & Anselmo-Matthews, 2012). Nonetheless, future research should focus on how to retain participants in an online positive psychology RCT, perhaps by providing more intensive personal reminders and guidance.

Another issue raised in the limitations section was the possible 'non-specific factors' that may also have influenced the significant effects in both the Psyfit.nl and the Mentalvitality@work trial - such as the mere offer of an online intervention. In both of our RCTs, no-intervention control groups were used. Therefore, we cannot distinguish between the true intervention effects and any possible effects due to non-specific factors. In future research, researchers should seek ways to separate those effects by using, for example, placebo control groups, in such a way that both groups experience 'non-specific factors' to the same extent. The use of 'dismantling designs' is a way of determining the active features of a multi-component intervention, and are recommended after the effectiveness of a full intervention package has been proven.

Expansion

In this thesis, two randomized controlled trials were conducted to examine the effectiveness of the interventions. However, it is becoming clear that online intervention research in general cannot rely solely on randomized controlled trials, but must make use of other research methods across the entire process: at the development stage, testing efficacy under controlled conditions and determining effectiveness while implementing the intervention in real-life conditions. In other words, research methods for online positive psychology need to be *diversified*. Alongside controlled outcome studies, future research should focus on how to create a suitable tailor-made device for particular target groups. The person-activity fit, how to tailor a PPI to the specific needs and preferences of the target group, is a current

and relevant theme in research on well-being (Lyubomirsky, Dickerhoof, Boehm, & Sheldon, 2011). To ensure a good person-activity fit, there is a need to make use of other forms of research, such as action designs and co-creation, to ensure a good fit between the technology, the participants in online interventions and the organizational environment. The fit might have been suboptimal in the two interventions tested in this thesis, since many participants did not use the intervention as intended. Van Gemert-Pijnen et al. (2011) propose a holistic framework which serves as a practical guideline to plan, coordinate, and execute the participatory development process for online interventions (the CeHRes roadmap, see Figure 1). The framework recommends a mixed-methods approach, combining both qualitative and quantitative methods, and both formative and summative evaluations (van Gemert-Pijnen et al., 2011). Within this framework, 'quick-and-dirty' research designs are also valued, because they fit better to the rapid R&D cycles for new technologies. Furthermore, process evaluations, i.e., testing the prototype in a small-scale pilot study in order to identify possible impeding and facilitating factors for future implementation and dissemination, and real-world impact studies are highly recommended in this model. The Experience Sampling Method can be used to gather information on well-being in real time at any time of the day, while using an online positive psychological intervention (Kahneman & Krueger, 2006; Parks, Della Porta, Pierce, Zilca, & Lyubomirsky, 2012). The experience sampling method could be an appropriate research direction for both the Psyfit.nl as the Mentalvitality@work study in

Figure 1. CeHRes roadmap for the development of eHealth technologies (van Gemert-Pijnen et al., 2011)

order to find out if the results of an RCT are sustained into real-life situations.

2. Designing a population approach

By using online positive psychological interventions, a population approach aiming to improve the well-being of many people is on the horizon (Rose, 2008), as we have seen in the introduction section of this thesis. In the studies that we have conducted, we made an

effort to build a population health strategy to enhance well-being. We succeeded only in part. In the Psyfit effect study (Chapters 5 and 6), we succeeded in demonstrating that a well-being intervention can reach a large group of people in a very short time. It appears that the positively framed recruitment message, in combination with an attractive and accessible intervention persuaded people to participate in the trial. On the other hand, the participants in the trial were self-selected ('happiness-seeking sample') and we imposed inclusion criteria, thereby excluding people both without depressive symptoms and with rather severe depressive symptoms. In reality, this could be classified as a high-risk preventive strategy (Rose, 2008) rather than a population strategy. Therefore, we cannot generalize the results to the population at large. The same cannot be said for the Mentalvitality@work trial (Chapter 8). All nurses and allied health professionals, regardless of their risk status, were offered a tailored choice of interventions. Thus, in theory, this can be regarded as a population approach in a large hospital. However, results for this entire population are not available, because only the workers who filled in the questionnaire at baseline were counted as participants in the trial, which may have caused a selection bias.

We can conclude that the interventions used in the trials were, in principle, appropriate for use in a well-being population health approach. However, to ascertain whether the interventions would also be effective in the broader population, trials in other groups (as per Psyfit intervention) and an analysis across the entire intended target group (as per Mentalvitality@work) would also be necessary.

Embedding PPIs and oPPIs in public health

A further step would be required to enhance well-being at a collective level: the interventions should be embedded in a public health approach. In the public health sector, mental health promotion aims to build strengths, competencies and resources (Barry, 2001). In terms of their basic assumptions and foundations, mental health promotion and positive psychology have a lot in common (Gudmundsdottir, 2011). Both approaches focus more on health than on disease and both aim to enhance positive mental health and well-being at an individual level, as well as at an environmental or societal level. Public mental health care could, in theory, gain much if well-being interventions stemming from positive psychology were used as mental health promotion interventions. Such interventions can be used as non-stigmatizing tools in mental health promotion campaigns, as well as first-step interventions in a stepped care model, for example, for depression. In stepped care models, clients start with a low-intensity intervention if possible (showing minor depressive complaints), and are monitored carefully (van Straten, Seekles, van 't Veer-Tazelaar, Beekman, & Cuijpers, 2010). Some of the online positive psychological interventions might be an attractive and suitable choice to help people with minor mental health issues, without the need to medicalize the problem.

PPIs can help people to function well, to make their lives more fulfilling, and may also help to prevent deterioration or to develop a full-blown disorder. When systematically applied, this approach can reach many people, thereby contributing not only to the well-being of an individual, but also to the well-being of the population as a whole.

From the perspective of a population health approach, initiatives to improve well-being by intervention in physically diseased people might also be worthwhile (Chapter 2). Diseases such as coronary heart disease and diabetes are highly prevalent in the general population (Nationaal Kompas, 2012). Even a small effect of well-being on the prognosis of the illness may make a considerable impact in a diseased population, on the condition that many patients are reached. Notwithstanding the aforementioned issues in 'well-being – disease' research (9.2 *Key findings*), it may be still worthwhile to research ways to improve well-being among the physically ill. Not necessarily because of the proclaimed effect on the progression of the disease, but rather because well-being may enhance self-management practices and prevent mental health problems among people with chronic physical diseases (Celano, Beale, Moore, Wexler, & Huffman, 2013; DuBois et al., 2012). Psyfit, or similar interventions, could be adapted and used for these chronically ill target groups.

3. Empowerment, from buzzword to real substance

We expected that participants in Psyfit and Mentalvitality@work, would be motivated to take charge of their own health and well-being. In other words, they would have become 'empowered'. 'Empowerment' is among the widely used buzzwords in healthcare and society and we also used it in the context of our interventions. Have the participants in our interventions attained an empowered state of mind? As mentioned before, the web-based interventions applied in our study, Psyfit and Mentalvitality@work, were not always used as intended. Although we did not measure empowerment as an outcome, we doubt that many participants were truly empowered, especially those using the Mentalvitality@work intervention. In Psyfit, many people were enthusiastic to start the intervention; compliance was somewhat higher and there were qualitative user reviews that indicate positive experiences. In this section, we discuss what empowerment is about and what would be needed to make the interventions used in our studies, and oPPIs in general, more empowering.

How to define empowerment

Empowerment is defined as a multi-dimensional social process that helps people gain control over their own lives (Page & Czuba, 1999). For many programs and interventions, empowering the people involved is one of the primary goals. The term is embraced by community programs, local and national government, healthcare institutions, schools and workplaces. 'Empowerment' is often used in relation to a need for change: people need

to be empowered to take care of themselves, make their own plans and goals, and take charge of their own lives. National and local governments also see 'empowerment' as an opportunity to unburden the healthcare sector by helping people to seek their own solutions, and to stimulate people to be more productive: empowered people may apply for a job if they are unemployed or work more productively out of intrinsic motivation. As such, the focus on empowerment cannot be viewed separately from the societal trend in which 'personal responsibility' and 'your own power' are important values for patients and citizens in general (Boumans, 2012). 'Patient empowerment' is being used in the context of chronic disease care in which disease management and the relationship between patient and healthcare professional are core elements (Samoocha, Bruinvels, Elbers, Anema, & van der Beek, 2010). Patient empowerment is often mentioned in the same breath as the Health 2.0 movement in eHealth (van de Belt, Engelen, Berben, & Schoonhoven, 2010). Health 2.0 can be distinguished from eHealth in general as involving a more participative role for the people involved and collaboration between all stakeholders (patients, caregivers, professionals), drawing on the power of networks and a focus on personalized health care (Hughes, Joshi, & Wareham, 2008). The participant becomes an active and responsible partner in his/her own health and care pathway (van de Belt et al., 2010). However, in health care, it seems that there is not always an accurate and complete understanding of the concept of empowerment. For example, across a range of empowerment projects in the Netherlands, degrees of participation varied and in one case 'empowerment' was mentioned as a mere formality in a project plan (Jacobs, 2008). Another example was found in diabetes care; empowerment is viewed by professionals as a process to 'increase patient compliance or adherence to diabetes care recommendations' (Anderson & Funnell, 2010, page 2). Reading this description, 'empowerment' seems to be more a professional construction than a way to help people to find their own strengths and motives. It almost seems as though the professionals tell patients, 'We are going to empower you'. Empowerment can be seen as an pretext to reformulate the boundaries of responsibility in health care (Salmon & Hall, 2004).

Positive psychology and empowerment

If we put our own interventions and positive psychological interventions in general on a scale measuring empowerment, what would the verdict be? Because PPIs touch upon intrinsic motivation by dealing with subjects such as values, goal setting and meaning, there is an inherent empowering aspect to these interventions. Also, PPIs have a natural appeal: people may be more inclined to follow a well-being intervention with a positive character instead of doing a problem-based interventions, to work on depression for example. Therefore, it is easier to reach target groups for such interventions: people are attracted by the content (Bolier & Martin Abello, 2013). We observed this effect in the Psyfit trial in which more than 800 people expressed their interest within five weeks. However, compliance can be low in

PPIs, which raises questions as to whether people were truly empowered by the interventions. Many PPIs are characterized by short-term and exercise oriented techniques. A top-down approach is applied in many cases. For example, in an experiment in a hospital setting, gratitude, strengths and forgiveness exercises were delivered to patients with serious suicidal thoughts and behavior (Huffman et al., 2014). Patients were not involved in choosing the mode of delivery. Although there were indications for positive effects, there was also a rather large proportion of patients who were 'overwhelmed', thus the evidence for an empowering experience seemed limited. In Psyfit, people do have a choice as to whether or not they participate and can choose a module that suits them well. On the other hand, the system is rigid to a certain extent and once a participant has chosen a module, he or she must follow a four-week protocol.

Directions for the future

What would a true empowerment intervention look like? And how do we make the transition from 'empowerment' as a buzzword to a term with real substance? In the development of online positive psychological interventions, it seems imperative to engage with the target group as closely as possible. Co-creation and user-experience techniques can be used in order to develop an intervention based on experiential knowledge that is intrinsically motivating and empowering. The intervention must be adapted to fit personalities, resources, goals and interests, resulting in a good 'person-activity fit' (Lyubomirsky, Dickerhoof, Boehm, & Sheldon, 2011). In interventions, user-generated content such as blogging or support through social media, can be embedded to enhance the user experience. For health professionals who make use of general and online positive psychological interventions, the recommendation is to draw on the inner wisdom of the client or patient. An empowering approach requires a different professional approach: the professional takes on the role of a coach and an equal sparring partner, making use of empowering communication skills such as motivational interviewing and solution-focused techniques.

4. Adherence and real-life behavioral change

Adherence refers to the extent to which the participant completes the intervention (Kelders, 2012). There is evidence that greater adherence is associated with better outcomes (Donkin et al., 2011), although this relationship is not always clearly present (van der Zanden, Kramer, Gerrits, & Cuijpers, 2012). Empowerment and adherence seem to be interrelated, because the more empowered a person is by following an intervention, the greater the likelihood of adherence. In this thesis, we have seen that adherence to interventions was quite low. In Psyfit, 78 percent of the participants started the intervention and followed one lesson, but only 9% finished it in accordance with the protocol. In the Mentalvitality@work intervention, the adherence rate was much lower: only 5 percent started the intervention and

none of the participants finished. Despite of the low adherence rates, interventions in both trials significantly enhanced the well-being of participants. In case of the MentalVitality@Work study, this could have been caused by the assessment with personalized feedback only, which was offered to all participants in the experimental group and which may have raised a sense of awareness and subsequent behavioral/emotional/cognitive change (Boon, Risselada, Huiberts, Riper, & Smit, 2011). For Psyfit, it may have been that participants used the intervention until their needs were satisfied: Psyfit was created as a toolbox from which participants could 'pick and mix' to draw up their own personal training program. They may have used Psyfit until they felt better, thereby explaining the positive effects reported for non-adhering participants. On the other hand, the positive effects of Psyfit might also be linked with the aforementioned 'non-specific factors' of the intervention.

Low adherence as a natural feature of oPPIs?

Low adherence might be a natural and typical feature online interventions (Eysenbach, 2005), especially in fully automated or unguided web-based interventions. The Internet is the type of medium where people come to take a quick look and leave whenever they no longer feel attracted by the website or are distracted by something else. This aspect also applies to online positive psychological interventions (Mitchell et al., 2009; Powell et al., 2012). In positive psychology, the person-activity fit is an important aspect that is likely to determine the actual uptake and use of the intervention (Lyubomirsky et al., 2011). Improving well-being and resilience is a dynamic and active process. People must take real action and change their behavior, cognitions and attitudes. To make progress, PPIs not only require continuous effort, the intervention must also 'fit' with the personality, motives, strengths and needs of the person (Sheldon & Lyubomirsky, 2006). Technology can play a role in this process. Developing online interventions 'should be value-creation process to match the technology with needs, motivations, incentives, profiles and contexts', as Nijland has stated in her thesis (Nijland, 2011). In contrast, many oPPIs still take a 'one-size-fits-all' approach, which may not be appropriate for a large group of people who will, as a consequence, not fully adhere to the intervention.

Persuasive technology

Persuasive technology could help enhance adherence to the interventions used in this thesis. Incorporating persuasive elements in the functional and technical design of an Internet intervention is believed to be an important prerequisite for engagement, in order to arouse and prolong motivation for sustained behavioral change (Fogg, 2003). According to the Persuasive System Design-Model (PSD-Model), persuasive technology can be classified into four broad categories (Oinas-Kukkonen & Harjumaa, 2009): primary task support (such as personalization of content, reduction of complex behavior into simple steps, self-monitoring),

dialogue support (such as reminders, rewards), social support (such as normative influence and social sharing), and system credibility support (such as trustworthiness, perceived expertise). A systematic review has shown that persuasive elements in an intervention could explain 55% of the variance in adherence (Kelders, Kok, Ossebaard, & van Gemert-Pijnen, 2012). At present, many online positive psychological interventions are designed in the simple form of an e-mail containing exercise instructions, without persuasive design features (Gander, Proyer, Ruch, & Wyss, 2012; Seligman, Steen, Park, & Peterson, 2005). Sometimes, reminders are part of the intervention, or are sent as part of the study. Psyfit is an exception in this regard, as it already contains persuasive elements such as self-tests to monitor progress, and e-mail reminders. However, the intervention could be made much more personalized and engaging by, for example, tailoring content and visualizing the steps toward the desired behaviors. There is some empirical evidence that supports the proposition that tailoring positive psychology exercises to preferences and needs, as an added persuasive element, can indeed effectively enhance intervention engagement and adherence (Schueller, 2010; Schueller, 2011).

Mobile health

Psyfit and Mentalvitality@work, require access to a personal computer or laptop. While such devices are still widely used, mobile health ('mHealth') (Donker et al., 2013) and social media use (Grajales III, Sheps, Ho, Novak-Lauser, & Eysenbach, 2014) have become increasingly widespread over the past few years. 'Apps' for mobile phones or tablets have the potential to enhance the reach of and adherence to preventive online interventions, although effectiveness research is still in its infancy (Riper, Van Ballegooijen, Kooistra, De Wit, & Donker, 2013). This potential concerns PPIs and oPPIs as well. People can be reached at convenient times, and learning and practice can be more easily integrated into daily life as people carry around their smartphone all the time. Regular assessments could be used to measure progress and identify activities, markers or situations that help to enhance well-being (Experience Sampling or Ecological Momentary Assessments).

Real-world behavioral change

Adherence to the intervention is the first step. The next is implementing behavioral change in the real world. This issue applies to oPPIs too: for example, after an individual has assessed his or her strengths, the objective is to use a top strength in a practical situation. In the Psyfit and Mentalvitality@work trial, we did not find out whether people really are making behavioral changes in their lives. Oinas-Kukkonen (2010) classifies C, B and A changes as follows: changes in compliance (= adherence), behavioral change or an attitude change (such as motivation and self-efficacy). He recommends that in the future, more emphasis should be placed on A-Change, because in his view attitudes form the basis for our behavior (Oinas-

Kukkonen, 2010). *Serious games* could be one way to help people to begin and sustain the desirable behavior necessary to maintain the effects of a positive psychological intervention (Baranowski, Buday, Thompson, & Baranowski, 2008). For example, in a randomized controlled trial, effectiveness was established for an exciting serious game, named SPARX (Smart, Positive, Active, Realistic, X-factor thoughts), that aimed to tackle depression in adolescents (Merry et al., 2012). McGonigal discusses in her best-selling book 'Reality is broken – How games make us better and how they can change the world' the way serious games not only create fun and engagement, but also how they can intrinsically motivate people to do things that do not come easily or naturally (McGonigal, 2011). For example, she describes the game 'Chore wars' which makes the most hated domestic work a fun thing to do for roommates or couples. Every done chore grants the player with points or extra virtual skills or abilities. It is a so-called 'alternate reality game', a game that you play in the real world, but with the help of an app or website. A linked trend is 'the quantified self' (Swan, 2012): self-knowledge and awareness through repeated self-tracking (footsteps, food, well-being, ...). Data can be displayed graphically, which may motivate the person to make behavioral changes. In such a way, technology is becoming more and more supportive of the integration of tasks into daily life. Eventually, no active participation will be required, only invisible support for the natural process: *'computers disappear – not in a technical sense, but from a psychological perspective...they have to anticipate the user's needs in a particular situation and act proactively to provide appropriate assistance'* (Schmidt, 2013). Technology could help and offer support in a way that the individual is not even aware of it.

A final issue that could have caused the low adherence rates is the lack of personal contact in the interventions, as all the interventions are fully automated. In general, the use of personal guidance in online interventions that aim to treat depression is related to enhanced effectiveness (Andersson & Cuijpers, 2009).

To conclude this section, future developments and research on online positive psychology should focus on experimenting with innovative techniques, such as persuasive technologies, gamification and quantified self, developing oPPIs for mobile devices, and considering personal guidance for the interventions as a motivating factor. Such measures are likely to help people to stay engaged and motivated while following the intervention.

5. No impact without implementation

In this thesis, the effectiveness of Psyfit and Mentalvitality@work is investigated. Both interventions were envisioned in a population health approach and were studied in real life settings, the Internet and a large academic hospital, respectively. Based on the design (randomized controlled trial), we assessed the extent to which the interventions are effective. However, how the interventions should be applied in other settings and how to disseminate

them on a large scale remains largely unknown. For example, it would be valuable to know whether Psyfit or other online positive psychological interventions could serve as accessible and non-medicalized first-step interventions (or perhaps relapse prevention interventions) in a stepped care depression approach in primary care. For that reason, we need to understand the attitudes and ideas of professionals working in primary care toward oPPIs, and further assess facilitating and impeding factors for implementation in the system/organization, and among professionals and the target group, alongside the monitoring of the patients. The aim should be to develop an appropriate implementation strategy. Until now, translational research, the investigation of implementation strategies and process indicators with a view to boosting reach and uptake of interventions, has been overlooked in positive psychology (Hone, Jarden, & Schofield, 2014).

Kobau et al. (2011) make a convincing argument for greater synergy between positive psychology and public health policy. Mental health promotion practice offers a greater reach for positive psychological interventions and likewise, the positive mental health approach in positive psychology offers additional asset-based strategies for mental health promotion (Kobau et al., 2011). To achieve this potential synergy, general and online positive psychological interventions should be embedded into the public healthcare system. To that end, implementation science should be used in a more systematic way. However, according to Diffusions of Innovations theory, most innovations do not occur spontaneously (Rogers, 1995). Few people are innovators or early adopters, but many are early or late majority and laggards. In terms of interventions, broad-scale implementation lags behind development and efficacy/effectiveness studies of interventions. This also applies to positive psychological interventions.

Scalability as a prerequisite for successful implementation

Once effectiveness has been established, oPPIs such as Psyfit must be scaled up in order to reach population-scale well-being. Scalability is defined as: 'The ability of a health intervention shown to be efficacious on a small scale and under controlled conditions to be expanded under real world conditions to reach a greater proportion of the eligible population, while retaining effectiveness' (Milat, King, Bauman, & Redman, 2013). Scalability considerations include the need for a sufficiently large and sustainable workforce, acceptability of the program by both clients and professionals, and the interaction between the intervention, on the one hand, and the community and political and organizational context on the other (Milat et al., 2013). For ICT systems, such as Psyfit and Mentalvitality@work, scalability refers not only to embedding the intervention in the wider context, but also to the ability of the system or network to handle growing levels of data traffic. However, this is a limited view of how online interventions should be scaled up. Van Gemert-Pijnen et al. (2011) propose a holistic framework to boost the

uptake and impact of online health interventions (van Gemert-Pijnen et al., 2011). In this model, a fit is needed between human, organizational, and technological factors in such a way as to ensure uptake and optimal implementation. Stakeholder participation, continuous evaluation cycles, business modeling and the intertwining with implementation issues are indispensable elements of the model.

The RE-AIM framework: Implementation determines the impact of an oPPI

RE-AIM is a conceptual model that helps to assess the real impact of an intervention program (Glasgow, Vogt, & Boles, 1999). The acronym stands for: Reach (the intended target group), Efficacy/Effectiveness, Adoption (by target staff, settings, or institutions), Implementation (consistency, costs and adaptations made during delivery) and Maintenance (of intervention effects in individuals and settings over time). However, this thesis concludes with 'Effectiveness'. The impact of Psyfit is well-established: the intervention effectively enhanced well-being and reduced symptoms of anxiety and depression in a particular target group of mildly depressed people ('Reach'). Now, the intervention must find its way in real life conditions (taking into account the suggestions for improvement, set out in the paragraph on adherence) by testing it in different settings and target groups. In the words of RE-AIM; to adopt, implement and maintain the intervention in real life. There are some indications of attenuating clinical effects in the process of large-scale implementation which may relate to implementation issues (Durlak & DuPre, 2008). Overall, properly implemented programs showed larger effect sizes than poorly implemented programs. Monitoring of the implementation was also an enhancing factor for effect size. These findings show the importance of good implementation strategies. Future research on positive psychology should focus on how to upscale general and online positive psychological interventions in an effective way and how to integrate these interventions into different settings using implementation science and models such as RE-AIM. One implementation initiative is currently underway: Maastricht University, in collaboration with Trimbos Institute disseminates Psyfit by connecting it to the health monitor of the local Municipal Health Service (Gemeentelijke Gezondheids Dienst, GGD) (Schneider, Schulz, Pouwels, de Vries, & van Osch, 2013). Every four years, a large representative sample of citizens fill in this questionnaire, which is now followed by a personal feedback message. On indication (in case there are no severe mental complaints), people received a login account for Psyfit. The main research questions are whether people will make use of Psyfit and what are the predictors for its use. Another question is whether the effectiveness of the intervention is sustained at an acceptable level when implemented on a large scale. Initial results show that uptake of Psyfit is very low. Therefore, embedding the intervention in a healthcare system, such as primary care, seems to be recommended. We expect further results in the near future.

CONCLUSION

The studies in this thesis contribute to the growing evidence for positive psychological interventions, and in particular the large scale dissemination of PPIs over the Internet. Although the results are promising, recommendations were made to explore further possibilities in relation to the population health approach, to improve and diversify research methods in positive psychology (including the publishing of null results) and to make greater use of the state-of-the-art research on empowerment, adherence and implementation science. To make a real impact, positive psychology should go beyond a single intervention strategy. A more profound and comprehensive approach is needed by embedding general and online positive psychological interventions into various delivery systems (e.g. health care, work, school, etc.). As a complement to the traditional focus in public mental health on mental pain and pathology, PPIs and oPPIs can offer a more balanced approach. This is a call to the positive psychological research community to develop new knowledge to inform policy and practice in their decision-making processes, in order to make evidence-based general and online positive psychological interventions widely available and their use an empowering and meaningful experience for the individual.

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SUMMARY

Chapter 1 presents a general introduction to this thesis. It describes the main objectives and context of the research reported. In short, promoting well-being in the adult population might be a worthwhile preventive strategy for public mental health. Research originating in positive psychology - a rather new movement in psychology that studies concepts such as well-being, happiness and human flourishing - shows promising results for the longitudinal effects of well-being on adult physical health and longevity, social behavior and quality of life. Furthermore, well-being enhancement can contribute to the prevention of depression and might be an attractive and easily accepted intervention for people who are in need of mental health support. Given the rather low levels of psychological and social well-being in the Dutch population in comparison with other European countries, and the high prevalence of depressive symptoms, together with a demanding society which requires good coping skills, social skills and creative ability, investing in well-being in the adult population might be worth exploring. Providing well-being interventions via the Internet may offer an opportunity to reach and engage large numbers of people. To investigate these premises, this thesis pursued three goals: 1) To further explore the impact of well-being on recovery and survival in people with physical illnesses; 2) To examine the overall effectiveness and potential of positive psychological interventions (PPIs) and online positive psychological interventions (oPPIs) on well-being and depression; 3) To study if two newly developed oPPIs (Psyfit – mental fitness online and Mentalvitality@work) have the capacity to enhance well-being in an effective and cost-effective way.

The first goal, to explore the impact of well-being on recovery and survival in people with physical illnesses, is examined in **Chapter 2**. This chapter presents the results of a meta-analysis which examines well-being as a predictor for recovery and survival for people with physical diseases. We identified 17 eligible studies in reference lists and the Medline and PsycInfo databases. The results show that emotional well-being is positively related to the long-term prognosis for physical illness ($LR = 1.14$). Higher levels of emotional well-being are beneficial for recovery and survival rates in people with physical diseases, such as coronary artery disease. The strongest relation was found for recovery ($LR = 1.39$, vs $LR = 1.11$ for survival). The results must be interpreted with caution in light of the small effect size, the variable quality in the study designs and the findings of publication bias. Nevertheless, the results can be described as important: physical diseases such as heart disease and cancer are prevalent. Enhancing well-being in these populations might have small, but positive effects on the prognosis of the illness.

The second goal, to examine the overall effectiveness of positive psychological interventions both offline and online, has been explored in Chapters 3 and 4. **Chapter 3** synthesizes the

effectiveness of positive psychological interventions in a meta-analysis. After a systematic literature search using PubMed, PsycInfo, the Cochrane register and manual searches, 39 studies of randomized controlled trials, with a total of 6,139 participants, were included. For each study, a standardized effect size was calculated and the various effect sizes were pooled together to assess subjective well-being, psychological well-being and depression. A random-effects model was used. Small but significant effect sizes were found for PPIs when compared with various control conditions, such as placebo and no intervention control groups. An overall, significant effect size at post-test of 0.34 was found for subjective well-being, 0.20 for psychological well-being and 0.23 for depression. At a 3 to 6-month follow-up, effects were only significant for subjective well-being ($d = 0.22$) and psychological well-being ($d = 0.16$). For depression, interventions were more effective if they were of a longer duration and if delivered to people with an elevated level of psychosocial problems. The quality of the studies predicted the effect size for depression: the lower the quality, the higher the effect. Moreover, indications for publication bias were found. Therefore, we concluded that more high-quality randomized controlled trials are necessary to confirm the results of this meta-analysis. **Chapter 4** describes the foundation for the use of online interventions in positive psychology and provides a pragmatic review on the effectiveness of online positive psychological interventions. Through the use of the Internet and technology, positive psychological interventions have the potential to reach large, and perhaps as yet un-reached target groups, which might be important for a public health approach. The use of persuasive technology, i.e. technologies that aim to change people's attitudes and behavior, can help to engage and motivate people to make the effects of positive psychological interventions last (sustainable behavioral change). In the literature review, 11 studies that described a randomized controlled trial on an online positive psychological intervention were included. The evidence suggests that oPPIs can be effective in enhancing well-being and reducing depressive symptoms. However, results of the effects were mixed insofar as some interventions, but not all, helped to enhance well-being and reduce depressive symptoms. The extent to which persuasive technologies (such as tailoring, personalization, reminders) were used in the interventions was still limited. Therefore, it is recommended to make greater use of such technologies in order to better fit oPPIs to the needs and preferences of participants. It was again concluded that more high-quality studies are needed to strengthen the evidence-base for online positive psychological interventions.

The third goal of this thesis, the extent to which two newly developed oPPIs (Psyfit – mental fitness online and Mentalvitality@work) are effective and cost-effective, is examined in Chapters 5, 6, 7 and 8. **Chapter 5** presents the design of the Psyfit study. The study is designed as a randomized controlled trial with two arms: access to Psyfit as the intervention arm ($N = 143$) and a waiting-list control condition ($N = 141$). Psyfit is a mental fitness self-

help intervention that aims to improve well-being among adults. The intervention is for the most part based on principles that stem from or are related to positive psychology, such as optimistic thinking, positive relationships and mindfulness. The primary study outcome was well-being/positive mental health, and secondary outcomes were depression and anxiety symptoms, vitality and general health. Adult participants were included if they presented mild symptoms of depression and a moderate to low level of well-being. The outcomes were measured at baseline, 2- and 6-month follow-up. In **Chapter 6**, the results of the randomized controlled trial of the Psyfit intervention are presented. In comparison with the control group, Psyfit was found to be effective in helping participants to enhance their well-being ($d = 0.31$), vitality ($d = 0.22$) and general health ($d = 0.14$) and to reduce symptoms of anxiety ($d = 0.32$) and depression ($d = 0.36$) when compared with the control condition. Effects were maintained at 6-month follow-up for depression ($d = 0.35$) and anxiety ($d = 0.35$). All significant effects were small-sized. Furthermore, the results suggest that the higher-educated and older participants aged over 45 benefited more from the intervention. Regarding adherence, almost 80% completed at least one lesson in Psyfit and almost 10% completed a whole module which consisted of four lessons. There was no clear dose-response effect of adherence on effectiveness, although some significant differences appeared across most outcomes in favor of those completing at least one lesson in the intervention. **Chapter 7** describes the results of the cost-effectiveness analysis within the randomized controlled trial conducted on Psyfit. As far as we know, this is the first economic evaluation of a positive psychological intervention. Results indicated that improved clinical outcomes were achieved, but at substantially higher costs in comparison with the waitlisted usual care group. It was difficult to explain these results, in light of the clinical improvements and the overall low costs of the intervention. One possible explanation for the intervention not being cost-effective is that by using the intervention, participants became more aware of their stress levels and value system, resulting in more frequent reports of illness (which was the biggest cost driver), as a preventive measure. However, a closer look at the data reveals that the number of people that became sick-listed did not differ between the groups, which runs counter to this explanation. A more plausible explanation may be that in the Psyfit group, a few, possibly accidental, outliers accounted for a large share of the costs. Indeed, the costs were reduced considerably and cost-effectiveness was improved when these outliers were removed ($N = 5$ in Psyfit group and $N = 2$ in control group). The question of whether Psyfit and online positive psychology in general are cost-effective, remains to be answered. **Chapter 8** presents the results of another randomized controlled trial, the Mentalvitality@work study. In this cluster-randomized trial, the effects of a workers' health surveillance system were examined, which is a mandatory preventive system in the Netherlands. All nurses and allied health professionals ($N = 1140$) working in one academic hospital were invited to participate in the study and were randomized to the intervention group ($N = 178$) or to the control group ($N = 188$).

The control group consisted of a waiting list that were offered access to the intervention after 6 months. At 3 and 6 month follow-up, the intervention significantly enhanced well-being, in comparison with the waitlisted control group. No significant differences were found for symptoms of depression and anxiety. No significant effects of the online program were reported on other outcomes (such as work functioning) published in other articles on the same trial. Adherence to the online interventions was very low: Only 5% of the participants followed an online intervention to some extent.

Chapter 9 is the discussion section of this thesis. It discusses the main findings, limitations and implications for research and practice. It was concluded that positive psychological interventions, and online positive psychological interventions in particular, have potential to enhance well-being in adult populations. Furthermore, in the Psyfit trial, positive effects on mental health complaints (reductions in symptoms of depression and anxiety) were found. A lack of adherence to the intervention protocols was an important issue in both randomized controlled trials. Several recommendations were made to improve practice and research on general and online positive psychological interventions. In order to make a real impact, there is a need to: 1) explore further possibilities in relation to the population health approach, 2) improve and expand research methods in positive psychological intervention research, 3) make greater use of the principles drawn from the empowerment movement in the development and delivery of PPIs and oPPIs (such as co-creation and a bottom-up approach), 4) make use of persuasive technologies within the interventions and/or professional guidance, which may improve engagement, adherence and, ultimately, sustainable behavioral change, 5) conduct more implementation studies in positive psychology. More knowledge is needed on how to successfully embed general and online positive psychological interventions in various delivery systems, such as healthcare, schools, companies and via the World Wide Web.

SAMENVATTING

Hoofdstuk 1 is de algemene inleiding van dit proefschrift. Het hoofdstuk beschrijft de doelen van het onderzoek en de context waarbinnen de verschillende studies zijn uitgevoerd. In het kort kan gesteld worden dat het versterken van welbevinden een preventieve strategie kan zijn voor de publieke geestelijke gezondheid. Onderzoek vanuit de positieve psychologie - een snelgroeiende stroming in de psychologie die gericht is op het bestuderen van welbevinden, geluk en bloei - laat zien dat welbevinden een positieve invloed heeft op fysieke gezondheid en levensduur, sociaal gedrag en kwaliteit van leven. Daarnaast zou het bevorderen van welbevinden kunnen bijdragen aan het voorkomen van depressie. Positieve interventies kunnen bovendien als toegankelijker en aantrekkelijker worden ervaren door mensen met psychische klachten. Het investeren in het welbevinden van de Nederlandse populatie is evident gezien het relatief lage niveau van welbevinden van Nederlanders in vergelijking met inwoners van andere Europese landen. Bovendien is in Nederland sprake van een hoge prevalentie van depressie in een maatschappij die in toenemende mate een beroep doet op copingvaardigheden, sociale vaardigheden en creativiteit. Het aanbieden van interventies die welbevinden bevorderen via het internet zou een grote groep mensen kunnen bereiken. Dit wordt onderzocht aan de hand van drie doelen: 1) Nader onderzoeken van de impact van welbevinden op herstel en overleving bij mensen met een lichamelijke ziekte; 2) Toetsen van het potentieel van (online) positief psychologische interventies ((o)PPIs) en de effectiviteit op welbevinden en depressie; 3) Onderzoeken van de (kosten)effectiviteit van twee nieuw ontwikkelde interventies: Psyfit - mental fitness online en Mentalvitality@work.

Het eerste doel, exploreren van de impact van welbevinden op herstel en overleving bij mensen met een lichamelijke ziekte, komt aan bod in **Hoofdstuk 2**. Dit hoofdstuk presenteert de resultaten van een meta-analyse die welbevinden als voorspeller onderzoekt voor de herstel- en overlevingskans van mensen met lichamelijke ziektes. We selecteerden 17 geschikte studies vanuit referentielijsten en de Medline en PsycInfo databases. De resultaten lieten zien dat emotioneel welbevinden positief gerelateerd is aan de lange-termijn prognose van lichamelijke ziekte ($LR = 1.14$). Een hoger niveau van emotioneel welbevinden zorgt voor een grotere kans op herstel en overleving bij ziektes zoals hartziektes. De sterkste relatie werd gevonden voor herstel ($LR = 1.39$, versus $LR = 1.11$ voor overleving). De resultaten moeten wel voorzichtig worden geïnterpreteerd want het gaat slechts om een klein effect. Daarnaast waren er grote verschillen in kwaliteit van het onderzoek en aanwijzingen voor publicatiebias. Evengoed zijn de resultaten van belang: lichamelijke ziektes zoals hartziektes en kanker komen veel voor. Het bevorderen van welbevinden in deze populaties zou wel eens een klein, positief effect op de prognose van de ziekte kunnen hebben.

Het tweede doel, toetsen van het potentieel en de effectiviteit van (online) positief

psychologische interventies is onderzocht in hoofdstukken 3 en 4. **Hoofdstuk 3** vat de effectiviteit van positief psychologische interventies samen in een meta-analyse. Een systematische literatuurstudie met zoekopdrachten in verschillende databases (PubMed, PsycInfo, Cochrane register) en handmatige searches, leverde 39 studies op van gerandomiseerde studies, met een totaal aan 6.139 deelnemers. Van iedere studie werd een gestandaardiseerde effectmaat berekend. Deze effecten zijn gepoold tot een totale effectmeting van subjectief welbevinden, psychologisch welbevinden en depressieve symptomatologie. Er is gebruik gemaakt van een random-effects model. Kleine maar significante effecten zijn aangetoond voor de PPIs, in vergelijking met diverse controlegroepen zoals placebo en controlegroepen waarbij geen interventie werd aangeboden. Voor subjectief welbevinden werd een significant effect gevonden van 0.34 op de nameting. Voor psychologisch welbevinden was de effectgrootte 0.20 en voor depressie 0.23, beiden significant. Bij de follow-up van 3 tot 6 maanden waren de effecten alleen significant voor subjectief welbevinden ($d = 0.22$) en voor psychologisch welbevinden ($d = 0.16$). Voor depressie gold dat interventies effectiever werden naarmate ze langer duurden en werden aangeboden aan een groep mensen met psychosociale problemen. De kwaliteit van de studies voorspelde het effect op depressie: hoe lager de kwaliteit, hoe hoger het effect. Daarnaast waren er aanwijzingen voor publicatiebias. Daarom concludeerden wij dat er meer gerandomiseerde trials van hoge kwaliteit nodig zijn om de bewijskracht voor positief psychologische interventies te verstevigen. **Hoofdstuk 4** beschrijft de onderbouwing voor het gebruik van online interventies in positieve psychologie en bevat een pragmatische literatuurreview over de effectiviteit van online positief psychologische interventies. Door het gebruik van internet en technologie kunnen PPIs mogelijk grote en wellicht nog niet-bereikte doelgroepen bereiken, wat belangrijk kan zijn in een publieke gezondheidsbenadering. Persuasieve technologie, ofwel technologie die helpt bij attitude- en gedragsverandering, kan helpen bij het stimuleren en motiveren van mensen zodat de effecten van PPIs duurzaam zijn. In het literatuuroverzicht werden 11 gerandomiseerde studies naar een oPPI geïnccludeerd. Het bewijs tot dusver suggereert dat oPPIs effectief kunnen zijn in het bevorderen van welbevinden en het verminderen van depressie. Echter, de resultaten waren niet eenduidig, in zoverre dat sommige maar niet alle studies positieve effecten lieten zien. Binnen de interventies werd nog niet veel persuasieve technologie toegepast (zoals tailoring, personalisatie, herinneringen). Daarom is het aan te bevelen om hier meer gebruik van te maken, zodat oPPIs beter worden toegesneden op de behoeftes en voorkeuren van de deelnemers. Ook hier werd geconcludeerd dat meer studies van hoge kwaliteit nodig zijn om de bewijskracht voor online positief psychologische interventies te vergroten.

Het derde doel van dit proefschrift, onderzoeken van de (kosten)effectiviteit van twee nieuw ontwikkelde interventies: Psyfit – mental fitness online en Mentalvitality@work, wordt

behandeld in de hoofdstukken 5, 6, 7 en 8. **Hoofdstuk 5** beschrijft de onderzoeksoepzet van de Psyfit studie; een gerandomiseerde studie met toegang tot Psyfit als experimentele conditie (N = 143) en een wachtlijst controle conditie (N = 141). Psyfit is een mental fitness zelfhulpinterventie met als doel het verhogen van welbevinden bij de volwassen gebruikers. De interventie is voor een groot gedeelte gebaseerd op principes die voortkomen of gerelateerd zijn aan positieve psychologie, zoals optimistisch denken, positieve relaties en mindfulness. De primaire uitkomstmaat was welbevinden/positieve geestelijke gezondheid, de secundaire uitkomstmaten vitaliteit, gezondheid en symptomen van depressie en angst. Geïnteresseerden werden geïncludeerd als ze 21 jaar of ouder waren, milde symptomen van depressie vertoonden en een gematigd niveau van welbevinden. Uitkomsten werden gemeten in een voormeting en op 2-maands en 6-maands follow-up. **Hoofdstuk 6** presenteert de resultaten van het onderzoek naar de effectiviteit van Psyfit. In vergelijking met de controleconditie was Psyfit effectief in het verbeteren van welbevinden ($d = 0.31$), vitaliteit ($d = 0.22$) en algemene gezondheid ($d = 0.14$) en in het verminderen van depressieve klachten ($d = 0.32$) en angstsymptomen ($d = 0.35$) bij de deelnemers. In de 6-maands follow-up waren de effecten nog significant voor depressie ($d = 0.35$) en angst ($d = 0.35$). Alle gevonden positieve effecten waren klein. Daarnaast waren er aanwijzingen dat hoger opgeleide en oudere deelnemers (boven de 45 jaar) meer baat hadden bij de interventie. Bijna 80% van de deelnemers maakte ten minste één les af binnen een module en bijna 10% maakte een hele module van vier lessen af (adherentie). Er was geen duidelijke dosis-respons relatie van adherentie op effectiviteit, hoewel er wel wat significante verschillen waren bij de meeste uitkomsten als de deelnemer ten minste één les had afgerond. **Hoofdstuk 7** beschrijft de resultaten van een kosteneffectiviteitsanalyse op de data van de Psyfit trial. Voor zover we weten is dit de eerste economische evaluatie van een positief psychologische interventie. De resultaten lieten zien dat er verbeteringen waren in klinische uitkomsten in de Psyfit conditie, maar wel tegenover flink hogere kosten in vergelijking met de wachtlijst controleconditie. Het was lastig om deze bevindingen te verklaren, gezien de klinische verbeteringen en de in het algemeen lage kosten voor de interventie. Een mogelijke verklaring voor de geringe kosteneffectiviteit is dat deelnemers die Psyfit gebruikten zich meer bewust werden van hun stressniveau en waardensysteem, waardoor ze zich vaker ziek gingen melden (dit was de grootste kostenpost) als een soort van preventieve maatregel. Maar als we beter naar de data kijken zien we dat het *aantal* mensen dat zich ziek meldt niet verschilt tussen de groepen, waardoor deze verklaring minder aannemelijk is. Een meer plausibele verklaring zou zijn dat in de Psyfit conditie een paar, mogelijk toevallige, uitschieters zijn die een groot deel van de kosten met zich meebrengen. Bij het verwijderen van deze uitschieters werden de kosten inderdaad aanzienlijk gereduceerd en verbeterde de kosteneffectiviteit (N = 5 in de Psyfit conditie and N = 2 in de controleconditie). Op de vraag of Psyfit kosteneffectief is moeten we op dit moment het antwoord schuldig blijven. **Hoofdstuk 8** presenteert de

resultaten van een andere gerandomiseerde trial, de Mentalvitality@work study. In deze cluster-gerandomiseerde trial werden de effecten onderzocht van een Preventief Medisch Onderzoek (PMO) gericht op psychische gezondheid van verpleegkundigen en paramedici. In Nederland zijn werkgevers verplicht om werknemers periodiek een dergelijk onderzoek te laten ondergaan. Het PMO bestond uit een online vragenlijst met daaraan gekoppeld een online terugkoppeling van de resultaten en een aanbod van online interventies. Alle 1.140 verpleegkundigen en paramedici werkzaam in één universitair medisch centrum waren uitgenodigd om mee te doen aan het onderzoek en werden gerandomiseerd over de interventieconditie, het online programma (N = 178) en de wachtlijst controleconditie (N = 188). In de follow-up van 3 en 6 maanden was het welbevinden in de online interventieconditie significant verbeterd ten opzichte van de wachtlijst controleconditie. Er zijn geen significante effecten gevonden voor depressie en angst. Ook zijn er geen significante effecten op andere uitkomstmaten gevonden (zoals functioneren op het werk) welke zijn gepubliceerd in andere artikelen. De adherentie binnen de online interventies van het PMO was heel laag: slechts 5% van de deelnemers volgde een online interventie tot op zekere hoogte.

Hoofdstuk 9 bevat de discussie van het proefschrift. De belangrijkste bevindingen, de beperkingen van het onderzoek en de implicaties voor onderzoek en praktijk worden besproken. De conclusie was dat positief psychologische interventies, en online varianten in het bijzonder, potentieel hebben om het welbevinden in een volwassen populatie te vergroten. Daarnaast zijn er in het Psyfit effectonderzoek positieve effecten aangetoond voor psychische klachten (vermindering van symptomen van depressie en angst). In beide trials die in dit proefschrift staan beschreven was het gebrek aan adherentie een belangrijk aandachtspunt. Verschillende aanbevelingen zijn gedaan om de praktijk van en het onderzoek naar (online) positief psychologische interventies te verbeteren. Om daadwerkelijk impact te hebben is het nodig om: 1) De mogelijkheden van een gezondheidsbenadering op populatieniveau verder te verkennen, 2) Onderzoeksmethoden in het interventieonderzoek in positieve psychologie te verbeteren en te verbreden, 3) Kennis vanuit empowerment beter te benutten in de ontwikkeling en het aanbieden van PPIs en oPPIs (zoals co-creatie en een bottom-up benadering), 4) Meer gebruik te maken van persuasieve technologie en/of professionele begeleiding binnen de interventies, met als doel een toename in motivatie, adherentie en uiteindelijk duurzame gedragsverandering, 5) Opzetten van implementatiestudies in positieve psychologie. Er is meer kennis nodig over hoe (online) positief psychologische interventies succesvol kunnen worden ingezet in de gezondheidszorg, op scholen, werkplekken en via het wereldwijde web.

DANKWOORD

Dankwoorden schijnen het meest en vaak ook als eerste gelezen te worden in een proefschrift (...en?). Natuurlijk vanwege nieuwsgierigheid, maar ook omdat het uiten van dankbaarheid van grote waarde is in onze cultuur, zowel voor de gever als voor de ontvanger. En misschien ook wel voor de mensen die het gadeslaan. Onderzoek in de positieve psychologie laat zien dat dankbaarheidsuitingen vooral effectief zijn als het direct aan iemand is gericht, via de telefoon, een brief of face-to-face. Voor mij dus nu een uitgelezen mogelijkheid om wat gelukkiger te worden, en voor u wellicht ook.

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Schreurs, prof. dr. Lisette van Gemert-Pijnen, dank voor de tijd die u heeft genomen om mijn proefschrift te beoordelen en naar de universiteit te komen voor de verdediging. Estimada prof. dr. Christina Botella, es un honor que usted forme parte del tribunal examinador que me evaluará. Muchísimas gracias por todo el tiempo dedicado a mi tesis, y por venir a la defensa en Holanda.

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CURRICULUM VITAE

Jerina Marlinde (Linda) Bolier was born in Middelburg in the Netherlands on the 10th of May 1972. She graduated from high school (Atheneum) at the Christelijke Scholengemeenschap Walcheren. She studied for one year piano at the Royal Conservatory of The Hague and after that, developmental and clinical psychology at Utrecht University. During her student years, she developed an interest in how to deal with life's challenges in a positive way, resulting in her thesis about coping strategies and resilience in refugee children. She started her career as a research assistant at the Gemeentelijk Pedologisch Instituut and Bureau Driessen and as a telephone consultant at the Drug information helpline. Currently, she works as a research associate at the Department of Public Mental Health of the Trimbos Institute (Netherlands Institute of Mental Health and Addiction). From 2015, she will hold a similar position at the University of Twente for one day a week.

Her main interests lie in research, development and implementation of preventive interventions that aim to promote positive mental health. She has a particular interest in the online delivery of interventions by means of PCs, tablets or mobile phones and implementation in diverse settings such as schools and (mental) health care facilities. She authored and co-authored over 30 publications in national and international journals and books. In addition, she co-authored the self-help book *Mental fitness – verbeter je mentale conditie* (2010) and co-edited the *Handboek positieve psychologie – theorie, onderzoek en toepassingen* (2013) and *Sturen op geluk - geluksbevordering door nationale overheden, gemeenten en publieke instellingen* (2012). She is an ad hoc reviewer of several peer-reviewed journals, including the *Journal of Medical Internet Research* and the *Journal of Positive Psychology*.

As a country representative of the European Network for Positive Psychology (ENPP) she aims to connect people in the Netherlands engaged in the research and practice in the field of positive psychology. She manages a Dutch LinkedIn group on positive psychology of almost 600 members. In 2014, she was involved in organizing the 7th European Conference on Positive Psychology in Amsterdam.

Linda lives in Utrecht. In her spare time she loves to go for long walks, play piano and gather with her friends.