Understanding mental well-being in the face of adversity

A scientific exploration in eating disorder patients

Jan Alexander de Vos

UNDERSTANDING MENTAL WELL-BEING IN THE FACE OF ADVERSITY

A SCIENTIFIC EXPLORATION IN EATING DISORDER PATIENTS

Jan Alexander de Vos

Thesis, University of Twente
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UNDERSTANDING MENTAL WELL-BEING IN THE FACE OF ADVERSITY

A SCIENTIFIC EXPLORATION IN EATING DISORDER PATIENTS

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Dit proefschrift is goedgekeurd door:

de promotoren

Prof.	dr.	G.J. Westerhof	Universiteit Twente
Prof.	dr.	E.T. Bohlmeijer	Universiteit Twente

de co-promotor

	dr.	M. Radstaak	Universiteit Twente

De openbare verdediging van dit proefschrift vindt plaats ten overstaan van de **Promotiecommissie** die bestaat uit:

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Prof.	dr.	E.T. Bohlmeijer	Universiteit Twente

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	dr.	M.L. Noordzij	Universiteit Twente

Begeleiding tijdens de verdediging wordt gegeven door:

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Drs.	C. A. Bijkerk
	M.E. de Vos-Groeneveld

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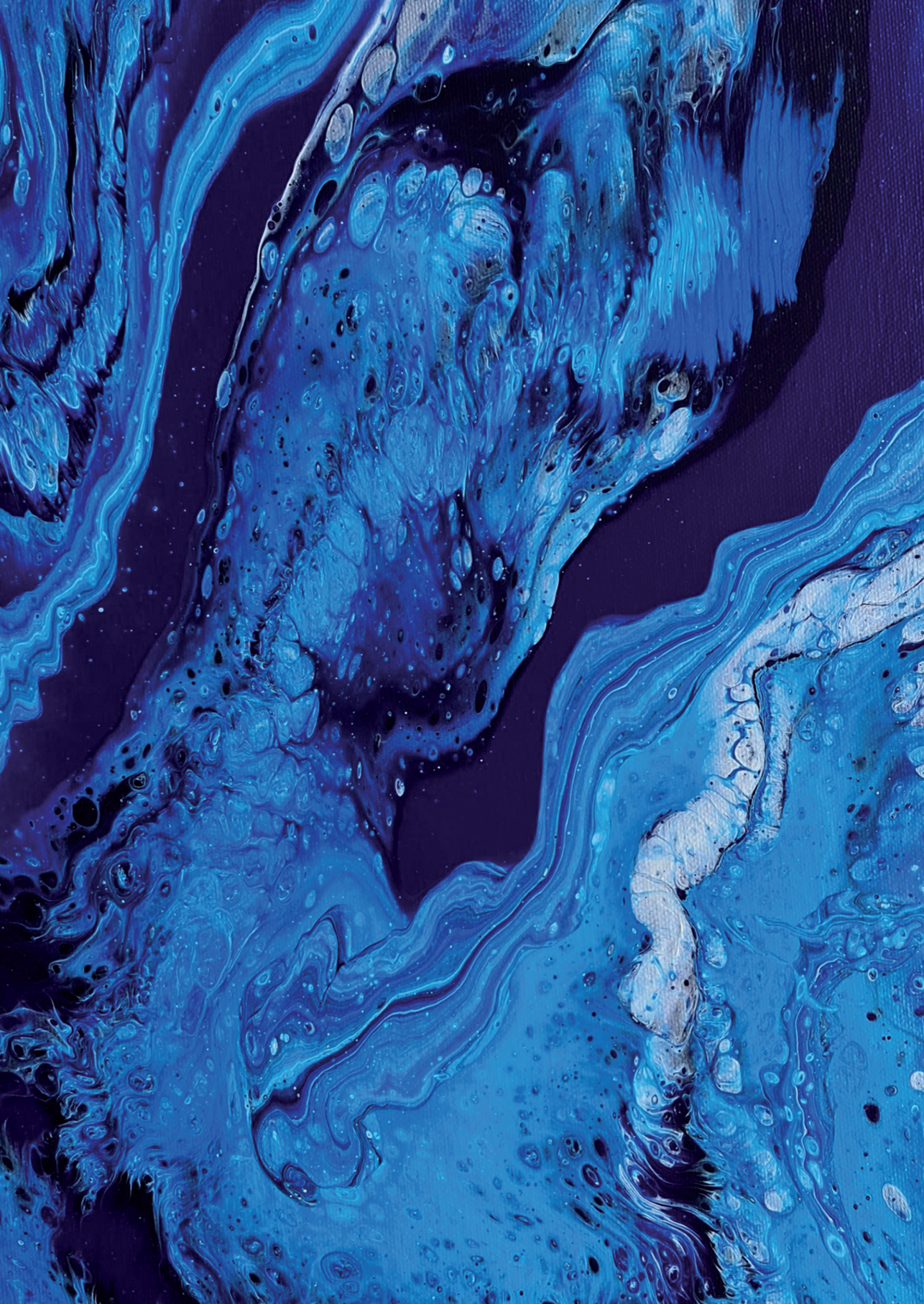

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General introduction

A journalist asks a psychiatrist, researcher, and a recovered patient:

"When is a patient recovered from an eating disorder (ED)?"

The psychiatrist says:
"Well, this depends on the type of ED, but we have certain criteria for this. For instance, we look at biological parameters, such as weight normalization and behavioral criteria, such as restricting, binge eating, purging, or excessive exercising, to compensate for food intake or calories. When these criteria are within normal ranges, we consider a patient as recovered."

The researcher adds:
"If you look at the most widely used criteria in scientific studies to assess the effectiveness of treatments, weight gain is the primary criterion for anorexia nervosa, abatement or absence of bingeing and compensatory behaviors, such as purging for bulimia nervosa, and abatement or absence of binging for binge eating disorder. Secondary indicators are often not meeting any of the ED criteria (full recovery) or improvements in ED attitudes, usually measured with a self-report questionnaire."

The recovered patient says:
"First of all, it is about understanding that I have an 'ED self' and that I also have a 'healthy self', so I guess it is about finding identity, realizing that I can choose to be the healthy 'me'. It is actually not really about eating, but much more about finding meaning and purpose in life, accepting myself for who I am, including my body, and finding joy again in the things that I do."

When I started to work as a junior researcher at Stichting Human Concern, a multisite treatment center for eating disorders (EDs) in the Netherlands, I knew close to nothing about EDs. Although I started to learn quickly from professionals, patients, advocates, and literature, it became less and less clear for me what recovery from an ED constitutes. Many definitions and even more operationalizations were used, and what I understood from the patient's view did not seem to converge with the criteria I found in outcome studies. The fictional statements at the beginning of this chapter hopefully indicate some of the differences I noticed. Human Concern works with clinicians who have been recovered from an ED. Therefore, I was in an excellent position to ask many clinicians how they experience or can tell they are recovered. I cannot recall hearing anyone say it is because my weight or body mass index (BMI) is within normal ranges or because I do not purge or binge anymore. They usually told things about more existential aspects of life, such as changes in their sense of identity, improved self-acceptance, having a sense of meaning and purpose in life, and

having meaningful relationships. Later I found out that these life aspects were rather clearly described in the psychological literature as aspects of mental well-being.

This thesis explores mental well-being in patients with EDs and during the recovery process. In this first chapter, we (the other authors and myself) present a general overview of definitions, prevalence, consequences of EDs, and the current status of treatment outcomes. Then we describe theories on human well-being and current psychological models on mental health. This chapter ends with an overview of the studies we conducted to understand mental well-being in patients with EDs.

Eating disorders

EDs are serious psychiatric diseases represented by disturbances in eating behavior and related cognitions. The chapter on Feeding and Eating Disorders in the Diagnostic and Statistical Manual of Mental Health (DSM 5) describes several main eating and feeding disorders of which anorexia nervosa (AN), bulimia nervosa (BN) and binge eating disorder (BED) are the most well-known (American Psychiatric Association, 2013). The remaining feeding disorders are avoidant restrictive food intake disorder, pica and rumination disorder. A residual category, labeled as other specified feeding and eating disorders (OSFED), is used for patients not meeting the criteria for a typical classification.

AN is represented by a restriction of energy intake or refusal to maintain a body weight above a minimum that is considered healthy, an intense fear of weight gain or becoming fat, and body evaluation disturbances. There are two types of AN, the restricting and the binge/purging type. Individuals with the restricting type usually lose weight or maintain an unhealthy low weight through restrictive eating habits, such as avoiding certain types of food, counting calories, following other obsessive rules, and skipping meals without engaging in binge-eating or purging. The binge/purging type also emphasizes restricting, with patterns of (over)eating or bingeing and compensatory behaviors, such as self-induced vomiting or misuse of laxatives or diuretics. Excessive exercising to lose or control weight may play a role in both types. The severity of AN is based on the body mass index (BMI kg/m^2). A BMI below 15 kg/m^2 is considered extremely severe.

BN is represented by regular overeating or bingeing, with a sense of lack of control and

recurrent inappropriate compensatory behaviors. The self-evaluation of body shape and weight is also influenced, leading to negative cognitions and perceptions. The symptoms should be present at least once a week for three months. The severity of BN is based on the frequency of compensatory behaviors, and an average of more than 14 episodes per week is considered extremely severe.

BED is represented by recurring episodes of binge eating with marked distress. Binge eating is explained as eating an amount of food that is definitely larger than what most people would eat in a similar period of time, combined with a sense of lack of control over eating. Binge eating can be associated with eating large amounts of food, eating much more rapidly than normal, eating in secret, feeling embarrassed or disgusted, and feeling guilty afterward. Binge episodes should be present at least once a week for three months, and the severity is based on the number of episodes per week. An average of more than 14 episodes per week is considered extremely severe.

EDs usually start during adolescence, although they can also manifest at younger ages or later in life. The onset of AN starts in general somewhat earlier than BN and BED, and an onset after age 30 is rare for AN (Treasure, Duarte, & Schmidt, 2020). AN also seems to start at increasingly younger ages (Steinhausen & Jensen, 2015). Women are more likely to develop an ED compared to men. The worldwide lifetime prevalence for all EDs is estimated at 8.4% for women and 2.2% for men (Galmiche, Déchelotte, Lambert, & Tavolacci, 2019). The lifetime prevalence estimates are 1.4% and 0.2% for women and men with AN, 1.9% and 0.6% for BN, 2.8% and 1.0% for BED, and 4.3% and 3.6% for OSFED. The prevalence of EDs is also rising, with a mean point prevalence for all EDs of 3.5% between 2000 to 2006, 4.9% between 2007 to 2012, and 7.8% between 2013 to 2018 (Galmiche et al., 2019).

EDs affect many life domains, such as mental and physical health, productivity at work and education, interpersonal and social functioning (Jenkins, Hoste, Meyer, & Blissett, 2011; Treasure et al., 2020). Over 70% of patients with EDs have co-morbidity, of which mood, anxiety, personality, alcohol & substance abuse, and neurodevelopmental disorders are most common (Keski-Rahkonen & Mustelin, 2016; Treasure et al., 2020). Individuals with EDs also have significantly elevated mortality rates compared to age- and gender-matched controls (Arcelus, Mitchell, Wales & Nielsen, 2011; Fichter & Quadflieg, 2016; Hoek, 2006).

Worldwide over 3.3 million healthy life years were lost to ED-related disability in 2017 alone (van Hoeken & Hoek, 2020). Van Hoeken and Hoek (2020) also noted that EDs were more disabling than, for example, chronic state kidney disease or severe heart failure, and EDs lead to stress and emotional burden in patients and relatives, such as caregivers (parents) and children. Causal pathways of EDs are currently explained as a complex interplay between genetic expression, neurobiological functioning, personality functioning, and environmental influences (Treasure et al., 2020).

The average duration of untreated EDs in help-seeking populations at the time of first ED treatment is estimated at 2.5 years for AN, 4.3 years for BN, and 6.6 years for BED (Austin et al., 2020). However, only about 20% of individuals with EDs actually present for treatment (Forrest, Smith, & Swanson, 2017). For many patients, EDs become chronic. Long-term follow-up studies (> 20 years) show that about a third of patients with AN and BN are reported with a persistent ED (Treasure et al., 2020).

Evidence-based ED treatments, such as cognitive-behavioral therapy (CBT), family-based treatment (FBT), and interpersonal psychotherapy (IPT), alleviate ED symptoms, but only for a modest proportion of patients. For AN, about 23 to 33% of the adolescents and 0 to 25% of the adults achieve remission at the end of treatment, usually measured as absolute BMI or weight change or reaching a specific cut-off point (Murray, Loeb, & Le Grange, 2018). Also, no statistically significant differences were found between psychological treatments and control conditions in a recent meta-analysis concerning weight gain, ED pathology, and Quality of life (QoL) (van den Berg et al., 2019). A meta-analysis of randomized controlled trials found that about 40% of patients with BN recover from core symptomatology at the end of treatment (Thompson-Brenner, Glass, & Westen, 2003). At the termination of treatment, patients continued to binge 1.68 times and purge 2.34 times per week on average, which does not constitute a return to normal healthy behavior (Thompson-Brenner et al., 2003). Also, the reported studies' exclusion rate was 40% on average, excluding patients with, for instance, bipolar disorders, borderline personality disorders, or patients with low weight or psychotropic drug use (Thompson-Brenner et al., 2003). These patients do receive treatment in naturalistic treatment settings. In addition, the 40% recovery rate was based on patients finishing treatment. The average recovery rate of all patients entering treatment in the RCTs (whether or not they completed treatment) was only 33% (Thompson-Brenner et al., 2003).

A meta-analysis examining treatments for BED shows that about 45 to 54% of the patients achieve abstinence from binge eating (Hilbert, Petroff, Herpertz, & Pietrowsky, 2019). Recovery is, however, not only about symptom remission. Researchers and patients note that recovery encompasses other aspects of mental health (Noordenbos, 2006). These mental health related aspects can be explained in terms of human mental well-being.

Mental well-being

There is a rich philosophical history of knowledge about human mental health. Some of the oldest written treatises about mental well-being and illnesses are estimated to date back a few thousand years B.C. (Gautam, 1999). These Eastern Vedic philosophical texts described psychopathological symptoms related to depression, anxiety and psychosis, and appreciative states of mind, such as happiness, peace of mind, free will (autonomy), self-control and means to minimize pathology and cultivate appreciative states (Gautam, 1999). Many Vedic texts emphasized the importance of living a good and moral life for prosperous mental health, and self-realization was considered the main goal in life. Western ideas about well-being and mental health can be traced back to Greek philosophy several hundreds of years B.C. (Konstan, 2018; Shields, 2020). In general, two schools of thought can be distinguished. In the first, the hedonic tradition, the main goal in life is to maximize pleasure or happiness, and in the second, the eudaimonic tradition, the main goal of life is to fulfill one's potential and live a good (moral) and virtuous life (Konstan, 2018; Shields, 2020). The eudaimonic tradition shows striking similarities with Vedic philosophy (Gautam, 1999).

Both Greek traditions emphasize that happiness is important in life. The distinction between the hedonic and eudaimonic tradition leads back to a more fundamental difference in the two schools of thought, namely that in the first one, humans are considered to be merely a physical body, and in the second one, humans are thought to have a soul or divine part (Konstan, 2018; Kraut, 2018). In the eudaimonic tradition, life's goal is believed to be the realization of this divine potential. Following this distinction, it seems evident to focus on sensible pleasures if one identifies himself only as a body and focus on cultivating and expressing the virtue or divinity if one identifies himself with the soul.

In modern psychology, mental illnesses are described in terms of classifications with psychopathological symptoms, such as EDs, while the appreciative states of mind are

described as mental well-being (Bohlmeijer, Bolier, Westerhof, & Walburg, 2012). Mental well-being refers to optimal psychological experience and functioning (Bohlmeijer, ten Klooster, de Kleine, Westerhof, & Lamers, 2016; Deci & Ryan, 2008). Several domains of mental well-being have been theorized. Emotional or subjective well-being is related to the hedonic tradition (Diener, Suh, Lucas, & Smith, 1999; Keyes, 2012; Larsen & Diener, 1985). It is currently considered as a multidimensional concept, including evaluations of life in general and life domains in emotional terms, as well as the presence of positive affect and the absence of negative affect (Bohlmeijer et al., 2012; Bohlmeijer & Westerhof, 2021; Deci & Ryan, 2008). Psychological well-being is related to the eudaimonic tradition and is based on the reviews of psychological theories and conceptualizations of mental health by Marie Jahoda and later Carol Ryff (Jahoda, 1958; Larsen & Diener, 1985; Ryff, 1989). Their reviews were grounded in humanistic and lifespan theories on healthy human development (Bohlmeijer & Westerhof, 2021). Ryff (1989) discerned six domains for psychological well-being:

1. Self-acceptance, a positive stance towards the self, including good and bad qualities;

2. Positive relationships, warm, satisfying, trusting relationships;

3. Autonomy, being self-determined and independent;

4. Environmental mastery, a sense of mastery and competence in managing the environment;

5. Purpose in life, establishing goals in life, a sense of directedness and the feeling there is a meaning to life;

6. Personal growth, seeing self as growing and having a sense of realizing his or her potential.

Keyes (1998) identified social well-being as a third main component of mental well-being, defined as how much individuals see themselves thriving in their public and social life. Social well-being consists of five dimensions (Keyes, 1998):

1. Integration, the evaluation of the quality of one's relationship to society and community;

2. Acceptance, the construal of society through the character and qualities of other people as a generalized category;

3. Contribution, the evaluation of one's social value;

4. Actualization, the evaluation of the potential and trajectory of society;

5. Coherence, the perception of the quality, organization, and operation of the social world.

Keyes (2005) also proposed that well-being can be classified similarly as a psychiatric disease. Just as specific symptoms need to be present to classify, for instance, an ED, specific dimensions or 'symptoms' of emotional, psychological and social well-being must be present to classify well-being (Keyes, 2005). People can languish, have moderate well-being or flourish on this continuum. People who are languishing experience below-average functioning on mental well-being, and people who are flourishing experience above-average functioning (Keyes, 2005).

Dual continua model and sustainable mental health framework

Although one could argue that psychopathology and well-being are two ends of one mental health continuum, a dual continuum model with related but distinct dimensions shows a better fit to the data in healthy and clinical samples (Franken, Lamers, Ten Klooster, Bohlmeijer, & Westerhof, 2018; Keyes et al., 2008; Lamers, Westerhof, Bohlmeijer, Ten Klooster, & Keyes, 2011; Magalhães & Calheiros, 2017; Perugini, de la Iglesia, Castro Solano, & Keyes, 2017). This is also supported by a study examining changes in psychopathological symptoms and well-being during acceptance and commitment treatment for depression (Trompetter, Lamers, Westerhof, Fledderus, & Bohlmeijer, 2017). The researchers found that the majority of the patients improved either on psychopathological symptoms or positive mental health, but not on both (Trompetter et al., 2017). The notion that well-being should be considered as an indicator for treatment outcome has been substantiated by several researchers (Bohlmeijer & Westerhof, 2021; Fava, 1996; Fava & Guidi, 2020; Fava, Rafanelli, Cazzaro, Conti, & Grandi, 1998; Trompetter et al., 2017). Keyes (2005) defined mental health as a complete state in

which individuals are free of psychopathology and flourishing, with high levels of emotional, psychological, and social well-being. In a similar vein, Fava (1996) considered the presence of psychological well-being as a key indicator for recovery in affective disorders in addition to the remission of psychopathology (Fava, 1996). Fava and colleagues (1998) also noted that it was already suggested in 1954 by Parloff and colleagues that the goals of psychotherapy were not necessarily the reduction of symptoms but increased personal effectiveness. More recently, Fava and Guidi (2020) noted that the pursuit of psychological well-being should be conceived as a transdiagnostic approach in individual treatment plans for patients with psychiatric disorders (Fava & Guidi, 2020).

Bohlmeijer & Westerhof (2020) argue that the dual-continua model and the predictive value of mental well-being for future relapse or incidence of mental illness should inform clinical practice. They developed a model for sustainable mental health. This model postulates that mental well-being is an equally important outcome of psychological treatment. Bohlmeijer and Westerhof (2020) also argued that it is not realistic to expect that life will always be without suffering or that it will always be characterized by flourishing, and both states of mental health will fluctuate with time. Therefore, the ability to adapt can be seen as a critical underlying process.

Mental well-being and eating disorders

The measurement of the positive side of mental health in ED patients has focused primarily on the quality of life (QoL) and emotional well-being (Tomba, Offidani, Tecuta, Schumann, & Ballardini, 2014). Psychological well-being has often been neglected, while these domains seem particularly important in the process of ED recovery. In qualitative research focusing on narratives from patients and carers, aspects related to psychological well-being are frequently described as essential in the journey to recovery (Bowlby, Anderson, Hall, Willingham, & Lewis Hall, 2012; Dawson, Rhodes, & Touyz, 2014; Jenkins & Ogden, 2012; Lamoureux & Bottorff, 2005; Lindgren, Enmark, Bohman, & Lundstrom, 2015; Noordenbos & Seubring, 2006; Shahar, Latzer, & Buchbinder, 2012; Weaver, Wuest, & Ciliska, 2005). In several of these studies, recovery is defined as an existential process of self-exploration and finding a 'healthy' identity, related to the domains of psychological well-being, such as personal growth, self-acceptance, and finding meaning and purpose in life (Bowlby, Anderson, Hall, & Willingham, 2012; Dawson et al., 2014; Jenkins & Ogden, 2012; Lamoureux & Bottorff, 2005;

Weaver et al., 2005). Tomba and colleagues (2014) were the first to measure psychological well-being in ED patients. They found that ED patients reported significantly lower self-acceptance, autonomy, environmental mastery, and positive relationships with others compared to healthy controls, even when controlling for confounding variables (Tomba et al., 2014). In 2017 they followed up with a longitudinal study showing that patients improve on psychological well-being during outpatient treatment (Tomba, Tecuta, Schumann, & Ballardini, 2017). However, over 50% of the patients in remission still had scores that fell below the 50th percentile of healthy controls in all dimensions of psychological well-being, despite significant treatment response (Tomba et al., 2017). Tomba and colleagues (2014) noted that impaired levels of psychological well-being were associated but independent from the presence of psychopathology, indicating that the presence of mental well-being does not simply correspond to the absence of psychological distress.

When translating the dual continua model to ED recovery, remission may often not be realistic, reflected by the modest outcome percentages of evidence-based treatments. If patients fail to achieve remission during treatment, there may still be meaningful changes in other life domains, such as well-being. It may well be that people can live joyful, engaged, and meaningful lives, also in the presence of mild ED symptoms. On the other hand, promoting well-being may lead to overall changes in well-being and psychopathology and vice versa. There is currently a lack of knowledge about well-being in ED patients and its associations with psychopathology.

In sum, we conclude that EDs are psychiatric disorders with severe consequences. Treatments show modest effects on symptom remission. Recovery is not only about symptom remission but about mental health in a broad sense. According to the dual-continua model, mental health is conceived as the absence of psychopathology and the presence of mental well-being. The importance of mental well-being for recovery has also been highlighted from the patients perspective in qualitative studies. These studies have not been systematically examined to understand which aspects are considered essential for recovery. Only a few studies have examined the presence of mental well-being in ED patients and changes during treatment. It remains largely unclear how psychopathology is associated with mental well-being in ED patients and how these associations evolve during treatment. A better understanding of the relationship between psychopathology and mental well-being may help identify which mental health symptoms to address in treatment to promote recovery.

Aim and outline of this thesis

The aims of this thesis are to explore the patient understanding of criteria for recovery, the function of mental well-being in recovery, and understand the relationship between psychopathology and mental well-being in people with EDs. The thesis is divided into three main parts.

Part 1 Perspectives of individuals with an eating disorder history

The first part examines the perspectives of individuals with lived experience (experiential knowledge) on ED recovery. Many qualitative studies have been published on what recovery constitutes from a patient's perspective. It has not been systematically examined which criteria are considered essential for recovery. Therefore the criteria for recovery are examined in a systematic review of qualitative studies (chapter two). By thematizing the results of these studies, the frequency or importance of relevant themes within a mental health framework can be calculated with a qualitative meta-analytic procedure (Timulak, 2009).

Part 2 Cross-sectional associations between psychopathology, well-being and personality

In the second part, the relationships between psychopathology, well-being and personality are examined in ED patients. In chapter three, the levels of emotional, psychological, and social well-being are the primary focus of investigation in treatment-seeking ED patients. The results are compared to the general population. Bivariate associations between well-being domains (i.e., emotional, psychological, social) and psychopathology (i.e., general and ED specific) are also explored to test the dual continua model's assumptions.

In chapter four, psychometric network analysis is applied to examine the associations between the well-being and psychopathology domains and the underlying symptoms that make up these domains. Marie Jahoda (1958) made the important notion in her seminal work on concepts of positive mental health that not all psychological functions are equally relevant for mental health. We tried to understand which mental health functions or domains are more relevant in EDs. Psychometric network analysis is a method to examine associations between psychopathological symptoms by estimating a network with correlations (Epskamp, Maris, Waldorp & Borsboom, 2018). The centrality of symptoms and the correlations between them are estimated while controlling for each other's influence. Psychometric network theory suggests that targeting central (highly influential) symptoms may lead to

greater changes overall (across other symptoms) than targeting peripheral symptoms. This study provides knowledge about how symptoms relate to each other in ED patients.

The fifth chapter examines potential relationships between personality trait facets and emotional, psychological, and social well-being. Jahoda (1958) stated that mental health should be considered either a relatively constant and enduring function of personality or a momentary function of personality and situation. A substantial body of literature indicates that personality plays an important role in the maintenance of ED pathology. It has not been examined how personality is related to well-being in ED patients. Strong relationships are found between trait facets and well-being in the general population, suggesting that personality functioning plays a key role in experiencing well-being (Anglim, Horwood, Smillie, Marrero, & Wood, 2020).

Part 3 Longitudinal changes in well-being and psychopathology

In the third part, changes in mental health among ED patients and associations between psychopathology and well-being over time are examined. The sixth chapter focuses on the trajectories of change in well-being and ED pathology during a year of outpatient treatment. With growth curve analysis, patients can be divided into latent classes with similar change trajectories. Patients in specific classes can also be examined on potentially other shared characteristics. Ultimately this may have prognostic value for clinicians to help detect whether a patient is likely to respond to treatment.

The seventh chapter examines the relationships of psychopathology and well-being over time during ED treatment. Average within-person effects are examined to understand how psychopathological and well-being symptoms relate to each other over time. Also, average between-person effects are examined to understand the overall connectedness of mental health symptoms over time in patients with EDs. Novel psychometric network analysis is applied for this chapter (Epskamp, 2020). Understanding how symptoms are related over time may give further directions on what to address in treatment to improve the effectiveness.

In the final chapter 8, the studies' main findings are summarised, and the practical implications and recommendations for new research are addressed. Furthermore, the limitations and strengths of this thesis are described.

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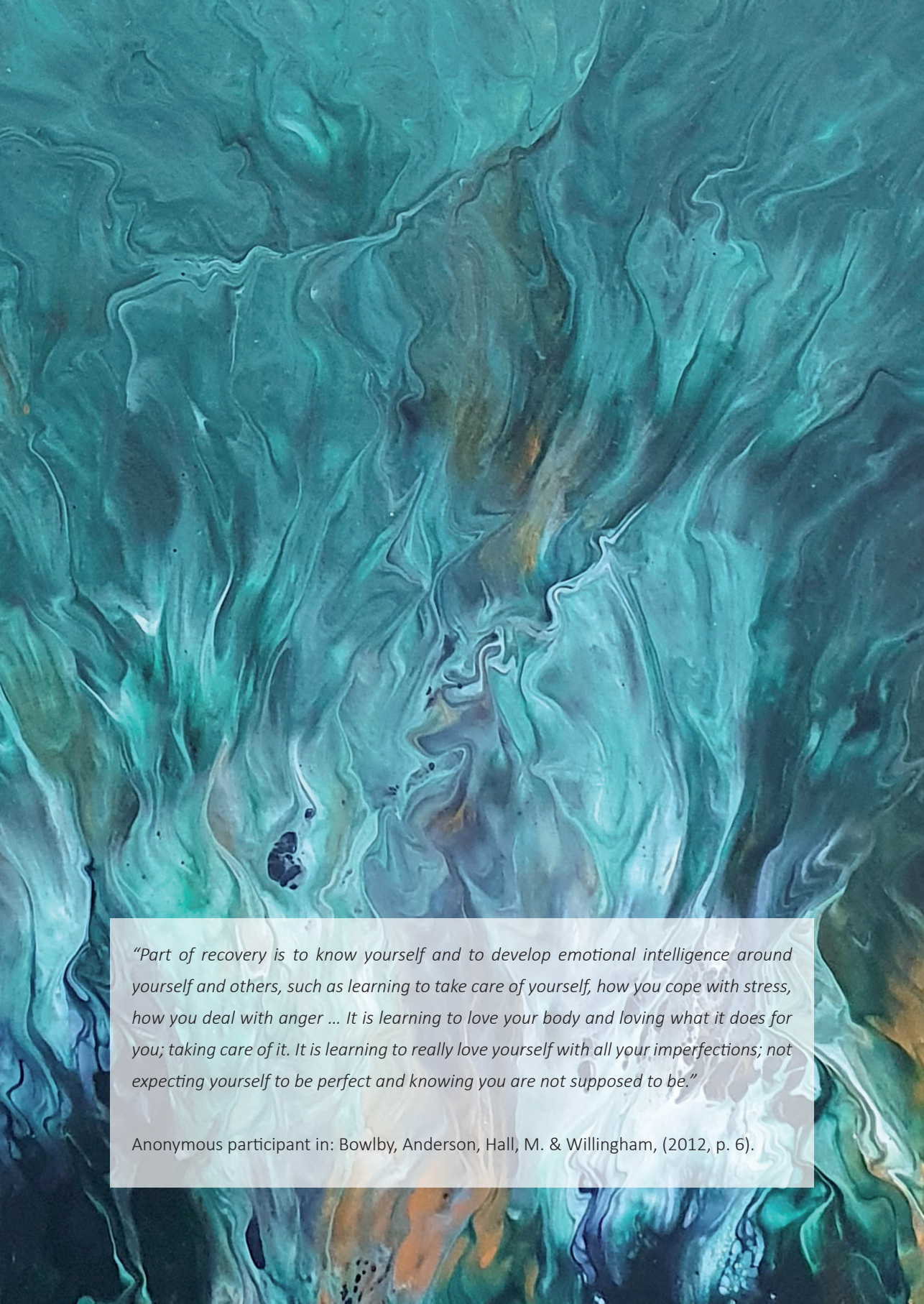
Part 1

perspectives of individuals with an eating disorder history



"Part of recovery is to know yourself and to develop emotional intelligence around yourself and others, such as learning to take care of yourself, how you cope with stress, how you deal with anger … It is learning to love your body and loving what it does for you; taking care of it. It is learning to really love yourself with all your imperfections; not expecting yourself to be perfect and knowing you are not supposed to be."

Anonymous participant in: Bowlby, Anderson, Hall, M. & Willingham, (2012, p. 6).

2

Identifying fundamental criteria for eating disorder recovery: a systematic review and qualitative meta-analysis

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This study has been awarded best systematic review paper published in the Journal of Eating Disorders 2017 according to the editorial board

ABSTRACT

Background

Outcome studies for eating disorders regularly measure pathology change or remission as the only outcome. Researchers, patients and recovered individuals highlight the importance of using additional criteria for measuring eating disorder recovery. There is no clear consensus on which additional criteria are most fundamental. Studies focusing on the perspectives of recovered patients show criteria that are closely related to dimensions of positive functioning as conceptualized in the complete mental health model. The aim of this study was to identify fundamental criteria for eating disorder recovery according to recovered individuals.

Methods

A systematic review and a qualitative meta-analytic approach were used. Eighteen studies with recovered individuals and meeting various quality criteria were included. The result sections of the included papers were searched for themes that were stated as criteria for recovery or being recovered. All themes were analyzed using a meta-summary technique. Themes were labeled into criteria for recovery and the frequencies were calculated.

Results

In addition to the remission of eating disorder pathology, dimensions of psychological well-being and self-adaptability/resilience were fundamental criteria for eating disorder recovery. The most frequently mentioned criteria were: self-acceptance, positive relationships, personal growth, decrease in eating disorder behavior/cognitions, self-adaptability/resilience, and autonomy.

Conclusions

People who have recovered rate psychological well-being as a central criterion for eating disorder recovery in addition to the remission of symptoms. Supplementary criteria, besides symptom remission, are needed to measure recovery. We recommend including measurements of psychological well-being and self-adaptability/resilience in future research, such as outcome studies and in routine outcome measurement.

Key Words

Eating Disorders, Recovery, Psychopathology, Psychological Well-Being, Positive Mental Health, Meta-analysis, Qualitative Research, Systematic Review, Positive Psychology

INTRODUCTION

Eating disorders (EDs) are serious mental disorders that impact all facets of people's lives, including quality of life at home and work, personal functioning, and social life (Jenkins, Hoste, Meyer, & Blissett, 2011; Mitchison, Hay, Slewa-Younan, & Mond, 2012; Mond, Hay, Rodgers, & Owen, 2012). anorexia nervosa (AN) has the highest mortality rate of all mental illnesses (Harris & Barraclough, 1998; Hoek, 2006). EDs are often chronic and refractory (Lowe et al., 2001).

Clinical guidelines have been established in the last decade with treatment options based on evidence (Hay et al., 2014; Trimbos, 2006; Yager et al., 2006). These treatment options, however, work only for a percentage of patients; for AN, in particular, there is no single superior treatment option (Bulik, Berkman, Brownley, Sedway, & Lohr, 2007; Hay, 2013; Zipfel, Giel, Bulik, Hay, & Schmidt, 2015). Effectiveness and efficacy studies, herein called outcome studies, are critical for establishing guidelines for evidence-based care. Outcome studies use measures to examine which treatments are effective, based on the degree of recovery from an ED on certain criteria. There is significant disagreement in the field around the definition of ED recovery and the relevant criteria that must be present in order to claim recovery (Bardone-Cone et al., 2010; Berkman, Lohr, & Bulik, 2007; Jarman & Walsh, 1999; McGilley & Szablewski, 2010; Noordenbos, 2011; Rosenvinge & Pettersen, 2012). As a result, recovery rates between outcome studies vary widely, ranging from 3% to 96% depending on the criteria used (Couturier & Lock, 2006). Recovery is usually measured as the remission of ED symptoms (Steinhausen, 2002). In a systematic review of 119 patient outcome studies on AN, Steinhausen (2002) concluded that remission from all essential clinical symptoms could be considered as recovery. However, he also noted substantial variation in outcome criteria between studies. In a systematic review of predictors of ED outcomes by Vall and Wade (Vall & Wade, 2015), over 80% of the 126 included studies reported outcomes based solely on symptom remission (Vall & Wade, 2015). Commonly-used measures were: frequency or absence of binging/purging, change or reaching cut off scores on a questionnaire/interview for measuring ED symptoms (Fairburn & Beglin, 1994), changes or remission from overall ED symptoms, or change in BMI or reaching a specific cut off point (Vall & Wade, 2015). In sum, outcome studies generally frame recovery around clinically relevant changes in ED symptoms or remission.

Simultaneously, a growing body of literature in the ED field highlights that ED symptom change (remission) is not sufficient for understanding, capturing, and measuring ED recovery and emphasizes the importance of additional criteria related to (mental) health, such as quality of life, well-being, psychological, social and emotional functioning (Dawson, Rhodes, & Touyz, 2015; de la Rie, Noordenbos, & van Furth, 2005; Emanuelli, Waller, Jones-Chester, & Ostuzzi, 2012; Jarman & Walsh, 1999; Noordenbos & Seubring, 2006). This study aims to identify fundamental criteria for recovery from EDs, focusing on clinical symptoms and additional criteria, related to mental health and well-being.

Mental health: the critical role of well-being

Psychologists have lobbied for decades to convey that health is not merely the absence of disease (i.e., symptoms) but also the presence of something positive (Fava, 1996; Fava & Ruini, 2003; Jahoda, 1958; Keyes, 2002; Lamers, 2012; Ryff & Singer, 1996; Seligman & Csikszentmihalyi, 2000; Westerhof & Keyes, 2010). The emergence of positive psychology, for example, is based on re-focusing the exclusive attention on the absence of pathology as a marker for health only, to positive aspects of mental and social functioning as markers for well-being as well (Seligman & Csikszentmihalyi, 2000). This is in line with the declaration of the World Health Organization (WHO) on mental health: '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 fruitfully, and is able to make a contribution to his or her community' (World Health Organization, 2005, p. 12). Keyes (2005) proposed the complete mental health model, based on this definition, taking both the absence of psychopathology and the presence of well-being as two related but different aspects of health into account. He did not define health and well-being as a fixed state but operationalized it as a syndrome consisting of several criteria, where upon people can develop, meeting certain thresholds for optimal well-being (Keyes, 2005).

Well-being is theoretically divided into psychological, emotional and social well-being (Keyes, 2005; Lamers, 2012; Ryff, 1989). Psychological well-being (PWB) was conceptualized by Ryff (1989) and consists of six key dimensions: self-acceptance, autonomy, environmental mastery, purpose and meaning in life, personal growth, and positive relationships with others (Ryff, 1989; Ryff & Singer, 1996). Emotional well-being includes happiness, positive affect and avowed life satisfaction. Social well-being encompasses social contribution, integration,

actualization, acceptance, and coherence (Keyes, 2005). See for instance (Deci & Ryan, 2008; Lamers, Westerhof, Bohlmeijer, & Keyes, 2013; Ryff, 1989) for an overview of well-being and its theoretical and philosophical background. Recent studies show that psychopathology and well-being are separate but complementary aspects of mental health and reflect two related continua instead of opposites on one continuum (Keyes, 2005; Lamers et al., 2013; Westerhof & Keyes, 2010). In addition, a bi-directional relationship between psychopathology and positive mental health over time is found (Lamers, Westerhof, Glas, & Bohlmeijer, 2015).

The complete mental health model emphasizes the importance of positive functioning for mental health. However, this is widely neglected in research on EDs (Tomba, Offidani, Tecuta, Schumann, & Ballardini, 2014). While several studies have focused on positive mental health in terms of quality of life or subjective well-being, only one study examined all PWB dimensions among ED patients (de la Rie, Noordenbos, Donker, & van Furth, 2007; de la Rie et al., 2005; Doll, Petersen, & Stewart-brown, 2005; Jenkins et al., 2011; Mond et al., 2012; Tomba et al., 2014). In the study that examined PWB, the authors found that ED patients had impaired PWB compared to a control group (Tomba et al., 2014).

In qualitative research examining recovery criteria from EDs, there are several recovery themes related to well-being dimensions. For instance, Bowlby and Anderson (2012) found several themes for recovery in a sample of therapists who were recovered from an ED. Most of these themes matched the descriptions of the well-being dimensions. For example, the themes “learning to understand and value the self” matches with the well-being dimensions “personal growth” and “self-acceptance,” the theme “finding purpose and meaning in life” matches with the dimension “purpose,” and the theme “developing healthy and meaningful relationships” matches with “positive relationships with others.” In a survey examining criteria for recovery from EDs, Noordenbos & Seubring (2006) found high consensus between ex-patients and clinicians on all proposed 52 statements divided into five themes: eating behavior, physical, psychological, emotional, and social functioning. However, patients labeled self-esteem, a positive body attitude and expressing emotions as more important, while therapists accentuated eating behavior and physical recovery (Noordenbos & Seubring, 2006). Emanuelli and colleagues (Emanuelli et al., 2012) replicated this study in a sample of patients and clinicians. They concluded that recovery included general criteria (e.g., social, psychological, and emotional) and specific ED criteria (e.g., weight control behaviors and

evaluation of one's appearance) (Emanuelli et al., 2012). Patients and clinicians agreed on the ranking of importance of most criteria, but patients considered "psychological, emotional, social" and "evaluation of one's appearance" criteria as more important for recovery than did clinicians. The researchers did not find weight and weight gain as central criteria for defining recovery (Emanuelli et al., 2012). Dawson, Rhodes, and Touyz (2015) used a different approach and conducted an extensive Delphi study with ED professionals to determine criteria for recovery from AN. They also concluded that, in addition to the minimal criteria (i.e., weight restoration and symptom reduction), psychological and quality of life measures should be part of the definition for AN recovery.

While these studies show the importance of additional criteria, they have several limitations, making it difficult to understand which criteria are most fundamental besides the ED pathology-based criteria (remission). Noordenbos and Seubring (2006) and Emmanuelli and colleagues (2012) used a pre-fixed set of statements, making their study susceptible to missing criteria which might have been endorsed by ex-patients or clinicians had they been articulated in the design of the study. Several qualitative studies report criteria for recovery that were not present in the consensus studies with the pre-fixed statements (Emanuelli et al., 2012; Noordenbos & Seubring, 2006), such as improved self-acceptance, identity development, feelings of purpose and meaning in life, self-management and empowerment (Bowlby, Anderson, Hall, Willingham, & Lewis Hall, 2012; Duncan, Sebar, & Lee, 2015; Lamoureux & Bottorff, 2005). Other studies only focused on AN or did not take the perspective of recovered individuals into account. The importance of exploring the perspectives of those with lived experience on their recovery cannot be understated in this regard. Studies have shown that the orientation of patients towards recovery can change over time and during treatment (Leslie, 2014; Shohet, 2007).

In conclusion, outcome studies tend to follow recovery criteria based on changes in ED symptoms (remission) rather than aiming to ascertain health and well-being. It remains inconclusive which recovery criteria should be considered as fundamental. We argue that knowledge from individuals who have recovered from an ED should be leading and incorporated into the establishment of fundamental criteria for recovery. Qualitative studies examining the personal experience of recovered individuals highlight the importance of taking additional recovery criteria into account, closely related to the dimensions of well-

being. However, the results of these qualitative studies have never been systematically reviewed. Responding to this knowledge gap, we carried out a systematic review and meta-analysis of existing qualitative studies of ED recovery.

The aim of this study is to identify fundamental criteria for recovery according to recovered individuals by performing a qualitative meta-analysis. Qualitative meta-analysis can be explained as the aggregation of studies to discover a phenomenon's essential elements and translate these results into a more comprehensive description or clear end-product (Schreiber, Crooks, & Stern, 1997; Timulak, 2009). Therefore, an integrative interpretation of findings from multiple qualitative studies is more substantive than those resulting from individual investigations (Finfgeld, 2003; Timulak, 2009). To our knowledge, this is the first study to use a qualitative meta-analysis to identify fundamental criteria for ED recovery over the ED types among people who were considered recovered.

METHOD

Search strategy and selection of studies

Guidelines from the PRISMA statement for reporting systematic reviews were used for the search strategy (Liberati et al., 2009). The first step was to systematically search two electronic databases, Medline and PsycInfo (final search date 04-02-2016). Terms were searched within all fields. There was no limitation for the year in which the study was published. The main search terms were "recovery" OR "recovered" AND "eating disorders" OR "anorexia nervosa" OR "bulimia nervosa" OR "binge eating disorder" AND "qualitative" resulting in 238 hits from PubMed and 403 hits from PsycInfo (with a subselection "qualitative studies").

The second step was an additional search in which the reference list of two comprehensive qualitative studies of ED recovery (Bowlby et al., 2012; Lamoureux & Bottorff, 2005) were screened. The third step was to screen all articles in the Google Scholar search engine that had cited Bowlby et al. (2012) and Lamoureux & Bottorff (2005) (search date: 06-02-2016). Duplicates were removed as follows: 103 duplicates between PsycInfo and PubMed, five duplicates between the study of Bowlby et al. (2012) and Lamoureux & Bottorff (2005), and 49 duplicates between the first (PsycInfo and PubMed) and the additional search. In total,

630 unique studies remained for screening.

The inclusion criteria were studies that 1) reported on the processes or criteria for ED recovery, 2) included recovered individuals, either because they considered themselves to be recovered, and/or the study used a rigorous system to assess recovery, 3) used a qualitative study design, 4) were published in a peer-reviewed journal or edited academic book, and 5) had a rigorous system for ensuring the credibility of data-analysis (i.e., meeting the CASP protocol, see Procedure and analysis). All ED types as defined in the DSM5 (American Psychiatric Association, 2013) were included since we were interested in overall criteria for recovery for ED patients. Studies that only or primarily included patients who were not recovered were excluded, as we were interested in understanding the markers or criteria for recovery instead of future perspectives on recovery from those actively experiencing EDs. Unpublished reports and dissertations were not included to avoid studies that have not been peer-reviewed for quality and ensure that studies were not duplicating results (Barroso & Powell-Cope, 2000).

The first and second author screened all eligible studies separately in two phases. In the first phase, selection was based on title and abstract. All selected articles were independently screened by the first two authors based on full text in the second phase. Inter-rater agreement (kappa coefficient) between authors in the second round of screening was 0.81, 95% confidence interval [CI, .68, .91]. When there was no agreement, the first two authors discussed decisions to include or exclude studies until consensus was reached. Finally, the reference lists of the included studies were cross-checked on eligible studies. This did not result in additional studies. In total, 18 studies were included in the meta-analysis (see Figure 1).

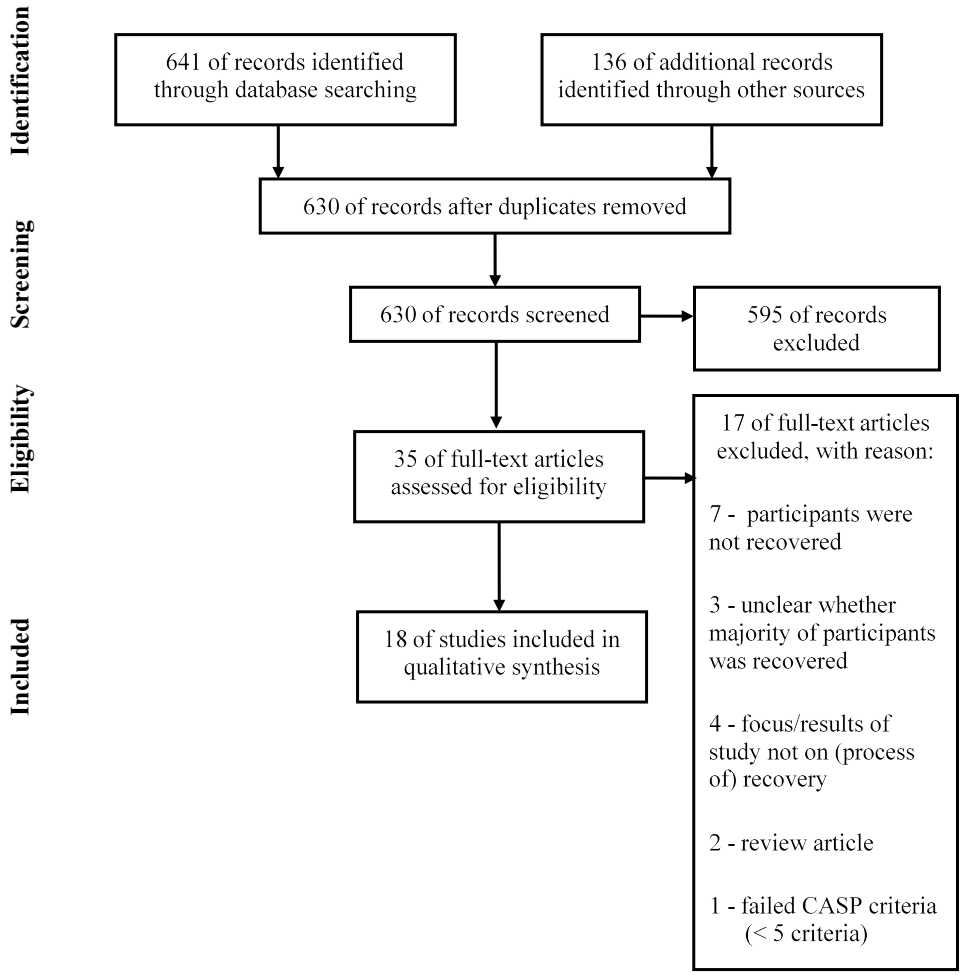

Figure 1. Prisma diagram of study selection

Procedure and analysis

A qualitative meta-analysis requires both 1) an assessment of the quality of the studies (i.e., the influence of the method of investigation on the findings) and 2) results of a more comprehensive explanation of a phenomenon, including its ambiguities and differences found in the primary studies (Timulak, 2009).

Assessment of the quality of the studies

For the first requirement, the Critical Appraisal Skills Programme (CASP, 2013), in addition to a complementary rating, was used. The CASP method is a standardized tool to help

researchers systematically examine qualitative studies. CASP is a commonly used method within qualitative meta-analysis or -synthesis studies to assess the credibility, value, and relevance of the selected studies (Campbell et al., 2003; Duncan et al., 2015; Espindola & Blay, 2009; Feder, Hutson, Ramsay, & Taket, 2006). In accordance with the CASP method and study (Duncan et al., 2015), the quality of the studies was assessed on ten themes and classified as "A" low risk of bias (studies meeting 9 or 10 of the questions) or "B" moderate risk of bias (studies meeting at least 5 of the questions, but not more than 8). CASP method applies the following ten criteria: 1) a clear statement of the aims, 2) methodological design is adequate to aims, 3) research design is appropriate to address aims, 4) recruitment strategy is appropriate to aims, 5) data collection is in a way that addresses research issue, 6) relationship between researcher and participant is considered, 7) ethical issues are considered, 8) sufficiently rigorous analysis, 9) clear statement of findings, and 10) the importance of research is addressed. Besides the CASP method, a complementary rating for checking the credibility was used by dividing studies in "A" low risk of bias (participants were recovered/in recovery for at least two years and recovery was at least self-reported), and "B" moderate risk of bias (participants were recovered/in recovery for less than two years, or it was unclear how long participants were recovered and/or it was unclear whether recovery was self-reported). Combining both ratings resulted in 4 possible categories: 1) "A/A" low risk of bias, 2) "A/B" and 3) "B/A" moderate risk of bias, and 4) "B/B" substantial risk of bias.

Analysis of criteria for recovery

For the second requirement, a meta summary technique described by Sandelowski & Barroso (2003) was used. In contrast to a meta-synthesis, this method allows for extracting themes and evaluating their frequencies (Sandelowski & Barroso, 2003; Timulak, 2009). The following strategy was used: 1) extract relevant themes from each study, 2) reduce these themes into abstract findings and 3) calculate effect sizes. First, the result sections of the included papers were searched for themes that were stated as criteria for recovery or "being recovered." Themes that were included were: themes that were stated by all participants and themes endorsed by an unknown number of participants, but wherein the theme was part of a main category. For instance, in one study (Lamoureux & Bottorff, 2005), it was unclear how many respondents endorsed the theme "sense of self-worth" this theme was, however, part of a main category in the results, "discovering and reclaiming self as good enough" and therefore included. Themes that specifically addressed aspects of the process of recovery (i.e., how

long it took, development, stages) were excluded, as were themes that were part of the first or initial phases of a recovery process, since we were interested in criteria that are present when people are fully recovered. The themes were identified independently by the first and second author and stored in their original content. To obtain one dataset for the second step (abstract findings), results were first discussed for half of the included articles. For the other half of the studies, the data set of the first author was used by the second author to look for further differences in themes. Differences in found statements were discussed until an agreement was reached. This resulted in a dataset with 346 statements which the third and fourth author audited.

In the second step, the reduction into abstract findings, the labels were established. ED pathology was divided into three sub-labels (behavior/cognitions, body evaluation, and physical functions). For the additional themes, the well-being dimensions were used since they seem to relate closely to the themes described in qualitative research on ED recovery. The following additional labels were used; emotional, psychological, and social well-being with their underlying dimensions as stated in earlier work (Keyes, 2005; Lamers, 2012; Ryff, 1989). Also, a "miscellaneous" label was used for criteria that did not fit into one of the other labels. All themes were read carefully by the first two authors to examine whether they could be labeled corresponding the concept labels. Some of the well-being dimensions were very strictly or narrowly described in the literature (Keyes, 2005; Lamers, 2012; Ryff, 1989). A minor adjustment in the description of three labels was necessary for the purpose of labeling the themes (see Table 1 for the adjustments). Then, all 346 original themes were labeled separately by the first and third author. Inter-rater agreement (kappa coefficient) for the labeling process between the authors was .81, 95% CIs [.77, .86] before discussion.

Table 1. Labels

Health criteria	Description
1. Eating disorder pathology	
ED behavior/cognitions	Improvement/absence of ED related behavior (bingeing/purging, slimming) and cognitions (more relaxed/normal thoughts/affect regarding food/weight/exercising)
ED body evaluation	More relaxed regarding body/weight (satisfaction/evaluation)
ED physical functions	Improvement in BMI and/or other physical functions
2. Emotional well-being	
Avowed happiness	Feeling happy, feeling joy, enjoyment
Positive affect	Feeling cheerful, in good spirits, calm, and peaceful, satisfied, and full of life
Avowed life satisfaction	Feeling satisfied with life in general or specific areas of one's life
3. Psychological well-being	
Self-acceptance	Holding positive attitudes towards oneself and past life and conceding and accepting varied aspects of self, holding a compassionate attitude towards self. ** Having self-respect. Having feelings of self-worth or self-esteem/confidence. Taking self-care*
Environmental mastery	Exhibiting the capability to manage a complex environment, and the ability to choose or manage and mold environments to one's needs
Positive relationships with others	Having warm, satisfying, trusting personal relationships and being capable of empathy and intimacy, and being open and personal to others
Personal growth	Showing insight into one's own self and potential, having a sense of development, and being open to new and challenging experiences **Identity formation/integration: Having a sense of integration of several/all aspects of self and or formation of (healthy/autonomous) aspects of self*
Autonomy	Exhibiting a self-direction that is often guided by one's own socially accepted and conventional internal standards and resisting unsavory social pressures **Self-determination, independence, and the regulation of behavior from within* (Ryff & Keyes, 1995). *Autonomy, as used in self-determination theory, means acting with the experience of choice* (Deci & Ryan, 2008)
Purpose in life	Holding goals and beliefs that affirm one's sense of direction in life and feeling that life had a purpose and meaning

Table 1 continued from previous page

Health criteria	Description
4. Social well-being	
Social contribution	Feeling that one's own life is useful to society and that the output of one's activities is valued by or valuable to others
Social integration	Having a sense of belonging to a community and deriving comfort and support from that community
Social actualization	Believing that people, social groups, and society have potential and can evolve or grow positively
Social acceptance	Having a positive attitude towards others while acknowledging and accepting people's differences and their complexity
Social coherence	Being interested in society or social life and feeling that society and culture are intelligible, somewhat logical, predictable, and meaningful
5. Miscellaneous labels	
Self-adaptability/resilience	Copingstrategies/resilience/empowerment/willpower/persistance/emotion-regulation, (Healthy) strategies to cope with emotions and difficult life situations.
Spiritual integration	Having a sense of being part of or in contact with a higher power (Universe, God, Jesus, other) and deriving comfort and support from that. Exercises/activities that promote this: meditation, going to Church, praying, etc.

Note: well-being descriptions are published earlier in (Lamers, 2012; Westerhof & Keyes, 2010), * = added descriptions to the original labels.

Interpretation of results

During the discussion, the miscellaneous label could be split into two sub-labels (self-adaptability/resilience and spiritual integration). Themes that were part of the discussion were "social contribution" versus "purpose and meaning in life". For instance, the theme "Helping others" was sometimes explained as a new purpose for participants, but it is also a form of social contribution. Other things that were discussed were; "Identity integration" as part of "personal growth" or as an independent label, and "self-adaptability/resilience" as a part of "autonomy" or as an independent label. See Table 1 for an overview of the final list regarding the labels and descriptives.

In the third step, frequency and intensity effect sizes were calculated for all labels. The

frequency effect size shows how frequently labels are mentioned across studies and is calculated by dividing the number of studies containing the same finding by the total number of studies (Sandelowski & Barroso, 2003). Labels were indicated as strong evidence for ED recovery criteria, when they were reported by at least 75% of the primary studies, as substantial evidence when they were reported by 50 to 75% of the primary studies, as moderate evidence when they were reported by 25 to 50% of the primary studies, and as insufficient evidence if less than 25% of the studies reported on a dimension. Although these cut-off points are rather arbitrary, we decided to use quartiles for ease of interpretation and pragmatic value for those seeking evidence on recovery criteria.

The intensity effect size gives a clear measure for how fundamental recovery criteria are compared to each other. The intensity effect size is calculated as the number of findings for criteria produced in all studies, divided by all findings (Sandelowski & Barroso, 2003). To examine possible effects of the methodological quality of the studies on the results, differences in outcomes on the intensity effect size between low risk of bias studies (A/A) and substantial risk for bias studies (B/B) were tested using a proportion significance test (χ^2 test for homogeneity).

RESULTS

Descriptives

See Table 2 for an overview of the included studies and quality ratings. The 18 included studies covered 286 participants (269 women and 17 men), with an average age of 30.2 years (*SD* = 7.3 years). One hundred-sixty-three participants had been diagnosed with AN, 25 participants had been diagnosed with bulimia nervosa (BN), 18 participants had a history of both AN and BN diagnosis over their life course, 8 participants had been diagnosed with binge eating disorders (BED), and 13 participants had been diagnosed with an ED not otherwise specified (EDNOS). The average duration of the ED was 8.2 years (*SD* = 5.1, study number: 1,3,6,11,16) with a minimum length of 1.5 years and a maximum length of 44 years (study number: 1,6,11,16,17). The average length of recovery was 9.1 years (*SD* = 6.1 years, study number: 1,3,6,11), with a range of 1 year to 35 years (study number: 1,2,6,7,8,11,13,17). However, for many studies this was unknown.

Table 2. Summary of included studies

Nr	Study	Country	Diagnosis	*N* of Participants	Study focus	Ethics approval	Data collection	Data analysis	Credibility	Recovery criteria	Minimal recovery length	Quality rating
1	Lisa Dawson et al., 2014	Australia	AN	8	process of recovery chronic AN	yes	open-ended interviews (face to face)	narrative inquiry	member-check with each participant, cross-check by two authors	self-reported, Bardone-Cone criteria (2010)	5 years	A/A
2	Lamoureux & Bottorff, 2005	Canada	AN	9	recovery from AN	unknown	in-depth, open-ended interviews	grounded theory approach	review process by 3 individuals	self-report	3 years	A/A
3	Arthur-Cameselle & Quatromoni, 2014	U.S.	AN, BN, EDNOS	17	athletes' ED recovery experiences	yes	semi-structured interviews	content analysis procedure	reviewing of coding structure by two colleagues, discussion until agreement	DSM-IV-TR criteria	3 months	B/B
4	Hay & Cho, 2013	several	AN	3	influences on the process of recovery from AN	no	purposive/ extreme sampling to identify published narratives	framework approach to qualitative analysis	coding by two authors, discussion until agreement	as described by the personal account	unknown	B/B
5	Lindgren, Enmark, Bohman, & Lundström, 2015	Sweden	BN	5	experiences of recovery from AN	yes	open-ended interviews (semi-structured)	narrative interviews with qualitative content analysis	added quotations from participants to results	self-reported (being healthy)	2 years	A/A
6	Jenkins & Ogden, 2012	U.K.	AN	15	views of recovering from AN	yes	semi-structured interviews (in-depth, by phone)	interpretative phenomenological analysis	discussion between authors	self-defined recovery/ recovered	no requirement	B/B

Table 2 continued from previous page

Nr	Study	Country	Diagnosis	*N* of Participants	Study focus	Ethics approval	Data collection	Data analysis	Credibility	Recovery criteria	Minimal recovery length	Quality rating
7	Linville, Brown, Sturm, & McDougal, 2012	U.S.	AN	22	perspectives of recovered individuals on ED, recovery, and social support	yes	interviews	generic qualitative description analysis	separately coded by two authors, comparing initial codes and consensus-seeking. Member checking with participants	measured: eating screening	1 year	A/B
8	Espíndola & Blay, 2013	Brazil	AN	15	factors involved in the outcome of AN	yes	ethnographic face to face interviews (semi-structured)	grounded theory approach	analyzing separately, calculating inter-rater agreement	reported by self, family member, and assistant MD	5 years	A/A
9	Björk, Wallin, & Pettersen, 2012	Norway Sweden	AN, BN EDNOS	15	experiences of life after recovery	yes	open-ended interviews (semi-structured)	phenomenological approach	analyzed by three different teams and discussion until consensus	self-report (experienced recovery or marked improvement)	unknown	A/B
10	Nilsson & Hagglof, 2006	Sweden	AN	58	patient perspectives of AN recovery	yes	interview	content analysis procedure	separate analysis by three researchers, calculating inter-rater agreement	clinical assessment (DSM-III-R)	unknown	B/B
11	Bowlby et al., 2012	U.S.	AN, BN	13	exploring ED recovery	yes	semi-structured interviews	phenomenological approach	addressing researcher bias, authors independently reading transcripts, and discussing emergent themes, included extended quotations	self-report	6 years	A/A

Table 2 continued from previous page

Nr	Study	Country	Diagnosis	*N* of Participants	Study focus	Ethics approval	Data collection	Data analysis	Credibility	Recovery criteria	Minimal recovery length	Quality rating
12	Shahar et al., 2012	Israel	AN	18	patients perspective of recovery from AN	yes	in-depth semi-structured interviews	phenomenological approach	adding quotes to results	DSM-IV	5 years	A/A
13	Krentz, Chew, & Arthur, 2005	Canada	BED	6	recovery from binge eating disorder	unknown	two interviews (unstructured and structured)	grounded theory approach	audit by second author	self-reported, DSM-IV (objective measure)	6 months	A/B
14	Hsu, Crisp, & Callender, 1992	U.K.	AN	6	the patients perspective of recovery from AN	unknown	interview	case descriptions	unknown	assessment	unknown	B/B
15	Matusek & Knudson, 2009	U.S.	AN, BN	3	rethinking recovery	yes	semi-structured interview	interpretative biographical method	working with performance texts	self-identified as recovered	unclear (well into process of recovery)	B/B
16	Björk & Ahlström, 2008	Sweden	AN, BN EDNOS	14	Patients perception of having recovered from an ED	yes	semi-structured interviews	phenomenological approach	second author scrutinized statements in relation to conceptions and categories	self-identified as recovered at 1-year follow-up	unclear	A/B
17	Patching & Lawler, 2009	Australia	AN, BN	20	experiences of developing and recovering from ED	yes	open-ended interviews (semi-structured)	live history interviews	two researchers reading and making margin notes	self-reported	3 years	A/A
18	Weaver et al., 2005	Canada	AN	12	understanding journey of recovery from AN	yes	interviews	feminist grounded theory	confirm/refine explication of emerging theory by participants	self-identified as recovered	unknown	B/B

Criteria for eating disorder recovery

See Table 3 for the intensity and frequency effect sizes of the criteria for recovery. The frequency effect sizes show strong evidence for positive relationships with others (100%), self-acceptance (88.9%), autonomy (83.3%), personal growth (77.8%), improved ED behavior/cognitions (77.8%), and self-adaptability/resilience (77.8%). Substantial to moderate evidence was found for improved body evaluation (55.6%), social contribution (50%), purpose and meaning in life (38.9%), spiritual integration (33.3%), improved (ED) physical functioning (27.8%), and positive affect (27.8%). Insufficient evidence was found for happiness (22.2%), avowed life satisfaction (22.2%), environmental mastery (11.1%), social acceptance (11.1%), social integration (11.1%), social actualization (0%) and social coherence (0%).

Examining the intensity effect sizes of the overall mental health dimensions, psychological well-being accounted for 52.2% of all recovery criteria, ED pathology for 20.8%, self-adaptability/resilience and spiritual integration for 13.8%, social well-being for 8.6%, and emotional well-being for 4.6%. Examining the intensity effect sizes of the underlying ED pathology criteria, improved ED behavior/cognitions accounted for 12.4% of the whole sample, improved body evaluation for 5.8%, and physical improvement for 2.6%. Improved behavior/cognitions were described in the original studies in several ways. Recurring themes were; returning to a normal eating pattern, no weight phobia, or ending the obsession with weight/food. Physical improvement was primarily about weight recovery and improvement of physical complications.

Testing risk of bias

Eight studies had an “AA” status, and eight studies had a “BB” status. Except for the criteria “personal growth” and “spiritual integration” no differences in proportions of the intensity effect sizes were found between “AA” and “BB” studies (see Table 2). Only two studies had a moderate indication for bias (A/B, or B/A) status and could not be used for testing significance because of the low sample size.

Table 3. Meta-analysis: Intensity and frequency effect sizes of ED recovery criteria

Recovery Criteria	Evidence for recovery	Frequency effect size	All (N = 18 Intensity effect size	A/A (n = 8) Intensity effect size	B/B (n = 8) Intensity effect size	χ^2	p-value (2-sided)
Self-acceptance	Strong	88.9%	15.3%	17.6%	13.8%	.679	.486
Positive relationsships with others	Strong	100%	12.7%	13.4%	14.6%	.070	.791
Personal growth	Strong	77.8%	12.7%	18.5%	8.5%	**5.432**	**.020**
Decrease in ED behavior/cognitions	Strong	77.8%	12.4%	9.2%	12.3%	.603	.437
Self-adaptability/ resilience	Strong	77.8%	9.2%	9.2%	7.7%	.082	.774
Autonomy	Strong	83.3%	7.8%	8.4%	9.2%	-	.791*
Social contribution	Substantial	50%	6.9%	6.7%	6.9%	.004	.950
Improved (ED) body evaluation	Substantial	55.6%	5.8%	1.7%	6.2%		
Spiritual integration	Moderate	33.3%	2.9%	.8%	6.2%	**-**	**.037***
Purpose & meaning	Moderate	38.9%	2.9%	3.4%	3.1%	.016	.899
Improved (ED) physical functioning	Moderate	27.8%	2.6%	4.2%	1.5%	-	.264*
Happiness	Insufficient	22.2%	1.7%	.8%	1.5%	-	1.000*
Positive affect	Moderate	27.8%	1.7%	2.5%	.8%	-	.351*
Other	-	33.3%	1.7%	.8%	2.3%	-	.623*
Avowed life satisfaction	Insufficient	22.2%	1.2%	.8%	.8%	-	1.000*
Environmental mastery	Insufficient	11.1%	.9%	.8%	1.5%	-	1.000*
Social acceptance	Insufficient	11.1%	.9%	-	2.3%		.247*
Social integration	Insufficient	11.1%	.9%	.8%	.8%		1.000*
Social actualization	Insufficient	**-** -		-	-	-	-
Social coherence	Insufficient	**-** -		-	-	-	-

Note: Frequency effect size: Total N of studies divided by n of studies containing a criterion X 100, Intensity effect size: n of found criteria produced in all studies, divided by all found criteria in all studies X 100, χ^2 test of homogeneity (differences in two proportions), * p-value was calculated by Fisher's Exact test for violation of the minimal sample size of the χ^2 test.



Figure 2. Intensity effect sizes of criteria for recovery. Circles represent criteria for recovery and are based on the intensity effect sizes. The larger the circle, the larger the intensity effect size. Circles labeled with a text have moderate, substantial, or strong evidence for a recovery criterion. Circles that are not labeled with a text are the remaining criteria.

DISCUSSION

Criteria for recovery were examined using a qualitative meta-analytic approach. Studies were selected that examined the personal experiences of recovered individuals.

Fundamental recovery criteria

The aim of this study was to identify fundamental criteria for eating disorder (ED) recovery according to recovered individuals. Several health dimensions besides symptom remission were found that should be considered as fundamental criteria of ED recovery. Large frequency effect sizes, indicating strong evidence, were found for the following six criteria: positive relationships with others, self-acceptance, autonomy, personal growth, improved ED behavior/cognitions, and self-adaptability/resilience. Further, substantial to moderate evidence was found for the following six criteria: improved body evaluation, social contribution, purpose and meaning in life, spiritual integration, improved physical functioning, and positive affect. At last, insufficient evidence was found for the following seven criteria: happiness, avowed life satisfaction, environmental mastery, social acceptance, social integration, social actualization, and social coherence. These results show relevant criteria from the perspective of people who have experienced recovery. While remission of ED pathology is considered important, many criteria were about psychological well-being (PWB). Moreover, PWB was mentioned more frequently (52.2% of all criteria) than the remission of ED pathology (20.8% of all criteria) as a marker for recovery.

These results underscore the conclusions of earlier work about the importance of including psychological dimensions in definitions of ED recovery (Emanuelli et al., 2012; Noordenbos, 2011; Rosenvinge & Pettersen, 2012). PWB is not about happiness or positive affect but explained as living a good life, with purpose and meaning, growing towards optimal functioning and self-realization (Deci & Ryan, 2008; Ryff, 2014). The philosophical roots of PWB lead back to Aristotle's formulation about the virtuous life. The essence of this Greek philosophy is to know yourself and to become what you are (Ryff, 2014). Many themes in the studies were about finding a new or healthy identity and developing self-insight and self-acceptance. Our results suggest that the underlying dimensions of PWB should be considered fundamental aspects of ED recovery, perhaps equally important to focus on during treatment as the abatement of symptoms. A focus on well-being in treatment has been suggested earlier for

other psychiatric disorders by Fava and others (Fava, 1996; Lamers et al., 2015). It is noted that Parloff and colleagues already suggested in 1954 that the goals of psychotherapy were not necessarily the reduction of symptoms but increased personal effectiveness (Fava, 1996). Several therapies have been developed focusing on PWB (Fava, Rafanelli, Cazzaro, Conti, & Grandi, 1998; Fava et al., 2005; Fava & Tomba, 2009; Gander, Proyer, & Ruch, 2016; Weiss, Westerhof, & Bohlmeijer, 2013, 2016). PWB is further related to work productivity, physical and overall mental health, and care consumption, even when controlling for symptoms of mental illness (Chida & Steptoe, 2008; Keyes, 2005; Weiss, 2016). It can also improve the quality of life for psychiatric patients and the change to recover on symptoms and decrease the risk of relapse (Sin, Della Porta, & Lyubomirsky, 2011; Weiss, 2016).

Environmental mastery was the only PWB dimension that showed insufficient evidence. However, environmental mastery could be considered to be an aspect of self-adaptability. Self-adaptability is defined broader, taking social and emotional adaptability into account. If the description of environmental mastery was described more broadly, taking all aspects of self-adaptability into account, this probably would have been found as evidence for a criterion for ED recovery. Limitations in the first WHO definition of health have recently led to a new definition, described as the ability to adapt and to self-manage in the face of social, physical, and emotional challenges (Huber et al., 2011, 2016). The importance of self-adaptability/resilience as a criterion for ED recovery, fits this recently proposed definition of health (Huber et al., 2011). In addition, Ryff (2014) stated that PWB is fundamentally anchored in how individuals face the challenges of life. It is noted that "being recovered" is certainly not achieving a perfect state on the found criteria. It is explained as a unique and self-determined process by recovered individuals, without a clear endpoint (Dawson, Rhodes, & Touyz, 2014; Hay & Cho, 2013; Jenkins & Ogden, 2012; Lamoureux & Bottorff, 2005; Lindgren, Enmark, Bohman, & Lundstrom, 2015; Nilsson & Hägglöf, 2006; Shahar, Latzer, & Buchbinder, 2012). A new definition for ED recovery based on the latest definition of health and the results of this study could be: recovery from an ED is the ability to adapt and to self-manage in the face of social, physical, and emotional challenges with an overall tendency towards growth in psychological well-being and adequate symptom remission (for instance as operationalized by Bardone-Cone et al., 2010). ED patients reported an overall impairment in PWB in a controlled study, which was not necessarily dependent on the presence of high levels of symptom severity, suggesting that PWB does not simply correspond to the absence

of pathology (Tomba et al., 2014). Well-being and pathology as two different but related aspects of health have been well validated in several samples of the normal population and patients (Keyes, 2005; Lamers, 2012; Lamers et al., 2015).

"Recovery" may indicate both a process and a state (Fava, 1996). For ED recovery, criteria also occupy a tenuous place between facilitators of recovery and criteria for demonstrating recovery in the literature. It is not always clear whether these themes are offered as requirements for ascertaining the degree to which someone is recovered or facilitators to achieve recovery. In outcome studies, most themes, from changes in BMI to improvement in self-esteem, are used both as predictor variables and outcome variables; see, for instance, Vall and Wade (2015). One of the conclusions of a recent meta-synthesis was that supportive relationships are an important facilitator for recovery (Duncan et al., 2015). Recovery in the qualitative sense is often described as a process or journey (Dawson et al., 2014; Hay & Cho, 2013; Weaver, Wuest, & Ciliska, 2005); and yet, what we need in a clinical sense is criteria to gauge and compare outcomes (see also Rosenvinge and Pettersen, 2012, p. 1). We argue that recovery dimensions that remain important aspects for individuals' health, such as positive relationships, are operationalized as criteria for recovery according to health and well-being definitions (Keyes, 2005; Ryff & Keyes, 1995). It is likely that these criteria, related to well-being, are also important as criteria for recovery for other psychiatric disorders, such as depression. In a sample of patients with depressive symptoms, it was found that not only psychopathology improves but also that PWB increases during treatment (Bohlmeijer, Lamers, & Fledderus, 2015). In another outcome study, it was found that many patients with depressive symptoms improved either on psychopathology or on the well-being dimensions but not on both, suggesting that both are important to measure in outcome studies and should be considered as criteria for recovery for psychiatric disorders (Trompetter, Lamers, Westerhof, Fledderus, & Bohlmeijer, 2017).

Limitations

Although a qualitative meta-analytic approach allows for a more comprehensive explanation of a phenomenon than the individual qualitative studies explain, this study has several limitations. First, the presented methods and results were influenced by the methodology of the primary studies and their findings. Some of the primary studies failed to provide sufficient details about the background of the participants, used methods or results. It is also unclear

how different systems of data analysis have formed the results in the primary studies. By examining differences in outcomes between low risk of bias studies and substantial risk of bias studies, we tried to minimize potential bias. Second, that some hypothesized dimensions were or were not supported does not necessarily depend only on the studies and participants but also may be a flaw in inadequate thematic analysis or misclassification of themes. We tried to address possible classification bias by independent analysis and calculating an interrater agreement. Third, this study shows frequencies, constituting the importance of recovery criteria, but fails to show the contradictions between studies, including, but not least, that to claim that those in the study were recovered, they had to determine provisional criteria for recovery, which differed significantly between studies. The method of this study did not allow to examine differences in criteria between the type of EDs. Most primary studies focused either on AN, or all ED types, making it challenging to divide results into ED type groups.

Further research could focus on differences in well-being criteria between ED types. In a study examining the dimensions of PWB among ED patients, differences in severity were found (Tomba et al., 2014). Compared with a control group, patients with BN had greater impairment on all PWB scales, whereas patients with BED showed greater impairment on only three scales and patients with AN on only two scales. It is possible that improvement on the well-being dimensions has a different priority depending on the ED type (Tomba et al., 2014). Also, the search strategy was relatively narrow, with a lack of synonyms for "recovery" or "recovered," such as "remission," "rehabilitation," and "restoration." However, we argue that these synonyms are not used regularly in qualitative ED recovery studies examining the view of patients or recovered individuals. In fact, in the reference check, no suitable other studies were found using these synonyms. At last, this study examined criteria for being recovered among people who were considered recovered. Further research should examine how these recovery criteria develop and influence each other during the recovery process.

Conclusions

We conclude that psychological well-being and self-adaptability are core aspects of recovery in addition to the remission of ED symptoms. A focus in treatment on these health dimensions seems, therefore, important to achieve recovery. Whether someone is recovered or not remains a question primarily to be answered by the patient her/himself. However,

researchers and clinicians need to measure the most fundamental criteria for recovery to find the best treatment options. This study, among other studies (Dawson, Rhodes, & Touyz, 2015; Duncan et al., 2015; Emanuelli et al., 2012; Jarman & Walsh, 1999; Noordenbos & Seubring, 2006; Rosenvinge & Pettersen, 2012), provides a further direction to understand which criteria are most important to measure. Developing and validating instruments that measure recovery on these fundamental criteria is warranted. It is also advised to establish an international standard or guideline on how to measure ED recovery outcomes and which instruments to use so that we might be able to compare treatment outcomes.

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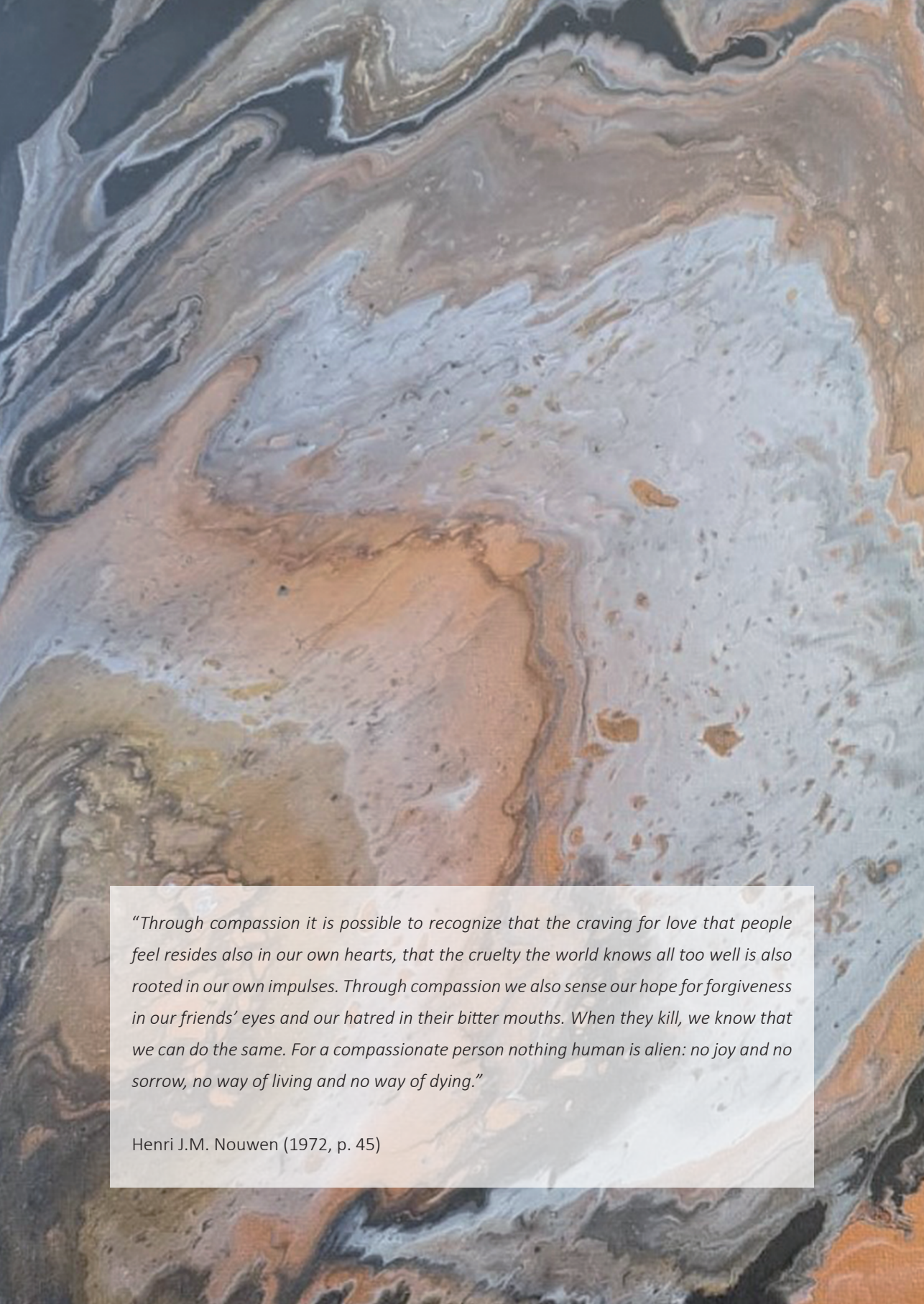
Part 2

Cross-sectional associations between well-being, psychopathology and personality



"Through compassion it is possible to recognize that the craving for love that people feel resides also in our own hearts, that the cruelty the world knows all too well is also rooted in our own impulses. Through compassion we also sense our hope for forgiveness in our friends' eyes and our hatred in their bitter mouths. When they kill, we know that we can do the same. For a compassionate person nothing human is alien: no joy and no sorrow, no way of living and no way of dying."

Henri J.M. Nouwen (1972, p. 45)

3

Having an eating disorder and still being able to flourish? Examination of pathological symptoms and well-being as two continua of mental health in a clinical sample

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ABSTRACT

Introduction

Eating Disorders (EDs) are serious psychiatric disorders, impacting physical and psychosocial functioning, often with a chronic course and high mortality rates. The two continua model of mental health states that mental health is a complete state, that is, not merely the absence of mental illness, but also the presence of mental health. This model was studied among ED patients by examining the presence and correlates of well-being and psychopathology. In addition, the levels of well-being were compared to the Dutch general population.

Method

A total of 468 female ED patients participated in this study during application and intake at a specialized ED treatment center in the Netherlands. They filled out questionnaires about well-being (MHC-SF), general psychopathology (OQ-45), and ED psychopathology (EDE-Q). Categorical and mean well-being levels were calculated. Also, the relationships between these variables were examined with Pearson correlation and multiple hierarchical regression analyses.

Results

ED patients showed lower levels of emotional, psychological, and social well-being on average compared to the general population. About 26% of the ED patients experienced low levels of well-being (languishing). However, also 13% experienced high levels of well-being (flourishing), varying between 9% in anorexia nervosa to 25% in binge eating disorder. ED psychopathology and general well-being showed a moderate negative correlation. For patients with bulimia nervosa and binge eating disorder, however, no such correlation was found. Lower general psychopathology, not having a history of hospitalization for the ED, and adaptive personal functioning were correlated with well-being among ED patients.

Conclusion

This study shows initial support for the two continua model of mental health among ED patients. Psychopathology and well-being should be considered as related but distinct dimensions of mental health in ED patients. Further research should focus on the possible reciprocal relationships between psychopathology and well-being during recovery. It is

recommended to monitor well-being during treatment and implement interventions for well-being to realize complete recovery for those patients with inadequate levels of well-being.

KEYWORDS
Eating disorders, anorexia nervosa, bulimia nervosa, binge eating disorder, other specified feeding and eating disorders, psychopathology, well-being, psychological well-being, positive functioning, positive mental health

INTRODUCTION

Eating Disorders (EDs) are serious psychiatric disorders (American Psychiatric Association, 2013). They often lead to severe psychological, physical, and social impairment and chronic conditions (Jenkins, Hoste, Meyer, & Blissett, 2011; Lowe et al., 2001; Mitchison, Hay, Slewa-Younan, & Mond, 2012; Mond, Hay, Rodgers, & Owen, 2012). Anorexia nervosa (AN) has the highest mortality rate of all psychiatric disorders because of the severe physical conditions and suicide (Harris & Barraclough, 1998; Hoek, 2006). The lifetime prevalence estimates for women with EDs are 0.9% for AN, 1.5% for bulimia nervosa (BN), 3.5% for binge eating disorder (BED), and 0.3%, 0.5%, and 2.0% among men (Hudson, Hiripi, Pope, & Kessler, 2008).

The severity and chronicity of EDs might explain the main focus in research on psychopathological symptoms and the ignorance of well-being (Tomba, Offidani, Tecuta, Schumann, & Ballardini, 2014). However, mental health is more than the absence of mental illness or psychopathological symptoms. Mental health is also about the presence of well-being (Jahoda, 1958; Keyes, 2002, 2012; Seligman & Csikszentmihalyi, 2000; Westerhof & Keyes, 2010; World Health Organization, 2005). Well-being consists of three components: emotional, psychological, and social well-being (Keyes, 2002; Ryff & Keyes, 1995; Westerhof & Keyes, 2010). Emotional well-being is about satisfaction with life and positive affect (Diener, Suh, Lucas, & Smith, 1999; Lamers, Westerhof, Bohlmeijer, Ten Klooster, & Keyes, 2011). Psychological well-being concerns optimal psychological functioning and consists of six dimensions: positive relationships, self-acceptance, environmental mastery, autonomy, personal growth, and purpose in life (Ryff, 1989; Ryff & Keyes, 1995). Social well-being is about optimal functioning in the societal context and consists of five dimensions: social contribution, integration, actualization, acceptance, and coherence (Keyes, 1998). People with high levels of well-being have been described as flourishers, whereas those who are low on well-being as languishers (Keyes, 2002, 2005).

Studies among the general and clinical populations showed the importance of well-being in mental health. Psychopathology and well-being are not two opposites of one dimension but represent two distinct, yet negatively related dimensions of mental health, the so-called two continua model (Franken, Lamers, Ten Klooster, Bohlmeijer, & Westerhof, 2018; Keyes, 2005, 2006, 2007; Keyes et al., 2008; Lamers et al., 2011; Magalhães & Calheiros, 2017; Perugini,

de la Iglesia, Castro Solano, & Keyes, 2017; Peter, Roberts, & Dengate, 2011). This means that someone with psychopathology may still have high levels of well-being and that someone with low well-being does not necessarily also have psychopathology. Further evidence for the two continua model comes from studies showing that pathological symptoms and well-being are correlated with different characteristics. For example, Westerhof and Keyes (2010) found different correlates for psychopathology (age, married, employed, number of illnesses, subjective health) compared to well-being (gender, migration, subjective health) in the general population.

The two continuum structure of mental health in clinical samples is further substantiated by results of a randomized controlled study of Acceptance and Commitment Therapy, where 64% of the participants improved either on depressive symptoms or well-being, but not on both (Trompetter, Lamers, Westerhof, Fledderus, & Bohlmeijer, 2017).

Well-being has been considered as an essential component of recovery in psychological treatments (Fava, 1996), and specific therapies for improving well-being among clinical populations have been developed (Bolier et al., 2013; Fava et al., 2005; Fava, Rafanelli, Cazzaro, Conti, & Grandi, 1998; Fava & Ruini, 2003; Gilbert, 2009; Weiss, Westerhof, & Bohlmeijer, 2016). Even though persons who are recovered from an ED consider several aspects of well-being as fundamental criteria for ED recovery in addition to symptom remission (de Vos et al., 2017), the important role of well-being for mental health has been widely neglected in research among ED patients (Tomba et al., 2014). Some researchers have focused on health-related components among ED patients, such as quality of life or subjective well-being (de la Rie, Noordenbos, Donker, & van Furth, 2007; de la Rie, Noordenbos, & van Furth, 2005; Doll, Petersen, & Stewart-brown, 2005; Jenkins et al., 2011; Mond et al., 2012; Tomba et al., 2014). Two studies examined psychological well-being (PWB) among ED patients (Tomba et al., 2014; Tomba, Tecuta, Schumann, & Ballardini, 2017). In the first study, it was found that ED patients had impaired PWB compared to a healthy control group (Tomba et al., 2014). Furthermore, patients with BN had greater impairment on all PWB scales than a control group, whereas patients with BED showed greater impairment only on autonomy, environmental mastery, and self-acceptance, and patients with AN only on positive relationships with others and self-acceptance. This study also found that impaired levels of PWB were independent of the presence of psychopathology. This indicates that the

presence of PWB does not simply correspond to the absence of psychopathology (Tomba et al., 2014). In the other study, change in PWB among ED patients during outpatient cognitive-behavioral-based treatment was examined. It was found that patients improved on the PWB dimensions during treatment (Tomba et al., 2017). However, after treatment, ED patients still showed impaired positive relationships with others and self-acceptance compared to controls (Tomba et al., 2017). Whereas previous studies addressed several aspects of well-being, no study has examined all levels of well-being or the two continua model among ED patients.

Psychopathology and well-being might have different correlates among ED patients. Correlates related to the severity of ED psychopathology are, among others, personality traits, emotion regulation difficulties, psychiatric pathology such as depression and anxiety, traumatic past and body mass index (BMI) (Cassin & Von Ranson, 2005; Costa, Ramos, Severo, Barros, & Lopes, 2008; Haynos, Roberto, & Attia, 2015; Jacobi, Hayward, de Zwaan, Kraemer, & Agras, 2004; Johnson, Cohen, Kasen, & Brook, 2002). Correlates with well-being have not been examined yet, while this may provide information on which ED patients might be vulnerable to inadequate well-being, which may guide treatment.

In summary, there is growing support that well-being is an important dimension of mental health, while no studies have been conducted on all three levels of well-being in ED patients. This study aimed to answer the question of whether the two continua model for mental health can be confirmed among a clinical sample of ED patients by addressing the following research questions:

1. What are the levels of well-being and the proportions of ED patients who are languishing and flourishing, and does this differ from the general population?

2. To what extend are psychopathology and well-being related in ED patients?

3. What are the correlates of psychopathology and well-being in ED patients?

Questions one and two are examined for each ED type and the overall sample. For research question *one,* we expect that ED patients will have lower levels of well-being and are less

likely to flourish compared to the general population. However, we also expect substantial variation in well-being between ED patients, with a substantial part showing moderate to high well-being, as an indicator that well-being functions as a distinct continuum of mental health. Regarding the specific ED types, based on Tomba and colleagues (2014), we expect more patients with BN languishing compared to other ED types and more patients with AN flourishing than other ED types. For research question *two,* we expect a low to moderate negative correlation between a) general psychopathology and well-being and b) ED psychopathology and well-being as additional indicators for the two continua model. We expect no differences between ED types. For research question *three*, we expect that different correlates will be associated with ED pathology and well-being based on the two-continua model. However, the analysis of correlates is explorative since this is the first study to examine correlates for well-being in ED patients. Overall, we expect that the two-continua model of complete mental health can be replicated among ED patients and consider the results of all three research questions as potential support for the two-continua model.

METHODS

Participants and procedure

A cross-sectional research design with a control group was used. Participants were patients who applied for outpatient treatment and followed the intake procedure at Stichting Human Concern, a specialized treatment center for EDs in the Netherlands. Data collection took place between March 2015 and January 2017. Inclusion criteria for this study were participants with a) a minimum age of 16 years, b) a DSM 5 (American Psychiatric Association, 2013) ED diagnosis at intake, and c) a signed informed consent. In total, 472 patients were diagnosed with an ED and initially included in the study. However, after examining sex status, only four men were present in the study and excluded because of the very low sample size. In total, 468 participants, all women, were included in the final study. Patients were diagnosed by a psychiatrist in collaboration with an intake team consisting of a dietician, psychiatrist or clinical psychologist, and a clinician with an ED history who has been trained to use this experiential knowledge in treatment (Vos, Netten, & Noordenbos, 2016). All patients filled in the questionnaires as part of the intake procedure and the baseline of Routine Outcome Monitoring (ROM). ROM is used during the treatment to monitor treatment progress.

The following characteristics were collected during the intake interview; the presence of psychiatric history among family members in the first line (parents, brothers, sisters, medical classification), using psychotropic medication, having followed earlier treatments, being hospitalized earlier for the ED, duration and start year of the ED, complex trauma (sexual abuse, verbal/physical abuse, severe instability in the family, or multiple negative life events), daily activities such as work or study and the financial situation (whether there were financial worries or actual financial problems). Educational level and living situation were collected according to the instructions of Stichting Benchmark GGZ, a national benchmark for treatment outcomes of mental health providers in the Netherlands (Stichting Benchmark GGZ, 2013). Patients were informed about the aims of the study and signed an informed consent stating that they could terminate the possibility to include their data for scientific research. The The Behavioral, Management, and Social Sciences Ethics Committee of the University of Twente approved this study protocol.

To compare the well-being scores of ED patients with the general population, a control group of the LISS-panel (Longitudinal Internet Study in the Social Science) of CentERdata was used with a sample of 835 Dutch-speaking non-institutionalized women from households in the Netherlands (Lamers, Westerhof, Bohlmeijer, & Keyes, 2013). Data of the LISS-panel was collected between 2007 and 2008.

Measures

Eating disorder psychopathology (EDE-Q)

ED psychopathology was measured with the original 36-item Eating Disorder Examination (EDE-Q), a widely used questionnaire for measuring ED psychopathology (Fairburn & Beglin, 1994). Patients rated the frequency of symptoms in the last 28 days using a 7-point Likert scale, ranging from 0 (not one day) to 6 (every day). The scale consists of 22 items measuring the core attitudinal ED psychopathology. The global score is considered a valid index of the general level of ED psychopathology (Aardoom, Dingemans, Slof Op't Landt, & Van Furth, 2012). The internal consistency of the global score in this sample was .92. Lower scores are indicative of lower ED psychopathology.

General psychopathology (OQ-45 Symptomatic Distress scale)

The scale symptomatic distress (SD scale) of the OQ-45 (Jong, Nugter, Lambert, & Burlingame,

2008) was used as a measure for general psychopathology, in accordance with the Dutch benchmark for mental healthcare (Warmerdam, Barendregt, & de Beurs, 2017). The OQ-45 SD scale has 25 items and shows good psychometric properties (Jong et al., 2008). Items are scored on a 5-point Likert scale, ranging from 0 (never) to 4 (always). The internal consistency in this sample was .91. Higher scores are indicative of higher psychopathology.

Well-being (MHC-SF)

Well-being was measured with the Mental Health Continuum Short Form (MHC-SF). The Dutch MHC-SF was developed by Lamers et al. (2011) and includes emotional, psychological, and social well-being. It consists of 14 items, rated on a six-point Likert scale ranging from 0 (never) to 5 (always) and gives an overall impression of well-being. To examine whether the MHC-SF measures the same three dimensions of well-being in ED patients, as found in the general population (Lamers et al., 2011), confirmatory factor analysis (CFA) was tested prior to the main analysis in R statistics (R Core Team, 2013) with the Lavaan package version 0.5-23.1097 (Rosseel, 2012). The following fit indices were used: Root Mean Squared Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Tucker-Lewis Index (TLI). CFA showed that a three-factor model, with the dimensions emotional, social, and psychological well-being, showed the best fit in our data, compared to a one or two-factor model (RMSEA = .075, CFI = .93, and TLI = .92). The internal consistency in this sample was .90 for the total scale, .86 for the scale emotional well-being, .73 for the scale social well-being, and .83 for the scale PWB. Higher scores are indicative of higher well-being.

The percentages of ED patients languishing and flourishing were calculated according to Keyes (2002, 2012) and Lamers et al. (2011) instructions. For the category languishing, participants had to score low (“never” or “once or twice” during the past month) on at least one of the three emotional well-being dimensions and at least six of the eleven (combined) psychological and social well-being dimensions. For the category flourishing, participants had to score high (“almost every day” or “every day” during the past month) on the same dimensions.

Severity indices of personality problems (SIPP-SF)

The SIPP-SF measures the core components of (mal)adaptive personality functioning in clinical samples using 60 items and is a shortened version of the SIPP-118 (Verheul et al.,

2008). The SIPP measures the following components: self-control, identity integration, responsibility, relational capacities, and social concordance. Only the first three components were relevant for this study because the last two exhibit a high overlap in construct and meaning with the social and psychological well-being dimensions. Self-control relates to the capacity to tolerate, use and control emotions and impulses. Identity integration relates to experiencing a coherence of self or identity and the capacity to see oneself and one's own life as stable, integrated, and purposive. Responsibility is related to taking responsibility for one's own life and the capacity to set realistic goals and achieve these goals (Verheul et al., 2008). The self-control, identity integration, and responsibility scales all consist of 12 items and were rated from 1 (fully disagree) to 4 (fully agree). Higher scores are indicative of lower levels of personality problems. The scales of the SIPP-SF show good construct validity and can be used to screen for (mal)adaptive personality functioning in adults (Rossi, Debast, & van Alphen, 2016; Verheul et al., 2008). The internal consistency in this sample was .89 for the self-control/emotion regulation scale, .91 for the identity integration scale, and .86 for the responsibility scale. There was a lower response on the SIPP-SF (n = 269) because it was not administered in the first year of the data collection.

Analysis

Analyses were performed in Statistical Package of the Social Sciences (SPSS) 24. Differences in mean levels of well-being between ED patients and the general population, and between AN, BN, BED, Other Specified Feeding and Eating Disorders (OSFED) and the general population were examined using one-way ANOVA analysis with the groups as a fixed factor. Partial eta-squared values (η^2) were reported as measures for the effect size. Eta-squared values were interpreted as follows; low, ranging from .01 to .05, medium between .06 and .13, and large when .14 and higher (Field, 2005). Tukey's test was used for post-hoc analysis when homogeneity of variances was met. Welch's ANOVA and Games-Howell post-hoc tests were used when homogeneity of variances was not met.

Chi-square tests were used with post hoc analysis using a Bonferroni correction to analyze differences in proportions flourishers and languishers between ED patients and the general population and between the ED types. For correlation analysis, the Pearson coefficient was used. Correlations were interpreted as follows (Santrock, 2007): very low: 0 to .20 low: 21 to .40; moderate:, .41 to .60; high moderate: .61 to .80; high: .81 to .90, and very high: .91 to 1.0.

For the analysis of correlates that were expected to be associated with mental health, a multiple hierarchical regression analysis was used with the ED psychopathology and the well-being dimensions as dependent variables. Hierarchical regression was chosen because we used a broad set of potential associated patient characteristics, classified into four main categories (demographics, illness history-related correlates, current illness-related correlates, and (mal)adaptive personality functioning. Separate analyses were run on the following dependent variables; emotional well-being, psychological well-being, social well-being, and ED psychopathology. Analysis of the three separate dimensions of well-being instead of only general well-being was done because the dimensions are both theoretical and psychometrically different concepts of well-being (Deci & Ryan, 2008; Joshanloo & Lamers, 2016). The following predictor variables were used: demographic determinants: age, educational level, living situation, having a job or studying, and financial situation; illness history-related determinants: ED duration, start age of ED, earlier hospitalization for the ED without remission, psychiatric history of a family member (1st degree), history with complex trauma; current illness-related determinants: ED type, using psychotropic medication, general psychopathology, having frequent suicidal thoughts, Body Mass Index (BMI kg/m^2) and personality-related determinants: self-control/emotion-regulation, identity integration, and responsibility. Given the substantial number of independent variables in the regression analysis (n = 18), only p values of <.01 were considered as significant determinants in the models.

Four hierarchical Models were used to test the associated correlates (independent variables) across the Models. In Model 1, the demographic variables were tested. In Model 2, the addition of illness-history-related variables to demographic variables were tested. In Model 3 and 4, the addition of current illness-related variables and (mal-)adaptive personality functioning were tested. The assessments of the Q-Q plots, partial regression plots, plots of studentized residuals, and the tolerance values below 0.1 indicated that the assumptions for linearity, homoscedasticity, and normality were met and that there was no multicollinearity.

RESULTS

Background characteristics

In total, 468 female patients with an average age of 28.4 years (*SD* = 9.9) participated in the study. Thirty-five patients (7,8%) had followed low education, 71 participants (15.8%) intermediate education, and 343 (76.4%) high education. The average start age of the ED was 16.0 years (*SD*=5.0), and the average duration of the ED was 10.9 years (*SD* = 9.6). Hundred-sixty-one patients (34.4%) were diagnosed with AN, 96 patients (20.5%) with BN, 61 patients (13.0%) with BED, and 150 patients (32.1%) with OSFED. The average start age and duration for AN was respectively 16.6 years (*SD* = 4.2) and 7.7 years (*SD* = 7.8), for BN 15.5 years (*SD* = 4.9) and 11.6 years (*SD* = 8.6), for BED 16.3 years (*SD* = 7.3) and 16.1 years (*SD* = 10.2), and for OSFED 15.7 years (*SD* = 4.9) and 11.9 years (*SD* = 10.8). Eighty-five percent of the patients had received earlier psychiatric treatment. Mean scores on the EDE-Q global scale were 4.00 (*SD* = 1.19) for the overall ED sample, and 3.75 (*SD* = 1.25) for AN, 4.45 (*SD* = .92) for BN, 4.17 (*SD* = 1.01) for BED, and 3.93 (*SD* = 1.27) for OSFED. See the supplementary material (https://doi.org/10.3389/fpsyg.2018.02145) for an overview of the other background characteristics of the sample.

Levels of well-being and percentages of flourishers and languishers

The first research question concerned the levels of well-being and the proportions of ED patients languishing and flourishing (categorical scores) compared to the general population. There were statistically significant differences between ED patients and the general population for overall well-being, *Welch's* $F(1, 884.14) = 188.55$, $p < .001$, emotional well-being, *Welch's* $F(1, 800.779) = 464.89$, $p < .001$, psychological well-being, $F(1, 1301) = 199.78$, $p < .001$, and social well-being $F(1, 1301) = 13.83$, $p < .001$. ED patients had lower average scores compared to the general population on all well-being scales with medium effect sizes for overall ($\eta^2 = .13$) and psychological well-being ($\eta^2 = .13$), a low effect size for social well-being ($\eta^2 = .01$) and a large effect size for emotional well-being ($\eta^2 = .29$). See Table 1 for an overview of the results. Post hoc analysis showed statistically significant lower well-being scores for all ED types compared to the general population on overall ($p < .001$), emotional ($p < .001$), and psychological well-being ($p < .001$). Social well-being was only statistically significantly lower for AN ($p < .05$) and BN ($p < .05$) compared to the general population. Differences between the ED types were only found between AN and BED for emotional ($p < .01$) and psychological

well-being (*p <.05*).

Sixty-one patients in this sample were flourishing (13.0%), 285 patients had moderate well-being (60.9%), and 122 patients (26.1%) were languishing. Compared to the general population, there were statistically significant differences in the proportions of ED patients who were languishing, had moderate well-being, and were flourishing, $\chi^2(2) = 169.327$, $p < .001$. Post hoc comparisons of categorical scores showed that significantly more patients with AN were languishing (33.5%, $p < .001$), and more patients with BED flourishing (24.6%, $p < .001$), compared to the other ED types.

These results confirm our hypothesis that ED patients show lower levels of well-being and have a higher chance to languish compared to the general population. Substantial variation was found in ED patients' well-being, while all were diagnosed with severe psychopathology. These results suggest that psychopathology and well-being are two related but distinct continua of mental health.

Table 1. Categorical and mean scores of well-being for the general population and ED patients

	Groups							ED Types									
	General population (*N* = 835, women)		ED patients (*N* = 468)		Statistics			AN (*n* = 161)		BN (*n* = 96)		BED (*n* = 61)		OSFED (*n* = 150)		Statistics	
	n	*%*	*n*	*%*	χ^2	*p*		*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*	χ^2	*p*
Mental health categories					169.327	.000										*17.204*	*.009*
Languishing	40	4.8%	122	26.1%**				54	33.5%*	27	28.1%	12	19.7%	29	19.3%		
Moderate	488	58.4%	285	60.9%				92	57.1%	59	61.5%	34	55.7%	100	66.7%		
Flourishing	307	36.8%	61	13.0%**				15	9.3%	10	10.4%	15	24.6%*	21	14.0%		
	M	*SD*	*M*	*SD*	*F*	*p*	*η*2	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	*p*
Well-being																	
Total	3.00	.84	2.29	.94	188.555	.000	.13	2.17	.94	2.21	.92	2.52	1.02	2.36	.89	52.632	.000
Emotional	3.70	.92	2.36	1.16	464.899	.000	.29	2.16	1.25	2.34	1.04	2.79	1.12	2.40	1.10	119.922	.000
Psychological	3.22	.98	2.40	1.04	199.780	.000	.13	2.25	1.04	2.32	1.03	2.68	1.12	2.50	.99	52.803	.000
Social	2.32	1.02	2.10	1.00	13.836	.000	.01	2.07	.93	2.00	1.06	2.18	1.12	2.17	.99	4.018	.003

* Statistically significant different at post-hoc comparisons at the $p < .01$ level with Bonferroni correction, ** Statistically significant different at post-hoc comparisons at the $p < .001$ level, with Bonferroni correction, percentages are rounded to the nearest tenth.

Relationship of psychopathology with well-being

The second research question concerned the correlations between psychopathology and well-being. Table 2 shows the correlations (Pearson's *r*) between psychopathology and well-being for ED patients overall and the specific ED types.

Table 2. Pearson correlation between psychopathology and well-being per eating disorder type

	Psychopathology		Well-being			
ED type		General	Total	Emotional	Psychological	Social
Total	ED	.43*	-.35*	-.33*	-.33*	-.29*
	General	-	-.73*	-.71*	-.69*	-.55*
AN	ED	.52*	-.53*	-.48*	-.54*	-.41*
	General	-	-.75*	-.74*	-.72*	-.58*
BN	ED	.48*	-.20	-.20	-.15	-.18
	General	-	-.69*	-.62*	-.64*	-.57*
BED	ED	.22	-.07	-.08	-.00	-.14
	General	-	-.72*	-.72*	-.69*	-.56*
OSFED	ED	.42*	-.39*	-.38*	-.37*	-.29*
	General	-	-.72*	-.72*	-.68*	-.51*

Note: * = correlation is significant at the .001 level (2 sided)

General psychopathology showed a *high moderate negative* correlation with overall (r =-.73, p < .001), and emotional well-being (r =-.71, p < .001), and a *moderate negative* correlation for psychological (r =-.69, p < .001) and social well-being (r =-.55, p < .001).

ED psychopathology showed a *low negative* correlation with overall (r = -.35, p <.001), emotional (r =-.33, p < .001) psychological (r =-.33, p <.001) and social well-being (r =-.29, p < .001).

Analysis per ED type showed *moderate* to *high negative* correlations of general psychopathology with all well-being dimensions for AN, BN, BED, and OSFED (p <.001). For ED psychopathology, however, only significant *low to moderate negative* correlations with well-being dimensions were found for AN and OSFED (p <.001), while for BN and BED, no significant correlations were found with any well-being dimension.

The results suggest that ED psychopathology and well-being are two related but distinct continua, whereas general psychopathology and well-being are two separate but more strongly related continua. Overall, our hypothesis was confirmed.

Correlates with mental health

The third question concerned correlates for psychopathology and well-being. See Table 3 for each regression model and Table 4 for the tested variables in the hierarchical multiple regression.

Correlates associated with ED psychopathology

The explained variance of the baseline Model (1) with demographic variables related to ED psychopathology was not statistically significant, R^2 = .032, F(7, 254) = 1.21, p > .01. The addition of illness-history-related variables correlated to ED psychopathology (Model 2) above the standard demographic variables (Model 1) did not lead to a statistically significant increase in R^2 = .013, F(7, 254) = .653, p > .01. The explained variance increased significantly with the addition of current illness-related variables (Model 3), R^2 = .226, F(19, 242) = 10.70, p < .001. The addition of personality-related variables (Model 4) did not lead to a statistically significant increase in R^2 = .010, F(22, 239) = 1.10, p > .01. Model 3 showed the best fit determining ED psychopathology, R^2 = .281, F(19, 242) = 4.238, p < .001. AN (β =-.332, p < .01) and general psychopathology (β = .413, p <.001) were significantly associated with ED psychopathology.

Correlates associated with Emotional Well-being (EWB)

The explained variance of the baseline Model (1) with demographic variables related to EWB was not statistically significant, R^2 = .053, F(7, 254) = 2.023, p > .01. The addition of illness-history-related variables relating to EWB (Model 2) above the standard demographic variables (Model 1) did not lead to a statistically significant increase in R^2 = .014, F(7, 254) = .726, p > .01. The explained variance increased significantly with the addition of current illness related variables (Model 3), R^2 = .455, F(19, 242) = 32.894, p < .001. The addition of personality related variables (Model 4) showed a statistically significant increase in R^2 = .075, F(22, 239) = 14.757, p <.001. The final model (4) showed the best fit to determine EWB, R^2 = .596, F(22, 239) = 16.051, p < .001. General psychopathology (β =-.236, P <.01), and identity integration (β = .575, p < .001) were significantly associated with EWB.

Correlates associated with Psychological Well-being (PWB)

The explained variance of the baseline Model (1) with demographic variables related to PWB was statistically significant, R^2 = .056, F(7, 254) = 2.16, p < .05. The addition of illness-

history-related variables (Model 2) above the standard demographic variables (Model 1), did not lead to a significant increase, R^2 = .019, F(7, 254) = 1.05, p > .05. The addition of current illness-related variables (Model 3) led to a statistically significant increase, R^2 = .422, F(19, 242) = 29.01, p < .001. The addition of personality-related variables relating to PWB (Model 4) led to a statistically significant increase, R^2 = .144, F(22, 239) = 33.08, p <.001. The final Model (4) showed the best fit to determine PWB, R^2 = .642, F(22, 239) = 19.46, p < .001. Specific correlates for PWB were, an Earlier hospitalization (β = .150, p <.001), and the personality traits identity integration (β = .711, p <.001), and responsibility (β = .195, p < .001).

Correlates associated with Social Well-being (SWB)

The baseline Model (1) with demographic variables related to SWB was not statistically significant, R^2 = .061, F(7, 254) = 2.37 p > .05. The addition of illness history related variables relating to SWB (model 2) above the standard demographic variables (Model 1), led not to a statistically significant increase, R^2 = .008, F(7, 254) = .419, p > .05. The addition of current illness-related variables (Model 3) showed a statistically significant increase, R^2 = .272, F(19, 242) = 14.23, p < .001. The addition of personality-related variables relating to SWB (Model 4) led to a statistically significant increase, R^2 = .103, F(22, 239) = 14.72, p <.001. The final Model (4) showed the best fit to determine SWB, R^2 = .444, F(22, 239) = 8.69, p < .001). The personality trait identity integration (β = .600, p <.001) was significantly associated with SWB.

Our hypothesis can be partly confirmed, as there were different correlates associated with ED psychopathology (having AN) and well-being (earlier hospitalization for the ED, identity integration, and responsibility). However, general psychopathology was associated with both ED psychopathology and emotional well-being.

Table 3. Hierarchical Multiple Regression with four models

Model	**R^2**	*F*	*p*-value	R^2 change	*F*-change	*p*-value
ED psychopathology						
Model 1	**.032**	1.216	.295	-	-	-
Model 2	**.045**	.976	.472	.013	.653	.659
Model 3	**.271**	5.276	.000	.226	10.700	.000
Model 4	**.281**	4.724	.000	.010	1.103	.348
Emotional WB						
Model 1	**.053**	2.023	.053	-	-	-
Model 2	**.066**	1.476	.133	.014	.726	.604
Model 3	**.522**	13.887	.000	.455	32.894	.000
Model 4	**.596**	16.051	.000	.075	14.757	.000
Psychological WB						
Model 1	**.056**	2.169	.037	-	-	-
Model 2	**.076**	1.703	.067	.019	1.047	.390
Model 3	**.497**	12.609	.000	.422	29.009	.000
Model 4	**.642**	19.460	.000	.144	32.080	.000
Social WB						
Model 1	**.061**	2.374	.023	-	-	-
Model 2	**.069**	1.544	.109	.008	.419	.835
Model 3	**.342**	6.580	.000	.272	14.299	.000
Model 4	**.444**	8.685	.000	.103	14.720	.000

Note: Model 1 Demographics: age, educational level, living situation, having a job or study and financial situation, Model 2: model 1 + *Illness history*: ED duration, start age of ED, earlier hospitalized, psychiatric history of a family member (1st degree), having complex trauma, Model 3: model 2 + *Current Illness variables*: eating disorder type, using psychotropic medication, general psychopathology, having frequent suicidal thoughts, Body Mass Index (BMI kg/m^2) Model *4: model 3 + Personality traits*: self-control/emotion-regulation, identity integration, responsibility.

Table 4. Hierarchical multiple regression results of the final model

Variable	Psychopathology			Well-being								
	Eating disorder			Emotional			Social			Psychological		
	B (CI 95%)	*SE*	β	B (CI 95%)	*SE*	β	B (CI 95%)	*SE*	β	B (CI 95%)	*SE*	β
Block 1 demographics												
Age	-.018 (-.047- .011)	.015	-.151	.002 (-.019- .023)	.011	.021	-.002 (-.023- .020)	.011	-.015	-.014 (-.032- .004)	.009	-.135
Low education	.312 (-.504 – 1.127)	.414	.069	-.084 (-.678- .511)	.302	-.019	-.135 (-.737- .466)	.306	-.036	-.342 (-.845- .160)	.255	-.087
Intermediate education	.173 (-.565- .911)	.375	.052	-.225 (-.763- .312)	.273	-.070	-.428 (-.972- .118)	.277	-.153	-.477 (-.932--.022)	.231	-.165
High education	.068 (-.607 – .743)	.343	.025	-.231 (-723- .260)	.250	-.089	-.248 (-.746- .250)	.253	-.110	-.325 (-.741- .091)	.211	-.138
Living situation	-.104 (-.385- .177)	.143	-.042	.018 (-.187- .225)	.104	.007	.097(-.111- .304)	.105	.047	.068 (-.105- .241)	.088	.032
Main activity	-.110 (-.441- .221)	.168	-.039	.017 (-.224- .258)	.122	.006[a,b]	-.082 (-.326- .162)	.124	-.035[a,b]	.078 (-.126 – 282)	.104	.032[a,b]
Financial situation	.083 (-.382- .548)	.236	.020	-.008 (-.347- .331)	.172	-.002	-.061 (-.404- .282)	.174	-.018	.004 (-.283- .291)	.146	.001
Block 2 illness history												
ED duration	.002 (-.028- .032)	.015	.015	-.004 (-.025- .018)	.011	-.029	-.002 (-.024- .020)	.011	-.017	.005 (-.013- .024)	.009	.050
Start age ED	.007 (-.029- .042)	.018	.028	-.004 (-.030- .021)	.013	-.018	-.006 (-.032- .020)	.013	-.031	-.004 (-.025- .018)	.011	-.017
Earlier hospitalized	.145 (-.197- .488)	.174	.050	-.189 (-.438- .061)	.127	-.067	-.245 (-.497- .008)	.128	-.101	**-.380 (-.591 - -.169)**	**.107**	**.150*** **
Psychiatric family	-.067 (-.348- .214)	.143	-.028	.006 (-.211- .199)	.104	.003	.031 (-.177- .339)[c]	.105	.015	-.067 (-.240- .107)	.088	-.032
Complex trauma	.198 (-.247- .644)	.226	.051	-.216 (-.514- .109)	.165	-.057	-.062 (-.391- .267)	.167	-.019	-.004 (-.279- .271)	.139	-.001
Block 3 current illness												
AN	**-.832 (-1.378 - -.286)**	**.277**	**-.332****	-.114 (-.511- .265)	.201	-.047	.037 (-.366- .440)	.205	.018	.033 (-.304- .369)	.171	.015
BN	-.012 (-.502- .478)	.249	-.004	-.192 (-.549- .165)	.181	-.067	-.134 (-.495- .228)	.184	-.054	-.126 (-.428- .177)	.153	-049
BED	-.448 (-.913- .016)	.236	-.176	-.243 (-.581- .096)	.172	-.098	-.068 (-.411- .274)	.174	-.032	-.119 (-.405- 168)	.145	-.053
BMI	.004 (-.019- .027)	.0011	.026	-.004 (-.020- .013)	.008	-.025	-.015 (-.032- 002)	.008	-.114[c]	.003 (-.011- .017)	.007	.020
Psychotropic medication	.156 (-.179- .492)	.170	.054	-.071 (-.315- .174)	.124	-.025	.069 (-.178- .317)	.126	.019	.117 (-.089- .324)	.105	.046
General psychopathology	**.035 (.016 - .054)**	**.010**	**.413*****	**-.020 (-.034 - -.006)**	**.007**	**-.236***	.000 (-.015- .014)	.007	-.007[c]	.002 (-.012- .016)	.007	-.015[c]
Frequent suicidal thoughts	-.010 (-.495- .476)	.246	-.002	-.079 (-.432- .275)	.180	-.020	.217 (-.141- .575)	.182	.063	.262 (-.037- .562)	.152	.074
Block 4 personality traits												
Self-control/emotion regulation	.004 (-.022- .029)	.013	.021	-.006 (-.024- .013)	.009	-.034	.002 (-.017- 021)	.013	.017	-.006 (-.022- .010)	.008	-.041
Identity integration	-.010 (-.042- .022)	.016	-.071	**.079 (.056 - .103)**	**.012**	**.575*****	**.071 (.047 - .095)**	**.012**	**.600*****	**.088 (.068 - .108)**	**.010**	**.711*****
Responsibility	.019 (-.007- .046)	.013	.105	-.008 (-.027- .012)	.010	-.043	.021 (.002- .041)	.010	.137	**.031 (.015 - .048)**	**.008**	**.195*****

Note: * $p < .01$, ** $p < .001$, *** $p < .0001$, a = significant predictor in model 1, b = significant predictor in model 2, c = significant predictor in model 3. *Model 1 Demographics*: age, educational level, living situation, having a job or study and financial situation, Model 2: model 1 + *Illness history*: ED duration, start age of ED, earlier hospitalized, psychiatric history of a family member (1st degree), having complex trauma. Model 3: model 2 + *Current Illness variables*: eating disorder type, using psychotropic medication, general psychopathology, having frequent suicidal thoughts, Body Mass Index (BMI kg/m^2). Model *4: model 3 + Personality traits*: self-control/emotion-regulation, identity integration, responsibility.

DISCUSSION

This is one of the first studies to examine all dimensions of well-being (emotional, psychological, and social) in female ED patients. The levels of well-being and the derived percentages of languishing and flourishing were compared to the general population. Also, the relationship of well-being with psychopathology and correlates for both were examined. Overall, results indicate a two-continuum structure of mental health where psychopathology and well-being are negatively related. As expected, ED patients in this sample had lower levels of well-being compared to the general population. There was also substantial variation in the levels of well-being among ED patients, despite the high levels of psychopathology, indicating that well-being should be considered a distinct mental health continuum. The two continua model is further supported by the fact that there were no high correlations between ED psychopathology and well-being and that different correlates were associated with ED psychopathology and well-being.

The presence of well-being in ED patients

In this study, we found overall lower mean levels of emotional, psychological, and social well-being among female ED patients compared to the general female population. In particular, a large difference was found for emotional well-being, with ED patients scoring the lowest levels compared to controls. The percentage of ED patients languishing (26.1%) was substantially higher, and of flourishing substantially lower (13.0%) compared to the general population (respectively 4.8% and 36.8%). These results correspond with earlier work of Tomba and colleagues (2014), who found lower levels of psychological well-being among ED patients at the start of outpatient treatment compared to general controls. The two continua model of mental health suggests that clinical populations, on average, will have lower levels of well-being and higher levels of psychopathology compared to the general population, but that a part may still have moderate or high levels of well-being. Although the patients in this study have been diagnosed with a severe psychiatric disorder, are seeking specialized ED treatment, and show on average a long duration (10.9 years) of the ED, a substantial part of them still functions moderately well on well-being (60.9%), and a small part (13%) even shows high well-being (flourishing). It is important to examine further why some patients can still experience adequate levels of well-being despite having an ED.

Our research showed interesting differences between ED types. We found that languishing was most prevalent in patients with AN (33.5%) and that flourishing was most prevalent in patients with BED (about 24.6%). This seems contrary to Tomba and colleagues (2014) results, who found that patients with AN were the most similar to "healthy" controls on the dimensions of psychological well-being, while patients with BN showed the most impairment compared to controls. They related the relative good outcomes of AN patients to possible ego-syntonic aspects of the disease, a lack of insight, their ability to control weight, socio-cultural values, such as thinness desirability, and personality traits (Tomba et al., 2014). This study suggests that patients with AN are vulnerable to lower overall well-being. It is possible that our sample of patients with AN was more severe in terms of lower BMI (16.1 kg/m2 compared to 17.5 kg/m2 in Tomba et al., 2014), a more prolonged illness duration, or higher ED psychopathology. A recent review on the ego-syntonic nature of anorexia nervosa showed that in the initial phases of the disease, patients might experience a sense of mastery and self-control to manage food and reach weight-related goals. In addition, they may attain confidence and self-worth as a result of positive feedback from family and friends (Gregertsen, Mandy, & Serpell, 2017). These advantages are primarily related to the dimensions of psychological well-being and reinforce the ego-syntonic nature of the disease. However, as the disease progresses and begins to take over their thoughts and behavior, these patients begin to lose control rather than be in control (Gregertsen et al., 2017). The consequences of the disease, such as physical health issues, adverse changes in brain functioning, negative instead of positive feedback from family and friends, social isolation, and psychological problems, become more apparent and may outweigh the advantages (Gregertsen et al., 2017). It is plausible that patients with AN who are longer in the process of the disease and are beginning to outweigh these disadvantages above the advantages will perceive lower levels of well-being, while patients in the initial phases of the disease, on the other hand, will experience higher levels of well-being. Therefore, the levels of well-being in patients with AN might be determined by the duration of the ED, ego-syntonic aspects, and physical consequences, which should be a topic for further study.

Patients with BED, on the other hand, showed higher well-being compared to the other ED types, but also a long average duration of the ED (16.1 years). Therefore, BED patients may be able to maintain positive functioning in their lives and maintain higher well-being levels, despite a long-term ED. It has been suggested that binge eating can be considered a coping

mechanism for perceived daily stress (Freeman & Gil, 2004). A possible explanation for BED patients is that using binges without extreme compensating behaviors could be considered a relatively effective coping mechanism for internal and external stressors. Another reason might be that, in general, the brain of patients with BED receives sufficient nutrition to experience forms of well-being. For patients with AN, the severe implications of prolonged malnutrition on altered brain functioning and mental health (Fuglset, Landrø, Reas, & Rø, 2016) may also contribute to lower well-being later in the illness process.

The relationship of well-being with psychopathology

General psychopathology showed negative moderate to high correlations, and ED psychopathology low correlations with the well-being dimensions. Moderate correlations between general psychopathology and well-being were also found in other clinical populations (Franken et al., 2017; Schotanus-Dijkstra, Have, Lamers, & Graaf, 2016). Contrary to our expectations, the correlations between ED psychopathology and well-being were substantially lower than those between general psychopathology and well-being. It seems that ED psychopathology functions relatively independently from the well-being levels. This may have important implications for treatment and suggests that a focus only on alleviating ED psychopathology in treatment does not necessarily adequately improve well-being among ED patients and contrariwise. Alleviating general psychopathology, however, might both improve emotional well-being and alleviate ED psychopathology. While there were no differences between the correlations of general psychopathology and well-being between the ED types, for ED psychopathology, there were low to moderate correlations for patients with AN, OSFED, and overall ED's, and no significant correlations with the well-being dimensions for patients with BN and BED. This was also unexpected, and we have no clear explanation for these results. It is suggested to perform qualitative research to explore these relationships among ED patients further and examine this complex relationship between psychopathology and well-being and possible reciprocal relationships in a longitudinal study design to make more reliable conclusions on ED psychopathology and well-being.

Correlates associated with ED psychopathology and well-being

Our research showed that different correlates were associated with well-being and psychopathology. Having AN and lower general psychopathology was associated with lower ED psychopathology. This probably has to do with how ED psychopathology is measured,

namely with the EDE-Q. It is found that outpatients with AN score significantly lower on the global score compared to patients with BN (Dahlgren, Stedal, & Rø, 2017). In this study, patients with AN also scored substantially lower on the EDE-Q than the other ED types. The association of higher general psychopathology with higher ED psychopathology is supported by other research (Jacobi et al., 2004; Spindler & Milos, 2007).

There were several associated correlates for emotional, psychological, and social well-being. Patients with higher general psychopathology and a lower identity integration had a higher change on poorer emotional well-being. Patients with a history of hospitalization for the ED and a lower score on the personality traits, responsibility, and identity integration had a higher chance of poorer psychological well-being. Finally, lower identity integration was also associated with lower levels of social well-being. The importance of personality traits, more specific conscientiousness, and extraversion as predictors for adequate well-being was also found in the general population (Schotanus-Dijkstra et al., 2015). Responsibility is related to conscientiousness and is related to goalsetting and maintaining the discipline necessary to achieve those goals. This may suggest that patients who have learned to take responsibility for their recovery process, for instance, by doing the homework provided in treatment, will have a higher chance to improve on well-being dimensions during treatment. Previous research shows that disturbances in overall identity development are a core vulnerability for ED pathology (Farchaus Stein & Corte, 2007), and it is suggested that the development of a positive self may be an important factor in ED recovery. Further research is needed to examine the complex relationship between identity impairment, well-being, and ED pathology. Also, these correlates should be examined in a longitudinal design to conclude whether they might predict changes in ED psychopathology and well-being later in treatment.

Notably, being hospitalized earlier in life for an ED was associated with lower psychological well-being, while it was not associated with more severe ED psychopathology. Patients admitted once often need at least one readmission, which enhances the risk of later poorer psychosocial functioning (Steinhausen & Grigoroiu-serbanescu, 2008). In a longitudinal study, readmission showed no effect on ED symptoms at eight years follow-up. However, there was clear evidence that patients with readmissions functioned less well in terms of psychosocial adaptation (Steinhausen & Grigoroiu-serbanescu, 2008). Hospitalization for an ED is possibly a specific negative life event, even when it was not compulsory, impacting a

patient's psychological well-being. Therefore, it is warranted to study further the best way to deliver these treatments and carefully consider and monitor the possible impact on a patient's psychological well-being.

Strengths and limitations

The strengths of this study are the large sample of ED outpatients and the large control group. The limitations of this study are its design, having only an adult female sample, the use of self-report instruments, and the arbitrary criteria for categorizing levels of well-being. A cross-sectional design was used, meaning that no causal inferences can be made and longitudinal study designs are necessary for more conclusive results. No adolescents younger than 16 and no males were included in this sample, and results are therefore not generalizable to these populations. Self-report instruments were used, which may have led to biases, such as social desirability bias (Atkinson, Zibin, & Chuang, 1997; Van De Mortel, 2008). However, to date, no other valid, generally recognized methods for examining well-being were available. The criteria for flourishing and languishing used in this study should be considered arbitrary, and there are other approaches, based on other questionnaires and categorical scorings to examine flourishing, which are not necessarily comparable (Schotanus-Dijkstra et al., 2015).

Conclusions and clinical implications

Overall the results of this study have some important implications. This study shows initial support for the two continua model for mental health among ED patients. ED patients have lower levels of well-being compared to the general population. However, a small part is also flourishing. Examining the levels of well-being at the start of treatment is therefore advised. A focus in treatment on well-being should be considered for those patients with inadequate well-being. A focus *only* on alleviating ED psychopathology in treatment might inadequately improve well-being, given the correlations' overall low to moderate strengths. This might be even more important to consider in specific ED subtypes such as BN and BED, where no significant correlations between both were found. Several correlates were found to be associated with ED psychopathology and well-being. A focus on alleviating general psychopathology is advised and might decrease ED psychopathology and increase emotional well-being. Treatments should aim at increasing personality functioning on identity integration and responsibility and prevent hospitalization for ED because this may have a positive effect on well-being among ED patients.

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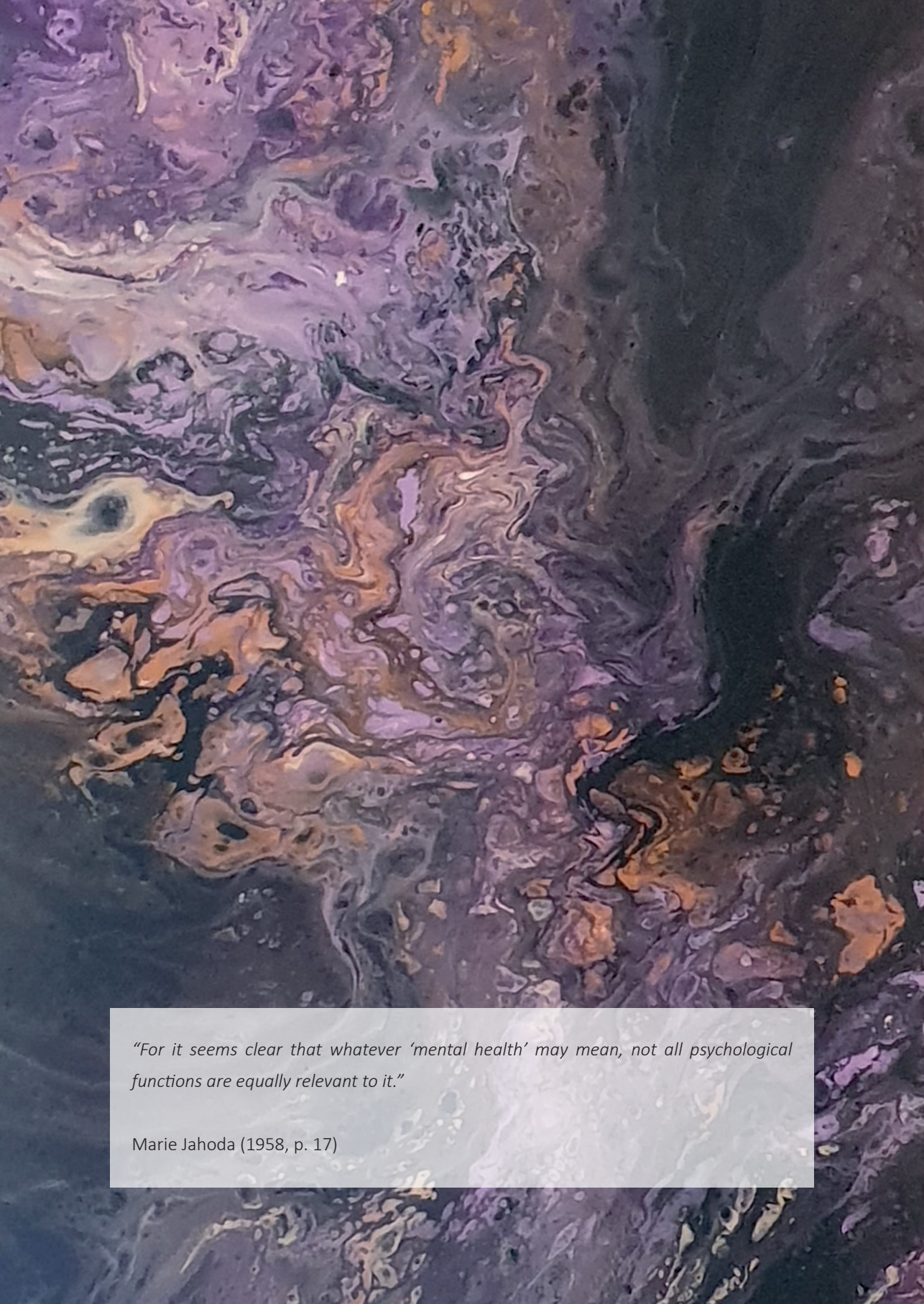

"For it seems clear that whatever 'mental health' may mean, not all psychological functions are equally relevant to it."

Marie Jahoda (1958, p. 17)

4

The psychometric network structure of mental health in eating disorder patients

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ABSTRACT

Objective

Psychometric network analysis has led to new possibilities to assess the structure and dynamics of psychiatric disorders. The current study focuses on mental health networks in patients with anorexia nervosa, bulimia nervosa, binge eating disorder, and other specified eating disorders (EDs).

Method

Network analyses were applied with five mental health domains (emotional, psychological & social well-being, and general & specific psychopathology) among 905 ED patients. Also, networks of 36 underlying symptoms related to the domains were estimated. The network stability, structure, and (bridge) centrality of the nodes were assessed for the whole sample and each ED type. Network differences between the ED types were also examined.

Results

ED psychopathology was only weakly connected with the well-being domains. Psychological well-being was the most central node in the domain network. The most central nodes in the symptom network were *feeling depressed*, *feeling worthless*, *purpose in life,* and *self-acceptance*. Bridge symptoms between well-being and psychopathology were *self-acceptance*, *environmental mastery*, *interested in life* and *feeling depressed*. There were no network differences between the ED types in both the domain and symptom networks.

Conclusions

This study shows novel associations between well-being and psychopathology in ED patients. Central domains and their underlying symptoms may be especially important to consider in treatment for promoting mental health in ED patients.

KEYWORDS

Eating disorders, Well-being, network analysis, Psychological well-being, Positive functioning, Positive mental health

INTRODUCTION

Psychiatric diseases, such as eating disorders (EDs) are traditionally explained with the medical disease model (Engel, 1977). In statistical terms, the medical disease model is considered a latent variable model (Borsboom, 2016). This means that the symptoms are understood to be caused by an underlying (biological) disorder. However, for many psychiatric diseases, there is no identifiable underlying disorder with a known common cause (Zachar & Kendler, 2007). EDs are currently understood as the result of a complex interaction between biological, psychological, and environmental factors (Himmerich, Bentley, Kan, & Treasure, 2019).

While clear (biological) causes may be discovered in the future, an alternative approach is to understand psychiatric disorders as networks of symptoms, caused and maintained by biological, psychological, and environmental mechanisms (Borsboom, 2016). Borsboom (2016) states that if these causal relationships are sufficiently strong, the symptoms may generate a level of feedback that makes them self-sustaining, leading to a network being stuck in a disorder state. Psychometric network theory proposes that this is a primary feature of mental disorders, which can be understood as strongly connected symptom networks (Borsboom, 2016). Developments in psychometric network analysis have led to new possibilities to examine and understand the structure and dynamics of psychiatric disorders. In these analyses, symptoms are specified as nodes, which can be associated with each other in a network. In a psychometric network, the centrality of nodes (e.g., the relative importance in a network compared to each other) can be estimated, as well as the strength of the association between nodes (i.e., edge-weights) (Epskamp, 2020; Epskamp & Fried, 2017).

ED pathology networks

There is an emerging body of literature examining the network structure of ED pathology in patients with anorexia nervosa (AN), bulimia nervosa (BN), binge eating disorder (BED), or other specified feeding and eating disorders (OSFED) (Christian et al., 2019; DuBois, Rodgers, Franko, Eddy, & Thomas, 2017; Elliott, Jones, & Schmidt, 2020; Forbush, Siew, & Vitevitch, 2016; Forrest, Jones, Ortiz, & Smith, 2018; Levinson et al., 2017; Perko, Forbush, Siew, & Tregarthen, 2019; Wang, Jones, Dreier, Elliott, & Grilo, 2019). These studies show that specific symptoms are more central in ED pathology networks than others. For instance, *weight-*

related concerns and *shape and weight over-evaluation* were the most central symptoms in several studies (DuBois et al., 2017; Elliott et al., 2020; Forbush et al., 2016; Forrest et al., 2018; Levinson et al., 2017; Smith et al., 2019). *Shape and weight over-evaluation* are considered a primary maintaining factor for ED symptoms in enhanced cognitive behavioral therapy (CBT-E), the first choice of treatment for EDs (Fairburn et al., 2015; Forrest et al., 2018). In a longitudinal study, it was found that *feeling fat* and *fear of weight gain* were among the most central symptoms, and baseline symptom centrality predicted posttreatment recovery status in patients with AN (Elliott et al., 2020).

ED pathology/co-morbidity networks

Associations between ED pathology and co-morbidity have also been examined recently (Elliott et al., 2020; Forrest et al., 2019; Levinson et al., 2018, 2017; Monteleone et al., 2019; Smith et al., 2019; Solmi, Collantoni, Meneguzzo, Tenconi & Favaro, 2019; Vanzhula, Calebs, Fewell, & Levinson, 2019). Networks with both ED pathology and general psychopathology (i.e., general distress, anxiety, and mood symptoms) showed several highly central symptoms in addition to the ED symptoms, such as *depression*, *anxiety*, *interpersonal sensitivity*, *ineffectiveness* (Monteleone et al., 2019; Solmi et al., 2019), and *nervousness*, *feeling overwhelmed*, *concentration difficulties*, and *low self-esteem* (Smith et al., 2019). In addition, several studies examined the centrality of bridge symptoms linking two communities of nodes, for instance, ED pathology and general psychopathology, with the bridge function from the R networktools package (Jones, 2020). Central bridge symptoms play a primary role in connecting two or more communities (Jones, Ma, & McNally, 2019). Specific bridge symptoms were found, relating ED pathology to general psychopathology, such as *sensitivity to physical sensations* (i.e., changes in appetite, feeling wobbly or dizzy) among patients with BN (Levinson et al., 2017) and *feelings of worthlessness*, *not wanting to eat in social situations* and *negative reactions to weighing oneself* among patients with AN (Elliott et al., 2020). Network analyses have also been applied to ED pathology and other specific psychopathology such as social anxiety or post-traumatic stress disorder (PTSD) (Levinson et al., 2018; Vanzhula et al., 2019). Levinson and colleagues (2018) found that *difficulty with drinking beverages* and *eating in public* were central bridge symptoms between ED pathology and social anxiety. Vanzhula and colleagues (2019) identified *binge eating*, *irritability* (PTSD), *desire for a flat stomach,* and *concentration problems* (PTSD) as the strongest bridge symptoms connecting ED pathology with PTSD. In a study examining ED pathology and

both general and specific psychopathology (anxiety, depression, obsessive-compulsive and post-traumatic stress problems) in patients with AN, it was found that *depression*, *personal alienation*, *low self-esteem,* and *interoceptive deficits* showed the highest bridge centrality (Monteleone et al., 2019).

Well-being and mental health

Patients with EDs do not only report high levels of co-morbidity but also lower levels of well-being compared to the general population (de Vos, Radstaak, Bohlmeijer, & Westerhof, 2018; Tomba, Offidani, Tecuta, Schumann, & Ballardini, 2014). Well-being consists of three core dimensions, emotional, psychological and social (Bohlmeijer, Bolier, Westerhof, & Walburg, 2012; Keyes, 2006, 2012; Westerhof & Keyes, 2008). Emotional well-being is about subjective happiness, comprising positive affect and being satisfied with one's life (Keyes, 2002). Psychological well-being is defined as positive individual mental functioning, indicated by six facets: self-acceptance, personal growth, autonomy, environmental mastery, positive relationships, and purpose in life (Ryff, 2014; Ryff & Singer, 1996). Social well-being concerns adequate societal functioning and comprises five dimensions: social actualization, contribution, integration, acceptance, and interest (Keyes, 1998).

Adequate levels of well-being are considered as necessary as low levels of psychopathology for mental health (Fava & Guidi, 2020; Keyes, 2005; Radstaak, Hüning, & Bohlmeijer, 2020; Westerhof & Keyes, 2010). The complete mental health or dual continua model describes that well-being and psychopathology are two related but distinct domains of mental health (Keyes, 2005; Westerhof & Keyes, 2010). This suggests that optimal levels in one domain do not necessarily lead to optimal levels in the other domain (Trompetter, Lamers, Westerhof, Fledderus, & Bohlmeijer, 2017). Factor analysis shows further support for the dual continua model, compared to alternatives (Keyes et al., 2008; Lamers, Westerhof, Bohlmeijer, Ten Klooster, & Keyes, 2011; Magalhães & Calheiros, 2017; Perugini, de la Iglesia, Castro Solano, & Keyes, 2017). Correlational studies report low or negligible (Magalhães & Calheiros, 2017; Perugini et al., 2017) to moderate correlations between well-being and general psychopathology (Peter, Roberts, & Dengate, 2011). In clinical populations, such as patients with anxiety, mood, ED, and personality disorders, moderate to high correlations between well-being and general psychopathology were found (de Vos et al., 2018; Franken, Lamers, Ten Klooster, Bohlmeijer, & Westerhof, 2018). However, correlations between well-being and

specific ED psychopathology were low and not even statistically significant for patients with BN and BED (de Vos et al., 2018). The strength of the correlations between well-being and ED-pathology were dependent on the type of pathology (i.e., general or specific), as well as the ED type (de Vos et al., 2018).

These associations have only been tested in separate bivariate analyses. Psychometric network analysis will provide additional knowledge on how the mental health dimensions are connected by controlling for each other's influence. In addition, the underlying symptoms of the mental health dimensions can be examined on centrality and how they are connected. Examining both well-being and psychopathology in a psychometric network is further substantiated by the perspective of people with lived experience. People who have recovered from an ED consider several aspects of well-being as fundamental criteria for recovery in addition to the absence of ED symptoms, such as self-acceptance, positive relationships, personal growth, and autonomy (de Vos et al., 2017). In addition, people who consider themselves recovered use other transdiagnostic criteria for recovery, besides ED pathology, such as general psychopathology, quality of life and social participation (Slof-Op 't Landt, Dingemans, de la Torre Y Rivas, & van Furth, 2019).

This study

Psychometric network studies among ED patients have primarily focused on ED pathology or co-morbidity networks. However, mental health is not only about symptoms of psychopathology but also about the presence of well-being. The network structure of overall mental health has not been examined among ED patients.

The first aim was to examine the network structure of the mental health domains. Five domains were distinguished: emotional, psychological, and social well-being, and general and specific (ED) psychopathology. The overall network structure and centrality of the domains were examined for each ED type. Also, differences in networks between ED types were examined. Research question (RQ)1 is, which nodes are most central in the domain mental health network, and RQ2, are there differences in the network structures and node strength centralities between the ED types?

The second aim was to examine networks of underlying symptoms that make up the mental

health domains among ED patients. RQ3 is, which nodes are most central and which nodes serve as a bridge symptom between well-being and psychopathology in the symptom mental health network of ED patients, and RQ4, are there differences in the network structure and node strength centrality between the ED types?

METHOD

Participants and procedure

Participants were ED patients receiving treatment at Stichting Human Concern, a specialized center for the treatment of EDs with five outpatient treatment centers located in the Netherlands. The inclusion criteria were: 1) a primary DSM 5 ED diagnosis at intake, 2) a minimum age of 17, since this is the minimum age for treatment at the center, 3) being able to understand and fill in the questionnaires, and 4) consent to participate in the research. Exclusion criteria for treatment were 1) not being able to write and understand the Dutch language, 2) severe and active auto-mutilation, 3) active psychosis, 4) severe depression, 5) active suicidal ideation, and 6) acute somatic complications. A total of 1066 patients who started treatment between March 2015 and September 2018 were screened for inclusion. Eleven patients did not have an ED diagnosis, 121 patients did not fill in the questionnaires, and 29 patients did not consent to have their data used for research purposes.

A psychiatrist sets the diagnosis in collaboration with an intake team consisting of a dietician, family therapist, and a psychologist. Patients followed outpatient treatment with sessions once or twice a week with a psychologist. A combination of the following methods was used in treatment: insight-giving therapy, cognitive-behavioral change, emotion-regulation, and food/weight management. Patients filled in questionnaires every three months as part of their treatment to monitor recovery. These results were discussed with the patient and within the multidisciplinary team to evaluate treatment. This study used these anonymized questionnaires, meaning that the study did not lead to any additional workload for patients. Patients were informed about the aims of the study and signed an informed consent stating that they could withdraw the possibility to include their data for scientific research. The Behavioral, Management, and Social Sciences Ethics committee of the University of Twente approved the study protocol.

Instruments

Eating disorder psychopathology

The 36 item Eating Disorder Examination Questionnaire (EDE-Q) was used to measure ED psychopathology (EDP domain) with the global score (Fairburn & Beglin, 1994). A seven-point Likert scale from 0 (not 1 day) to 6 (every day) was used to measure the frequency of symptoms in the last 28 days. An example item is: "Has your weight influenced how you think about (judge) yourself as a person?" Lower scores are indicative of lower EDP. The internal consistency of the global scale was .92.

General psychopathology

The symptomatic distress (SD) scale of the Outcome Questionnaire (OQ-45) (Jong et al., 2008) was used for the measurement of general psychopathology (GPP domain) (Warmerdam et al., 2017). The symptomatic distress scale has 25 items and shows good psychometric properties (Jong et al., 2008). Items are scored on a five-point Likert scale, ranging from 0 (never) to 4 (always). An example item is: "I feel irritated." The internal consistency of the SD scale was .91.

Well-being

The Mental Health Continuum Short Form (MHC-SF) was used to measure well-being (Keyes, 2002; Lamers et al., 2011). The MHC-SF measures overall, emotional, psychological, and social well-being with 14 items, rated on a six-point Likert scale ranging from 0 (never) to 5 (always). Emotional well-being (EWB domain) consists of three items measuring happiness, avowed life satisfaction, and interested in life. Psychological well-being (PWB domain) consists of six items measuring self-acceptance, positive relationships, autonomy, personal growth, environmental mastery, and purpose in life. Social well-being (SWB domain) consists of five items measuring social actualization, contribution, integration, acceptance, and interest. The internal consistency of the scales were .86, .83, and .73 for respectively emotional, psychological, and social well-being.

Analysis

One-way analysis of variance (ANOVA) with Games-Howell post hoc analyses and chi-square tests with post-hoc analyses were used to examine differences in background characteristics between the ED types.

Symptom network item selection

To estimate stable networks, the number of nodes in the symptom network had to be limited. Also, nodes should not represent the same underlying symptom (topological overlap) (Levinson et al., 2018). Two strategies were used to limit the number of nodes and prevent topological overlap, based on the procedure used by Levinson and colleagues (2020).

First, the authors assessed all items on relevance for the domain and topological overlap. For the measurement of EDP, we focused only on the core symptoms to limit the number of nodes. Seven of the 22 attitudinal EDE-Q items were selected based on a comparison study of short forms of the questionnaire (Machado, Grilo, Rodrigues, Vaz, & Crosby, 2020). The EDE-Q7 short-form items efficiently screen and measure core EDP (Grilo, Reas, Hopwood, & Crosby, 2015; Machado et al., 2020). For the measurement of GPP, 16 of the 25 OQ-45 SD items were used. The following items were excluded. “After heavy drinking, I need a drink the next morning to get going” showed a near-zero variance and was therefore not eligible for network estimation. Four items asking about physical symptoms (example item: “I have sore muscles”) were excluded because we were primarily interested in psychopathology. Four items showed substantial topological overlap with a well-being item and were therefore removed. “I feel no interest in things” was considered similar to the well-being question “how often did you feel interested in life” (EWB). “I am satisfied with my life” was considered similar to the question “how often did you feel satisfied with life” (EWB). “I like myself” was considered similar to the item “how often did you feel that you liked most parts of your personality” (PWB). “I am a happy person” was considered similar to the item “how often did you feel happy” (EWB). For the measurement of well-being, all 14 items of the MHC-SF were included.

In the second part, the correlations between the items were examined with the goldbricker function of the R networktools package (Jones, 2020). The goldbricker function compares dependent overlapping correlations in a network and is best implemented when overlapping items have already been removed theoretically by trained professionals (Levinson et al., 2018). Goldbricker function measures the proportion of correlations between items. Based on earlier research, 0.25 was used as a cut-off for a significant proportion and < .01 as the *p*-value for determining statistical significance (Levinson et al., 2018). Two EDE-Q items were significantly correlated (deliberately trying to limit the amount of food and trying to exclude

foods from diets). The second item was removed upon discussion, leading to 36 included items for the symptom network analyses. See Table 1 for an overview of the included symptoms and their description.

The original scales of the EDE-Q (global) and MHC-SF (emotional, psychological, social) were used for the domain networks. However, because of the topological overlap and items not strictly measuring GPP, a revised scale with the selected 16 items of the OQ-45 SD scale was used. The internal consistency of this scale was .89.

Table 1. Node descriptions and strength centrality of the symptom mental health networks

Node	Symptom	Short description	Strength centrality		
			EDs	AN	OSFED
Emotional well-being (EWB)					
WB1	happiness	feeling happy, joy, enjoyment	0.53	0.95	0.46
WB2	interested in life	being interested in life	1.49	1.25	1.29
WB3	life satisfaction	feeling satisfied with life	0.12	0.92	-0.16
Social well-being (SWB)					
WB4	contribution	feeling that one's life is useful to society	0.33	-0.48	0.57
WB5	integration	having a sense of belonging to, and support from a community	-0.84	-0.93	-0.65
WB6	actualization	believing that people, social groups, and society can evolve positively	-0.33	-0.42	-0.90
WB7	acceptance	having a positive attitude towards others while accepting and acknowledging people's differences and their complexity	-0.27	-0.42	-0.12
WB8	coherence	being interested in society or social life	-1.23	-0.91	-1.49
Psychological well-being (PWB)					
WB9	self-acceptance	holding warm and positive attitudes towards oneself and past life	1.53*	1.86*	1.04
WB10	Environmental mastery	the ability to manage responsibilities and mold environments to one's needs	-0.13	-0.40	-0.08
WB11	positive relationships	having warm, satisfying, trusting personal relationships and being capable of empathy and intimacy and being open and personal to others.	-0.04	-0.52	0.03
WB12	personal growth	Showing insight into one's own self and potential, having a sense of development	-0.57	-0.06	-1.10
WB13	autonomy	exhibiting a self-direction that is often guided by one's own socially accepted and conventional internal standards	-0.61	-0.13	-0.99
WB14	purpose in life	holding goals and beliefs that affirm one's sense of direction in life and feeling that life had a purpose and meaning	1.79*	1.96*	1.61*

Table 1 continued from previous page

Node	Symptom	Short description	Strength centrality		
			EDs	AN	OSFED
Eating disorder psychopathology (EDP)					
ED1	limit food	deliberately trying to limit the amount of food to influence shape or weight	-0.91	-0.91	-0.80
ED2	food rules	trying to follow definite rules regarding eating to influence shape or weight	-0.38	-0.24	-0.48
ED3	influence weight	has weight influenced thinking (judging) about self as a person	0.29	0.11	0.41
ED4	influence shape	has shape influenced thinking (judging) about self as a person	0.86	1.06	0.59
ED5	dissatisfied weight	being dissatisfied with weight	-0.49	-0.75	-0.26
ED6	dissatisfied shape	being dissatisfied with shape	0.70	0.72	1.11
General psychopathology (GPP)					
GP1	fatigue	feeling tired quickly	-0.56	-0.79	-0.06
GP2	self-blame	blaming self for things happening	-0.12	0.02	-.53
GP3	irritated	feeling angry or irritated	-1.35	-1.23	-.82
GP4	suicidal thoughts	having thoughts of ending one's own life	-0.86	-1.36	-0.68
GP5	feeling weak	feeling fragile or weak	1.01	0.69	1.52*
GP6	anxiety	feeling fearful or anxious	0.36	0.55	0.22
GP7	feeling worthless	feeling worthless	1.88*	1.58*	1.62*
GP8	concentration issues	having difficulty to concentrate on tasks	-0.81	-0.34	-0.76
GP9	feeling hopeless	feeling hopeless or desperate	1.04	1.04	1.43
GP10	disturbing thoughts	disturbing thoughts which come to the mind and a person cannot get rid of.	-0.02	-0.21	0.09
GP11	feeling worrisome	feeling that something bad is going to happen	-0.28	-0.63	-0.10
GP12	afraid of open spaces	feeling afraid of open spaces, of driving, or being on buses, subways, etc.	-1.47	-1.72	-0.68
GP13	nervousness	feeling nervous or jumpy	0.16	0.84	-0.40
GP14	mind wrong	feeling that something is wrong with one's own mind	-0.86	-0.62	-1.15
GP15	sleep problems	having trouble falling or staying asleep	-2.11	-1.88	-2.23
GP16	feeling depressed	feeling sad, blue, or down	2.11*	1.42	2.21*

Network estimation and centrality measures

Regularized networks were estimated in the R package qgraph using the Gaussian graphical model (Epskamp, Borsboom, & Fried, 2018; Epskamp, Cramer, Waldorp, Schmittmann, & Borsboom, 2012). For the first and second research question, partial correlations were estimated (interval scales). For the third and fourth research questions, polychoric correlations were estimated (ordinal scales). For all networks, the Graphical LASSO (GLASSO) with the Extended Bayesian Information Criterion (EBIC) was used to regularize the networks (Epskamp et al., 2018). Each line (edge-weights) between two nodes (symptoms) reflects the partial or polychoric correlations, and the GLASSO shrinks low correlations to 0 to reduce false-positive errors (Epskamp et al., 2018).

Node centrality was examined for all networks with the strength measure. Strength centrality (*S*) is a measure of a node's overall involvement in the network and is calculated as the sum of all absolute connections to other nodes (McNally, 2016). Although there are other centrality measures, such as betweenness or closeness, recent work shows that these may not be considered valid and meaningful for centrality in psychometric networks (Bringmann, Elmer, & Epskamp, 2019). Bridge symptoms (Jones et al., 2019) are symptoms that connect two communities of nodes and can be quantified with bridge centrality (Jones et al., 2019). Bridge strength centrality (*BS*) was used to quantify the connectivity, measured as the sum of all absolute connections of a symptom with symptoms in another community, and was estimated with the bridge function of the networktools R package (Jones, 2020). The three domains of well-being were clustered into one community (well-being), and the two domains of psychopathology in a second community based on the assumptions of the dual-continua model. This allowed for testing which symptoms connect well-being with psychopathology.

Network stability

The stability of all networks was assessed with the R package bootnet (Epskamp et al., 2018). First, the accuracy of the edge-weights was estimated by drawing non-parametric bootstrapped 95% confidence intervals (CIs) with 2,000 bootstraps. Second, the stability of the strength centrality was estimated using the correlation-stability (CS) coefficient with 2,000 bootstraps. The CS-coefficient gives an indication of the maximum proportion of cases that can be dropped from the dataset such that with 95% probability, the correlation between original centrality indices and centrality indices based on the subsets remains above (by default) 0.7 (Epskamp et al., 2018). The CS-coefficient should not be below 0.25 and preferably above 0.5 (Epskamp et al., 2018).

Network comparisons

The network comparison test (NCT) package in R (van Borkulo et al., 2017) was used to identify network differences between the ED types (research questions 2 and 4). The NCT is a two-tailed permutation test and can be used for examining differences in both cross-sectional groups and repeated measures (van Borkulo et al., 2017). The overall network structure and global strength centrality were examined, and p-values < .05 indicate a significant difference. We tested only for differences in specific edge-weights or strength centrality when the overall tests were statistically significant in order to minimize the likelihood of type I error (Van Borkulo et al., 2017).

RESULTS

Patient characteristics

The average age of the patients was 26.9 years (*SD* = 8.9), and the age of onset and duration of the ED was 16.2 years (*SD* = 5.5) and 10.1 years (*SD* = 9.2). One hundred and twenty-eight patients (14.1%) had a personality disorder, and 562 patients (62.1%) had a co-morbid psychiatric disorder. There were no differences between the ED types in the start age of the ED, Welch's $F(3, 294.41) = 1.79$, $p = 0.073$ and in the proportions of patients having a personality disorder, $\chi^2(3) = 3.46$, $p = 0.326$ or other psychiatric disorder, $\chi^2(3) = 1.69$, $p = 0.640$. However, statistically significant differences between the ED types were found for age, Welch's $F(3,297.41) = 14.81$, $p < 0.001$, duration of the ED, Welch's $F(3,295.59) = 19.33$, $p < 0.001$, and body mass index (BMI kg/m^2), Welch's $F(3, 254.07) = 302.94$, $p < 0.001$. See Table 2 for an overview of the results of the post-hoc analyses with the specific differences between the ED types.

Table 2. patient characteristics

	ED	AN	BN	BED	OSFED	Statistics	
N	905	318	195	80	312		
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*F*	*Post-hoc analysis*
Age	26.9 (8.9)	24.6 (7.9)	27.1 (7.5)	31.2 (10.4)	28.0 (9.6)	14.81*	BED > AN, BN; AN < BN, OSFED
Startage ED	16.2 (5.5)	16.4 (4.8)	16.6 (5.3)	14.8 (6.5)	16.2 (6.0)	2.33	
ED duration	10.1 (9.2)	7.6 (7.7)	9.5 (7.2)	15.9 (11.0)	11.6 (10.3)	19.33*	BED > AN, BN, OSFED; BN < OSFED; AN < BN, OSFED;
BMI kg/m^2	21.7 (7.2)	16.5 (1.7)	22.5 (3.9)	32.2 (8.4)	23.9 (7.4)	302.94*	AN < BN, BED, OSFED; BED > BN, OSFED; BN < OSFED
	n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)	χ^2	*Post-hoc analysis*
Personality disorder	128 (14.1%)	54 (17%)	24 (12.3%)	9 (11.3%)	41 (13.1%)	3.46	
Co-morbid disorder**	562 (62.1%)	200 (62.9%)	127 (65.1%)	49 (61.3%)	186 (59.6%)	1.69	

Note: * *p*-value < .001, ** Co-morbid disorders include mood and anxiety, developmental, trauma-related, neurocognitive and addictive disorders.

Domain mental health networks

Research question 1 and 2 concerned the network structure and potential differences between the ED types of the domain mental health networks. First the accuracy of the networks was tested. The overall network structure was considered stable for the ED, AN, BN and OSFED networks with relatively small edge-weights CI's (see the supporting information, https://doi.org/10.1002/erv.2832, for the figures). The BED network showed somewhat larger CI's compared to the other networks. The strength centrality was excellent for the overall ED (CS(cor = .7) = .75), AN (CS(cor = .7) = .75), BN (CS(cor = .7) = .67) BED (CS(cor = .7) = .60) and OSFED (CS(cor = .7) = .75) network.

Network estimates

Figure 1 represents the domain mental health networks per ED type. All networks show positive associations between the well-being domains and between the psychopathology domains. The associations between well-being and psychopathology were negative, with the strongest edge-weights between EWB, PWB, and GPP. EDP was not, or only weakly connected with the well-being domains.

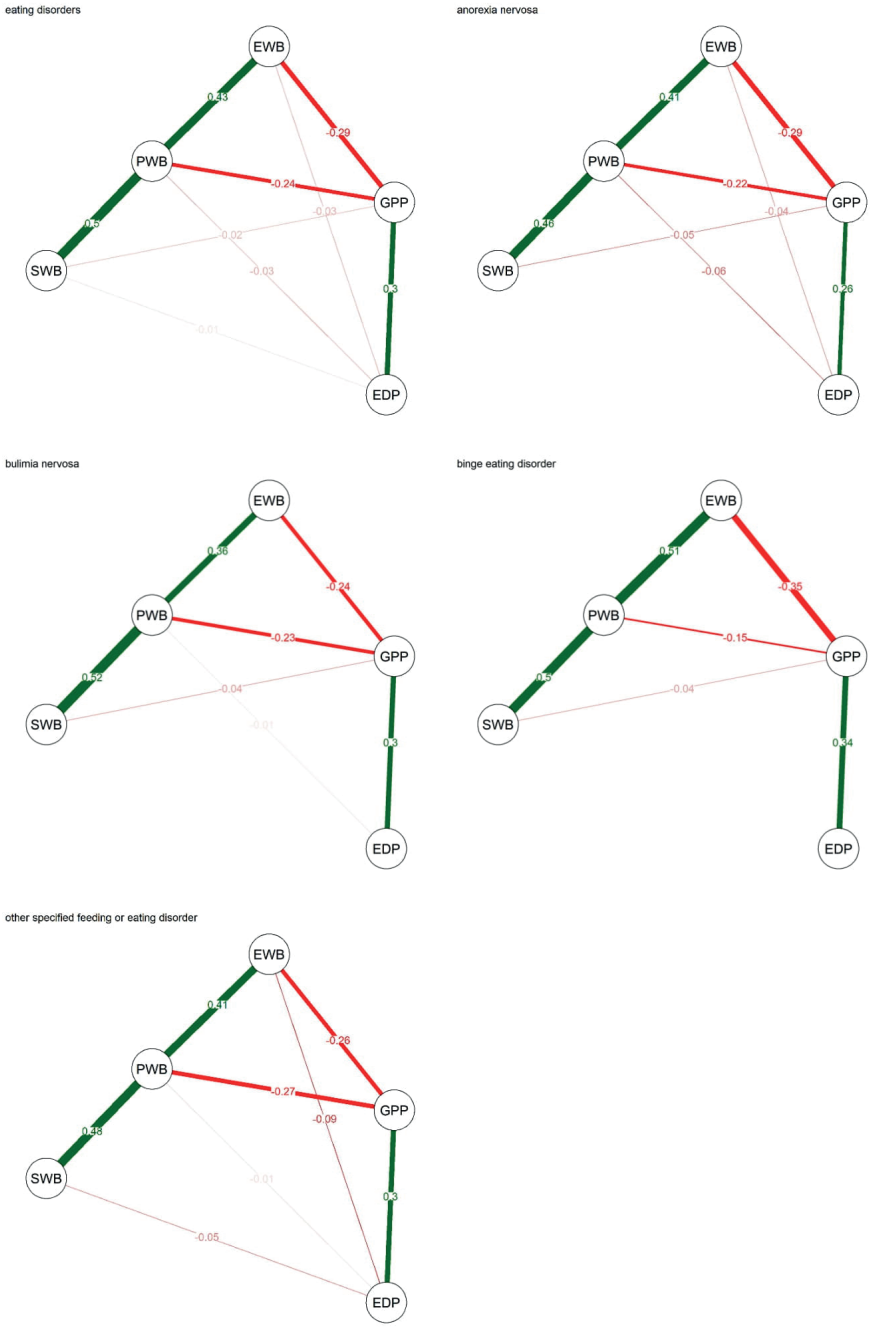

Figure 1. Domain mental health networks for each ED type. EDP = eating disorder psychopathology, EWB = emotional well-being, GPP = general psychopathology, PWB = psychological well-being, SWB = social well-being.

Table 3 shows the strength (*S*) centralities of the nodes and the mean scores of the domains. The results demonstrate that the most central overall mental health domain across all ED types is PWB (*S* = 1.37), followed by GPP (*S* = .26) and EWB (*S* = .21), and the least central domain is EDP (*S* =-1.33).

Table 3. Mean scores and strength centrality and mean scores of the domain mental health networks for each ED type

Node	Description	ED		AN		BN		BED		OSFED	
		M (SD)	*S*	*M (SD)*	*S*	*M (SD)*	*S*	*M (SD)*	*S*	*M (SD)*	*S*
	psychopathology										
EDP	ED	3.84 (1.21)	-1.33	3.77 (1.21)	-1.41	4.11 (1.12)	-1.48	3.46 (1.01)	-1.38	3.79 (1.26)	-1.28
GPP	General	34.35 (9.80)	.26	36.05 (9.43)	.16	35.08 (9.51)	.26	29.56 (8.02)	.18	32.94 (10.13)	.22
	Well-being										
EWB	Emotional	2.44 (1.11)	.21	2.24 (1.16)	.37	2.44 (1.07)	.07	2.72 (1.08)	.48	2.58 (1.06)	.27
PWB	Psychological	2.37 (1.01)	1.37	2.23 (1.02)	1.30	2.30 (.99)	1.30	2.67 (1.04)	1.25	2.50 (.99)	1.37
SWB	Social	2.13 (1.00)	-.49	2.11 (.95)	-.42	1.98 (1.01)	-.15	2.27 (1.14)	-.53	2.22 (1.00)	-.58

Note: *S* = strength centrality reported in standardized scores

Network comparisons

The bootstrapped difference test (NCT) did not show significant differences in the network structure and global strength between the AN, BN BED, and OSFED networks on overall network structure and global strength (see the supporting information, https://doi.org/10.1002/erv.2832).

Symptom mental health networks

Research questions 3 and 4 concerned the symptom mental health network structure and potential differences between the ED types. The accuracy of the networks was tested. The bootstrapped CI's of the edge-weights were considered relatively stable in the total ED network, as well as the AN, BN, and OSFED network. The BED network was, however, considered unstable (see the supporting, https://doi.org/10.1002/erv.2832, information for the figures). The overall strength centrality for the symptom networks were stable for the ED (CS(cor = .7) = .75), AN (CS(cor = .7) = .59) and OSFED network (CS(cor = .7) = .52) The BN (CS(cor = .7) = .21) and BED (CS(cor = .7) = .00) networks were however considered unstable, and therefore not estimated and used for comparisons.

Network estimates

Figure 2 shows the symptom mental health network for the total ED group. The network shows overall positive associations between the well-being symptoms, positive associations between the psychopathology symptoms, and negative associations between both. The strongest bridge symptoms (≥ 1.5 *SD* from the *BS* mean) for the ED network were; *self-acceptance* (WB9, *BS* = 0.40), *environmental mastery* (WB10, *BS* = 0.35), *interested in life* (WB2, *BS* = 0.28) and *feeling depressed* (GP16, *BS* = 0.28). For the AN and OSFED network respectively the following bridge symptoms were found, *self-acceptance* (WB9, *BS* = 0.35), *feeling depressed* (GP16, *BS* = 0.32), *interested in life* (WB2, *BS* = 0.32), and; *environmental mastery* (WB10, *BS* = 0.41), *feeling hopeless* (GP9, *BS* = 0.35), *self-acceptance* (WB9, *BS* = 0.34) and *feeling depressed* (GP16, *BS* = 0.33). The AN and OSFED networks and BS centrality of all symptoms can be found as supporting information, https://doi.org/10.1002/erv.2832.

The node strength centrality of the networks can be found in figure 3 and Table 1. The most central nodes (≥ 1.5 SD from the mean *S* centrality) : were *feeling depressed* (GP16, *S* = 2.11), *feeling worthless* (GP7, *S* = 1.88), *purpose in life* (WB14, *S* = 1.79) and *self-acceptance* (WB9, *S* = 1.53) for the ED network, *purpose in life* (WB14, *S* = 1.96), *self-acceptance* (WB9, *S* = 1.86) and *feeling worthless* (GP7, *S* = 1.58) for the AN network and *feeling depressed* (GP16, *S* = 2.21), *feeling worthless* (GP7, *S* = 1.62), *purpose in life* (WB14, *S* = 1.61) and *feeling weak* (GP5, *S* = 1.52) for the OSFED network.

Comparisons

The AN and OSFED networks were compared on overall network structure and strength centrality. No differences were found in the overall network structure (*M* = 0.20, *p* > .05) and global network strength (*S* = 0.18, *p* > .05).

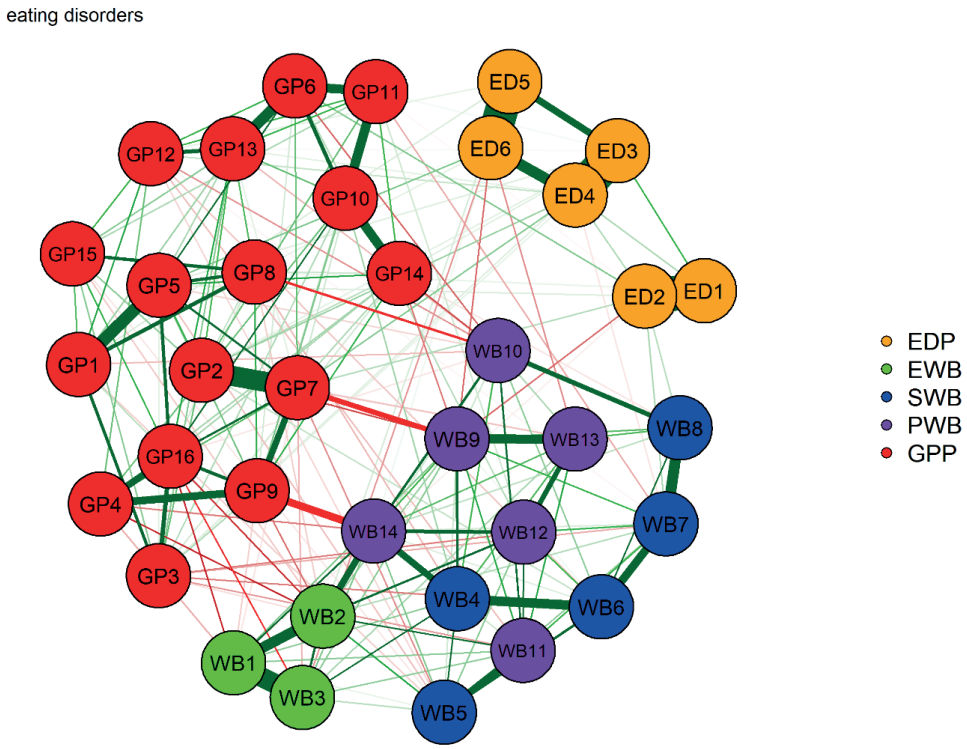

Figure 2. Symptom mental health network. Descriptions of the nodes can be found in Table 1.

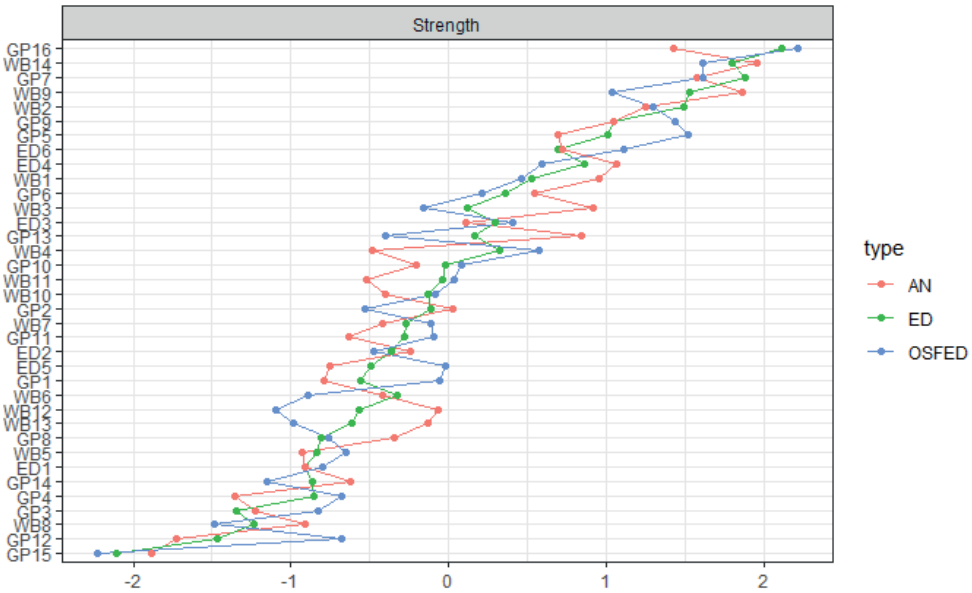

Figure 3. Strength centrality of the symptom mental health networks. Standardized scores in descending order. Descriptions of the nodes can be found in Table 1.

DISCUSSION

Well-being and psychopathology are two distinct but related dimensions of mental health according to the dual continua model (Keyes, 2012). From a psychometric perspective, it is unclear which mental health domains (i.e., emotional, psychological, and social well-being, general and ED specific psychopathology) and their underlying symptoms are central and related to each other. This study aimed to examine psychometric networks of mental health in ED patients on a domain and symptom level.

Domain mental health networks

The strongest negative associations between well-being and psychopathology were between EWB, PWB, and GPP, while the associations of well-being with EDP were negligible. These results correspond with earlier research (de Vos et al., 2018) and imply that improvements in specific ED psychopathology may not necessarily lead to changes in well-being and vice versa. Several pathways may explain the absence of significant associations between well-being and EDP. For instance, a low insight in, or denial of the disease's severity may contribute to inaccuracy in self-reporting among ED patients (Vitousek, Watson, & Wilson, 1998). This may also apply to other aspects of mental health, such as well-being. Based on clinical experience, some patients may still function well in society, have an academic career, and therefore report adequate (social) well-being despite the illness. Lastly, binge eating and other ED behaviors may serve as a mechanism to cope with daily stressors and anxiety, making it possible to function relatively adequately in society, as long as the disadvantages, such as shame, low self-worth, interpersonal problems, and physical consequences do not overweigh the advantages of being able to cope with daily stressors (Goss & Gilbert, 2002).

The most central node (RQ1) in the domain network was PWB, followed by EWB and GPP. Theories on mental health have emphasized PWB as essential for living a good and fulfilling life (Ryff & Singer, 1996, 2008). ED patients report lower PWB than controls (de Vos et al., 2018; Tomba et al., 2014), while its presence is considered essential for personal recovery (de Vos et al., 2017). In a qualitative meta-analysis, it was found that recovered individuals consider several aspects of PWB, such as self-acceptance, positive relationships, personal growth, and autonomy as fundamental criteria for ED recovery (de Vos et al., 2017).

No differences between the ED types were found (RQ2) in the overall network structure and strength centrality. These results correspond with earlier research examining bivariate correlations between the mental health domains, where low correlations (edge-weights) between well-being and EDP were found for AN and OSFED and no relevant correlations (edge-weights) for BN and BED (de Vos et al.,2018). However, it is important to note that an unknown but substantial number of the same patients were present in this study and the earlier study from de Vos and colleagues (2018). The results suggest that the overall structure of mental health may be independent of the ED type. This is consistent with the idea that well-being and GPP are transdiagnostic constructs. Fava & Guidi (2020) note that the pursuit of mental health cannot be conceived as a therapeutic intervention for specific mental disorders but as a transdiagnostic strategy incorporated in individualized therapeutic plans.

Symptom mental health networks

The most central symptoms (RQ3) in the overall mental health network were *feeling depressed*, *feeling worthless*, *purpose in life* and *self-acceptance*, and the most influential bridge symptoms *self-acceptance*, *environmental mastery*, *interested in life*, and *feeling depressed*. This is largely in line with earlier co-morbidity network studies. Earlier studies considered *feeling depressed* and *feeling worthless* also as highly central symptoms in co-morbidity networks among ED patients (Elliott et al., 2020; Smith et al., 2019; Solmi, Collantoni, et al., 2019). A general conclusion of the co-morbidity network studies was that these central transdiagnostic symptoms should be addressed in treatment in addition to the ED symptoms in order to improve overall psychopathology. This study adds to the knowledge that several influential well-being symptoms should also be considered in a transdiagnostic approach for treatment addressing mental health.

Several influential ED symptoms were found in network pathology studies (DuBois et al., 2017; Elliott et al., 2020; Forbush et al., 2016; Levinson et al., 2017; Wang et al., 2019), such as *weight-related concerns* and *shape and weight over-evaluation.* However, ED symptoms were not influential in the mental health networks. While relationships between happiness, depression, and perceived body image have been substantiated in an earlier study (Stokes & Frederick-Recascino, 2003), this study showed relatively small edge-weights between ED pathology and well-being.

Based on the results, we conclude that in order to improve overall mental health, a focus in treatment may be warranted on influential symptoms, such as *feeling depressed*, *feeling worthless*, *purpose in life* and *self-acceptance.* Although the role and importance of centrality in network analysis are still under debate (Bringmann et al., 2019), network theory suggests that changes or improvements on these central (bridge) symptoms may lead to improvements of the overall mental health network, while changes in peripheral symptoms may less likely lead to changes in other symptoms (Borsboom, 2016; McNally, 2016). A recent network study among patients with AN showed that central symptoms predict posttreatment outcomes and clinical impairment, which supports the validity of network theory in that central symptoms may have a strong influence on clinical impairment and recovery (Elliott et al., 2020).

This study found no differences in the symptom networks between AN and OSFED (RQ4). These results may support a transdiagnostic approach in clinical treatment to promote mental health in ED patients, as suggested by Fava and Guidi (2020). However, the network stability for patients with BN and BED was insufficient in this exploratory study. Also, differences between BN, BED, and the other ED types were found on several background characteristics. The insufficient stability of the networks and potentially confounding background characteristics make it difficult to draw firm conclusions across all ED types. New research is needed to further examine the transdiagnostic approach in clinical treatment for ED patients.

Several psychological treatments have been developed specifically targeting some of these mental health symptoms or aspects. These treatments may be effective by addressing influential mental health symptoms. Enhanced cognitive-behavioral therapy (CBT-E) for EDs was developed to target feelings of worthlessness, hopelessness, and low self-esteem (Cooper & Fairburn, 2011). Acceptance and commitment therapy (ACT) helps patients choose life directions in various domains (i.e., meaning and purpose in life) with committed action (Hayes, Luoma, Bond, Masuda, & Lillis, 2016). Compassion-focused therapy (CFT) strongly emphasizes the importance of alleviating self-criticism and shame by fostering self-acceptance or compassion (Gilbert, 2009). Well-being therapy addresses all six aspects of PWB (Fava, Rafanelli, Cazzaro, Conti, & Grandi, 1998; Fava et al., 2005; Radstaak et al., 2020). Outcome studies show that these so-called third-wave behavioral treatments effectively alleviate symptoms in ED patients (Linardon, Fairburn, Fitzsimmons-Craft, Wilfley, & Brennan, 2017). However, little is known about whether these treatments help to improve patients'

overall mental health. Gains in positive functioning are frequently not considered in outcome studies, despite the impaired PWB in clinical populations (Tomba & Tecuta, 2016). Studies should focus on the effectiveness of interventions on both ED pathology and transdiagnostic criteria.

Limitations

A limitation is that the network analyses were performed on a cross-sectional level. This means that no causal inferences or prognostic consideration can be drawn, and longitudinal study designs with multiple measurements, using a random intercept cross-lagged panel model (Hamaker, Kuiper, & Grasman, 2015) or panel data network analysis (Epskamp, 2020) may provide more definite knowledge on the associations between the domains and potential causal determinants. We excluded several items from the general psychopathology domain showing topological overlap with well-being items. However, excluding them from the psychopathological domain instead of the well-being domain was arbitrary and may have led to different results if excluded from the well-being domain. However, the pathological items were positively worded, for instance, *interested in life*, which seems to be more about well-being or positive mental health. We considered nodes with an *S SD* ≥ 1.5 as the most central nodes, which is arbitrary. There are currently no specific rules of thumb as we are aware of how many nodes should be classified as central. It is possible that not all relevant symptoms for mental health were included. For instance, it was found that resilience was considered important for mental health and recovery among ED patients (Calvete, Las Hayas, & Gómez Del Barrio, 2017; de Vos et al., 2017). We were not able to obtain data on psychotropic drug use among the patients, while the use of psychotropic drugs may alter feelings of well-being and psychopathological symptoms. Another limitation is that the BN and BED networks were not considered stable and, therefore, not tested. This also means that the overall ED network results and conclusions should be interpreted with caution and may not apply to BN and BED patients. It is recommended to test the symptom networks in larger groups of patients with BN and BED. At last, self-report measures were used, which are subject to measurement biases (Anglim, Horwood, Smillie, Marrero, & Wood, 2020).

Conclusion

This study shows novel associations between well-being and psychopathology in ED patients. Psychological well-being was the most central mental health domain, and the most central underlying symptoms were *feeling depressed*, *feeling worthless*, *purpose in life* and *self-acceptance*. Primary bridge symptoms between well-being and psychopathology were *self-acceptance*, *environmental mastery*, *interested in life*, and *feeling depressed.* A transdiagnostic approach to ED treatment, focusing on central psychopathological and well-being symptoms may be warranted in order to improve overall mental health in patients with EDs.

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"Everything can be taken from a man but one thing: the last of the human freedoms — to choose one's attitude in any given set of circumstances, to choose one's own way"

Viktor E. Frankl (2006, p. 86)

5

Exploring associations between personality trait facets and emotional, psychological and social well-being in eating disorder patients

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ABSTRACT

Purpose

Personality functioning is strongly linked to well-being in the general population. Yet, there is a lack of scientific knowledge about the pathways between personality trait facets and emotional, psychological, and social well-being in eating disorder (ED) patients. The general aim was to examine potential associations between maladaptive personality trait facets and the three main dimensions of well-being.

Methods

Participants were 1187 female ED patients who were referred for specialized treatment. Patients were diagnosed with anorexia nervosa (31.7%), bulimia nervosa (21.7%), binge eating disorder (11%), and other specified eating disorders (35.5%). The Personality Inventory for the DSM 5 (PID-5) was used to measure twenty-five trait facets, and well-being was measured with the Mental Health Continuum Short Form (MHC-SF). Multiple hierarchical regression analyses were applied to examine potential associations between personality and well-being while controlling for background and illness characteristics.

Results

Personality trait facets led to a statistically significant increase of the explained variance in emotional (38%), psychological (39%), and social well-being (26%) in addition to the background and illness characteristics. The personality trait facets anhedonia and depression were strongly associated with all three well-being dimensions.

Conclusion

Personality traits may play an essential role in the experience of well-being among patients with EDs. In order to promote overall mental health, it may be critical for clinicians to address relevant personality trait facets, such as anhedonia and depression, associated with well-being in treatment.

Level of Evidence: Level V, cross-sectional descriptive study

INTRODUCTION

Personality trait facets are relatively stable patterns of behaviors, cognitions, and emotions, which develop during childhood and adolescence. Traits can be placed on a continuum from normality to pathology (dimensional), which means that they can develop in a healthy way or become maladaptive (Esbec & Echeburúa, 2015).

Decades of research highlight that personality plays a critical role in how people approach and appraise their lives and experience well-being (Anglim, Horwood, Smillie, Marrero, & Wood, 2020). Personality traits are strongly linked with the experience of subjective and psychological well-being (PWB) in the general population (Anglim et al., 2020). Subjective well-being, also described as emotional well-being (EWB), consists of three dimensions, life satisfaction, positive and negative affect (Lamers, Westerhof, Bohlmeijer, Ten Klooster, & Keyes, 2011). PWB or Eudaimonic well-being is about living a good life and is conceptualized in six dimensions; self-acceptance, positive relationships, autonomy, environmental mastery, personal growth, and purpose in life (Lamers et al., 2011). Social well-being (SWB) has been proposed as a third main factor of well-being, consisting of five dimensions, actualization, coherence, integration, contribution, and acceptance (Lamers et al., 2011). Well-being and psychopathology are considered two related but distinct dimensions of mental health, with potentially different determinants (Iasiello, van Agteren, & Cochrane, 2020).

In a comprehensive meta-analysis, it was found that on a domain level, neuroticism, extraversion, and conscientiousness were strongly associated with EWB and PWB (Anglim et al., 2020). However, analysis on a trait facet level (i.e., a specific and unique aspect of a broader personality domain) provided a more detailed description of the relationships between personality and well-being and improved the incremental prediction by 20% (Anglim et al., 2020). Multiple personality trait facets, such as anxiety, hostility, depression, self-consciousness, vulnerability, warmth, assertiveness, positive emotions, trust, competence, achievement striving, and self-discipline, were moderately to strongly associated with EWB and PWB (Anglim et al., 2020).

Studies examining personality functioning in patients with EDs have primarily focused on explaining ED pathology (Farstad, McGeown, & von Ranson, 2016). Personality is strongly

linked to the onset and maintenance of eating disorders (EDs), in particular perfectionism, neuroticism (i.e., depression, anxiety, anhedonia, impulsiveness, and stress vulnerability), avoidance motivation, sensitivity (to social rewards), extraversion, and self-directedness (Farstad et al., 2016).

Knowledge concerning the role of personality functioning for the experience of well-being in ED patients is sparse, while they experience lower levels compared to the general population (de Vos, Radstaak, Bohlmeijer, & Westerhof, 2018). Available studies have focused primarily on specific aspects of personality such as resilience or specific domains of Quality of Life (QoL) (Calvete, Las Hayas, & Gómez Del Barrio, 2017). Although some QoL domains have conceptual overlap with dimensions of well-being (e.g., emotional and social functioning), PWB is often neglected as a domain in QoL measures. However, PWB has a solid theoretical background, dating back to Greek philosophy, and is considered one of the most influential models concerning mental health (Anglim et al., 2020; Lamers et al., 2011).

Well-being is also important to consider as a measure for recovery in addition to symptom remission because people who have recovered from an ED consider the presence of well-being essential for recovery (de Vos et al., 2018). Since personality trait facets are strongly linked to the onset and maintenance of EDs and the experience of well-being in the general populations, it may function as an underlying maintaining factor for overall mental health (i.e., the presence of well-being and low levels of psychopathology). In order to improve well-being, as well as reduce ED pathology among patients, it may therefore be crucial to promote the strengthening of adaptive personality trait facets in treatment. Examining which specific personality trait facets are linked to the dimensions of well-being in ED patients may provide clinicians with knowledge on which trait facets to focus on in treatment.

This study, therefore, aimed to examine potential associations between maladaptive personality trait facets and the three main dimensions of well-being (emotional, psychological, and social) on a trait facet level in a transdiagnostic ED sample of patients with anorexia nervosa (AN), bulimia nervosa (BN) binge eating disorders (BED) and other specified feeding and eating disorders (OSFED).

METHODS

Participants and procedure

Participants were Dutch ED patients referred for treatment at Stichting Human Concern, a specialized center for the treatment of EDs. General practitioners referred patients to specialized care with a reference for further diagnosis or treatment. The inclusion criteria were: 1) a minimum age of 17 years, 2) a primary ED diagnosis at intake, achieved according to the criteria of the diagnostic and statistical manual (DSM-5), 3) being able to understand and fill in the questionnaires, and 4) consent to participate in the research. A total of 1356 patients were screened between January 2016 and March 2020 and received a written brochure about the aim of the study and options for contacting the researchers. Informed consent included that participants were informed about the study and could withdraw their data for scientific research at any time. The Behavioral, Management, and Social Sciences Ethics committee of the University of Twente approved the study protocol. One hundred and thirty-two patients did not give consent, and 37 men were excluded leading to a total of 1187 included patients. Patients were diagnosed by a psychiatrist in collaboration with an intake team consisting of a family therapist, dietician, and psychologist.

Data collection

The following background and illness characteristics were collected during intake: Age (*M* = 26.9 years, *SD* = 8.9, range 17 – 66), start age ED (16.5 years, *SD* = 5.6, range 4 – 55), ED duration (9.6 years, *SD* = 8.9, range .25 – 49), BMI kg/m^2 (*M* = 22.5, *SD* = 7.4, range 10.2 – 59), ED diagnosis (32.1% AN, 22.2% BN, 11% BED and 34.7% OSFED) and having a comorbid personality disorder (11%), or other psychiatric disorder (50.8%). Other psychiatric disorders were, mood and anxiety, developmental, trauma-related, neurocognitive and addictive disorders.

Personality trait facets were measured with the Dutch self-report Personality Inventory for DSM 5 (PID-5) (Bastiaens et al., 2015) according to the dimensional model of personality (Esbec & Echeburúa, 2015). The PID-5 is a 220-item self-report measure designed to assess personality domains (antagonism, detachment, disinhibition, negative affectivity, and psychoticism) and twenty-five underlying trait facets, included in the DSM-5 alternative dimensional model (Bastiaens et al., 2015). The items are evaluated on a 4-point Likert scale,

ranging from 0 (very false or often false) to 3 (very true or often true). An example question from the personality trait facet impulsivity is "I always do things on the spur of the moment." Higher scores are indicative of higher maladaptive personality functioning. The internal consistencies were acceptable to excellent with excellent mean inter-item correlations (see Table 1).

Table 1. mean scores of the PID-5 personality trait facets and scale statistics

Trait facet	*n* of questions	*M* (*SD*)	Cronbach's alpha (α)	Mean inter-item correlations
Anhedonia	8	1.26 (.60)	.83	.37
Anxiousness	9	1.58 (.62)	.85	.38
Attention seeking	8	.78 (.60)	.86	.44
Callousness	14	.19 (.23)	.75	.23
Deceitfulness	10	.47 (.43)	.82	.34
Depression	14	1.35 (.67)	.92	.44
Distractibility	9	1.50 (.72)	.90	.50
Eccentricity	13	.81 (.63)	.92	.48
Emotional lability	7	1.66 (.69)	.87	.48
Grandiosity	6	.28 (.35)	.69	.30
Hostility	10	.87 (.52)	.83	.33
Impulsivity	6	.83 (.67)	.89	.57
Intimacy avoidance	6	.82 (.72)	.84	.48
Irresponsibility	7	.56 (.50)	.77	.33
Manipulativeness	5	.52 (.50)	.72	.34
Perceptual dysregulation	12	.63 (.46)	.78	.26
Perseveration	9	1.45 (.60)	.82	.33
Restricted affectivity	7	.97 (.62)	.81	.39
Rigid perfectionism	10	1.52 (.68)	.88	.43
Risk taking	14	1.15 (.50)	.87	.32
Separation insecurity	7	1.12 (.64)	.80	.36
Submissiveness	4	1.65 (.75)	.86	.60
Suspiciousness	7	1.00 (.57)	.78	.35
UBE	8	.37 (.44)	.79	.33
Withdrawal	10	1.00 (.62)	.90	.46

Note: UBE = unusual beliefs and expectations

Well-being was measured with the Dutch Mental Health Continuum Short Form (MHC-SF) (Lamers et al., 2011). The MHC-SF consists of 14 items and measures emotional (*n* = 3), psychological (*n* = 6), social (*n* = 4) and overall well-being. The items are rated on a 6-point Likert scale ranging from 0 (never) to 5 (always), and an example question from the dimension PWB is "During the past month, how often did you feel that you had warm

and trusting relationships." Higher scores are indicative of higher levels of well-being. The internal consistency of the scales was .83 for emotional, .82 for psychological, and .72 for social well-being.

The Dutch 36 item Eating Disorder Examination (EDE-Q) was used to measure ED psychopathology (EDP) with the global score (Fairburn & Cooper, 1993). The internal consistency of the global scale was .92.

Analysis

Three multiple hierarchical regression analyses were run with emotional, psychological, and social well-being as dependent variables and the background and illness characteristics and personality trait facets as independent variables. A hierarchical model was tested in two steps and compared on model fit, explained variance and stability of the associations. In step 1, the background and illness characteristics were entered, and in step 2, personality trait facets were added. The assumptions for linearity, homoscedasticity, and normality were met as inspected with QQ plots and histograms. There was no multicollinearity between the independent variables as inspected with the variance inflation factor (highest VIF 4.4 for age). Regression analyses were performed in SPSS, version 26. A post-hoc power analysis (power = 1 – type II error) was performed in R statistics, package PWR, v1.3-0. The test power was .72 to detect a small effect size and 1 to detect a large effect size.

RESULTS

Overall, the most severe maladaptive personality trait facets ($M \geq 1.50$) among ED patients were found for the following trait facets (see Table 1): *emotional lability submissiveness*, *anxiousness*, *rigid perfectionism* and *distractibility*. The mean well-being scores were M = 2.52 (SD = 1.07) for emotional, M = 2.55 (SD = 0.99) for psychological and M = 2.23 (SD = 0.99) for social well-being. The mean global EDE-Q score was 4.12 (SD = 1.04). A correlation matrix of the variables can be found in the supplements, https://doi.org/10.1007/s40519-021-01107-6.

The model in step 1, with age, start age ED, BMI kg/m^2, ED diagnosis, personality disorder and other psychiatric disorder as independent variables was statistically significant in predicting EWB, R^2 = .15, F(10, 1154) = 20.94, p < .001; adjusted R^2 =.15, PWB, R^2 = .13, F(10, 1154) = 16.79, p < .001; adjusted R^2 = .12 and SWB, R^2 = .06, F(10, 1154) = 7.00, p < .001; adjusted R^2 = .05. The full model in step 2 with the addition of the personality trait facets led to a statistically significant increase in the explained variance for EWB, R^2 =.38, F-change(25, 1129) = 37.04, p < .001; adjusted R^2 = .52, PWB, R^2 = .39, F-change(25, 1129) = 37.09, p < .001; adjusted R^2 =.51 and SWB, R^2 =.26, F-change(25, 1129) = 17.51, p < .001; adjusted R^2 =.30.

Statistically significant variables associated with well-being in step 2 can be found in Table 2. *Anhedonia* (β =-.46, emotional; β =-.28, psychological; β =-.23, social)*,* and *depression* (β =-.34, emotional; β =-.32, psychological; β =-.16, social) were associated with all well-being dimensions over and beyond demographic and illness characteristics. *Eccentricity* (β =.07) and *submissiveness* (β =.12) were associated with EWB, in addition to *EDP severity* (β =-.07). *Distractibility* (β =.07)*, emotional lability* (β =-.08)*,* and *manipulativeness* (β =.08) were associated with PWB, in addition to *BN* (β =-.09). *Manipulativeness* (β =.08)*, suspiciousness* (β =-.10)*,* and *withdrawal* (β =-.17) were associated with SWB, in addition to having a *personality disorder* (β =-.06).

Table 2. Results regression analysis: (standardized)beta's of the independent variables for each dependent variable

	Emotional well-being						Psychological well-being						Social well-being					
	Step 1			Step 2			Step 1			Step 2			Step 1			Step 2		
	B	*SE*	β	B	*SE*	β	B	*SE*	β	B	*SE*	β	B	*SE*	β	B	*SE*	β
Background characteristics																		
Age	0.01	0.01	0.08	0.00	0.01	0.02	.01	.01	.08	0.00	0.01	0.01	0.01	0.01	0.05	0.00	0.01	0.01
Startage ED	-0.00	0.01	-0.01	-0.00	0.01	-0.02	-.01	.01	-.03	-0.01	0.01	-0.05	-0.01	0.01	-0.03	-0.01	0.01	-0.05
ED duration	-0.01	0.01	-0.05	0.00	0.01	-0.02	-.01	.01	-.10	-0.01	0.01	-0.06	-0.01	0.01	-0.07	-0.01	0.01	-0.06
BMI (kg/m^2)	0.01	0.01	0.09*	0.01	0.01	0.04	.01	.01	.08	0.01	0.00	0.04	0.00	0.01	-0.01	0.00	0.00	-0.02
EDP severity	-0.26	0.03	-0.26***	-0.08	0.02	-0.07**	-.22	.03	-.23***	-0.01	0.02	-0.02	-0.15	0.03	-0.16***	0.00	0.03	0.00
AN	-0.25	0.08	-0.11**	-0.09	0.06	-0.04	-.18	.07	-.09*	-0.02	0.06	-0.00	-0.04	0.08	-0.02	0.09	0.07	0.04
BN	-0.08	0.08	-0.03	-0.01	0.06	0.00	-.23	.07	-.10**	-0.17	0.06	-0.09*	-0.17	0.08	-0.07*	-0.07	0.07	-0.03
BED	-0.15	0.12	-0.04	-0.01	0.09	0.00	-.15	.11	-.05	-0.06	0.09	-0.07	0.00	0.12	0.00	0.09	0.10	0.03
Personality disorder	-0.31	0.10	-0.09**	-0.13	0.07	-0.04	-.24	.09	-.08**	-0.10	0.07	-0.02	-0.25	0.09	-0.08**	-0.17	0.08	-0.05*
Psychiatric disorder	-0.40	0.06	-0.19***	-0.08	0.05	-0.04	-.35	.06	-.18***	-0.05	0.04	-0.03	-0.20	0.06	-0.10**	0.01	0.05	0.00
Personality trait facets																		
Anhedonia				-0.82	0.07	-0.46***				-0.46	0.06	-0.28***				-0.38	0.07	-0.23***
Anxiousness				0.08	0.06	0.05				0.10	0.05	0.07				0.01	0.07	0.01
Attention seeking				-0.03	0.05	-0.02				0.06	0.05	0.04				0.02	0.06	0.01
Callousness				0.21	0.13	0.04				0.04	0.12	0.01				-0.25	0.15	-0.06
Deceitfulness				-0.13	0.08	-0.05				-0.13	0.08	-0.06				0.02	0.09	0.01
Depression				-0.55	0.07	-0.34***				-0.47	0.06	-0.32***				-0.25	0.07	-0.16**
Distractibility				-0.02	0.04	-0.01				-0.09	0.04	-0.07*				0.00	0.05	0.00
Eccentricity				0.12	0.05	0.07*				-0.03	0.05	-0.02				-0.04	0.06	-0.02
Emotional lability				-0.04	0.05	-0.03				-0.11	0.04	-0.08*				-0.04	0.05	-0.03
Grandiosity				-0.14	0.08	-0.05				0.09	0.08	0.03				0.06	0.05	0.03
Hostility				-0.03	0.06	-0.02				0.09	0.06	0.05				-0.06	0.07	-0.03
Impulsivity				0.00	0.04	0.00				0.06	0.04	0.04				0.04	0.05	-0.03
Intimacy avoidance				-0.07	0.04	-0.05				-0.02	0.03	-0.01				0.06	0.04	0.04

Table 2 continued from previous page

	Emotional well-being						Psychological well-being						Social well-being					
	Step 1			Step 2			Step 1			Step 2			Step 1			Step 2		
	B	*SE*	β	B	*SE*	β	B	*SE*	β	B	*SE*	β	B	*SE*	β	B	*SE*	β
Irresponsibility				0.08	0.06	0.04				-0.09	0.06	-0.05				-0.10	0.07	-0.05
Manipulativeness				0.12	0.07	0.06				0.16	0.06	0.08*				0.15	0.07	0.08*
Percept. dysreg.				-0.11	0.08	-0.05				-0.01	0.08	0.00				-0.07	0.09	-0.03
Perseveration				0.10	0.06	0.05				0.02	0.06	0.01				0.07	0.07	0.04
Restricted affec.				0.09	0.05	0.05				-0.02	0.05	-0.01				0.09	0.06	0.05
Rigid perfectionism				-0.05	0.05	-0.03				0.00	0.04	0.00				0.00	0.05	0.00
Risk taking				-0.01	0.06	-0.01				0.02	0.05	0.01				0.02	0.06	0.01
Separation ins.				0.00	0.04	0.00				-0.04	0.04	-0.03				-0.03	0.05	-0.02
Submissiveness				0.17	0.04	0.12***				-0.05	0.03	-0.04				0.04	0.04	0.03
Suspiciousness				-0.04	0.05	-0.02				-0.08	0.05	-0.05				-0.17	0.05	-0.10**
UBE				0.03	0.07	0.01				0.03	0.07	0.01				-0.08	0.08	-0.03
Withdrawal				-0.02	0.06	-0.01				-0.08	0.05	-0.05				-0.27	0.06	-0.17***
R^2	.15			.54			.13			.52			.06			.32		
F	20.94***			37.12***			16.71***			35.00***			7.00***			15.22***		
ΔR^2	-			.38			-			.39			-			.26		
ΔF	-			37.04***			-			37.09***			-			17.51***		

Note: Emotional, psychological and social well-being are the dependent variables, * = *p*-value < .05, ** = *p*-value < .01, *** = *p*-value < .001. Step 1 = regression analysis with patient background characteristics, Step 2 = regression analysis, with step 1 variables including the personality trait facets, BMI = body mass index, EDP severity = eating disorder psychopathology severity, Psychiatric disorder = other psychiatric disorders, except for personality disorders, Percept. Dysreg. = perceptual dysregulation, Restricted affec. = restricted affectivity, Separation ins. = separation insecurity, UBE = unusual beliefs and expectations.

DISCUSSION

Decades of research have highlighted the critical role of personality for the experience of well-being in the general population (Anglim et al., 2020). Studies among ED patients have primarily examined the role of personality in explaining ED pathology (Farstad et al., 2016). Much less is known about its role for experiencing well-being, while ED patients report lower functioning on well-being compared to the general population. The addition of personality trait facets above patient background and illness characteristics, led to a statistically significant increase of the explained variance in EWB (38%), PWB (39%), and SWB (26%). Personality trait facets may play a critical role in the experience of well-being among ED patients. *Anhedonia* and *depression* were strongly and negatively associated with all three well-being dimensions. These traits are also well linked to ED symptomatology (Farstad et al., 2016). Personality may function as an underlying mechanism maintaining both psychopathological symptoms and the experience of well-being. Therefore, it may be critical to focus on strengthening personality trait facets, especially *Anhedonia* and *depression*, in treatment to promote overall mental health (i.e., low levels of psychopathology and adequate well-being). Farstad and colleagues (2016) also concluded that it is important to capitalize on knowledge about personality in the treatment of EDs, for instance, by tailoring treatments based on personality dimensions. In addition, it may be fruitful to examine the effectiveness of treatments on ED symptom remission and well-being, specifically targeting personality functioning, such as dialectical behavior therapy (DBT) and schema therapy (Linardon, Fairburn, Fitzsimmons-Craft, Wilfley, & Brennan, 2017).

Several personality trait facets were associated with specific well-being dimensions that may be of interest to clinicians. *Emotional lability* and *distractibility* were negatively associated with PWB. Studies have suggested that *emotional lability* is also associated with EDs, particularly those that involve binge eating (Farstad et al., 2016). *Withdrawal* and *suspiciousness* were associated with lower EWB. *Withdrawal* is related to avoidance motivation and lower levels of extraversion, which are found to be frequently present in individuals with EDs, as well as *suspiciousness* among individuals with BN (Farstad et al., 2016). The review of Farstad and colleagues (2016) suggests that individuals with EDs consistently avoid situations associated with punishment, which may be a pathway to lower societal functioning and SWB.

Further relations were that *eccentricity* and *submissiveness* were associated with EWB and *manipulativeness* with PWB and SWB. There may be specific pathways to explain these associations, which should be a topic for further investigation. For instance, a person who is anxious for situations which are perceived as punishment, for instance for receiving criticism from others, may not only avoid this (*withdrawal*) but may behave *submissive* and with that experience adequate levels of EWB as long as they can avoid criticism. Also, for *manipulativeness*, this may be a way to achieve things in one's environment, such as getting things their way in treatment or daily life. Achieving things in the own environment is related to environmental mastery (PWB) (Lamers et al., 2011). Third-wave behavior therapies, such as acceptance and commitment therapy and compassion-focused therapy, may be especially effective in promoting mental health because they target these response-focused emotion regulation strategies by fostering acceptance, mindfulness, metacognition, psychological flexibility, and reducing experiential avoidance (Linardon et al., 2017).

Overall, similar associations between personality trait facets and well-being were found in our sample as in the general population (Anglim et al., 2020). *Hostility* and *callousness* were not related to well-being in our sample, in contrary to the general population (Anglim et al., 2020). Some personality traits are not measured by the PID-5, such as trust, competence, achievement striving, and self-discipline.

Limitations

It has been suggested that the measurement of stable personality traits may lead to biased results in adolescent samples because they are still in development (Esbec & Echeburúa, 2015). In this sample, however, the average age of the patients was 27 years, and the majority of the sample were adult patients. A major limitation is that this is a cross-sectional study meaning that no causal inferences can be made. All patients were females referred for specialized ED treatment, so results may not be generalizable to other ED patients in the community. No information was obtained from patients who did not give consent for this study. It is unknown how this may have affected the results. Also, there may be overlap in the constructs measuring well-being and personality trait facets (Anglim et al., 2020). Another limitation is that this study did not examine differences between ED types, while it is suggested that different personality trait facets may be linked to specific ED types (Farstad et al., 2016), although we did control for ED type in the analysis. At last, the questionnaires

were self-report measures, and results may have been influenced by social desirability as reported by Anglim and colleagues (2020).

Conclusions and implications

In support of earlier studies in the general population, maladaptive personality trait facets may play a critical role in the experience of well-being among patients with EDs. Clinicians should be aware of potential associations between maladaptive personality traits such as anhedonia and depression with well-being. A focus on these personality traits in treatment may be critical to promote and improve well-being and overall mental health in ED patients.

What is already known on this subject?

Multiple personality trait facets are well linked with the experience of emotional, psychological, and social well-being in the general population, while much less is known about potential associations in ED patients.

What do we now know as a result of this study that we did not know before?

Several personality trait facets are moderately or strongly linked with one or more well-being dimensions in patients with EDs. Anhedonia and depression were strongly associated with all well-being dimensions. Personality functioning may be important to focus on in treatment in order to improve overall mental health.

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Part 3

Longitudinal effects in mental health during outpatient treatment



"Each person is a unique individual. Hence, psychotherapy should be formulated to meet the uniqeness of the individuals's needs, rather then tailoring the person to fit the Procrustean bed of a hypothetical theory of human behavior."

Milton H. Erickson (2000, p. 17)

6

Modeling trajectories of change in psychopathology and well-being during eating disorder outpatient treatment

This chapter has been submitted as:

de Vos, J.A., Radstaak, M., Bohlmeijer, E.T., & Westerhof, G.J. Modeling trajectories of change in psychopathology and well-being during eating disorder outpatient treatment. (2021).

ABSTRACT

Introduction

There are considerable differences in how patients react to eating disorder (ED) treatment. Exploratory modeling of symptom change trajectories during treatment leads to scientific knowledge about how patients respond to interventions, which may have prognostic value. The aim of this study was to identify change trajectories of ED psychopathology and well-being during treatment in a transdiagnostic sample.

Method

Routine outcome monitoring data of 442 patients were used with five time-points (three monthly) during a year of outpatient treatment. ED psychopathology (EDE-Q) and well-being (MHC-SF) were used as primary measures. A series of latent growth mixture models were applied to model trajectories of change in distinct classes. Multinomial logistic regressions were applied to test for patient characteristics predicting class membership probability.

Results

A model with three latent classes was most parsimonious for both ED psychopathology and well-being. For ED psychopathology, a high baseline severity and slow recovery class, a high baseline severity followed by a substantial recovery class, and a moderate baseline severity and no significant recovery class were found. For well-being, a low baseline well-being, followed by a slow growth class, a low baseline and substantial growth class and a moderate and stable well-being class was found. General psychopathology, early symptom change, hope for recovery, intrinsic motivation, and the ED type were predictive of class membership in either ED psychopathology or well-being.

Discussion

This study shows substantial variability in change trajectories of ED psychopathology and well-being, modeled in meaningful latent recovery classes. These results may have clinical implications, such as adjusting treatments for patients based on class membership and related patient characteristics.

INTRODUCTION

Eating disorders (ED's), such as anorexia nervosa (AN), bulimia nervosa (BN), and binge eating disorder (BED), are psychiatric diseases (American Psychiatric Association, 2013), with a lifetime prevalence of around 5% (Treasure, Claudino, & Zucker, 2010). ED's can lead to severe physical, social and psychological impairment, chronic conditions and low quality of life, and high levels of co-morbidity and mortality are common (Jenkins, Hoste, Meyer, & Blissett, 2011; Klump, Bulik, Kaye, Treasure, & Tyson, 2009; Mond, Hay, Rodgers, & Owen, 2012; Murray, Loeb, & Le Grange, 2018; Smink, Hoeken, & Hoek, 2012). Psychological therapies are strongly recommended in the treatment of EDs, and several therapies have an evidence base, such as cognitive-behavioral therapy (CBT), family therapy, and interpersonal psychotherapy (Hay et al., 2014). However, a substantial portion of patients does not benefit from treatments (Linardon, Wade, de la Piedad Garcia, & Brennan, 2017; Murray et al., 2018).

Patients who receive treatment respond differently in terms of symptom changes (Melchior et al., 2016). It is highly relevant to detect these different change trajectories because they are related to treatment outcomes (Castonguay, Barkham, Lutz, & Mcaleavey, 2013; Melchior et al., 2016). Change trajectories can be investigated by defining (a priori) classifications or by exploratory modeling of the data. A priori classifications are usually binary, such as a class for rapid versus non-rapid response (e.g., MacDonald, Trottier, & Olmsted, 2017; Raykos, Watson, Fursland, Byrne, & Nathan, 2013). A disadvantage of defining classifications a priori is that it may unintentionally discount other response patterns relevant to treatment outcomes (Espel-Huynh et al., 2020). Methods for exploratory modeling of change allow distinguishing classes of patients with similar change trajectories during treatment (Muthén & Muthén, Linda, 2000; Preacher, Wichman, MacCallum, & Briggs, 2008; Uher et al., 2010). It is also possible to associate these change trajectories with background characteristics and predict class membership probability (Preacher et al., 2008). Knowledge about the identification of classes of patients with similar symptom change trajectories may help identify and improve treatments for specific subgroups of patients.

Research on exploratory modeling of symptom change trajectories in ED samples is still limited (Espel-Huynh et al., 2020). Several investigations have found clinically relevant patterns of change in body weight in AN (Berona, Richmond, & Rienecke, 2018; Jennings,

Gregas, & Wolfe, 2017; Makhzoumi et al., 2017), binge eating in BED (Hilbert et al., 2019), and overall ED pathology in a transdiagnostic sample (Espel-Huynh et al., 2020). Individual weight gain trajectories in patients with AN during inpatient and hospital treatment could be modeled in distinct classes. These classes were described differently in the studies but usually contained a class of rapid, moderate, and slow change (Berona et al., 2018; Jennings et al., 2017; Makhzoumi et al., 2017). Several patient characteristics were associated with weight gain class membership, such as mood disorders and parental expressed emotion (Berona et al., 2018). Hilbert et al. (2018) examined early change trajectories in binge eating, measured weekly during four months of outpatient CBT in adults with BED. They found four distinct classes of early change; a class with persistent binge eating at a low level and three classes with decreasing binge eating during treatment starting from varying baseline levels. These classes significantly predicted binge eating at six-month follow-up (Hilbert et al., 2019). Patients with low initial levels of binge eating and an early decrease were better off at follow-up, while stable binge eating over the course of treatment and, in particular, higher baseline levels of binge eating predicted a less favorable outcome (Hilbert et al., 2019). In a recent study from Espel-Huyn and colleagues (2020), change trajectories during a minimum stay of 21 days in a residential care setting were examined in a transdiagnostic sample of 360 ED patients. Change was measured weekly with a self-report instrument measuring ED pathology, such as ED behaviours and weight and shape concern (Espel-Huynh et al., 2020). Three latent classes emerged; a gradual response, a rapid response and a static response class with different baseline levels. They also found differences in clinical characteristics between the classes, such as body mass index (BMI), compensatory behaviours and ED pathology severity. They concluded that patients followed heterogeneous response patterns associated with differential treatment outcomes and suggested that tailoring a clinical intervention to a patient trajectory type may improve treatment response (Espel-Huynh et al., 2020).

However, researchers have suggested that the assessment of treatment response should include symptomatology and levels of well-being (Fava & Guidi, 2020; Trompetter, Lamers, Westerhof, Fledderus, & Bohlmeijer, 2017). Well-being is considered as an essential aspect of mental health and encompasses three main domains, emotional, psychological, and social (Bohlmeijer, Bolier, Westerhof, & Walburg, 2012; Deci & Ryan, 2008; Jahoda, 1958; Keyes, 2002; Ryff & Keyes, 1995; Ryff & Singer, 1996; World Health Organization, 2005). The dual-continua model postulates that psychopathology and well-being are related but distinct

aspects of mental health and should not be considered as two ends of one continuum (Franken, Lamers, Ten Klooster, Bohlmeijer, & Westerhof, 2018; Keyes, 2005; Lamers, Westerhof, Bohlmeijer, Ten Klooster, & Keyes, 2011; Lamers, Westerhof, Glas, & Bohlmeijer, 2015; Peter, Roberts, & Dengate, 2011; Trompetter et al., 2017; Westerhof & Keyes, 2008). Preliminary studies support the dual continuum model in patients with EDs (de Vos, Radstaak, Bohlmeijer, & Westerhof, 2018, 2021). A cross-sectional study examining the relationship between ED symptoms and well-being in a transdiagnostic sample found that the correlation between ED psychopathology and well-being was low for the overall group and even absent for patients with BN and BED (de Vos et al., 2018). These results have relevance for measuring change during treatment. For instance, in a sample of patients with depressive symptoms following acceptance and commitment therapy, it was found that the majority of the patients improved on either symptoms or well-being, but not on both (Trompetter et al., 2017). They noted that psychopathological symptoms and well-being should be monitored separately.

An additional argument to consider well-being as a measure for treatment response comes from the patient perspective on recovery (de Vos et al., 2017; Pettersen & Rosenvinge, 2002; Slof-Op 't Landt, Dingemans, de la Torre Y Rivas, & van Furth, 2019; Wetzler et al., 2020). A systematic review and qualitative meta-analysis showed that individuals who have recovered from an ED indicate several well-being dimensions, such as self-acceptance, positive relationships with others, autonomy and personal growth, as necessary for recovery as symptom remission (de Vos et al., 2017). Patients with EDs also report lower levels of well-being compared to the general population (de Vos et al., 2018).

Research aim

To conclude, exploratory modeling provides knowledge about change during treatment. Studies show the potential value of exploring interindividual change and associated patient characteristics, which may be considered a novel direction for the development of personalized psychiatry (Cuijpers, Ebert, Acaturk, Andersson, & Cristea, 2016). Building on Espel-Huyn and colleague's (2020) work, this study aimed to identify latent classes of recovery trajectories for ED psychopathology and growth trajectories of well-being during ED outpatient treatment over a 12-month duration. To our knowledge, there are no publications to date exploring change trajectories of both ED pathology and well-being during ED outpatient treatment in a transdiagnostic sample. The following research questions were addressed: 1) which latent

classes for ED psychopathology and well-being can be identified with exploratory modeling of observational data, and 2) are patient characteristics associated with class membership?

METHODS

Procedure

A naturalistic design was used based on routine outcome measurement (ROM) data during outpatient treatment in a specialized ED treatment center in the Netherlands. ROM data from the first twelve months of treatment was used. Questionnaires were administered at baseline and subsequently every three months, resulting in a total of five measurements. The data collection took place between March 2015 and August 2018.

Outpatient treatment was given in weekly (twice a week when necessary) sessions consisting of psycho-education, food management, cognitive behavioral therapy, and insight-oriented psychotherapy. Relationships and family functioning were also addressed in therapy. Treatment progress was evaluated by a multidisciplinary team consisting of a psychiatrist, (clinical) psychologist, dietician, and a family therapist. Primary clinicians had a professional degree as counselors or psychologists and were actively hired based on a history of lived experience with an ED. These clinicians were trained at the treatment center to professionally use their experiential knowledge during treatment before working as clinicians (Vos et al., 2016).

The inclusion criteria for this study were patients with a) a minimum age of 16 years, b) a DSM5 ED diagnosis at the start of treatment diagnosed by a psychiatrist, c) a minimum of 6 months treatment, d) at least the first measurement (baseline) and two of the other four measurements were filled out and e) a signed informed consent. Patients were informed about the aims of this study and signed an informed consent stating that they could at any point terminate the possibility to include their data in this scientific research. The Behavioral, Management, and Social Sciences Ethics Committee of the University of Twente approved this study protocol (registration number BCE15484).

In total, 679 patients who started treatment between March 2015 and May 2017 were

screened, and 442 patients were included in the study. Two-hundred-and-thirty-seven patients were excluded due to not signing the informed consent, missing the baseline measure, or two or more post-baseline data points. Information about dropouts during treatment can be found in Figure 1.

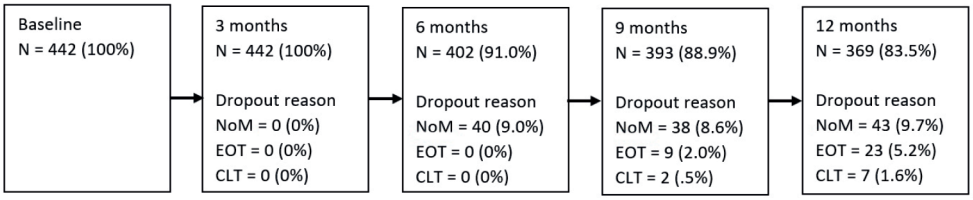

Figure 1. Information about dropout of patients during the study. NoM = no measurement at time point, patient has not filled in the questionnaire; EOT = no measurement due to end of treatment occurring after the previous time-point; CLT = patient was referred to clinical treatment, and outpatient measurements were stopped.

Assessments

Patient characteristics

The following characteristics were collected during the intake assessment; ED duration, age at the start of the ED, BMI (kg/m^2), treatment history, co-morbidity, and traumatic events.

Eating disorder psychopathology (EDP).

The original 36-item Eating Disorder Examination Questionnaire (EDE-Q) was used for the repeated measures (Fairburn & Beglin, 1994). The global scale has 22 items and is considered a valid index of the general level of EDP and shows good psychometric properties (Aardoom, Dingemans, Slof Op't Landt, & Van Furth, 2012). The frequency of symptoms in the last 28 days is rated using a 7-point Likert scale ranging from 0 (not one day) to 6 (every day). An example item is: "on how many of the past 28 days have you had a definite desire to have a totally flat stomach." The internal consistency at each time point was T1 = .92, T2 = .92, T3 = .94, T4 = .95, and T5 = .95. Lower scores are indicative of lower EDP.

Well-being (WB).

The Mental Health Continuum Short Form (MHC-SF) was used to measure WB. The MHC-SF measures emotional, psychological, and social WB and gives an overall impression of WB (Lamers et al., 2011). The MHC-SF has good convergent and discriminant validity (Lamers et al., 2011). The questionnaire has 14 items, rated on a six-point Likert scale, ranging from

0 (never) to 5 (always). An example item is: "during the past month, how often did you feel interested in life". The internal consistency at each time point for the total WB scale was T1 = .90. T2 = .91, T3 = .93, T4 = .93, and T5 = .93. Higher scores indicate higher WB.

General psychopathology

General psychopathology was measured with the Symptomatic Distress scale of the Outcome Questionnaire (OQ-45). The OQ-45 is a measure of general psychopathology severity and exhibits good psychometric properties (Jong, Nugter, Lambert, & Burlingame, 2008). The internal consistency in this sample was .91. Lower scores are indicative of lower psychopathology.

Clinician's assessment of patient characteristics

After the first three months of treatment, clinicians were asked to reflect on several patient characteristics that may be associated with treatment response. A panel group consisting of clinicians and former patients found consensus on several characteristics. These questions were: intrinsic motivation for treatment and recovery, hope for recovery, capacity to solve problems, resilience, insight into the illness, constructive family functioning, and meaningful daily functioning. The outcomes were used to develop a questionnaire with items rated on a four-point Likert scale, ranging from 0 (low) to 4 (high). An example of a checklist item is "The (internal) motivation (willingness to change) of the patient is."

Early change in treatment

Early change in treatment was based on the reliable change score of the EDE-Q global score, measured as the score at three months minus the score at the start of treatment divided by the standard error of measurement, calculated with the internal consistency and *SD* of this sample (Jacobson & Truax, 1991).

Analysis

Exploring for latent classes (recovery groups)

Analyses were conducted using MPlus version 8 (Muthén & Muthén, 2017). A series of latent growth mixture models (LGMM) were applied to model the time course of interindividual trajectories of change. LGMM assumes that patterns of observed change trajectories are based on underlying processes, which can be estimated as a series of growth parameters

(Muthén & Muthén, 2017). Growth parameters, such as shape (linear, quadratic), baseline scores (intercept), and rate of change (slope), are specified to best approximate longitudinal patterns from the observed data. Other advantages are that LGMM permits missing data without causing complications, and no data imputation is needed. This leads to enhanced statistical power compared to traditional types of longitudinal analysis (Curran, Obeidat, & Losardo, 2010; Preacher et al., 2008).

Basic LGMM requires assumptions, such as normally distributed scores, and missing values must be missing (completely) at random (Curran et al., 2010). The normal distribution was checked by assessing the skewness and kurtosis, and missingness was checked with Little's MCAR test (Little, 1998). The longitudinal measures (i.e., mean scores on the EDE-Q and MHC-SF) were normally distributed (highest skewness value =-.62, EDE-Q at start treatment, highest kurtosis value = -.95 EDE-Q at T5). Little's MCAR test suggests that data is missing completely at random for the longitudinal EDP measures $\chi^2(24) = 27.831$, $p > .05$, and Well-being measures $\chi^2(24) = 34.944$, $p > .05$. In addition, robust maximum likelihood estimator (MLR) was used to address missing data (Byrne, 2012). MLR makes use of all available data points. The sample size in this study was adequate for detecting classes, with the last measurement (time point 5) showing the lowest sample size ($n = 369$), which was above the minimum suggested sample size of 200 (Byrne, 2012). Classes were tested with the following free growth parameters; mean and variance of the intercept, slope and the quadratic effect, the covariances and the residual variances of the measurement. First baseline models with linear and non-linear (quadratic) effects were tested. Then we sequentially tested a new model (one more class) against the former model.

The overall improvement of fit of each model was assessed by examining Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), sample size-adjusted information criterion (aBIC), the log-likelihood and the entropy. The entropy is a measure for classification quality (values near .1 suggest optimal classification quality, while values near 0 suggest no classification quality) (Nylund, Asparouhov, & Muthén, 2007). To decide on the final number of classes, the Vuong-Lo-Mendell-Rubin log-likelihood ratio test (VLMR LRT) and adjusted Lo-Mendell-Rubin log-likelihood ratio test (LMR LRT) were used (Asparouhov & Muthén, 2012; Nylund et al., 2007). A non-significant VLMR LRT and LMR LRT was considered the primary indicator for rejecting a class solution and accepting the most parsimonious

model (Asparouhov & Muthén, 2012; Jung & Wickrama, 2008; Nylund et al., 2007). Class membership probability was estimated for each patient and averaged for each class. A class membership probability greater than .70 to .80 is considered an indicator that the class represents individuals with similar patterns of change and discriminates between individuals with distinct patterns of change (Andruff, Carraro, Thompson, Gaudreau, & Louvet, 2009). We also checked for the most common patterns of combinations of latent change trajectory classes of EDP and WB.

Patient characteristics and class membership

The characteristics of the patients were calculated with frequencies and mean scores. Outliers and normality were tested via visual inspection of boxplots and histograms, and violations of the homogeneity of variances were tested with Levene's test. ANOVA analysis with Tukey's post hoc tests, or Welch's ANOVA with Games-Howell post hoc tests when equal variances were not assumed, were used for continuous variables to examine differences in patient characteristics between the classes. For categorical variables, chi-square tests were used. Statistically significant findings suggest that specific patient characteristics are more present in certain classes.

Variables predicting class membership were tested for significance, and their odds ratios (OR) with 95% confidence intervals (CI) were calculated with forward stepwise multivariate multinomial logistic regression analyses. The statistically significant patient characteristics from the ANOVA's and chi-square tests were used as independent variables. Linearity of the continuous predictor variables with the logit of the dependent variables was assessed with the Box-Tidwell procedure (Box & Tidwell, 1962). All continuous predictor variables were linearly related to the logit of the dependent variables, and there were no predictor variables with a correlation higher than .7 (multicollinearity). SPSS version 24.0 was used for all ANOVA and regression analyses (IBM Statistics SPSS).

RESULTS

Background characteristics

Of the 442 patients who participated in this study, 141 were diagnosed with AN (31.9%), 98 with BN (22.2%), 39 with BED (8.8%), and 164 with OSFED (37.1%). The average age was 27.01 years (*SD* = 9.71) and 98.6% (*n* = 436) were female. The average start age of the ED was 16.10 years (*SD* = 4.93), and the duration of the ED 11.07 years (*SD* = 9.96).

Model fit of latent classes on change trajectories

The fit indices of the LGMMs for EDP and WB can be found in Table 1. First baseline models with a linear and non-linear effect were tested. The EDP model with a quadratic (non-linear) effect showed the lowest values for AIC, BIC, and aBIC, compared to the linear model. A quadratic model was therefore chosen as the baseline model for EDP. The WB baseline model with a linear effect showed a minor higher AIC, with the lowest BIC value and aBIC compared to the non-linear model. A linear model was therefore chosen as the baseline model for WB.

Then we sequentially tested a new model (one more class) against the former model for EDP and WB. A two-class solution improved all fit indices and significantly improved the log-likelihood tests compared to a one-class solution for both EDP and WB. A three-class solution also improved all fit indices for EDP and WB and significantly improved the log-likelihood tests compared to a two-class solution. Most fit indices did not further improve between a three and four class solution for EDP, and there was no significant improvement on the log-likelihood difference tests with a four-class solution compared to three classes, VLMR LRT = 19.802(4), p = .49, LMR LRT = 19.021(4), p = .50. We, therefore, considered a three-class solution as the most parsimonious model explaining the observed data for EDP. For WB, also a three-class solution was considered as the most parsimonious model with no significant differences on the loglikelihood test between a three and four-class solution, VLMR LRT = 13.774(3), p = .31, LMR LRT = 13.060(3), p = .32.

Table 1 Model Fit Indices: Latent Growth Mixture Modeling of eating disorder psychopathology and well-being trajectories

fit statistics	1 class baseline	1 class baseline	2 classes	3 classes	4 classes
eating disorder psychopathology (EDP)					
shape	linear	non-linear	non-linear	non-linear	non-linear
n free parameters	10	14	18	22	26
AIC	5083.922	5049.625	4984.258	4933.062	4921.260
BIC	5124.835	5106.527	5057.077	5023.071	5027.634
aBIC	5093.099	5062.098	5008.300	4953.253	4945.122
entropy			.789	.744	.744
loglikelihood	-2531.961	-2510.625	-2474.808	-2444.531	-2434.630
VLMR LRT *p*-value			.000	.004	.49
LMR LRT *p*-value			.000	.005	.50
well-being (WB)					
shape	linear	non-linear	linear	linear	linear
n free parameters	10	14	13	16	19
AIC	3966.032	3965.608	3944.588	3921.326	3913.552
BIC	4006.945	4022.886	3997.775	3986.787	3991.287
aBIC	3975.210	3978.456	3956.519	3936.011	3930.990
entropy			.627	.668	.736
loglikelihood	-1973.016	-1968.804	-1959.294	-1944.663	-1937.776
VLMR LRT p-value			.009	.001	.31
LMR LRT p-value			.001	.001	.32

Note; AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion, aBIC = sample size-adjusted information criterion, Entropy = a measure for classification quality (values near .1 suggest optimal classification quality, while values near 0 suggest no classification quality). VLMR LRT = Vuong-Lo-Mendell-Rubin log-likelihood ratio test. LMR LRT = adjusted Lo-Mendell-Rubin log-likelihood ratio test.

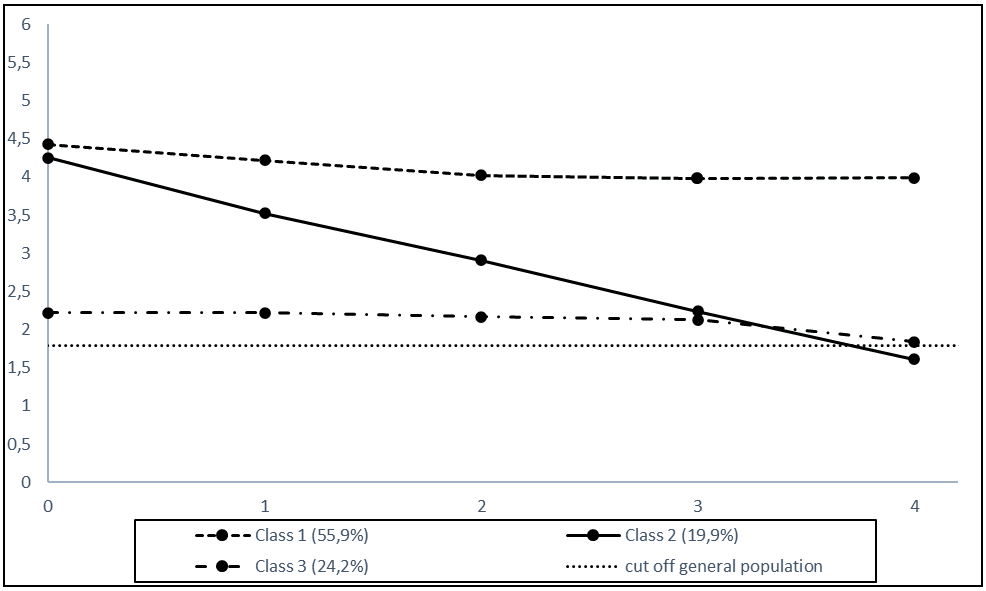

Figure 2. Sample means of the eating disorder psychopathology classes The cut-off score for the general population was based on the EDE-Q mean score of the Dutch general population (Aardoom et al., 2012) + 1 *SD*.

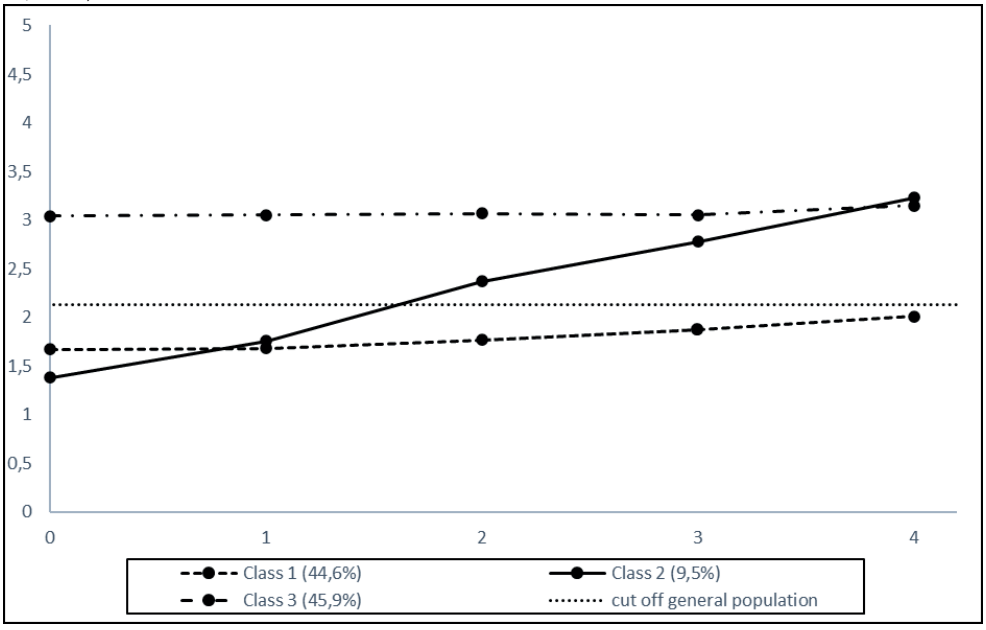

Figure 3. Sample means of the well-being classes. The cut-off score for the general population was based on the MHC-SF mean score of the general population (Lamers et al., 2011)- 1 *SD*.

General change trajectories of eating disorder psychopathology and well-being

Table 2 summarises the number of patients assigned to each class, the average class membership probability, the intercept, slope, and quadratic effect. Figures 2 and 3 provide an overview of the mean class change trajectories for EDP and well-being compared to community norms.

Table 2. Latent class characteristics for eating disorder psychopathology and well-being

	number	class prob	intercept	slope	quadratic
class	*n* (%)		*M* (*SE*)	*M* (*SE*)	*M* (*SE*)
eating disorder psychopathology (EDP)					
1 high baseline EDP, slow recovery	247 (55.9%)	.90	4.43 (.07)*	-.27 (.05)*	.04 (.01)*
2 high baseline EDP, substantial recovery	88 (19.9%)	.84	4.25 (.14)*	-.70 (.13)*	.01 (.03)
3 moderate baseline EDP, no recovery	107 (24.2%)	.89	2.22 (.11)*	.05 (.09)	-.04 (.02)
well-being (WB)					
1 low baseline WB, slow growth	197 (44.6%)	.83	1.63 (.09)*	.09 (.03)*	-
2 low baseline WB, substantial growth	42 (9.5%)	.77	1.35 (.13)*	.48 (.05)*	-
3 moderate baseline WB, stable	203 (45.9%)	.88	3.03 (.07)*	.03 (.02)	-

Note: * = $p < .000$, sig = significant, class prob = average class membership probability

All EDP classes showed adequate average class membership probability (>.80). The first class (55.9%) is labeled as the *high baseline EDP, slow recovery* class with a high level of EDP symptoms at the start of treatment ($M = 4.43$, $SE = 0.07$, $p < .001$), a low negative slope of change ($M = -0.27$, $SE = 0.05$, $p < .001$) and a quadratic effect ($M = 0.04$, $SE = 0.01$, $p < .001$). The second class (19.9%) is labeled as the *high baseline EDP, substantial recovery* class, with a high EDP baseline level ($M = 4.25$, $SE = 0.14$, $p < .001$), a steep slope of change ($M = -0.70$, $SE = 0.13$, $p < .001$) and no quadratic effect ($M = 0.01$, $SE = 0.03$, $p = .78$). The third class (24,2%) is labeled as the *moderate baseline EDP, no recovery* class, with a moderate EDP baseline level ($M = 2.22$, $SE = 0.11$, $p < .001$), no significant slope of change ($M = 0.05$, $SE = 0.09$, $p = .59$) and no quadratic effect ($M = -0.04$, $SE = 0.02$, $p = .08$).

The WB average class probability was adequate (>.80) for class 1 and 3 and moderate (>.70) for class 2. Class 1 (44.6%) is labeled as the *low baseline WB, slow growth* class, with a low WB baseline level ($M = 1.63$, $SE = 0.09$, $p < .001$) and a low slope of change ($M = 0.09$, $SE = 0.03$, $p < .001$). Class 2 (9.5%) is labeled as the low baseline *low baseline WB, substantial growth* class with a low baseline level of WB ($M = 1.35$, $SE = 0.13$, $p < .001$) and a steep slope

of change (*M* = 0.48, *SE* = 0.05, *p* < .001). The last class (45,9%) is labeled as the *moderate baseline WB, stable over time* class with a moderate level of baseline WB (*M* = 3.03, *SE* = 0.07, *p* < .001) scoring similar within community norms, and which remains stable over time (*M* = 0.03, *SE* = 0.02, *p* = .20), i.e. there is no significant slope change.

Table 3 shows the number of patients divided into the combined EDP and WB classes. Nine combinations were found. The highest proportions were found for the following combined classes; *slow EDP recovery* & *slow WB growth* (32.4%), *slow EDP recovery & moderate WB* (19.9%), *no EDP recovery & moderate WB* (16.5%). The lowest proportions were found for *no EDP recovery & substantial WB growth* (1.6%), *slow EDP recovery & substantial WB growth* (3.6%) and *substantial EDP recovery & substantial WB growth* (4.3%).

Table 3. Proportions of patients divided over the merged classes for eating disorder psychopathology and well-being

class	*well-being*								
	1 low baseline WB, slow growth			2 low baseline WB, substantial growth			3 moderate baseline WB, stable		
ED psychopathology	*n*	% tot	% row	*n*	% tot	% row	*n*	% tot	% row
1 high baseline EDP, slow recovery	143	32.4%	57.9%	16	3.6%	6.5%	88	19.9%	35.7%
2 high baseline EDP, substantial recovery	27	6.1%	30.7%	19	4.3%	21.6%	42	9.5%	47.7%
3 moderate baseline EDP, no recovery	27	6.1%	25.2%	7	1.6%	6.5%	73	16.5%	68.2%

Note: % tot = the percentages of patients assigned to the combined classes over the total group. % row = the percentages of patients assigned to the combined classes over the row total (EDP classes).

Patient characteristics and class membership

Patient characteristics of the total sample and the latent classes can be found in Table 4. Statistical significant differences in patient characteristics between the latent classes for EDP were found for ED diagnosis, $\chi^2(6, n = 442) = 17.79$, $p < .001$, earlier hospitalization, $\chi^2(2, n = 425) = 10.65$, $p < .01$, early response, $\chi^2(2, n = 425) = 39.39$, $p < .001$, general psychopathology, $F(2, 437) = 37.45$, $p < .001$, hope for recovery, $F(2, 349) = 14.80$, $p < .001$ and resilience, $F(2, 349) = 8.49$, $p < .001$.

Post-hoc analyses showed that participants assigned to high baseline EDP, slow recovery (Class 1) were less likely to be diagnosed with OSFED, more likely to be hospitalized in the past, were perceived to have lower hope for recovery, and were considered to be less resilient.

Participants assigned to high baseline EDP, substantial recovery (Class 2), were relatively less likely to be hospitalized in the past, more likely to be early response EPD, and were assessed to have higher levels of resilience. Participants who showed moderate baseline EDP, no recovery (Class 3) were relatively less likely to be diagnosed with BN, more likely to be diagnosed with OSFED, and reported lower levels of general psychopathology.

For WB, statistical significant differences between patient background characteristics and the latent classes were found for general psychopathology, *Welch's F*(2, 115.57) = 112.01, $p < .001$, intrinsic motivation, $F(2, 349) = 10.55$, $p < .001$, hope for recovery, *Welch's F*(2, 73.35) = 13.45, $p < .001$, problem solving capacity, $F(2, 349) = 17.41$, $p < .001$, resilience, $F(2, 349) = 23.30$, $p < .001$ and family functioning, $F(2, 349) = 4.78$, $p < .01$. Post-hoc analyses showed that participants who showed low baseline WB, slow growth (Class 1) were considered to have relative low levels of intrinsic motivation, hope for recovery and low levels of family functioning. Participants assigned to moderate baseline WB, stable WB (class 3) reported relative low levels of general psychopathology, and were considered by the clinicians to have relative high levels of intrinsic motivation, hope for recovery, problem solving capacity, resilience and family functioning.

Table 4. Characteristics of patients by class

		eating disorder psychopathology (EDP)				well-being (WB)			
characteristics	total	class 1	class 2	class 3	statistic	class 1	class 2	class 3	statistic
	n (%)	*n* (%)	*n* (%)	*n* (%)	χ^2	*n* (%)	*n* (%)	*n* (%)	χ^2
diagnosis					17.79**				9.53
AN	141 (31.9%)	84 (34%)	22 (25%)	35 (32.7%)	-	73 (37.1%)	9 (21.4%)	59 (29.1%)	-
BN	98 (22.2%)	62 (25.1%)	25 (28.4%)	11(10.3%)	1 – 3, 2 – 3	46 (23.4%)	13 (31.0%)	39 (19.2%)	-
BED	39 (8.8%)	23 (9.3%)	8 (9.1%)	8 (7.5%)	-	16 (8.1%)	3 (7.1%)	20 (9.9%)	-
OSFED	164 (37.1%)	78 (31.6%)	33 (37.5%)	53 (49.5%)	1 – 3	62 (31.5%)	17 (40.5%)	85 (41.9%)	-
BMI (kg/m2) < 15	45 (10.2%)	27 (11.1%)	5 (5.7%)	13 (12.3%)	2.55	24 (15.2%)	2 (7.4%)	19 (11.4%)	2.24
earlier hospitalization	94 (22.1%)	66 (27.4%)	9 (10.8%)	19 (18.8%)	10.65*, 1 – 2	51 (26.6%)	7 (17.9%)	36 (18.6%)	4.02
trauma	172 (40.9%)	108 (45.2%)	34 (41%)	30 (30.3%)	6.42	84 (44.2%)	15 (39.5%)	73 (37.8%)	1.65
early change (EDP)	67 (16.3%)	27 (11.7%)	32 (39%)	8 (8.2%)	39.39**, 1 – 2, 2 – 3	27 (15%)	10 (25.6%)	30 (15.6%)	2.78
	M (SD)	*M* (SD)	*M* (SD)	*M* (SD)	*F*	*M* (SD)	*M* (SD)	*M* (SD)	*F*
age	27.01 (9.74)	26.43 (9.39)	27.64 (10.14)	27.85 (10.19)	1.02v	27.24 (10.19)	24.43 (7.15)	27.33 (9.72)	1.64v
ED start age	16.10 (4.93)	15.23 (4.50)	16.22 (5.53)	16.17 (3.95)	2.35#v	15.24 (4.28)	15.67 (3.96)	16.04 (5.02)	1.41#v
ED duration	11.07 (9.96)	11.19 (9.45)	10.99 (9.03)	11.65 (10.59)	.12v	11.83 (9.83)	9.01 (7.91)	11.16 (9.74)	1.41v
general psychopathology	50.3 (13.9)	54.01 (12.34)	51.10 (12.42)	41.20 (14.03)	37.45** 1 – 3, 2 – 3	57.64 (10.09)	58.81 (11.08)	41.59 (12.16)	112.01**# 1 – 3, 2 – 3
clinicians opinion on patient's									
intrinsic motivation	3.01 (.81)	2.95 (.82)	3.24 (.70)	2.97 (.83)	3.39	2.80 (.83)	3.04 (.81)	3.20 (.74)	10.55** 1 – 3
hope for recovery	2.73 9 (.77)	2.55 (.74)	3.09 (.70)	2.86 (.80)	14.80** 1 – 2, 1 – 3	2.52 (.76)	2.63 (.74)	2.95 (.73)	13.45**#, 1 – 3
problem solving capacity	2.41 (.79)	2.31 (.75)	2.61 (.78)	2.47 (.85)	3.94	2.20 (.76)	2.07 (.68)	2.65 (.76)	17.41**, 1 – 3, 2 – 3
resilience	2.54 (.77)	2.41 (.75)	2.85 (.80)	2.59 (.77)	8.49** 1 – 2	2.27 (.75)	2.37 (.69)	2.81 (.71)	23.30**, 1 – 3, 2 – 3
insight in illness	2.79 (.81)	2.79 (.78)	2.91 (.78)	2.69 (.91)	1.30	2.70 (.78)	2.56 (.80)	2.90 (.83)	3.76
family functioning	2.35 (.87)	2.31 (.85)	2.55 (.81)	2.31 (.94)	2.03	2.24 (.87)	2.11 (.97)	2.50 (.83)	4.78*, 1 – 3
daily functioning	2.28 (.74)	2.28 (.75)	2.38 (.70)	2.22 (.74)	0.90	2.25 (.82)	2.26 (.76)	2.32 (.64)	0.46

F= Oneway Anova, posthoc comparisons with Bonferroni correction, posthoc comparisons with Bonferroni correction, * = *p*-value <.01, ** = *p*-value <.001, # = Welch's Anova was used. Percentages are rounded to the nearest tenth. Missing values were left out of the analyses, leading to slight differences in the calculated percentages for earlier hospitalization, trauma, and early response. Calculated percentages were based on the total number of available scores. v = The assumptions for normality and no outliers were violated. Tests were rerun after categorizing the continuous variables into groups, which did not lead to significant associations with the EDP and WB classes as was found with the Oneway ANOVA.

Predictive analyses

The first classes (*high baseline EDP, slow recovery* and *low baseline WB, slow growth)* were used as the reference category for the multinomial regressions. The addition of the predictors for EDP class membership to a model containing the intercept only significantly improved the fit between model and data, $\chi^2(8, n = 332) = 94.69$, Nagelkerke $R^2 = .29$, $p < .001$. See Table 5 for the statistically significant predictors and unique contributions in the final model.

Early change on EDP (OR = 3.52, $p < .001$, 95% CI [1.74, 7.15]) and hope for recovery (OR = 2.32, $p < .001$, 95% CI [1.49, 3.61]) were associated with a higher likelihood to be assigned to class 2 *high baseline EDP, substantial recovery* class membership. Not having BN (OR = 0.37, $p < .05$, 95% CI [.15, .89]) and lower levels of general psychopathology (OR = 0.93, $p < .001$, 95% CI [.91, .96]) were associated with a smaller likelihood to be assigned to class 3 *low baseline EDP, no recovery*.

Table 5. Significant predictors in a multinomial logistic regression for eating disorder psychopathology classes

	class 2 high baseline EDP, substantial recovery			class 3 low baseline EDP, no recovery		
	β *(SE)*	OR (95% CI)	*p-value*	β *(SE)*	OR (95% CI)	*p-value*
patient characteristics						
BN				-1.00 (.45)	0.37 (0.15- 0.89)	.028
general psychopathology				-0.07 (.01)	0.93 (0.91- 0.96)	<.001
early change (EDP)	1.26 (0.36)	3.52 (1.74 – 7.15)	<.001			
clinicians opinion on patient's						
hope for recovery	0.84 (0.23)	2.32 (1.49 – 3.61)	<.001			

Note: OR = odds ratio, CI = confidence interval. Only variables with a *p*-value of < .01 in the univariate analysis were used in the multivariate analyses. Class 1 was used as the reference category.

For WB (see Table 6), the addition of the predictors for class membership to a model containing the intercept only significantly improved the fit between model and data, $\chi^2(6, n = 350) = 158.54$, Nagelkerke $R^2 = .44$, $p < .001$. Predictors with a unique statistically significant contribution for the *moderate WB, stable over time* class membership were lower general psychopathology (OR = .88, $p < .001$, 95% CI [.86, .92]) and higher intrinsic motivation (OR = 1.71, $p < .01$, 95% CI [1.15, 2.55]). Higher intrinsic motivation also predicted the *low baseline WB, substantial growth* class membership (OR 1.98, $p < .05$, 95% CI [1.07, 3.36]).

Table 6. Significant predictors in a multinomial logistic regression for well-being classes

	class 2 low baseline WB, substantial growth			class 3 moderate WB, stable over time		
	β *(SE)*	OR (95% CI)	*p*-value	β *(SE)*	OR (95% CI)	*p*-value
background characteristics						
general psychopathology				-0.12 (0.01)	0.88 (0.86 – 0.91)	<.001
clinicians opinion on patient's						
intrinsic motivation	0.68 (0.31)	1.98 (1.07 – 3.63)	<.05	0.54 (0.20)	1.71 (1.15 – 2.55)	<.01

Note: OR = Odds ratio, CI = confidence interval. Only variables with a *p*-value of < .01 in the univariate analysis were used in the multivariate analyses. Class 1 was used as the reference category.

DISCUSSION

A central aim of psychotherapy research is to understand mental health change during treatment (Melchior et al., 2016). This study modeled intraindividual change trajectories of eating disorder psychopathology (EDP) and well-being (WB) based on the dual-continua model, which postulates that psychopathology and WB are two distinct but related mental health domains (Keyes, 2005). The variability in change trajectories between patients during a year of outpatient treatment could be explained with three distinct latent EDP and WB classes.

Understanding change trajectories of eating disorder psychopathology

The majority of the patients (56%) were assigned to the *high baseline EDP, slow recovery class*. These patients exhibited a modest treatment response and still reported high levels of EDP after a year of outpatient treatment. A relatively small class (20%) exhibited a substantial treatment response and benefited in terms of improving from a severe ED towards functioning comparable with norms from the general population (Aardoom et al., 2012). The last class (24%) did not report severe EDP levels but did not improve during treatment.

While earlier studies examined weight gain (Berona et al., 2018; Jennings et al., 2017; Makhzoumi et al., 2017) or binge eating change trajectories (Hilbert et al., 2019), Espel-Huyn and colleagues (2020) focused on trajectories of overall EDP change just as in the current study. They identified trajectories within a residential treatment setting during a shorter period compared to our study. However, they found three similar patterns of change,

despite the different treatment setting and substantially shorter duration. A class with a gradual response, a class with rapid response, both with high baseline levels, and a class with moderate baseline levels and static response (Espel-Huynh et al., 2020). Also noteworthy, even the proportions of patients divided over the classes were nearly similar in their study compared to our results. This suggests that EDP class membership, and subsequently recovery trajectories, are not necessarily the result of a specific treatment approach or setting (inpatient, residential or outpatient).

Overall, our results show clear variability in individual EDP change trajectories, which can be modeled in distinct classes. A relatively large group of patients was assigned to the class with *high baseline EDP symptoms and slow recovery*, which corresponds with effectiveness studies showing only modest or no improvements in a substantial proportion of patients (Linardon & Wade, 2018; Murray et al., 2018). The patients assigned to this class still report substantial symptom levels after 12 months of treatment and cannot be considered recovered. The question arises whether these patients need a longer treatment duration to promote further changes or that the rate of change can be enhanced with a different treatment setting or methodology. Considering the overall similar outcomes across different treatment methods (Grenon et al., 2018) and comparing our results to Espel-Huyn and colleagues (2020) study, different treatment settings or methods may arguably not lead to improved results. It is found that higher doses of ED inpatient and outpatient treatment or a longer duration do not lead to more favorable outcomes (Beintner & Jacobi, 2018; Bell, Waller, Shafran, & Delgadillo, 2017). It has been noted that psychotherapy may not be simply reduced to a dose-response effect, and change may be substantially dependent on factors, such as patient characteristics or other non-specific variables in treatment (Huibers & Cuijpers, 2015; Lambert & Asay, 1984; Wampold & Imel, 2015).

Patients assigned to the *moderate baseline EDP and no recovery* class exhibit treatment resistance in EDP. Several reasons for treatment resistance have been postulated, such as neurobiological vulnerabilities, understanding EDs as coping mechanisms that help patients deal with daily stressors, or the ego-syntonic nature of the disorder and inability to see the dangers (Halmi, 2013). For instance, if ED symptoms are considered as a coping strategy to regulate stress and emotions, it may lead to holding on to the coping behavior. This may be particularly relevant for *moderate baseline EDP and no recovery* class because patients do

not report severe ED levels and the detrimental effects of an ED may not (yet) weigh out the benefits in patients assigned to this class.

The validity of distinct latent classes of change trajectories was further substantiated by differences in patient characteristics, such as ED type, earlier hospitalization, early change, baseline levels of general psychopathology, hope for recovery, and resilience. More specifically, not having BN or lower general psychopathology predicted assignment to the *low baseline EDP, no recovery* class. Early change and higher hope for recovery were predictive for assignment to the *high baseline, substantial EDP recovery* class, compared to the *high baseline slow recovery* class. These findings are in line with previous research showing that early change and general psychopathology (i.e., anxiety and depression) are considered important predictors for treatment outcome (Chang, Delgadillo, & Waller, 2021; Hilbert et al., 2019; Linardon, Brennan, & de la Piedad Garcia, 2016; Vall & Wade, 2015). This study also linked hope to EDP change, which aligns with previous research (Las Hayas et al., 2015). If patients do not experience faith or hope within themselves, it was considered important to have someone around them instill it in them (Las Hayas et al., 2015). Working with recovered professionals shows the possibility that recovery is possible, which instills hope in patients (Vos et al., 2016). Also, peer supporters sharing their road to recovery provides hope for patients (Beveridge et al., 2018).

Understanding well-being change trajectories

The WB change trajectories were also characterized by three classes with 1) a low baseline level, followed by a slow and gradual trajectory of growth, 2) a low baseline level, followed by a substantial and rapid trajectory of growth towards moderate WB, and 3) a moderate level of WB, which remained stable over time. For WB, only a small group with low levels at baseline (10%) improved well towards adequate WB. At the end of treatment, the patients in this class reported similar scores as found in the general population (de Vos et al., 2018). Although treatment was not specifically focused on improving WB, these patients still benefited from treatment in terms of improved WB. Interestingly, most patients (46%) reported a moderate WB, comparable with the general population, which remained stable over time, despite having an ED. This may also be explained by patients not seeing the dangers, or assuming ED symptoms as coping mechanisms that enable patients to deal with stressors and emotions in daily life so that they experience adequate WB (Halmi, 2013; Wagener & Much, 2010).

Another large group (45%) reported low levels of WB with a slow trajectory of growth. It may be warranted to focus on WB related domains of mental health for this group in treatment in addition to EDP. Transdiagnostic interventions focusing on WB have been developed and effectively improve WB in a range of psychiatric disorders (Chakhssi, Kraiss, Sommers-Spijkerman, & Bohlmeijer, 2018; Fava et al., 2005).

Lower general psychopathology was predictive for assignment to the moderate WB, stable over time class compared to the low baseline WB slow growth class. Higher intrinsic motivation was predictive for assignment to the low baseline and substantial WB growth and the moderate WB, stable over time class. Interestingly, intrinsic motivation was not a predictor for EDP class membership, while it is considered an influential predictor for outcomes in the literature (Vall & Wade, 2015). Self-determination theory suggests it is promoted by focusing on universal needs, such as autonomy, competence, and connection (Deci & Vansteenkiste, 2004). These universal needs are closely related to the concept of WB. Vansteenkiste and colleagues (2005) argue that the quality of motivation is reflected more by the degree of internalization of change rather than by the motivation to change and that interventions based on psychological need satisfaction may facilitate self-endorsed motivation in patients with EDs (Van Der Kaap-Deeder et al., 2014; Vansteenkiste, Soenens, & Vandereycken, 2005).

Understanding mental health trajectories: the dual continua model

Examining the combined EDP and WB classes, there were nine separate classes with different trajectories, with the majority (32%) assigned to the EDP slow recovery and WB slow growth class. Only a minority of patients (4%) improved well both on EDP and WB. Twenty percent experienced moderate and stable WB over time while having high EDP baseline levels and a slow recovery trajectory. These results correspond with the dual-continua model in that both EDP and WB show separate and differential trajectories of change. This is further substantiated by different patient characteristics predicting EDP and WB class membership.

Strengths and limitations

A strength of this study was the adequate sample size to detect classes and the duration with repeated measures over a year of outpatient treatment in an ED sample. The use of repeated measures allowed for modeling similar trajectories of intraindividual change. There were several limitations. This was a naturalistic study, meaning that the researchers had no

control over the treatment setting, intensity and other practical differences between patients which may have occurred during treatment, such as a change of therapist. These unknown factors may have influenced the results. While a three-class solution was considered the most parsimonious, a four-class solution did perform slightly better on some metrics. The use of self-report instruments may have resulted in biases (Kessler, Wittchen, Abelson, & Zhao, 2009). Examining change with other measures in addition to self-report, such as clinician-reported, may further improve the validity of the results. At last, early change was measured after three months of treatment. However, in other studies, it is often measured within a shorter time frame, for instance, four weeks (Chang et al., 2021), and it may be argued whether our time frame can be considered a valid measure for early change.

Conclusions and future directions

Patients show differential trajectories of change during treatment which can be explained in three distinct classes of EDP and WB change. In addition, EDP and WB class membership was predicted by different patient characteristics. Therefore, it is warranted to address both EDP and WB to promote overall mental health in treatment. Specific predictors for EDP class membership were ED type, general psychopathology, early change, and hope for recovery. Predictors for WB class membership were general psychopathology and intrinsic motivation. Adjusting a treatment approach based on change trajectories and individual patient characteristics may further foster recovery in patients with EDs and promote WB. New research may examine the effects of applying personalized treatments and the predictive effects of EPD and WB class membership on (long-term) outcomes. In addition, it is advised to monitor treatment regularly in practice to identify trajectories of change in individual patients to evaluate treatment progress and consider alternative strategies.

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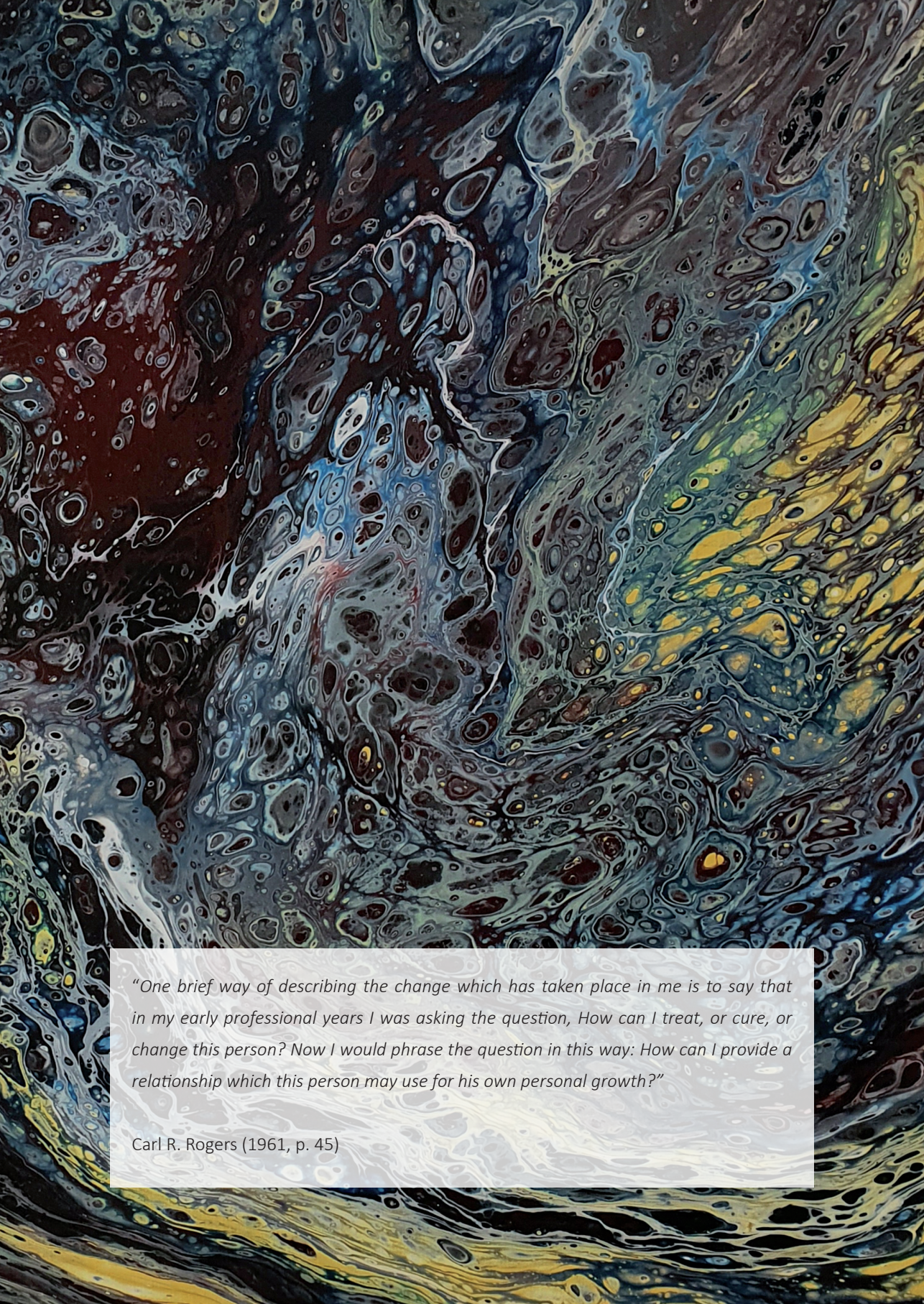

"One brief way of describing the change which has taken place in me is to say that in my early professional years I was asking the question, How can I treat, or cure, or change this person? Now I would phrase the question in this way: How can I provide a relationship which this person may use for his own personal growth?"

Carl R. Rogers (1961, p. 45)

7

Exploring mental health dynamics during eating disorder outpatient treatment: a psychometric network study with panel data

This chapter has been submitted as:

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ABSTRACT

The objective of this study was to explore mental health associations during eating disorder (ED) treatment. Based on the dual-continua model of mental health, general and ED-specific psychopathology, as well as emotional, psychological, and social well-being were considered as primary mental health domains. Novel network analyses with panel data were applied to explore within-person (temporal and contemporaneous networks) and between-person effects in a sample of 1250 female ED patients during 12 months of outpatient treatment. The associations between the domains and their centrality were examined. Autoregressive and cross-lagged effects were also estimated (temporal network). ED psychopathology was the most central domain in the temporal network. ED psychopathology changes predicted further ED psychopathology changes and small changes in the other domains within patients. Weak bi-directional associations were only found between changes in the well-being domains and general psychopathology. In contrast to the temporal network, ED psychopathology was the least central and psychological well-being the most central domain in the contemporaneous and between-subjects networks. This suggests a central role of psychological well-being for experiencing mental health within time points remaining stable over time. We conclude that ED psychopathology changes relatively independent from other mental health domains within patients and should be the primary focus in treatments. Well-being domains may be considered as more stable aspects of mental health. A secondary focus in treatment on psychological well-being may be warranted to promote overall mental health, especially for patients with lower levels.

INTRODUCTION

Eating disorders (EDs), such as anorexia nervosa (AN), bulimia nervosa (BN), and binge eating disorder (BED), are psychiatric disorders with a lifetime prevalence of over 8% for women and 2% for men (Galmiche, Déchelotte, Lambert, & Tavolacci, 2019). EDs lead to impaired quality of life and an increased risk for somatic complications and mortality (van Hoeken & Hoek, 2020). Also, psychiatric co-morbidity rates of over 70% are reported in ED patients (Keski-Rahkonen & Mustelin, 2016). The specific symptoms of an ED are dependent on the type and concern disordered behaviors, such as restricting or bingeing, compensatory behaviors such as self-induced vomiting, and cognitive and emotional disturbances around eating, weight and body shape (American Psychiatric Association, 2013). ED treatments show modest effects in terms of how many patients achieve remission on core symptoms. For AN, remission rates are estimated between 0 and 25% in adult patients and between 23 and 33% in adolescents (Murray, Loeb, & Le Grange, 2018). For BN, over 60% of patients do not achieve remission of core symptoms, even after receiving the most empirically supported treatments (Linardon & Wade, 2018). Around 50% of the patients with BED achieve symptom remission (Hilbert, Petroff, Herpertz, & Pietrowsky, 2019). These results show the need to improve treatments.

A better understanding of how symptoms interact and change over time may give direction on how to improve treatments. One innovative scientific approach to explore symptom associations and change is the application of psychometric network theory. Psychometric network theory suggests that psychopathological symptoms become self-sustaining in psychiatric disorders by actively maintaining and reinforcing each other (Borsboom, 2016). These self-sustaining patterns lead to a network of symptoms becoming stuck in a 'disorder state' (Borsboom, 2016). Knowledge of how symptoms maintain or reinforce each other during treatment may be crucial for understanding which symptoms to address. Jordan and colleagues (2020) noted that this knowledge might help prioritize treatment targets, identify key symptoms driving co-morbidity and understand the mechanisms by which patients shift from disordered to wellness states (Jordan, Winer, & Salem, 2020). A psychometric network gives a visual overview of how symptoms (described as nodes in a network) are associated with each other (described as edge-weights) (Epskamp, Rhemtulla, & Waldorp, 2014). Also, the centrality of the nodes can be measured in terms of how well connected a node is to other nodes (Bringmann, Elmer, & Epskamp, 2019). Centrality

implicates the influence of a node in a network compared to the other nodes (Epskamp et al., 2014). There is a rapidly growing body of psychometric network studies in ED patients, leading to a better understanding of how symptoms are related to each other. These studies have either focused on the associations between ED symptoms (within and across ED types) or on a combination of ED symptoms with co-morbidity, such as trauma, social anxiety, or general psychopathology (i.e., general distress, anxiety, and mood symptoms). Although some studies differed on what was specifically measured, similar influential ED symptoms were found across studies, such as shape and weight over-evaluation (DuBois, Rodgers, Franko, Eddy, & Thomas, 2017; Elliott, Jones, & Schmidt, 2020; Forbush, Siew, & Vitevitch, 2016; Levinson et al., 2017). Also, influential co-morbid symptoms across studies were found in ED patients, such as feeling overwhelmed, nervousness, concentration difficulties, low self-esteem (Smith et al., 2020), depression, anxiety, interpersonal sensitivity, and ineffectiveness (Monteleone et al., 2019; Solmi, Collantoni, Meneguzzo, Tenconi, & Favaro, 2019). Networks were estimated recently in ED patients with a focus on mental health (de Vos, Radstaak, Bohlmeijer, & Westerhof, 2021). These networks were based on a general framework for mental health consisting of psychopathology (i.e., ED specific and general psychopathology) and domains of mental well-being (de Vos et al., 2021). The World Health Organization (WHO) explains mental health not merely as the absence of psychopathology but also as the presence of mental well-being (*World Health Organization*, 2005). This has been operationalized as the dual-continua model of mental health (Keyes, 2005). A substantial body of research shows that psychopathology and well-being are not two extreme ends of a single continuum but distinct yet related continua, suggesting that both should be addressed in a mental health framework (Franken, Lamers, Ten Klooster, Bohlmeijer, & Westerhof, 2018; Keyes, 2005; Lamers, Westerhof, Bohlmeijer, Ten Klooster, & Keyes, 2011; Peter, Roberts, & Dengate, 2011; Westerhof & Keyes, 2008). The importance of a broader focus on mental health in treatment is growingly recognized (Bohlmeijer & Westerhof, 2020; Fava, 1996; Fava & Guidi, 2020; Fava, Ruini, & Belaise, 2007; Fava et al., 2005), and the importance also becomes evident from the patients perspective (de Vos et al., 2017; Wetzler et al., 2020). A qualitative meta-analysis including 18 studies with ED recovered individuals showed that mental well-being was essential for recovery (de Vos et al., 2017). Mental well-being can be defined in several ways but is often explained in three domains: emotional, psychological, and social (Keyes, 2005). Former research on the mental health network in ED patients showed that psychological well-being was the most central domain, and ED psychopathology was only

weakly related to well-being (de Vos et al., 2021). Also, a more detailed network on a symptom level was estimated, consisting of psychopathology (6 ED specific and 16 general symptoms) and 14 well-being symptoms. Feeling depressed, feeling worthless in life, purpose in life, and self-acceptance were the most influential nodes in the symptom network (de Vos et al., 2021). Psychometric network theory suggests that changes in influential symptoms may lead to more substantial changes in overall mental health than changes in peripheral nodes (Borsboom, 2016). The rationale is, therefore, that the most central nodes should be of primary importance in treatment. There is, however, discussion about the actual practical implications of centrality in networks (Bringmann et al., 2019). Network studies in EDs primarily used cross-sectional study designs depicting average associations across patients at one time-point. Cross-sectional studies do not allow to test for changes and symptom-to-symptom effects over time. In other words, a network estimated on a cross-sectional dataset may provide information about how symptoms are related overall in a group or on a population level. However, they do not depict associations over time within patients (i.e. within-subjects effects). Therefore, based on current studies, it cannot be concluded which symptoms maintain or influence other symptoms over time. Interpreting average associations on a population level as within-subjects processes may lead to seriously wrong conclusions, as clearly explained by Hamaker (2012).

Clinicians are in general interested in how changes occur in their patients (within-subjects effects) instead of general effects across patient groups (between-subject effects). Clinicians may wonder which symptoms to address during treatment to achieve recovery in their patients effectively or which psychopathological or well-being symptoms should be treated first or simultaneously. For instance, is it more efficient to promote self-acceptance or purpose in life first before patients can change their ED behaviours or vice versa, or is this individually different? These questions are highly relevant in ED patients because disparate evidence-based treatments give similar results in terms of effectiveness (Grenon et al., 2018), while they have very different theoretical assumptions about what leads to change. However, it is unclear how symptoms are related and change over time in patients from a psychometric network perspective.

Appropriate statistical methods to estimate networks and network dynamics over time have only become available recently (Epskamp, 2020). Epskamp introduced a novel framework to examine psychometric network effects over time with panel and time-series data

(Epskamp, 2020). In the panel-data model, average within-subjects effects and between-subjects effects (relationships between stable means) are estimated in separate networks. This allows to explore how, on average, symptoms interact with or maintain other symptoms over time within ED patients during treatment and separately explore average associations between symptoms on a sample level. Psychometric network analysis can be explained as an explorative data-driven approach to examine symptom associations.

In sum, ED treatments show modest effectiveness, and understanding symptom associations over time in patients may provide relevant clues to improve treatments. Change should be considered within a broad mental health framework, depicting both psychopathological symptoms and mental well-being. Novel network analysis has recently become available to explore mental health networks over time, but no studies have been published to date in ED patients using panel data. This study aimed to explore mental health networks over time during outpatient treatment in a large and representative sample of patients with EDs. We used an explorative, data-driven approach with a novel network methodology (Epskamp, 2020) to estimate average within- and between-person symptom associations over time.

METHODS

Research design and procedure

This study uses a (longitudinal) panel data design with multiple measurements. Data was collected at Stichting Human Concern, a specialized ED treatment center with five locations across the Netherlands (Amsterdam, Bilthoven, Den Haag, Tilburg, Zwolle). The measurements are based on routine outcome monitoring (ROM) data (Beurs & Zitman, 2007), collected every three months during a year of ED outpatient treatment. A total of five time points were used, including a baseline measure at the start of treatment. ROM data consists of self-report questionnaires that patients repeatedly fill in to monitor treatment progress. Clinicians discuss the results in a multidisciplinary team consisting of a psychiatrist, clinical psychologist, family therapist, and dietician, and separately with the patient. The questionnaires were sent automatically and digitally via Questmanager, a software program for patient-reported outcomes. Patients were given two weeks to fill in the questionnaires by default. However, this could be extended by clinicians for another two weeks if necessary.

This observational study did not lead to any extra workload for patients. Patients were informed about the aims of the study and signed an informed consent stating that they could withdraw their approval to include their data for research purposes. The study was approved by the Behavioral, Management and Social Sciences Ethics Committee of the University of Twente (registration number BCE15484).

Patients followed outpatient treatment with sessions once or twice a week with a psychologist. The treatment center used no pre-set length of treatment, and the majority of patients were in treatment for longer than a year. The procedure to terminate a treatment involved a session with the multidisciplinary team, and a separate conversation with the patient, to discuss whether the treatment goals were met and whether it would have added value to continue treatment. Also, patients could end treatment for a variety of reasons. The following methods were used in treatment; insight giving therapy, cognitive behavioral therapy, emotion-regulation, and food/weight management. Primary therapists were licensed practitioners/psychologists who were recovered themselves from an ED and trained to use their experiential knowledge in treatment (de Vos et al., 2016).

Participants

Participants were patients diagnosed with an ED by a psychiatrist in collaboration with a clinician and dietician at intake. The inclusion criteria were 1) a minimum age of 17 (criterion to apply for treatment), 2) a primary ED diagnosis, 3) being able to understand and fill in the questionnaires, 4) consent to participate in the research. Patients did not enter treatment if they met one or more of the following conditions during intake: severe and active auto-mutilation, active psychosis, active suicidal ideation, or acute somatic complications. In total, 1426 patients entered outpatient treatment between March 2015 and January 2020 and followed at least the first six months of treatment. Fifty-five patients did not give consent, 39 patients had filled in no (n = 2), or only one measurement (n = 37). Because only 33 patients were men, they were excluded because results would not be representative, leading to 1250 included patients. Three hundred and ninety-five patients were diagnosed with AN (31.6%), 272 with BN (21.8%), 94 with BED (7.5%), and 489 with other specified feeding and eating disorders (OSFED, 39.1%). Patients' characteristics for the complete sample and each ED type can be found in Table 1.

Table 1. Characteristics of patients

		ED	AN	BN	BED	OSFED
		M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Age	Years	27.3 (9.1)	25.1 (8.5)	27.7 (7.9)	32.1 (11.4)	28.3 (9.4)
BMI	(kg/m^2)	22.5 (7.6)	16.7 (1.7)	23.6 (4.6)	36.2 (9.3)	24.4 (7.6)
		n (%)	*n* (%)	*n* (%)	*n* (%)	*n* (%)
Educational level	Secondary	597 (49.0%)	215 (55.6%)	117 (43.5%)	39 (43.3%)	226 (47.8%)
	Higher	612 (50.2%)	165 (42.6%)	151 (56.1%)	51 (56.7%)	245 (51.8%)
Living situation	Single	380 (31.4%)	89 (23.1%)	108 (40.8%)	27 (30.0%)	156 (31.9%)
Co-morbidity	Mood	377 (30.2%)	124 (31.4%)	83 (30.5%)	30 (31.9%)	140 (28.6%)
	Anxiety	307 (24.6%)	124 (31.5%)	55 (20.2%)	10 (10.6%)	118 (24.2%)
	PD	141 (11.3%)	55 (13.9%)	30 (11.0%)	6 (6.4%)	50 (10.2%)
	Other*	200 (16.0%)	67 (17.0%)	45 (16.5%)	12 (12.8%)	76 (15.5%)

Note: percentages are based on the number of available measures for each indicator. *Other psychiatric disorders included trauma and stress-related disorders, neurobiological (developmental) disorders, substance abuse disorders, dissociative disorders, and behavioral disorders

Instruments and node selection

The following questionnaires were repeatedly administered to the patients: the Eating Disorder Examination Questionnaire (EDE-Q) (Fairburn & Beglin, 1994), the Mental Health Continuum Short Form (MHC-SF) (Lamers et al., 2011), and the Outcome Questionnaire (OQ-45) (Jong, Nugter, Lambert, & Burlingame, 2008). The EDE-Q measures ED pathology (EDP) with 22 attitudinal items divided over four subscales, eating concern (EAT), restraint (RES), shape concern (SHA) and weight concern (WEI), and a global scale. The frequency of symptoms was measured over the past 28 days with two 7-point Likert scales ranging from 0 (not 1 day) to 6 (every day) and from 0 (not at all) to 6 (extremely). An example item is: "Has your weight influenced how you think about (judge) yourself as a person." Lower scores are indicative of lower EDP. Also, several ED behaviors were measured on an item level, such as the frequency of overeating, bingeing, laxative use, self-induced vomiting, and exercising. The EDE-Q is an excellent indicator for measuring the severity of EDP (Aardoom, Dingemans, Slof Op't Landt, & Van Furth, 2012).

The MHC-SF measures overall mental well-being and three subdomains, emotional (EWB), psychological (PWB) and social well-being (SWB), with 14 items (Keyes, 2002; Lamers et al., 2011). The presence of well-being was measured over the past month with a 6-point Likert scale ranging from 0 (never) to 5 (always). An example item is: "During the past month, how

often did you feel good at managing the responsibilities of your daily life." Higher scores are indicative of higher well-being. The Dutch MHC-SF has demonstrated good construct validity (Lamers et al., 2011).

The OQ-45 measures symptomatic distress (SD), social role, and interpersonal functioning. The SD scale was used for this study to measure general psychopathology (GPP) (Warmerdam, Barendregt, & de Beurs, 2017). The frequency of symptoms was measured over the past week with a 5-point Likert scale, ranging from 0 (never) to 4 (always). An example item is "I feel blue."

Based on earlier work on mental health network analysis in ED patients (de Vos et al., 2021) and the assumptions of the dual continua model (Keyes, 2005), the domains of well-being (EWB, PWB, and SWB) and psychopathology (EDP, GPP) were considered as nodes in the overall mental health network. For the measurement of GPP, a modified 16-item scale of the OQ-45 SD scale was used according to the earlier network study (de Vos et al., 2021). Items unrelated to GPP or which showed a substantial topological overlap with well-being were excluded in the modified scale (de Vos et al., 2021). The internal consistency of the scales on each time point can be found in Table 2.

Table 2. Scales, abbreviations and internal consistency at each time point.

Domain/scale	Abbreviation	T1	T2	T3	T4	T5
		α	α	α	α	α
Emotional well-being	EWB	.85	.85	.88	.89	.89
Psychological well-being	PWB	.83	.85	.87	.88	.88
Social well-being	SWB	.73	.75	.78	.79	.81
General psychopathology	GPP	.88	.90	.91	.92	.92
Eating disorder psychopathology	EDP	.91	.92	.94	.95	.95
Eating concern	EAT	.56	.65	.66	.71	.70
Restraint	RES	.79	.80	.81	.82	.82
Shape concern	SHA	.86	.88	.90	.91	.92
Weight concern	WEI	.75	.78	.81	.82	.83

Note: T1 = the measurement at the start of treatment, and T2 – T5 are recurring measurements every three months.

Missing data strategy

Missing values in longitudinal studies may be intermittent missing data or dropouts during treatment (Yang & Shoptaw, 2005). Intermittent missing data can be considered as occasionally

missed data points, for instance, a patient who missed a measurement because he or she was on vacation. Dropouts are missing data of patients who stopped treatment due to whatever reason, which is especially relevant in observational data in outpatient treatment. See Figure 1 for an overview of the missing data at each time-point and the patients that went out of treatment (cumulative). Intermittent missing data was relatively stable across the time-points (T1 = 9.1%, T2 = 10.7%, T3 = 14%, T4 = 13.9% and T5 = 15.5%). The effects of dropouts are present at T4 and T5, with respectively 3.6% and 7.6%. Note that patients who stopped treatment around a time point may still have filled in the questionnaires.

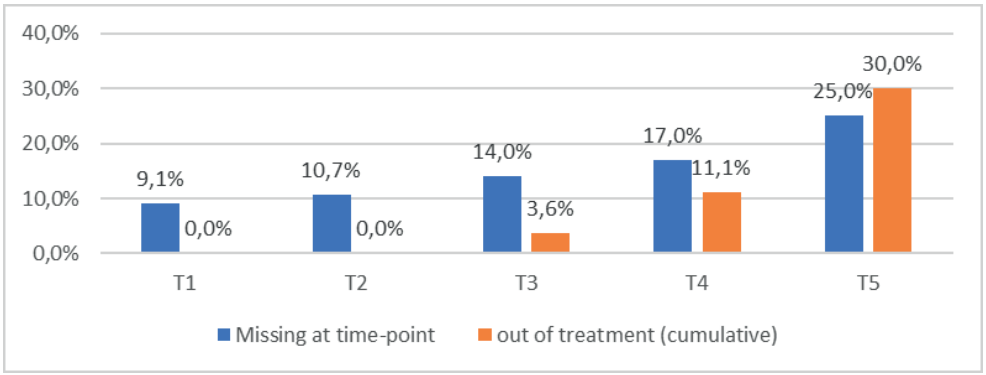

Figure 1. Percentages of patients who missed a measure or went out of treatment
Percentages of missing data at a time-point are based on the number of patients in treatment at each time-point (T), while the cumulative out-of-treatment patients were based on the number of patients included in the study. T1 = the measurement at the start of treatment, and T2 – T5 are recurring measurements every three months.

While intermittent missing data may be considered as missing (completely) at random (MCAR/MAR), this may not be the case for dropout data. For non-simulated longitudinal data, it is difficult or even impossible to discern if data are missing at random or not missing at random (NMAR) (Coertjens, Donche, De Maeyer, Vanthournout, & Petegem, 2017). Even if the MCAR assumption is met, some missingness may still be MAR or NMAR, which has consequences for the appropriate type of dealing with missingness and interpretation of the results. Therefore, it is suggested to test the stability of the models' results under different subsamples, assuming MCAR, MAR, and NMAR (Coertjens et al., 2017). Isvoranu and Epskamp (2021) suggest applying data-driven bootstrap methods to check the stability of the results by taking multiple subsamples of the data. In this study, the full information maximum likelihood (FIML) estimator (Cham, Reshetnyak, Rosenfeld, & Breitbart, 2017) was used to address missing data, assuming M(C)AR (Jordan et al., 2020). A simulation study

showed that FIML performed well on several stability benchmarks (i.e., specificity, sensitivity, and precision) when estimating psychometric networks (Isvoranu & Epskamp, 2021). In addition, 1000 bootstraps of 75% randomly selected subsamples of the final models were run to test the stability and address potential MNAR. The bootstrap results are compared with the estimated models to check the stability of the included edge-weights.

Analysis

Change scores

Average scores of the mental health domains with pairwise deletion were calculated. Further, the reliable change index (RCI) was measured as the score at twelve months minus the start of treatment divided by the standard error of measurement, calculated with the internal consistency and SD. The proportion of patients with normal health status (i.e., scoring within one SD of the community norms on the domains) was additionally calculated. The sum score of the original OQ-45 scale (GPP) was divided by the number of items of the modified scale to calculate an RCI and the normal health status. The results of the modified scale are not comparable with other studies and may show (minor) deviations from the original scale. We also calculated the RCI and number of patients with normal health status with the original OQ-45 SD scale to check for potential deviations. To measure the average change over time, linear growth curve models were applied to estimate the average slope (rate of change) using the r package Lavaan, version 0.6-7 (Rosseel, 2021). Missing data were addressed with FIML estimator, and linear model fit was checked with the root mean square error of approximation (RMSEA) and the incremental fit statistics comparative fit index (CFI), and Tucker-Lewis index (TLI) (Shi & Lee, 2019).

Background on network analysis

Mental health domains were represented as nodes in the psychometric networks and the (partial) correlations between nodes as edge weights (Epskamp et al., 2014). A network can be either undirected when the edge-weights are represented without a direction or causal relationships between nodes, or directed when the edge-weights are directional, assuming causal associations (i.e., nodes predicting other nodes) (Fried et al., 2017). Undirected networks can be estimated in a group of people in cross-sectional data, while directed networks require longitudinal data, such as time-series within participants or panel studies with multiple participants (Epskamp, 2020). Undirected networks provide information about

the structure of psychopathology and which nodes are considered influential (centrality) in the network. The relative influence of the nodes (domains) in the networks can be examined with strength centrality (*S*), which is a measure of a node's overall involvement in the network, calculated as the sum of all absolute connections to other nodes (McNally, 2016). For directed networks, the in-strength and out-strength were calculated. The in-strength is a measure of how strongly a node influences other nodes, and the out-strength is a measure of how strongly a node is influenced by other nodes.

Model estimation: panel-gvar

Panel-gvar models were fitted, using version 0.9 of the Psychonetrics package (Epskamp, 2021). The panel-gvar is a graphical vector auto-regression model (GVAR) (Epskamp, 2020). The (lag-1) GVAR model is a generalization of the Gaussian graphical model (GMM) for time series (single subject design) or panel data (multiple subjects) (Epskamp, 2020). The panel-gvar is a multi-level model (measurement occasions nested within individuals) with random effects on the mean structure. The panel-gvar models three separate networks depicting temporal and contemporaneous within-person effects and between-person effects.

Temporal network

Within-person dependencies are modeled via regression on the previous measurement in the GVAR, which can be used to estimate a directed (temporal) network because it encodes predictive effects over time (Epskamp, 2020). In a temporal network, autoregressive effects (changes in a variable are predicted by the same variable) and cross-lagged effects (changes in a variable are predicted by another variable) are estimated.

Contemporaneous network

In addition, the covariance structure can be modeled as a GGM after controlling for the previous measurement occasion, depicting within-person (contemporaneous) network estimates within time points (Epskamp, 2020). Contemporaneous networks show within-person associations between nodes in the same measurement window that cannot be explained by temporal effects (Epskamp et al., 2018). These relationships between nodes, in our case mental health domains, plausibly unfold faster than over a three months time-frame of measurement, such as moment-to-moment associations.

Between-subjects network

A GMM network can also be formed on the between-subjects effects level (relationships between stable means) when using panel data. This network explains how variables are related on average across the time points (stationary means) (Epskamp, 2020).

Networks were estimated in three steps based on the example study of Epskamp (2020). First, an unrestrained model was estimated without any penalties for edge-weight inclusion using the FIML estimator. Model fit was checked with the chi-square goodness of fit test, RMSEA and CFI, the Akaike information criterion (AIC), and the Bayesian information criterion (BIC). However, a good model fit was expected because of the data-driven exploratory approach, in contrast to testing a more confirmatory model. Next, a pruned model was estimated in which edges that were not significant at $\alpha = 0.01$ were fixed to zero. Third, using a stepwise search approach, a model with an optimal BIC value was fitted. The overall fit was then inspected for all three models. The model with the lowest BIC and adequate overall fit (i.e., CFI ≥ 0.95, RMSEA ≤ 0.06) was chosen as the final model. Given the large sample size, partial correlations were considered weak when .10, moderate when .30 or strong when .50 to interpret the edge-weights (Epskamp et al., 2018).

RESULTS

Change scores

Table 3 shows the mean scores at each time-point, the proportion of patients achieving reliable change, scoring within community norms (normal health status) at 12 months of treatment, and the average change (slope) for the health domains. Good model fit for a linear growth curve was found for EWB (RMSEA = 0.053, CFI = 0.99, TLI = 0.99), PWB (RMSEA = 0.050, CFI = 0.99, TLI = 0.99), SWB (RMSEA = 0.048, CFI = 0.99, TLI = 0.99), and adequate model fit for GPP (RMSEA = 0.066, CFI = 0.99, TLI = 0.99), and EDP (RMSEA = 0.090, CFI = 0.98, TLI = 0.98). Statistically significant slopes were found for all mental health domains (see Table 3), indicating that the average patients' mental health improved across the domains during treatment. EDP was the mental health domain in which most patients showed a reliable improvement (54.5%) and SWB the domain with the fewest patients improving (0.4%). The majority of the patients were labeled with a normal health status on the well-being domains at twelve months of treatment, while this was only the case for 24.9% of the patients on the EDP domain.

Table 3. Summary statistics of the mental health domains

	T1	T2	T3	T4	T5	Statistics		
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)	RCI	Health status	Slope
EWB	2.50 (1.08)	2.57 (1.08)	2.73 (1.09)	2.78 (1.10)	2.92 (1.07)	4.8%	59.8%	0.11**
PWB	2.44 (1.01)	2.53 (1.03)	2.69 (1.04)	2.85 (1.07)	2.91 (1.05)	3.9%	73.3%	0.14**
SWB	2.18 (0.99)	2.23 (1.02)	2.37 (1.05)	2.48 (1.06)	2.55 (1.08)	0.4%	87.6%	0.11**
GPP	2.11 (0.59)	2.04 (.63)	1.94 (.65)	1.85 (.69)	1.78 (.69)	36.1%*	27.7%*	-0.09**
EDP	3.90 (1.16)	3.62 (1.24)	3.29 (1.33)	3.04 (1.41)	2.88 (1.41)	54.5%	24.9%	-0.28**

Note: T1 = the measurement at the start of treatment and T2 – T5 are recurring measurements every three months. * the RCI and the normal health status percentages based on the original scale were respectively: 43.4% and 33.8%. The health status cut-off scores were < 1.79 for EDP, > 2.78 for EWB, > 2.24 for PWB, > 1.29 for SWB, < 1.33 for GPP and < 33.2 for the original scale OQ-45 SD scale. ** = statistically significant at the *p*-value of < 0.001.

Mental health network

Estimating psychometric networks and bootstrap results

We estimated a series of networks to exploratively examine mental health associations over time. Networks were estimated with the overall mental health domains. Table 4 shows the model fit indices. The pruned step-up model had the lowest BIC value (48089.81), with a good overall fit (RMSEA = 0.036, CFI = 0.98) and was selected as the final model.

Table 4. Model fit indices of the mental health models

Model	χ2	df	CFI	RMSEA	AIC	BIC
Unrestrained	753.01*	290	0.98	0.036	47849.60	48157.86
Pruned	809.70*	307	0.98	0.036	47872.28	48092.91
Pruned step-up	792.34*	305	0.98	0.036	47858.92	48089.81

Note: * = *p*-value < 0.01, df = degrees of freedom, CFI = comparative fit index, RMSEA = root mean square error of approximation, AIC = Akaike information criterion, BIC = Bayesian information criterion.

Networks and node centrality

The estimated mental health domain networks can be found in Figure 2, and Table 5 shows the edge-weights and centrality of the nodes for each network.

The temporal network shows overall weak pathways (directed partial correlations) between the domains. EDP shows only outgoing pathways, with a positive partial correlation to GPP (r = .11, p < .01) and negative partial correlations to all well-being (emotional, r =-.08, p < .01; psychological/social, r =-.09, p < .01) domains over time. This results in the highest out-strength (S = 1.33 and lowest in-strength (S =-1.71) for EDP. EDP is also the only domain with a moderate autoregressive correlation (r = .46, p < .01). Autoregressive effects over time within the other domains were weak. These results indicate that changes in EDP lead to further changes in EDP over time and relatively small improvements in the overall mental health network. Bi-directional associations were found in other domains, but changes in these domains did not lead to improvements in EDP over time. GPP shows the second-highest out-strength with weak pathways to well-being (emotional, r =-.11, p < .01; psychological, r =-.10, p < .01; social, r = -.08, p < .01). No pathways between EWB and PWB were found.

The contemporaneous network shows average within-person effects within time-points, or on a time span briefer than a three month interval, while controlling for temporal effects. Moderate partial correlations were found for the following edge-weights PWB by SWB (r = .38, p < .01), GPP by EDP (r = .31, p < .01) and GPP by EWB (r = .30, p < .01). PWB (S = 1.26) and GPP (S = 0.67) showed the strongest strength centrality. Interestingly, EDP had the lowest strength centrality (S =-1.21) in the contemporaneous network.

In the between-subjects network, PWB had the highest strength centrality (S = 1.55) and EDP (S =-0.92) the lowest.

Table 5. Estimated partial correlations and centrality results of the final mental health networks

	EWB	PWB	SWB	GPP	EPD	Centrality	
Estimated directed partial correlations (temporal)						Out-*S*	In-*S*
EWB	.10	-	-	-	-	-0.98	0.36
PWB	-	.10	.05	-.05	-	-0.38	0.76
SWB	-	.04	.12	-	-	-0.72	0.61
GPP	-.11	-.10	-.08	.23	-	0.75	-0.03
EPD	-.08	-0.9	-.09	.11	.46	1.33	-1.71
Estimated partial correlations (contemp, lower triangle; Between, upper-triangle)						Contemp-*S*	Between-*S*
EWB		.67	-	-.22	-	-0.02	0.09
PWB	.24		.50	-.21	-	1.26	1.55
SWB	.17	.38		-	.08	-0.71	-0.85
GPP	-.30	-.27	-		.47	0.67	0.13
EPD	-.05	-.10	-.08	.31		-1.21	-0.92

Note: *S* = standardized strength centrality, Contemp = contemporaneous, Between = Between-subjects. The meaning of the mental health abbreviations can be found in Table 2.

Bootstraps results

Table 6 gives an overview of the bootstrap results. Overall, the bootstraps consistently included the edge-weights of the final model, especially for the contemporaneous model. However, there were some edge-weights with lower inclusion rates (around 500) for EDP to EWB (*n* = 517) in the temporal network and EDP by WB (*n* = 504) in the between-subjects network. Of note is the edge-weight EDP by EWB in the contemporaneous network, which was included in only 289 of the 1000 bootstraps.

Table 6. The number of times each edge-weight was included in the case-drop bootstrap (*n* = 1000) for the final mental health networks

	EWB	PWB	SWB	GPP	EPD
Temporal					
EWB	**959**	283	76	181	72
PWB	391	**964**	**640**	**690**	361
SWB	175	**586**	**996**	208	91
GPP	**904**	**772**	**772**	**1000**	82
EPD	**517**	**846**	**782**	**842**	**1000**
Contemporaneous (lower triangle), between-subjects (upper-triangle)					
EWB		**1000**	180	**727**	403
PWB	**1000**		**1000**	**991**	231
SWB	**1000**	**1000**		64	**504**
GPP	**1000**	**1000**	265		**1000**
EPD	**289**	**999**	**856**	**1000**	

Note: The number of times each parameter was included in the case-drop bootstrap panel-gvar analysis of the final (pruned stepup) model. Each replication (1000 in total) was based on a 75% random subsample of the original dataset. Bold-faced values indicate parameters that were included in the final analysis (procedure based on Epskamp, 2020).

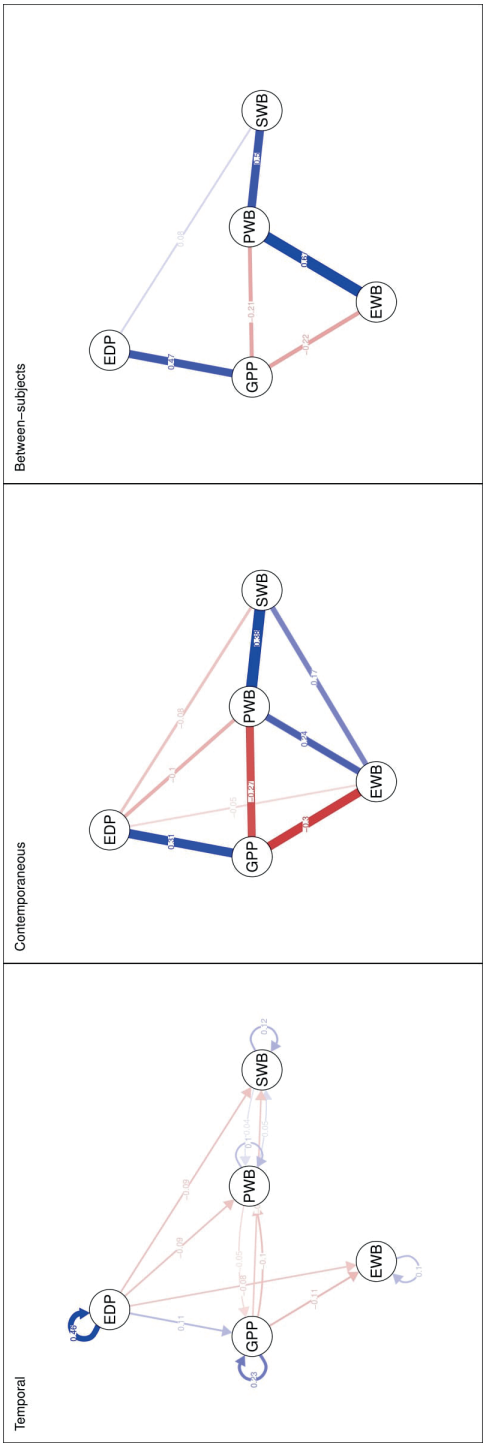

Figure 2. Mental health networks. The meaning of the abbreviations can be found in Table 2.

Extended mental health network

Model estimation

Given the relatively stable bootstrap results of the final mental health model and the solid out-strength centrality of EDP in the temporal network, we were interested in how the underlying EDP domains were more specifically interrelated and related to the other domains. Therefore, an extended model was estimated, replacing EDP with the subscales of the EDE-Q (EAT, SHA, WEI, and RES) to examine the relationships between well-being, GPP and EDP in more depth. See Table 2 for an overview of the abbreviations of the domains. In the extended model, the pruned-stepup solution was considered as the final model, with a good fit (RMSEA = 0.029, CFI = 0.98) with the lowest AIC (73745.10) and BIC (74181.22) value (see Table 7).

Table 7. Model fit indices of the extended mental health models

Model	χ2	df	CFI	RMSEA	AIC	BIC
Unrestrained	1465.94*	716	0.98	0.029	73765.26	74504.11
Pruned	1752.37*	786	0.98	0.031	73911.69	74291.37
Pruned stepup	1563.78*	775	0.98	0.029	73745.10	74181.22

Note: * = *p*-value < 0.01, df = degrees of freedom, CFI = comparative fit index, RMSEA = root mean square error of approximation, AIC = Akaike information criterion, BIC = Bayesian information criterion.

Networks and node centrality

The extended network shows which EDP nodes are connected with other nodes (i.e., GPP and well-being) and how they are interconnected. Overall, the networks show two separate clusters, a well-being cluster including PWB and an EDP cluster.

The temporal network shows overall weakly connected nodes. RES and EAT influence the other EDP nodes (WEI and SHA) and GPP and PWB over time. Hence, they have the highest out-strength (RES, *S* = 1.16; EAT, *S* = 1.13) combined with a low in-strength centrality for RES (*S* =-1.96). The highest in-strength was found for SHA (*S* = 1.50). See Table 8 for the estimated partial correlations and centrality measures and Figure 3 for the networks.

The contemporaneous network further shows somewhat stronger partial correlations within time-points. A strong correlation was found for WEI by SHA (*r* = .66, *p* < .01) and a moderate correlation for PWB by SWB (*r* = .39, *p* < .01). SHA was the most central node (*S* = 1.25, followed by WEI (*S* = .84) and PWB (*S* = 0.81).

The between-subjects network shows a similar pattern across patients compared to the basic mental health network, depicting that the EDP nodes (RES, EAT, and SHA) are primarily connected to GPP and not to the well-being nodes. PWB is the most central (*S* = 1.69), followed by SHA (*S* = 1.18).

Table 8. Estimated partial correlations and centrality results of the final mental health networks

	EWB	PWB	SWB	GPP	EAT	WEI	SHA	RES	Centrality	
Estimated directed partial correlations (temporal)									Out-*S*	In-*S*
EWB	.09	-	-	-	-	-	-	-	-1.20	-0.31
PWB	.05	.12	.08	-.07	-	-	-.02	-	0.26	0.11
SWB	-	.05	.12	-	-	-	-	-	-0.92	-0.04
GPP	-.12	-.09	-.09	.22	.04	-	-	-	0.99	-0.25
EAT	-	-.05	-	.05	.23	.08	.09	.09	1.13	0.08
WEI	-	-	-	-	-	.13	.05	-	-0.86	0.86
SHA	-	-	-	-	-	.07	.15	-	-0.56	1.50
RES	-	-	-	.05	.14	.08	.09	.30	1.16	-1.96
Estimated partial correlations (contemp, lower triangle; Between, upper-triangle)									Contemp-*S*	Between-*S*
EWB		.67	-	-.19	-	-	-.06	-	-0.43	0.12
PWB	.25		.49	-.23	-	.03	-	-	0.81	1.69
SWB	.18	.39		-	-	-	-	.07	-1.01	-1.05
GPP	-.31	-.26			.19	-	.08	.12	0.45	-0.54
EAT	-	-.06	-	.14		.20	.16	.20	-0.31	-0.62
WEI	-	-.04	-	.05	.17		.79	-	0.84	0.19
SHA	-	-	-.05	.07	.18	.66		.18	1.25	1.18
RES	-	-	-	.09	.21	.09	.11		-1.60	-0.96

Note: *S* = standardized strength centrality, Contemp = contemporaneous, Between = Between-subjects. The meaning of the mental health abbreviations can be found in Table 2.

Bootstrap results

The bootstrap results of the extended mental health network indicated a bit less stability compared to the basic mental health networks. Several edge-weights were included less than 500 times in the bootstraps, such as GPP to EAT (*n* = 357), PWB to EWB (*n* = 376), SHA to PWB (*n* = 440) in the temporal network, and EWB by SHA (*n* = 211), PWB by WEI (*n* = 384), WEI by GPP (*n* = 458) in the contemporaneous, and GPP by RES (*n* = 478) in the between-subjects network. However, the final model did not seem to miss highly relevant edge-weights. Only GPP by SHA was selected relatively frequently in the bootstraps (*n* = 520) while not included in the final model of the between-subjects network. Overall, this network needs to be interpreted more cautiously.

Table 9. The number of times each edge-weight was included in the case-drop bootstrap for the final mental health networks

	EWB	PWB	SWB	GPP	EAT	WEI	SHA	RES
Temporal								
EWB	**963**	259	92	196	99	81	97	81
PWB	**376**	**957**	**674**	**649**	239	257	**440**	173
SWB	190	**533**	**994**	278	113	129	184	187
GPP	**897**	**694**	**707**	**1000**	**357**	91	117	111
EAT	213	**740**	256	**657**	**1000**	**763**	**816**	**728**
WEI	99	74	90	127	213	**999**	**552**	208
SHA	99	138	302	101	139	**758**	**998**	148
RES	203	123	104	**579**	**986**	**803**	**862**	**1000**
Contemporaneous (lower triangle), between-subjects (upper-triangle)								
EWB		**991**	207	**669**	104	118	**211**	286
PWB	**1000**		**994**	**970**	96	**384**	184	118
SWB	**1000**	**1000**		117	291	96	92	**438**
GPP	**1000**	**1000**	262		**933**	226	520	**478**
EAT	168	**528**	234	**1000**		**562**	**686**	**747**
WEI	143	**589**	129	**458**	**1000**		**990**	137
SHA	109	250	**684**	**854**	**1000**	**1000**		**902**
RES	171	203	132	**862**	**1000**	**984**	**996**	

Note: The number of times each parameter was included in the case-drop bootstrap panel-gvar analysis of the final (pruned stepup) model. Each replication (1000 in total) was based on a 75% random subsample of the original dataset. Bold-faced values indicate parameters that were included in the final analysis (procedure based on Epskamp, 2020).

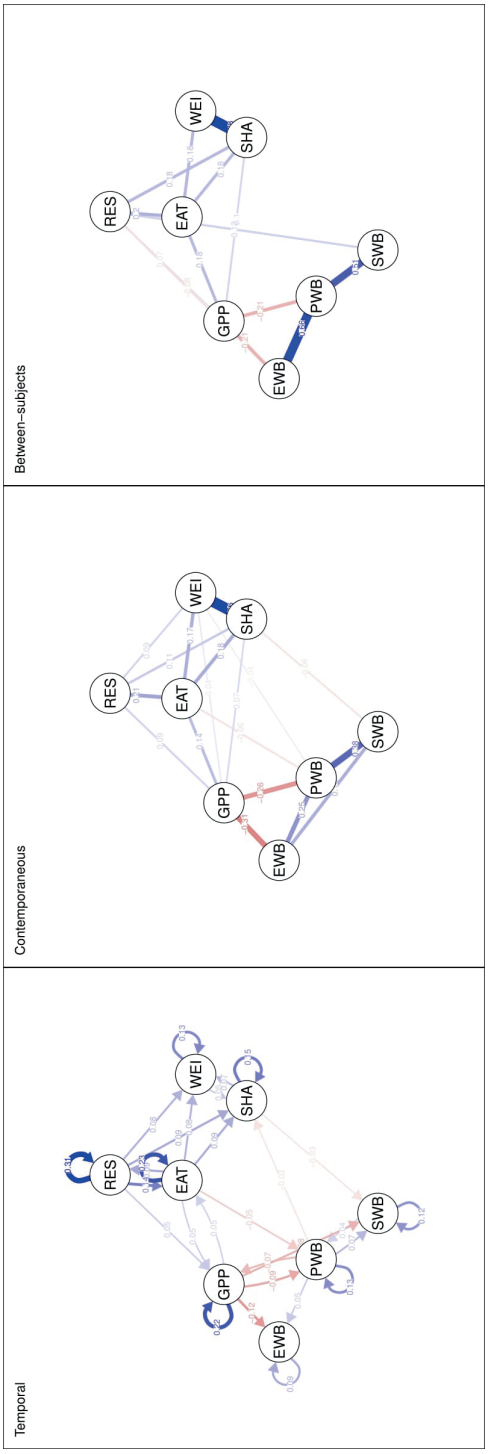

Figure 3. Extended mental health networks. The meaning of the abbreviations can be found in Table 2.

DISCUSSION

We used a novel network analysis approach with panel data to model mental health interactions during ED outpatient treatment. A model was first examined with the following main domains of mental health in a network; eating disorder psychopathology (EDP), general psychopathology (GPP), emotional (EWB), psychological (PWB), and social well-being (SWB). Then, a more detailed model was explored in a second step, including the following subdomains of EDP; eating concern (EAT), dietary restraint (RES), shape concern (SHA), and weight concern (WEI). For both models, average within-person (temporal and contemporaneous) and between-person effects were estimated. The associations between, as well as the centrality of, the domains, were assessed. Additionally, in the temporal networks, autoregressive and cross-lagged predictive effects (i.e., the direction of the associations) were examined.

Mental health networks

Average within-person effects on the temporal level showed weak predictive effects between the mental health domains. EDP was the most central domain in terms of predictive effects towards other domains over one year of treatment. Improvements in EDP (decreasing severity) led to minor improvements in GPP and the well-being domains, while there were no effects from the other domains towards EDP. Weak bi-directional effects were found between the other domains. Considering the high out-strength and low in-strength for EDP over a year of treatment, we conclude that changes in EDP do not first require changes in other mental health domains during outpatient treatment. More so, improvements in EDP in the short term led to further improvements in EDP in the longer term (i.e., autoregressive effects). These autoregressive effects were also present in the other domains but to a lesser extent. The moderately strong autoregressive effect of EDP corresponds with research indicating the importance of early symptom improvement in treatment (Pellizzer, Waller, & Wade, 2019; Vall & Wade, 2015).

However, PWB was the most influential domain in the contemporaneous and between-subjects networks, while EDP had the lowest centrality of all domains in these networks. The contemporaneous network suggests that PWB plays a stable and essential role in experiencing mental health within time points after controlling for temporal effects. These

seemingly contradictory results may be explained in several ways. Reliable change in well-being was only detected in a small group, and a substantial portion of patients reported moderate well-being with similar scores compared to the general population. When there is no substantial average change, predictive associations may not be detected over time. This may have to do with the content of treatment, which may have been primarily focused on changing EDP. Another explanation could be that well-being dimensions are more stable aspects of mental health over time. In explaining concepts of positive mental health, Marie Jahoda (1958) noted that mental well-being should either be considered a relatively constant and enduring function of personality or a momentary function of personality and environment (Jahoda, 1958). Well-being has been strongly linked to personality trait facets in the general population (Anglim, Horwood, Smillie, Marrero, & Wood, 2020) and recently in patients with EDs (Vos, Radstaak, Bohlmeijer, & Westerhof, 2021). In addition, a longitudinal study examining interactions between personality problems, GPP and EDP over a two-year follow-up after ED inpatient treatment (Rø, Martinsen, Hoffart, Sexton, & Rosenvinge, 2005) found that personality changes were only detected at the two-year time point and were not apparent in the first follow-up year. It was also found that ED symptom changes preceded personality changes. When considering well-being as a more stable function of mental health, these results correspond well with the findings of our study. However, it has been found that mental well-being can be changed in clinical samples with interventions (Chakhssi, Kraiss, Sommers-Spijkerman, & Bohlmeijer, 2018) and investigating these interventions in ED samples is warranted. In addition, personality trait facets may help in maintaining a stable mental well-being. Personality presents in individuals as stable habitual patterns and changing personality is often considered a complicated process, although it can be changed with interventions, and it does change across the lifespan (Anglim et al., 2020). Our findings suggest that it is warranted to promote well-being, particularly psychological well-being in ED patients, to sustain overall mental health, especially for patients with low levels of well-being and high levels of GPP (Radstaak, Hüning, & Bohlmeijer, 2020).

Extended mental health networks

The extended mental health networks depict how the specific ED domains were related to other domains and interrelated over time. Temporal pathways from EDP to other domains were primarily found for dietary restraint and eating concern. Also, they both predicted changes in shape and weight concern. The cognitive maintenance model on which CBT-E is

based provides hypotheses on the likely mechanism of change (Fairburn, Cooper, & Shafran, 2003). A dysfunctional self-evaluative system is considered the core psychopathology of EDs, where self-worth is based on weight and shape concerns. Being overly concerned with weight and shape is hypothesized to maintain dietary restraint and eating concern. This leads to distorted eating habits, such as bingeing, compensatory behaviors, or restricting, which further leads to increased concerns about weight and shape, resulting in a self-perpetuating cycle (Fairburn et al., 2003). Our study suggests that changes in dietary restraint and eating concerns precede changes in shape and weight concern, which may be important to break through this self-perpetuating cycle. Cross-sectional ED symptom network studies have consistently reported shape and weight concern, among other symptoms, as central nodes (DuBois et al., 2017; Elliott et al., 2020; Forbush et al., 2016), corresponding with our contemporaneous and between-subjects network results. This study adds that changes in these domains are predicted by dietary restraint and eating concern within patients. However, shape and weight concern had higher strength centrality in the extended contemporaneous and between-subjects networks than PWB. The high correlations between both may primarily cause this.

The dual continua model proposes that psychopathology and well-being are two distinct but related aspects of mental health (Keyes, 2005). The weak effects between EDP and well-being in the contemporaneous and between-subjects network correspond with earlier work examining associations in patients entering ED treatment (de Vos, Radstaak, Bohlmeijer, & Westerhof, 2018) and in a cross-sectional network study (de Vos et al., 2021). The networks in this study show two distinct clusters, a cluster with well-being domains, including GPP, and a cluster with the EDP subdomains. This suggests that GPP may be more strongly related to well-being, while specific ED psychopathology seems to form a distinct cluster, which also changes independently over time. In a study examining the dual-continua model, associations between GPP and well-being were higher in clinical samples, such as patients with depression, anxiety, and personality disorders, compared to the general population (Franken et al., 2018). Considering the dual-continua model for treatment, a primary focus on EDP and separately on promoting well-being and alleviating GPP seems to be warranted. Alternatively, a sequential treatment approach may be investigated. For instance, the effectiveness could be examined to apply well-being-focused interventions after EDP has improved or when patients do not improve on symptoms during regular treatment. Treating

EDP before focusing on other mental health aspects or underlying issues, such as personality functioning, has been substantiated before (Jansen, 2006). This approach may be conceived as a transdiagnostic strategy based on individual treatment plans proposed by Fava and Guidi (2020). A combined or sequential treatment is also in line with a recent model for sustainable mental health that postulates that mental illness and mental well-being are equally vital outcomes of mental health care (Bohlmeijer & Westerhof, 2020). This may be especially important in patients with low levels of well-being and high levels of GPP (Radstaak et al., 2020).

Strengths and limitations

The strengths of this study were the large number of patients consistently measured over a year of outpatient treatment, the novel method of analysis providing detailed insight about symptom-to-symptom associations over time and the relatively low systemic dropout. There are, however, several limitations that should be addressed. The EDE-Q measures how many times patients experience specific ED cognitions and behavior in the last 28 days. On the other hand, the MHC-SF measures how people feel in general about certain statements in the last month. These statements are arguably more abstract, and the MHC-SF may therefore not be as responsive to detect differences as the EDE-Q. For instance, personal growth may be considered a gradual process instead of linked to specific behavior that occurs regularly within a specific time frame. Entering more abstract and stable aspects of mental health together with specific psychopathological symptoms in a single network may have led to biases in measurement and subsequently detecting (temporal) associations. We did not test for measurement error by including a measurement model in the network analyses as suggested by Epskamp (2020).

It was unclear how treatment has influenced the results and how domain interactions over time would have presented with different treatments or in a natural course. Further, we did not test how the underlying symptoms of the domains were related because panel network analysis can only handle a certain amount of nodes, and a higher number of nodes requires large datasets (Epskamp, 2020). Modeling panel data networks on a symptom level may provide further knowledge about predictive associations. We consider symptom-to-symptom effects as predictive effects over time, also termed as Granger causality applied in time-series (Epskamp et al., 2018). However, Granger causality does not necessarily address

true causality or a predictive effect in the meaning that a change in one domain can be used as a proof of causation of change in another domain at the next time-point. Although we assume that a temporal link acts as a causal relationship, this link may also have occurred for other reasons (Epskamp et al., 2018). While we have identified average temporal pathways between mental health domains in ED patients, there may still be substantial variability within patients. Studies examining mental health associations with time series, such as experience sampling in individual patients, are suggested.

Also, we did not test for differences in mental health associations between the specific ED types because we had insufficient power. However, we have tested mental health networks over time, specifically for AN and BN, and included this in the (still to be published) supplements. The networks were extended with the core symptoms (i.e., primary remission indicator) for each (i.e., BMI for AN and compensatory behavior for BN) to understand better whether changes in these symptoms were related to the health domains. To prevent stability issues, two separate network models were estimated. One model with BMI/compensatory behavior, well-being, and GPP, a second model with the BMI/compensatory behavior, and the ED domains (SHA, RES, EAT, and WEI). We did not examine this for BED because the sample size (n = 94) was too small. Bootstraps results showed that the networks' stability performed worse than the extended mental health network, and we decided to exclude these results from this paper. However, all fit indices, networks, and bootstrap results of the AN and BN models can be found in the (still to be published) supplements for further investigation.

Conclusion and implications

We conclude that EDP changes relatively independently from other mental health domains (temporal effects), while PWB was considered a stable and influential domain for experiencing mental health within time points (contemporaneous effects). These findings have several implications. In line with current evidence, our findings corroborate that a strong focus on ED symptom change should be considered a primary aim of treatment. In addition, an important secondary aim of treatment could be to focus on promoting mental well-being, specifically PWB, and alleviating GPP. This approach may be conceived as a transdiagnostic strategy based on individual treatment plans proposed by Fava and Guidi (2020). This may be especially important in patients with low levels of well-being and high levels of GPP (Radstaak et al., 2020). Treatments for promoting psychological well-being have been developed

(Weiss, Westerhof, & Bohlmeijer, 2016), but further evaluation of their impact on ED patients is recommended. Research should also focus on replicating these results and examine the variability in (temporal) associations in individual patients with time series.

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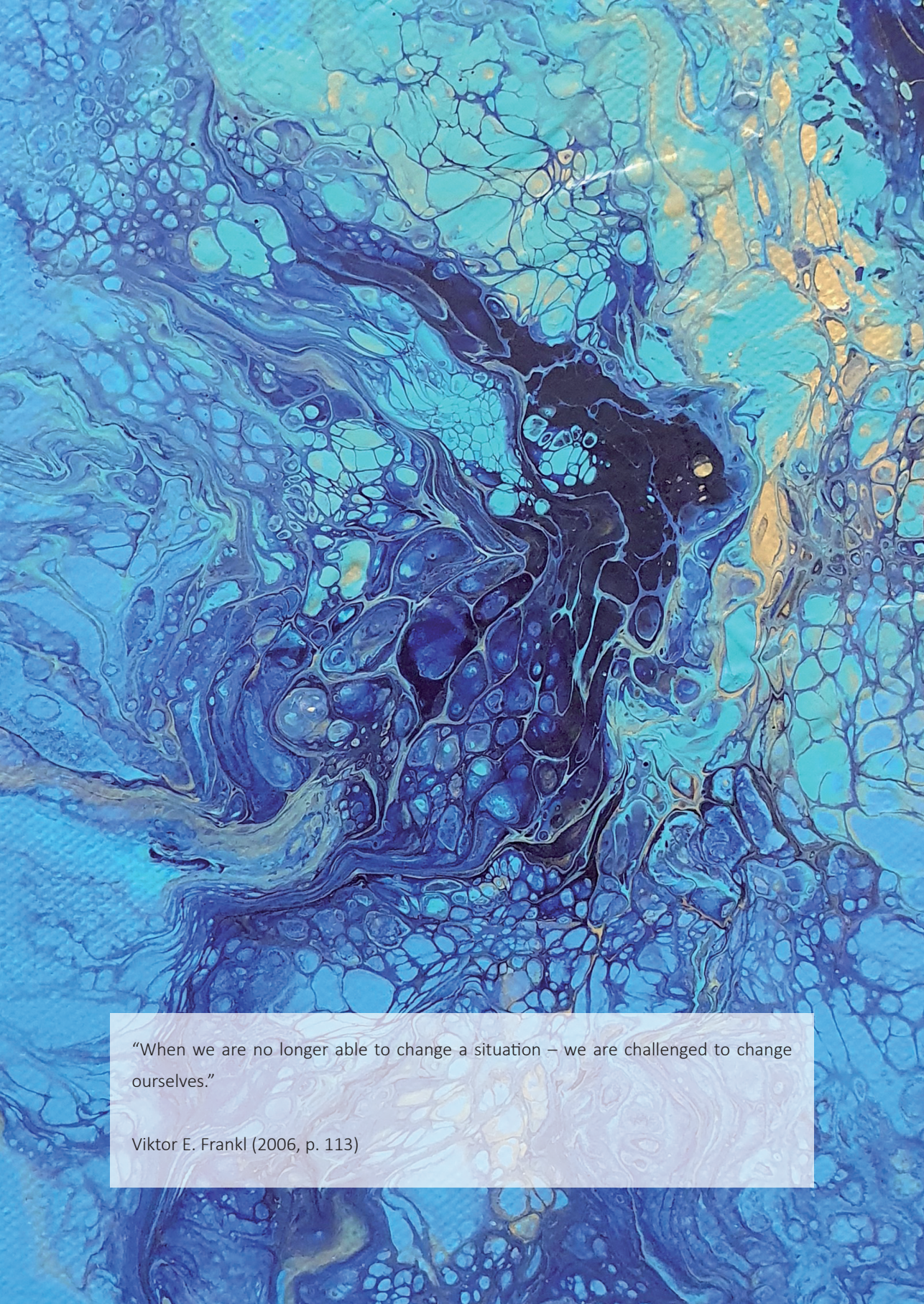

"When we are no longer able to change a situation – we are challenged to change ourselves."

Viktor E. Frankl (2006, p. 113)

8

General discussion

In the last decades, scientific studies about eating disorders (EDs) have predominantly focused on understanding their symptomatology and how to help patients achieve remission from these symptoms. However, mental health is not conceived as just the absence of psychopathological symptoms but also as the presence of mental well-being. The concept of mental well-being has only been examined in a few studies in ED patients. In this thesis, we presented a scientific exploration of mental well-being in ED patients. In this chapter, we reflect on the findings and implications by answering six questions; 1) What are fundamental criteria for ED recovery?, 2) How do ED patients experience mental well-being?, 3) How are mental well-being and psychopathology related in ED patients?, 4) Which ED patient characteristics are related to mental health?, 5) How does mental health change in ED patients?, and 6) How do the overall results relate to the dual-continua model of mental health?

A central mental health framework we applied across the chapters is the dual-continua model. This model postulates that well-being and psychopathology should be considered distinct but related mental health dimensions (Keyes, 2005). Mental well-being is about the positive aspects of life and consists of three main domains: 1) emotional well-being (EWB), which is characterized by positive affect and life satisfaction, 2) psychological well-being (PWB), which concerns optimal psychological functioning, and 3) social well-being (SWB) which refers to optimal functioning in the societal context. We distinguished between general psychopathology (GPP) and ED-specific pathology (EDP) in ED patients.

1. What are fundamental criteria for ED recovery?

Many researchers have investigated what recovery means to ED patients (see, for instance, Noordenbos & Seubring, 2006, Noordenbos, 2011 and McGilley & Szablewski, 2010 for an overview). These qualitative studies identified the recovery criteria as perceived by recovered ED patients, clinicians, and academics. This resulted in a range of recovery criteria, from ED symptom remission to different aspects of mental well-being. However, these studies have endorsed different recovery criteria, making it challenging to understand the most relevant criteria. Noordenbos and Seubring (2006) were the first to examine the relevance of recovery criteria based on the perception of academics, clinicians, and recovered patients. They summarized the literature on this subject and made a list of potentially relevant criteria.

Then they asked former patients and clinicians to rate the importance of each criterion and came up with a list encompassing the most relevant recovery criteria. These criteria were about ED symptom remission and psychological, emotional, and social functioning in general (Noordenbos & Seubring, 2006). There are two reasons why we wanted to investigate the relevance of criteria for recovery further. First, in Noordenbos and Seubring's (2006) study, patients and clinicians rated a pre-defined set of criteria, and relevant criteria may have been missed. Second, several qualitative studies have been published on this subject since 2006 that may have identified new fundamental recovery criteria. We performed a systematic review combined with a qualitative meta-analytic approach (chapter two). By using a meta-analytic approach, we could include relevant criteria that might have been missed by rating a pre-defined list. Other advantages are a systematic search for studies and an assessment of the quality of the methodology used in the underlying studies. It is considered an issue to interpret the trustworthiness and reliability of qualitative studies because of potential researcher bias, the variously used methodologies, and mostly small sample sizes (Grossoehme, 2014; Krane, Andersen, & Stream, 1997).

We included 18 relevant studies with adequate to good methodological quality and found a range of criteria recurring across these articles. The most described criteria, which were reported in more than 75% of the included studies, were: self-acceptance, positive relationships, personal growth, ED symptom remission (cognitive/behavioral), self-adaptability/resilience, and autonomy.

Self-acceptance, positive relationships, personal growth, and autonomy are aspects of PWB (Ryff, 1989). We concluded that PWB and self-adaptability might be considered fundamental for ED recovery in addition to symptom remission. These results provide direction to decide which aspects to measure in treatments and outcome studies. The attention for a broader focus on ED recovery in science has been growing in the last years. According to Web of Science, our study has been cited by 53 scientific papers (retrieved on July the 6th, 2021) since its publication in 2017. Also, a systematic review was recently published repeating the meta-analytic method to conceptualize personal recovery based on recovery frameworks (Wetzler et al., 2020). The central components for recovery the researchers identified were largely in line with our results, such as supportive relationships, meaning and purpose, empowerment, and self-compassion (Wetzler et al., 2020). However, the researchers also identified hope

and identity as central components. This is because recovery was conceptualized from frameworks developed from service user perspectives and individuals with experiences with mental disorders (i.e., the connectedness, hope and optimism, identity, meaning in life, and empowerment framework [CHIME] and the Substance Abuse and Mental Health Services Administration's framework [SAMHSA]). The mental health framework we used to conceptualize recovery emphasizes the importance of mental well-being. Concepts of mental well-being are rooted in Greek philosophical traditions on human functioning and concern general humanistic and lifespan theories on mental health and healthy human development (Bohlmeijer & Westerhof, 2020; Jahoda, 1958; Ryff, 1989). PWB, for example (Ryff, 1989), is based on the concepts of the fully-functioning person (Rogers, 1961), self-actualization (Maslow, 1968), personal development (Erikson, 1959), individuation (Jung, 1933), maturity (Allport, 1961) and basic life tendencies that work toward the fulfillment of life (Buhler, 1935).

Both meta-analytic studies summarise relevant qualitative studies and indicate that recovery in ED patients should be conceived from a broad perspective. The long-time restricted criteria that were used, such as regaining weight and normalizing eating behaviors, neglected the psychological and social dimensions of change (Noordenbos & Seubring, 2006). Which constructs we should specifically measure in treatments and research can be substantiated from both mental health and personal recovery frameworks. Consensus on these constructs and subsequent instruments to measure them would be a big step forwards in ED research. The lack of consensus on what to measure as an outcome has led to a wide variety of recovery definitions and measures across outcome studies and, subsequently, a lack of comparability (Bardone-Cone et al., 2010; Couturier & Lock, 2006; Noordenbos & Seubring, 2006). The results of our meta-analysis provide a clear direction for measuring meaningful recovery criteria during treatment and evaluating outcome studies.

2. How do ED patients experience mental well-being?

We have examined levels of well-being among ED patients and made the distinction between PWB, EWB, and SWB. We found that ED patients report lower levels on all three well-being dimensions compared to a representative community sample. ED patients differed the most on EWB (large effect size) and were the most similar on SWB (small effect size). Based on a classification introduced by Keyes (2005), we assessed whether patients overall had a very

low (labeled as languishing) or high (labeled as flourishing) well-being. The percentage of ED patients languishing was substantially higher, and the percentage of ED patients flourishing substantially lower compared to the community sample.

These results replicate previous research showing that ED patients reported lower PWB than a community sample (Tomba, Offidani, Tecuate, Schumann & Ballardini, 2014), but they contradicted the ED classification level. We found relevant differences between ED types. Languishing was most prevalent in patients with AN, and flourishing was most prevalent in patients with BED, while Tomba and colleagues (2014) reported that patients with AN were most similar to healthy controls in PWB. These differences may be explained by ED severity that might influence the association between mental well-being and psychopathology in ED patients. We will describe this in more detail in the next paragraph. EWB is in several studies measured as subjective well-being within the broader concept of quality of life (QoL) (de la Rie, Noordenbos, & van Furth, 2005; Doll, Petersen, & Stewart-brown, 2005; Engel, Adair, Hayas, & Abraham, 2009). Our results correspond with these studies in that QoL is lower in ED patients than community norms, and impairments are primarily found in EWB (Doll et al., 2005).

We concluded that ED patients have affected well-being and report, in particular poor EWB. There is also substantial variation in mental well-being functioning among ED patients, ranging from languishing to flourishing. We detected differences in well-being levels between the ED types. Low well-being may be most likely to occur in patients with AN. Including strategies focused on improving mental well-being in treatments may be warranted, especially for patients with AN.

3. How are mental well-being and psychopathology related in ED patients?

We have examined associations between the main mental health domains (chapters three and four) and between the underlying symptoms (chapter four). Overall, we found that well-being and psychopathology domains were negatively correlated. However, there was a clear difference between GPP and EDP. GPP was moderate to strongly correlated with the well-being domains, while EDP was only weakly related. Franken and colleagues (2018) also found moderate to high associations between mental well-being and GPP in clinical samples

compared to community norms. The low association of well-being with EDP does correspond with Tomba and colleagues (2014) study, which noted that impaired levels of PWB were independent of the presence of EDP.

Several working mechanisms may explain the weak associations between well-being and EDP and substantial variability in well-being among ED patients. For patients with AN, it may be explained by considering the egosyntonic nature or a lack of insight into (the severity of) the disease (Tomba et al., 2014). It has been noted that patients with AN may conceive anorexic behavior and the resulting weight loss or low weight maintenance as highly valuable (Gregertsen, Mandy, & Serpell, 2017). This may provide them with feelings of control, superiority or inner strength, mastery, and self-control. Feelings of control and mastery are related to PWB and may also lead to experiencing higher levels of EWB. Also, patients with AN may feel that they conform to sociocultural thin-ideal preferences, leading to higher self-esteem and enhanced feelings of social acceptance (Gregertsen et al., 2017; Tomba et al., 2014). Patients who have become more aware of the detrimental consequences of the disease or become more aware of the lost control over cognitions and behaviors may experience lower levels of well-being. It is found that the balance of experiencing positive to negative effects from the ED varies based on the duration of the illness and, in particular, the stage of change a patient can be contributed to (Schmidt & Treasure, 2006).

The stages of change are pre-contemplation, contemplation, preparation, action, and maintenance, based on Prochaska and Di Clemente (1984). Patients in the pre-contemplation stage endorse more positive aspects of the illness than negative effects, and for patients in the stage of action, this is reversed (Schmidt & Treasure, 2006). This may be substantiated by the differences we found compared to the study of Tomba and colleagues (2014). They found that patients with AN were most similar to healthy controls, while in our sample, patients were least similar to healthy controls compared to other ED classifications. Their sample included patients we may consider less severe based on a higher body mass index (BMI), shorter illness duration, and lower severity. So, it could be that the patients in their sample were still in the pre-contemplation stage and experience substantial benefits from the ED. In comparison, the patients in our sample may be considered more ill on average with a longer duration, and they may have become more aware of the negative consequences.

For patients with BED and, to a lesser extent, BN, understanding ED as a coping mechanism (Wagener & Much, 2010) may provide a feasible explanation for understanding the relationship between well-being and EDP. Bingeing and compensatory behaviors may be considered a coping strategy for internal and external stressors, helping patients maintain positive functioning and well-being in their lives due to managing stressors effectively. Links between daily stress and bingeing as a coping mechanism have been found (Freeman & Gil, 2004). For BN, the detrimental effects of compensatory behaviors, such as purging, may become more and more apparent in the course of the illness, while these detrimental effects may be less present in patients with BED. For instance, the average duration of the ED for patients with BED was over 16 years in the sample in chapter three when they applied for treatment. This was by far the longest duration compared to other ED types, while they still reported the highest well-being levels of all ED patients. This may indicate that bingeing is a relatively effective coping mechanism as long as the detrimental effects of the ED, such as prolonged shame, a lack of self-esteem (Duarte, Pinto-Gouveia, & Ferreira, 2014), and somatic complications, do not outweigh the benefits.

We conclude that several working mechanisms, such as egosyntonic aspects, the stages of change of a patient, and coping, may explain associations between mental well-being and EDP, which need to be further investigated.

We applied psychometric network analysis to arrive at a deeper understanding of how mental health is interconnected in ED patients (chapter four). Until chapter three, it was not clear how the underlying symptoms that make up the mental health domains are interconnected. In addition, certain domains and underlying symptoms may be more relevant for mental health than others. Marie Jahoda already pointed this out in 1958 by stating that not all psychological functions are equally relevant for mental health. In network analysis, the sum of the strength of the associations between symptoms can be estimated, leading to a measure of centrality (Epskamp & Fried, 2017). This is explained by how influential a symptom is in maintaining other symptoms within a network structure. One of the assumptions of psychometric network theory is that symptoms maintain each other, leading to self-sustaining patterns (Borsboom, 2016).

We found that PWB was the most influential domain in the mental health network of ED patients. The most influential mental health symptoms were feeling depressed, feeling worthless, purpose in life and self-acceptance. We did not find differences between ED patients in the mental health network structure. These results correspond with studies examining EDP and co-morbidity networks in that feelings of depression and worthlessness were central symptoms, although we did not find anxiety to be a central symptom (DuBois, Rodgers, Franko, Eddy, & Thomas, 2017; Elliott, Jones, & Schmidt, 2020; Forrest, Jones, Ortiz, & Smith, 2018; Monteleone et al., 2019; Smith et al., 2020). Also, other concepts, such as sensitivity and ineffectiveness, were not measured in our network.

The study in chapter four was also the first, to our best knowledge, to examine which specific underlying mental health symptoms link well-being with psychopathology. These symptoms are explained as bridge symptoms in network terms. Bridge centrality measures how strongly a symptom of a community (i.e., well-being) is connected to symptoms of another community (i.e., psychopathology). We found that the most influential bridge symptoms were self-acceptance, environmental mastery, interested in life, and feeling depressed. Although we could not compare this with other investigations, the results suggest that these specific bridge symptoms link mental well-being and psychopathology in ED patients, thereby providing a more detailed insight into the dual-continua model. However, longitudinal studies on a symptom level are needed to investigate these associations within persons further.

Overall we conclude that there is a negative relationship between mental well-being and psychopathology. Well-being seems to be primarily related to GPP. EDP may function relatively independently from the experience of well-being. Strategies for promoting mental health in ED patients may focus on PWB and specific underlying central symptoms. Also, central bridge symptoms may be of particular interest in strategies promoting mental health in ED patients since they may link well-being and psychopathology. Feeling depressed and self-acceptance were both found to be overall central and form a specific link between well-being and psychopathology and may therefore be especially relevant to address treatment strategies. However, the relevance of centrality in network studies is still debated, and further studies are needed to assess these associations within patients over time.

4. Which patient characteristics are related to mental health?

To further understand well-being functioning in ED patients, we have investigated which patient characteristics are related (chapters three, five, and six). Several characteristics emerged that might be of relevance for mental health. These characteristics can be divided into demographics (e.g., age), illness-related characteristics (e.g., ED duration), and characteristics related to personality functioning. We were specifically interested to understand whether different patient characteristics may explain mental well-being and EDP.

GPP was the only variable related both to mental well-being and EDP. Patients with higher levels of GPP were more likely to experience higher levels of EDP and lower mental well-being. In addition, we also found that patients' baseline GPP levels were predictive of change in both during outpatient treatment. GPP seems relevant for EDP and well-being functioning, which corresponds with studies reporting depression and anxiety related to EDP and as a predictor for treatment outcome (Bulik, 2002; Keski-Rahkonen, 2014; Vall & Wade, 2015).

Characteristics specifically related to EDP

ED type was associated with EDP levels, and hope for recovery and early EDP change were predictive for EDP symptom improvements during treatment. Hope was also a central theme in a meta-synthesis examining essential concepts for recovery (Wetzler et al., 2020), and early change has consistently been reported as a predictor for treatment outcome (Nazar et al., 2017; Vall & Wade, 2015). Having an AN diagnosis was associated with lower EDP levels, and a BN diagnosis was predictive for a slow EDP recovery during ED outpatient treatment. However, these results may not generalize to other ED patients because we found lower EDP scores for AN and higher scores for BN and BED than Dutch patient norms (Aardoom, Dingemans, Slof Op't Landt, & Van Furth, 2012). These analyses need to be replicated before further conclusions can be drawn.

Characteristics specifically related to mental well-being

Several characteristics were related to mental well-being. Being hospitalized for the ED and personality problems in responsibility were associated with lower psychological well-being. Personality problems in identity integration were associated with lower levels on all well-being domains. Identity integration has been described as a core vulnerability for EDs

(Farchaus Stein & Corte, 2007). Our results indicate that problems in identity integration may not necessarily be associated with the severity of EDP in patients but with lower levels of mental well-being. Hilde Bruch (1977, 1963) already related identity impairments in ED patients to lower autonomous functioning (PWB), impaired social functioning (SWB), and a maladaptive search for self-respect (PWB). EDs often emerge in the adolescent phase, and this phase is crucial for the formation of a healthy identity from a humanistic lifespan perspective (Westerhof & Bohlmeijer, 2010). During this phase, problems in identity integration are associated with psychopathology, such as depression and anxiety. However, the link with mental well-being is less well investigated (Westerhof & Bohlmeijer, 2010). Our findings suggest that problems in identity integration affect mental well-being among ED patients, and being aware of problems in identity integration and the subsequent potential impact on well-being may be warranted.

We also found that intrinsic motivation for recovery predicted well-being improvement. Interestingly, intrinsic motivation was not a predictor for EDP change during treatment, while it is considered an influential predictor for treatment outcomes in the literature (Vall & Wade, 2015). Self-determination theory suggests that intrinsic motivation is promoted by focusing on universal needs, such as autonomy, competence, and connection (Deci & Vansteenkiste, 2004). These universal needs are closely related to the concept of well-being which may explain that intrinsic motivation is primarily related to changes in mental well-being and not EDP change.

Given the potential relevance of personality for experiencing mental well-being, we investigated maladaptive personality trait facets in ED patients (chapter five). We found that maladaptive personality trait facets explain a substantial proportion of the variance in mental well-being, which corresponds with studies in the general population (Anglim, Horwood, Smillie, Marrero, & Wood, 2020). We found that different personality trait facets were related to the three well-being dimensions in ED patients. However, the personality trait facets anhedonia and depression were negatively associated with all well-being dimensions. Personality differs from well-being because it is defined as stable traits and habitual tendencies, while well-being is considered to be more about the experience and appraisal of life at a given moment (Anglim et al., 2020). However, as Anglim and colleagues (2020, p. 309) note, “it is unsurprising that an individual’s general approach to acting in and

experiencing the world (i.e., their personality) predicts his or her momentary emotional experiences and evaluations of life." Our study provides a direction for understanding which specific personality trait facets are related to mental well-being in patients with EDs and that the trait facets anhedonia and depression are of particular relevance. New studies may replicate these findings and consider personality functioning in interventions addressing well-being.

We conclude that GPP is associated with mental well-being and EDP and that different patient characteristics are related to mental well-being and EDP. Specific patient characteristics such as hope for recovery and early change during treatment are associated with EDP recovery, while personality functioning and intrinsic motivation are related to mental well-being recovery. This was further substantiated by the results in chapter five that specific personality trait facets were linked to well-being. These results may be considered in developing strategies for achieving EDP symptom remission and improving well-being.

5. How does mental health change in ED patients?

To understand how mental health changes in ED patients, we conducted longitudinal studies during a year of outpatient treatment (chapters six and seven).

Patients follow differential trajectories of change during treatment (Melchior et al., 2016). We wanted to understand better whether these trajectories have certain commonalities. Knowledge about this may help develop personalized treatments, for instance, by adjusting interventions based on the trajectory of change and related patient characteristics. We applied latent growth mixture modeling to model individual change by estimating classes of patients with similar change trajectories (chapter six). Both for well-being and EDP, we found three distinct classes. The majority of the patients (56%) were assigned to a class consisting of a high EDP baseline severity, followed by a slow recovery trajectory. Twenty percent of the patients were assigned to a class with a high baseline ED severity followed by a substantial recovery trajectory, and the other patients (24%) were assigned to a moderate baseline ED severity and no significant recovery trajectory. For well-being, we also detected three classes; a class with low baseline well-being, followed by a slow growth trajectory (45%), a class with a low baseline and substantial growth trajectory (10%), and a class with an adequate and

stable well-being trajectory (45%). These results correspond with other studies showing that individual change on relevant health criteria can be modeled into meaningful trajectories (Berona, Richmond, & Rienecke, 2018; Espel-Huynh et al., 2020; Hilbert et al., 2019; Makhzoumi et al., 2017). Change trajectories may have prognostic value. For instance, Hilbert and colleagues (2019) found that binge eating class membership predicted binge eating at follow-up. Identifying change trajectory probability may be considered a step towards personalized treatments (Cuijpers, Ebert, Acaturk, Andersson, & Cristea, 2016; Espel-Huynh et al., 2020). Specific treatment strategies may be based on patient characteristics that can be measured before treatment, such as GPP and personality functioning, or interventions adjusted based on the change trajectory. For instance, by detecting early change. New studies may examine whether change trajectories of individual patients can be predicted.

To further develop personalized treatment, it is relevant to understand what maintains mental health and predicts change during treatment. Although we have found several patient characteristics related to mental health functioning (see question four), the domains and underlying symptoms self may also maintain and influence each other over time, leading to self-sustaining patterns. The notion of symptoms maintaining each other is a central assumption of psychometric network theory (Borsboom, 2016). We applied panel data network analyses to understand associations between mental health domains during treatment (chapter seven). We used the same domains (i.e., EWB, SWB, PWB, GPP, and EDP) as included in the network analysis in chapter four. The advantage of panel data network analysis is that average within-person associations can be estimated separately from the between-person effects (Epskamp, 2020). The between-person effects in panel network analysis can be understood as effects also measured in cross-sectional studies, such as estimated in chapter four, with the addition that they represent average stable means over time. Within-person effects were further modeled on two levels depicting associations over time (temporal effects) and within time points (Epskamp, 2020). Estimating associations over time allows understanding whether certain domains change before others change, also explained as predictive effects. These predictive effects can be estimated within and between domains. The results showed that changes in EDP were predictive of further changes in EDP over time and minor improvements in the other domains. Well-being or GPP was not predictive of changes in EDP. This shows that EDP changes occur independently from changes in other mental health domains. However, PWB was the most influential domain

within patients within time points, while EDP was the least central within time points. This suggests that PWB drives changes in overall mental health. The central symptoms we found in chapter four (i.e., feeling depressed, feeling worthless, purpose in life and self-acceptance) may provide specific pathways on how mental health is primarily maintained.

In chapter seven, we also found that more than half of the ED patients achieved EDP improvement. However, three out of four patients still did not have a normal health status at 12 months (i.e., scoring comparable with community norms). For GPP, only one out of three patients achieved change, and less than 30% had a normal health status at 12 months. For mental well-being, the normal health status at 12 months ranged from 60% for EWB, and 73% in PWB, to almost 90% for SWB, indicating that mental well-being remained relatively stable and very few patients achieved improvement. Well-being may therefore be considered as a relatively stable aspect of mental health, although a small class of patients showed substantial growth in well-being. This may be substantiated by the relatedness to personality functioning. Even though our first study showed that recovered patients highly value PWB, our longitudinal studies also show that PWB does not substantially change in one year of treatment for most patients. In addition, although more than half of the patients did achieve reliable EDP change, most of the patients did not score within community norms after 12 months of treatment. In chapter two, we found that the average duration for recovery was over eight years, with a range of 1.5 to 44 years. Overall, these results may suggest that recovery is a long-term process for many patients. The necessity for a substantial treatment duration, most likely longer than a year, or the implementation of long-term support strategies after treatment may be warranted.

We conclude that ED patients show differential trajectories of change, both for mental well-being and EDP. Considering the independent change of EDP from other mental health domains while other domains show minor changes following EDP, we conclude that EDP should be considered the first strategy in treatment, corresponding with other research (Jansen, 2006). Addressing well-being and particular PWB may be addressed simultaneously or sequentially as a secondary strategy to promote overall mental health, which can be conceived as a transdiagnostic approach in clinical care (Bohlmeijer & Westerhof, 2020; Fava & Guidi, 2020).

6. How do the results of the different studies relate to the dual continua model

A central model we have applied across these chapters is the dual-continua model, which postulates that mental well-being and psychopathology should be considered distinct but related mental health aspects (Keyes, 2005). Overall, the findings from the studies presented in this dissertation substantiate the dual-continua model in ED patients. We concluded this considering the weak associations between well-being and EDP, the patient characteristics which are for the most part differently related to both, the differential change trajectories, and the lack of temporal associations between well-being and EDP. The dual-continua model has been tested and confirmed in a substantial number of studies, both in clinical samples and the general population (Franken et al., 2018; Iasiello, van Agteren, & Cochrane, 2020; Lamers, Westerhof, Bohlmeijer, & Keyes, 2013; Lamers, Westerhof, Bohlmeijer, Ten Klooster, & Keyes, 2011; Lamers, Westerhof, Glas, & Bohlmeijer, 2015). Our results show that certain mental health domains and symptoms such as PWB and feeling depressed, feeling worthless, purpose in life and self-acceptance may be more relevant for experiencing mental health in ED patients. In addition, we identified specific symptoms, such as self-acceptance, environmental mastery, interested in life, and feeling depressed, linking well-being with psychopathology. Our results also suggest that GPP and EDP may be differently related to well-being and that self-adaptability may be considered essential in ED patients. These findings and the dual continua model demonstrate that a more balanced treatment approach for ED patients is warranted.

Bohlmeijer and Westerhof (2020) recently proposed a new model for sustainable mental health for clinical care. The model consists of four central components: (1) in addition to reductions in psychopathological symptoms, signs, and expressions of mental well-being are considered essential outcomes of interventions, (2) the inclusion of adaptation processes, (3) the presence of contextual factors and (4) that treatments need to address both barriers and resources for adaptation and mental health. It is not realistic to state that life will always be without suffering or will always be characterized by flourishing. Expecting that both continua of mental health fluctuate over time, people need to know how to regulate daily stressors and life events (Bohlmeijer & Westerhof, 2020). This thesis shows the importance of self-adaptability from a recovery perspective and provides several patient characteristics, such as personality trait facets that may be conceived as barriers and resources for adaptation and mental health.

Several treatments and positive psychology interventions focus on well-being, such as compassion-focused therapy (CFT), acceptance and commitment therapy (ACT), and well-being therapy. Positive psychology interventions effectively promote mental well-being and alleviate symptoms in clinical populations (Chakhssi, Kraiss, Sommers-Spijkerman, & Bohlmeijer, 2018). Preliminary studies examining CFT and ACT in ED patients show promising results (Fogelkvist, Gustafsson, Kjellin, & Parling, 2020; Steindl, Buchanan, Goss, & Allan, 2017). However, further studies are needed to examine the effectiveness of these interventions on mental well-being. Given that maladaptive personality functioning and a lack of identity integration may be barriers for mental well-being, it may be warranted to examine the effects of treatments addressing personality, such as schema-focused therapy in ED patients (Smith & Simpson, 2019).

Strengths and limitations

Each chapter gives an overview of the specific strengths and limitations of that study. This thesis has some overall strengths and limitations.

Strengths

We have used novel qualitative and psychometric methods to investigate mental well-being in ED patients. More specifically, we applied a meta-analytic approach assessing qualitative studies about recovery criteria, latent growth mixture modeling to identify change trajectories, and network analyses to explore mental health associations. The application of these methods has led to new knowledge about mental well-being in ED patients and its relationship with EDP. In addition, we have applied cross-sectional and longitudinal study designs to understand between-person and within-person effects in mental health domains. We included relatively large datasets ensuring adequate statistical power to perform the analyses. We had low intermittent and systemic dropout in the longitudinal observational studies because the data was also used to inform clinicians and patients about their treatment progress. This approach ensured a high response rate. At last, the measures we applied were well validated and used in various other studies.

Limitations

Two limitations applicable across the studies are the generalization of the results to other ED patients and the measurement of mental health with self-report questionnaires. Although

we included patients with an ED diagnosis across locations in the Netherlands, there may be issues in generalizability to other ED patients. For instance, patients were recruited from a treatment center that mainly worked with therapists with a personal history of EDs. Due to the specific inclusion and exclusion criteria of the treatment center, we may not have examined these processes in patients with severe EDs. Related to this, we did not examine the potential effects of malnutrition, while it is found that this may alter brain functioning and influence mental health (Fuglset, Landrø, Reas, & Rø, 2016). In addition, we included only adults, and results can therefore not be generalized to children and adolescents with EDs. Results can also not be generalized to males, which were excluded in several studies because they were severely underrepresented.

In five of the six presented studies, we used self-report questionnaires to measure mental health and illness. The measurement of mental health may have been biased. For instance, the use of self-report questionnaires may have led to social desirability response bias (Van De Mortel, 2008). Although this is a general problem across psychological studies using self-report instruments, it may have affected our results. For instance, it is found that social desirability is related to the reporting of ED behavior (Ambwani & Chmielewski, 2013; Freitas, Oliveira, Correia, Pinhão, & Poínhos, 2017), and mental health in clinical samples (Latkin, Edwards, Davey-Rothwell, & Tobin, 2017). In addition, the mental well-being questionnaire measured how individuals felt in general about certain more abstract statements about health, while the psychopathology questionnaires asked about more concrete behaviors and cognitions. Asking about more abstract things may lead to lower responsiveness. For instance, personal growth may be considered a gradual process that individuals may not link to specific daily behavior that occurs regularly within a specific time frame (Ryff, 1989). This may have biased the results in comparing well-being and psychopathology change and their associations.

Implications for further research

Based on the findings from the studies, we have several recommendations for future research. We recommend investigating the effects of positive psychology interventions in ED patients. We propose to examine the associations between well-being and psychopathology further while considering potential working mechanisms, such as egosyntonic aspects, the stages of change, and coping. To further understand stability versus change in mental health domains, we suggest applying a combination of panel data research, including single subject

assessment such as experience sampling methods (ESM). This allows for distinguishing within-person change while accounting for more stable mental health aspects. ESM may provide further knowledge on how mental health domains are related on a day-to-day basis. Although our results provided insight into the importance of PWB within time points, we could not detect directional effects in this panel data study. By applying ESM, these effects may be detected. We also recommend applying longitudinal studies with a longer duration, for instance, two years, considering that mental well-being may be more stable over time and temporal changes may happen within a more extended study duration.

Implications for clinical practice

The findings from the studies in this dissertation have implications for clinical practice. It is suggested to monitor mental well-being and psychopathology in treatment to capture and evaluate ED recovery. Awareness of differential change trajectories and related patient characteristics may further help to evaluate treatments. Repeated measurements can be used to assess progress during treatment and compare a patient's outcomes to common change trajectories. The finding that EDP changes independently from other mental health domains suggests that improving symptom remission should be considered the first strategy in treatment. Mental well-being may be promoted simultaneously or sequentially to improve overall mental health. Self-acceptance, intrinsic motivation, identity integration, hope for recovery, depression, and anhedonia are factors that may be addressed in individual treatment plans as they might be relevant for recovery and experiencing mental health in ED patients. At last, the current tendency in mental health care in the Netherlands is increasingly focused on delivering shorter treatments and helping more patients with less financial resources. Given our results, it is questionable whether this national policy does justice to ED patient care in general.

Overall conclusion

Mental well-being is affected in ED patients. PWB is considered fundamental for ED recovery and plays a central role in the maintenance of mental health. We conclude that mental well-being should be addressed in strategies promoting mental health in ED patients. The differential trajectories of change and related patient characteristics suggest separate treatment strategies for promoting mental well-being and changing EDP. This is further substantiated by the result that EDP changes independently from other mental health

domains. A sequential treatment strategy may also be a viable option, with EDP as the first focus followed by promoting mental well-being. In addition, central underlying well-being and GPP symptoms, such as feeling depressed, feeling worthless, purpose in life and self-acceptance, are found, maintaining mental health in ED patients. The variation in well-being is further explained by several patient characteristics, in particular personality functioning. Knowledge about relevant patient characteristics and central mental health symptoms may be beneficial in developing treatment strategies for ED patients.

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ABSTRACT

The central subject of this thesis is mental well-being in patients with eating disorders (EDs). We aim to provide a base of knowledge about this subject by exploring mental well-being from different perspectives, which we outlined in three overarching themes: 1) perspectives of individuals with an ED history, 2) cross-sectional associations between mental well-being, psychopathology and personality, and 3) longitudinal effects in mental health during outpatient treatment. We start in chapter one with a general introduction of the central subjects in this thesis.

Perspectives of individuals with an ED history

In the second chapter, we present the results of a systematic review and qualitative meta-analysis in which criteria for recovery are examined according to people who have recovered themselves. Eighteen relevant studies are included to identify criteria that are consistently described across these publications. We have extracted and counted the reported criteria in each study based on a predefined mental health framework. If criteria did not apply to a predefined criterium, we created an additional one. We learn that recovery is primarily explained in terms of improved mental well-being, although symptom remission is also essential. The most frequently reported criteria in the underlying studies are *self-acceptance*, *positive relationships with others*, *personal growth*, *symptom remission*, *resilience,* and *autonomy*.

Cross-sectional associations between mental well-being, psychopathology and personality

In the third chapter, we explore how patients with EDs experience mental well-being and compare these outcomes with the general population. Including a representative sample of 468 female ED patients, we find that they experience lower levels of mental well-being, although a substantial proportion experiences adequate well-being. Over ten percent of the patients even meet the classification for flourishing. By using multiple hierarchical regression analysis, we find that well-being is correlated with several patient characteristics. Patients with higher levels of well-being report lower general psychopathology, are less likely to have a history of hospitalization for the ED and report more adaptive personality functioning. We also explore associations between mental well-being and psychopathology based on the dual-continua model, which assumes that both are distinct but related continua of mental

health. We examine the correlations for ED patients in general and each type (i.e., anorexia nervosa, bulimia nervosa, binge eating disorder and other specified feeding and eating disorders). Corresponding with the dual-continua model, we find overall low correlations between well-being and ED psychopathology and moderate to strong correlations between well-being and general psychopathology. We also find that patients with AN are more likely to experience lower, and patients with BED to experience higher well-being.

In chapter four, we use psychometric network analyses in a representative sample of 905 ED patients to arrive at a deeper understanding of the relationships between well-being and psychopathology. We estimate a network with the mental health domains (i.e., emotional, psychological and social well-being, and general and ED-specific psychopathology), and a network with the underlying symptoms that make up these domains. The advantage of psychometric network analysis is that the centrality of domains or symptoms can be estimated. Centrality is a measure of how influential a symptom is compared to other symptoms. Corresponding with the results of chapter three, we learn that ED psychopathology is only weakly connected with well-being domains. Psychological well-being is the most central domain. Central underlying mental health symptoms we find are *feeling depressed*, *feeling worthless*, *purpose in life* and *self-acceptance*. We also learn that mental health symptoms such as *self-acceptance*, *environmental mastery*, *interest in life* and *feeling depressed* act as bridge symptoms linking well-being with psychopathology. We expect that these results may have value to investigate further which mental health domains and symptoms to address in treatments.

In chapter five, we explore associations between maladaptive personality trait facets and emotional, psychological and social well-being in 1187 female ED patients referred for specialized treatment. We find that personality traits lead to a statistically significant increase of the explained variance in emotional (38%), psychological (39%) and social well-being (26%) in addition to background and illness characteristics. The maladaptive personality trait facets anhedonia and depression are negatively associated with all three well-being domains. ED patients report the highest scores on the maladaptive personality trait facets emotional lability, submissiveness, anxiousness, rigid perfectionism and distractability. We argue that maladaptive personality functioning is related to the experience of well-being.

Longitudinal effects in mental health during outpatient treatment

The studies in chapters three to five are cross-sectional studies using a measurement at a single time-point. Cross-sectional studies can be used to understand associations between variables on a sample or population level. However, these studies do not depict changes over time within persons. In order to understand change in patients, we use routine outcome monitoring (ROM) data collected during outpatient treatment in chapter six. ROM data was collected every three months in 442 patients for a year, resulting in five measures. We apply latent growth mixture modeling (LGMM) to understand change in well-being and ED psychopathology. LGMM allows to model intraindividual change by estimating classes of patients with similar change trajectories. Both for well-being and ED psychopathology, we find three distinct classes. Over half of the patients are assigned to a class consisting of a high baseline ED psychopathology severity, followed by a slow recovery trajectory. Twenty percent of the patients are assigned to a class with a high baseline ED severity followed by a substantial recovery trajectory, and about a quarter has a moderate baseline ED severity and no significant recovery trajectory. For well-being, we also detect three classes; a class with low baseline well-being, followed by a slow growth trajectory (45%), a class with a low baseline and substantial growth trajectory (10%), and a class with a moderate and stable well-being trajectory (45%). We also examine predictors for class membership and find that general psychopathology, early symptom change, hope for recovery, and the ED type are predictive for ED psychopathology class membership. General psychopathology and intrinsic motivation are predictive for well-being class membership. We conclude that individual well-being and ED psychopathology change trajectories can be explained with distinct latent classes. Well-being and ED psychopathology class membership is furthermore related with different patient characteristics substantiating the dual-continua model of mental health.

In chapter seven, we present our last study, which expands on chapter six by using a larger dataset of 1250 patients with the same five measurements during a year of treatment. This dataset enabled us to perform panel data network analyses to understand associations between mental health domains during treatment. We used the same domains as included in the network analysis in chapter four. Panel data network analysis has the advantage that average within-person associations can be estimated separately from the between-person effects. The between-person effects in panel network analysis can be understood as effects also measured in cross-sectional studies, such as estimated in chapter four, with the addition that

they represent average stable means over time. Within-person effects are further modeled on two levels, depicting predictive effects over time and within time points. These predictive effects can be estimated within and between the mental health domains. Within-person effects within time points can be understood as associations occurring in a shorter period than measured (in our case, three months). Psychometric network panel analysis can be explained as a multilevel model (measurement occasions nested within persons) and a random-intercept cross-lagged panel model. From this study, we learn that changes in ED psychopathology are predictive of further changes in ED psychopathology over time and minor improvements in the other domains. Other mental health domains were not predictive of changes in ED psychopathology. Also, we learn that psychological well-being plays a central role within time points. Psychological well-being is considered an influential domain for experiencing mental health on a day-to-day level with stable effects over time. We consider that ED psychopathology should be the first focus of treatment because it changes independently from other mental health domains. In addition, it may be warranted to address well-being in treatment as an additional focus, particularly psychological well-being, to improve overall mental health. In chapter eight, we present a general discussion and reflect on the findings of the studies. We conclude that we arrived at a better understanding of the role of mental well-being in ED patients. The strengths and limitations of the research and the implications for practice, and directions for further research are also outlined.

ABSTRACT IN DUTCH (SAMENVATTING)

Het centrale thema van deze thesis is mentaal welbevinden van patiënten met een eetstoornis. Het doel is om een basis van kennis over dit thema aan te reiken door welbevinden vanuit verschillende perspectieven te bestuderen binnen de volgende overkoepelende thema's; 1) het perspectief van mensen met een eetstoornisverleden, 2) cross-sectionele associaties tussen mentaal welbevinden, psychopathologie en persoonlijkheid, en 3) longitudinale effecten in de geestelijke gezondheid tijdens de behandeling. We starten in hoofdstuk één met een introductie van de centrale onderwerpen in deze thesis.

Het perspectief van mensen met een eetstoornisverleden

In hoofdstuk twee identificeren we criteria voor herstel gebaseerd op de perspectieven van mensen die zelf hersteld zijn van een eetstoornis. We voeren een systematische review en kwalitatieve meta-analyse uit en vinden 18 relevante studies. We onderzoeken deze studies om te identificeren welke criteria het vaakst beschreven worden gebaseerd op een model van geestelijke gezondheid. Criteria die we niet binnen dat framewerk konden plaatsen hebben we als aparte criteria opgenomen. We leren dat herstel voornamelijk beschreven wordt in termen van mentaal welbevinden. Meer specifiek vinden we sterke bewijsvoering voor het belang van *zelf-acceptatie*, *positieve relaties met anderen*, *persoonlijke groei*, *veerkracht* en *autonomie*, naast remissie van de eetstoornis klachten.

Cross-sectionele associaties tussen mentaal welbevinden, psychopathologie en persoonlijkheid

In het derde hoofdstuk exploreren we hoe patiënten met een eetstoornis mentaal welbevinden ervaren en vergelijken deze uitkomsten met de algemene populatie. In een representatieve steekproef van 468 vrouwelijke patiënten vinden we dat ze een lagere mate van welbevinden ervaren vergeleken met de algemene populatie, hoewel een substantieel deel aangeeft een goed welbevinden te ervaren. Meer dan tien procent blijkt zelfs te voldoen aan de classificatie van floreren. Door middel van hiërarchische regressie analyses vinden we dat de mate waarin patiënten welbevinden ervaren gerelateerd is aan verschillende achtergrondkenmerken van patiënten. Een hogere mate van welbevinden is gerelateerd aan een lagere mate van algemene psychopathologie, geen verleden hebben met ziekenhuis opnames ten gevolge van de eetstoornis en meer adaptief persoonlijkheidsfunctioneren.

We onderzoeken ook de relatie tussen welbevinden en psychopathologie. Gebaseerd op het twee-continua model, welke er vanuit gaat dat welbevinden en psychopathologie twee verschillende maar gerelateerde aspecten van mentale gezondheid zijn, exploreren we associaties tussen beiden. We onderzoeken de correlaties voor eetstoornispatiënten in het algemeen en voor de specifieke types (anorexia nervosa, bulimia nervosa, eetbuistoornis en overige gespecificeerde voedings en eetstoornissen). In overeenstemming met het twee-continua model, vinden we lage correlaties tussen eetstoornisklachten en welbevinden en matige tot sterke correlaties tussen algemene psychopathologie en welbevinden. Patiënten met anorexia nervosa ervaren over het algemeen een lagere mate van welbevinden terwijl patiënten met een eetbuistoornis een hogere mate van welbevinden ervaren.

In hoofdstuk vier gebruiken we psychometrische netwerkanalyse in een steekproef van 905 eetstoornis patiënten om de relaties tussen welbevinden en psychopathologie beter te begrijpen. We schatten een netwerk van geestelijke gezondheid op domeinniveau en één met de onderliggende gezondheidssymptomen. Een voordeel van psychometrische netwerk analyse is dat de centraliteit van de domeinen en symptomen geschat kan worden. Dit geeft een maat voor hoeveel invloed een symptoom in het netwerk heeft, vergeleken met andere symptomen. In overeenstemming met de resultaten van hoofdstuk drie vinden we dat eetstoornisklachten zwak gecorreleerd zijn met andere geestelijke gezondheidsdomeinen. Psychologisch welbevinden is het meest centrale domein in het netwerk. Centrale onderliggende mentale gezondheidssymptomen die we vinden zijn, *neerslachtigheid*, *zichzelf niks waard vinden*, *doel en betekenis geving* en *zelf-acceptatie*. We leren ook dat specifieke symptomen zoals *zelf-acceptatie*, *omgevingsbeheersing*, *interesse in het leven* en *neerslachtigheid* een brug tussen welbevinden en psychopathologie vormen. We verwachten dat deze resultaten gebruikt kunnen worden om te onderzoeken welke domeinen of symptomen aandacht moeten hebben in de behandeling.

In hoofdstuk 5 onderzoeken we associaties tussen maladaptieve persoonlijkheidstrekken en emotioneel, psychologisch en sociaal welbevinden onder 1187 vrouwen met een eetstoornis. We vinden dat persoonlijkheidstrekken een significant hogere variantie verklaren in emotioneel (38%), psychologisch (39%) en sociaal welbevinden in aanvulling op patiënt en ziektekenmerken. De maladaptieve persoonlijkheidstrekken anhedonie en depressiviteit zijn negatief geassocieerd met alle drie de welbevinden-domeinen. Eetstoornispatiënten scoren

het hoogst op de maladaptieve persoonlijkheidstrekken emotionele labiliteit, submissiviteit, angstige trekken, rigide perfectionisme en afleidbaarheid. We beargumenteren dat maladaptief persoonlijkheidsfunctioneren gerelateerd is aan het ervaren van welbevinden in patiënten met een eetstoornis.

Longitudinale effecten in geestelijke gezondheid tijdens eetstoornisbehandeling

Tot nu hebben we gebruik gemaakt van cross-sectionele studies. Deze studies leiden tot conclusies over populatiegemiddelden en die zijn mogelijk niet representatief voor symptoom-veranderingen in patiënten. Om symptoom-veranderingen en interacties te kunnen meten zijn longitudinale studies nodig. In hoofdstuk zes maken we gebruik van routine outcome monitoring (ROM) data van een jaar behandeling met vijf meetmomenten (drie-maandelijkse metingen) in een steekproef van 442 patiënten. We gebruiken latente groeimodellen om veranderingen in welbevinden en eetstoornisklachten tijdens de behandeling beter te kunnen begrijpen. Met groeimodellen kunnen latente klassen van patiënten met vergelijkbare hersteltrajecten geschat worden gebaseerd op de individuele hersteltrajecten. Zowel voor welbevinden als eetstoornisklachten vinden we dat de individuele hersteltrajecten ingedeeld kunnen worden in drie latente herstelklassen met vergelijkbare trajecten. Wat betreft de eetstoornisklachten valt meer dan de helft van de patiënten in een klasse met een hoog klachtenniveau bij aanvang en een langzaam hersteltraject. Twintig procent van de patiënten valt in een klasse met een hoog klachtenniveau bij aanvang en een substantieel of snel hersteltraject en ongeveer een kwart valt in een klasse met een laag klachtenniveau bij aanvang zonder een significant hersteltraject. Voor welbevinden vinden we de volgende klassen: een klasse met een laag welbevinden bij aanvang en een langzaam groeiproces van welbevinden (45%), een klasse met een laag welbevinden bij aanvang en een substantieel of snel groeiproces van welbevinden (10%) en een klasse met een adequaat welbevinden bij aanvang, dat stabiel blijft tijdens de behandeling (46%). We vinden ook dat toewijzing aan één van de klassen voorspeld wordt door een aantal patiëntkenmerken, zoals algemene psychopathologie, snelle symptoomverandering aan het begin van de behandeling, hoop op herstel, en het eetstoornistype voor de eetstoornisklachten. Voor welbevinden betreft dit intrinsieke motivatie en generieke psychopathologie. Het voorspellen van toewijzing aan een herstel klasse heeft mogelijk prognostische waarde voor de respons op de behandeling. We concluderen dat individuele hersteltrajecten ingedeeld kunnen worden in onderscheidende herstelklassen. De welbevinden en eetstoornisklachten klassen zijn bovendien gerelateerd

aan verschillende patiëntkenmerken, wat het twee-continua model verder ondersteunt.

In hoofdstuk zeven presenteren we onze laatste studie welke een uitbreiding betreft van hoofdstuk zes, door een grotere dataset te gebruiken met 1250 patiënten met dezelfde meetmomenten tijdens een jaar ambulante behandeling. Deze dataset maakt het mogelijk om paneldata netwerkanalyses toe te passen om de associaties tussen welbevinden en psychopathologie tijdens de behandeling te onderzoeken. Het voordeel van psychometrische paneldata netwerkanalyses is dat gemiddelde effecten binnen patiënten (within-person effects) onderzocht kunnen worden naast de algemene effecten in de steekproef (between-person effects). Algemene effecten in de steekproef zijn vergelijkbaar met resultaten uit cross-sectionele studies, met als verschil dat het gaat om stabiele gemiddelde effecten gedurende de behandeling. Effecten binnen personen kunnen verder gesplitst worden in effecten die over de tijd (voorspellende effecten) en binnen de meetmomenten plaatsvinden. Voorspellende effecten kunnen binnen en tussen de domeinen geschat worden. De effecten die binnen de meetmomenten plaatsvinden kunnen uitgelegd worden als associaties die ontstaan binnen een kortere tijd dan de gemeten tijdsspanne (in ons geval drie maanden) tussen de meetmomenten. De psychometerische netwerk panel data analyse betreft een multilevel en random intercept cross-lagged model. In deze studie leren we dat veranderingen in eetstoornisklachten voorspellend zijn voor verdere veranderingen in eetstoornisklachten en kleine veranderingen in de andere domeinen (voorspellende effecten). We leren ook dat psychologisch welbevinden een belangrijke centrale rol speelt binnen de meetmomenten. We beschouwen psychologisch welbevinden als een belangrijk domein voor de geestelijke gezondheid met stabiele effecten op de geestelijke gezondheid over de tijd. We concluderen dat eetstoornisklachten de primaire focus van behandeling moet hebben omdat deze relatief onafhankelijk van andere geestelijke gezondheidsdomeinen veranderen. Daarnaast is het belangrijk om aandacht te hebben voor welbevinden in de behandeling en dan met name psychologisch welbevinden om de algehele gezondheid te verbeteren. In hoofstuk acht presenteren we een algemene discussie en reflecteren op de resultaten van de studie. Afsluitend stellen we dat we een beter begrip hebben gekregen van de rol van welbevinden bij eetstoornissen en het herstel daarvan. We beschrijven de sterke punten en beperkingen van het onderzoek evenals de implicaties voor de praktijk en richtingen voor vervolgonderzoek.

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COMMON ABBREVIATIONS USED IN THIS STUDY

aBIC	sample size adjusted information criterion
AIC	akaike information criterion
AN	anorexia nervosa
BIC	bayesian information criterion
BMI	body mass index
BN	bulimia nervosa
BED	binge eating disorder
BS	bridge strength
CFI	comparative fit index
CI	confidence interval
CS	correlation-stability
DSM 5	Diagnostic and statistical manual 5th version
ED	eating disorder
EDE-Q	eating disorder examination questionnaire
EDNOS	eating disorder not otherwise specified
EDP	eating disorder psychopathology
EWB	emotional well-being
GLASSO	graphical lasso
GPP	general psychopathology
LASSO	least absolute shrinkage and selection operator
MHC-SF	mental health continuum short form
NCT	network comparison test
OQ-45	outcome questionnaire
OR	odds ratio
PID-5	personality inventory for DSM 5
PWB	psychological well-being
RMSEA	root mean squared error of approximation
ROM	routine outcome monitoring
RQ	research question
S	strength centrality
SWB	social well-being
TLI	tucker-Lewis index

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