Investigating the Dual-Continua Model of Mental Health: Assessment of Mental Wellbeing in the Context of Psychological Distress

By

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ABSTRACT

The dual-continua model of mental health suggests that mental illness and mental wellbeing reflect distinct continua, rather than the extreme ends of a single spectrum. This conceptualisation of the relationship between mental wellbeing and mental illness has significant potential implications in the way we promote mental health, and prevent, treat, and recover from mental illness. However, little is known about the evidence validating the model, and whether this evidence supports the implications that have been proposed in the literature. This thesis includes a systematic review examining the evidence and implications of the dual-continua model, which served as a framework for three subsequent studies aimed at addressing gaps in the literature. While the systematic review identified support from the dual-continua model, two key gaps were identified related to the role of mental wellbeing as a predictor of recovery from mental illness, and the importance of assessing mental wellbeing as a complement to assessment of distress or dysfunction. The studies included in the current thesis are: (1) a longitudinal cohort study investigating the role of wellbeing in recovery from clinical mental illness, (2) a meta-analytic factor analysis of the structure of a wellbeing measure, the Mental Health Continuum – Short Form (MHC-SF) in clinical and non-clinical populations, and (3) a cross-sectional analysis of measurement invariance of the MHC-SF in distressed and non-distressed members of the general population. The first study used a representative 10-year longitudinal cohort study (n=1,723) of individuals with a diagnosed affective disorder, to investigate whether level of wellbeing predicted recovery. Individuals who maintained or gained the highest levels of mental wellbeing were 27.6 and 7.4 times, respectively, more likely to recover when compared to those who maintained the lowest level of mental wellbeing. This study reinforced the need to assess mental wellbeing in clinical settings, leading to the following two studies in the thesis. The second study used data extracted from 26 studies (n=108,603) to investigate the factor structure of the MHC-SF, finding empirical and theoretical support for the hierarchical model which taps into a general wellbeing factor, and three lower-order characteristics of emotional, psychological, and social wellbeing. This model performed similarly across clinical and non-clinical populations, however a moderator analysis indicated that there were significant differences in the item loading on the lower-order factors. This result led to the final study, which investigated invariance of the MHC-SF to participant distress. A large Australian sample (n=8,406) was used to demonstrate that the MHC-SF is metric non-invariant, indicating that wellbeing items may be interpreted and valued differently in distressed and non-distressed individuals. This finding, in combination with the previous study indicate that total and subscale scores of the MHC-SF may not be equivalent between clinical or distressed and non-clinical populations, and caution is required when making comparisons between them. The thesis concludes that the dual-continua model of mental health is valid and has a range of important implications for mental health research and practice, however a need remains for improved assessment tools that are invariant to participant distress or clinical status.

DECLARATION

I certify that this thesis:

1. does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university

2. and the research within will not be submitted for any other future degree or diploma without the permission of Flinders University; and

3. to the best of my knowledge and belief, does not contain any material previously published or written by another person except where due reference is made in the text.

Signed.....Signature redacted.....

Date: 19 July 2023

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ABBREVIATIONS

CFA Confirmatory factor analysis

CLI Comparative fit index

DASS Depression anxiety stress scale

DSM Diagnostic and statistical manual

EFA Exploratory factor analysis

ESEM Exploratory structural equation modelling

HiTOP Hierarchical taxonomy of psychopathology

ICD International classification of diseases

MASEM Meta-analytic structural equation modelling

MHC Mental health continuum

MHC-SF Mental health continuum – short form

PERMA Positive emotion, engagement, relationships, meaning, and accomplishment

RMSEA Root mean square error of approximation

SAHMRI South Australian Health and Medical Research Institute

TLI Tucker-Lewis index

WHO World Health Organisation

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CHAPTER 1: INTRODUCTION

Mental health is a vital aspect of health, and mental illness and disorder are predicted to cause significant morbidity and mortality in Australia and around the world. The traditional focus of mental health services and psychological research has focused on 'what goes wrong with people', leading to a primary focus on identifying and addressing symptoms of disorder and mental illness. In recent years, a renewed emphasis concerned with positive functioning and understanding 'when people are at their best' has reoriented research and practice towards the positive aspects of mental health, or mental wellbeing. Integration of the movement towards mental wellbeing into the prevalent system and theories of mental illness require a clear theoretical understanding of the relationship between mental wellbeing and mental illness. A model of the relationship between these constructs has been proposed, called the dual-continua model of mental health, which poses that mental wellbeing and mental illness are distinct, yet related, concepts. This thesis is focused on synthesising extant literature of the dual-continua model, scoping its potential implications on mental health research and practice, and exploring the assessment of mental health and wellbeing in clinical and non-clinical populations. This thesis consists of four studies: a systematic review and three empirical studies. Each study is preceded by a brief overview of the background literature that provides context for the study and concludes with a synthesis of research findings with discussion of the implications of the work.

Mental health, mental illness, and mental wellbeing have been defined by diverse, sometimes irreconcilable philosophies or academic disciplines and are often misattributed, conflated, and misused. Maddux (2016) argued that "how we conceive psychological illness and wellness has wide-ranging implications for individuals, medical and mental health professionals, government agencies and programs, and society at large. It determines what behaviours we consider it necessary to explain with our theories, thus determining the direction and scope of our research efforts" (p.19). As such, Chapter 1 begins by detailing a working set of definitions for mental wellbeing and illness for use throughout the current thesis, and to summarises the current state of the literature on the burden of mental illness in Australia and around the world.

The chapter summarises the emergence of positive psychology in academic research, and the reorientation towards understanding and promoting mental wellbeing rather than addressing disorder and dysfunction alone. The chapter will present prevalent models of mental wellbeing and discuss the potential conceptual relationships between mental wellbeing and mental illness, before introducing the dual-continua model of mental health. Finally, the chapter will conclude with a summary of the overall aims and research questions of the current thesis, with rationale and flow of the various studies.

The burden of mental illness

The World Health Organisation (WHO) predicted that mental illness will be the leading burden of disease around the world by 2030 (WHO, 2008). It is estimated that approximately 45% of Australians will experience a mental illness in their lifetime, with 1 in 5 experiencing a mental illness at any one time, most commonly depression and anxiety (Australian Bureau of Statistics, 2007, 2018). Lack of progress in reducing the burden of mental illness has prompted calls for improved access to quality mental health care and assessment of mental disorders and for "programs to prevent mental disorders and promote mental health" (U. S. Burden of Disease Collaborators et al., 2018, p. 1469; Vigo et al., 2016). The distinction between mental *disorder* and mental *health* is a fundamental underlying element of this call for improvement, underlining the relevance of better understanding of the relationship between the two concepts.

Definitions of mental illness

Mental illness is generally defined as a health problem that significantly affects how a person feels, thinks, behaves, and interacts with other people. The term mental disorder is also used to refer to these health problems (Australian Government Department of Health, 2007). Mental illnesses are of different types and degrees of severity. Some of the major types include depression, anxiety, schizophrenia, bipolar mood disorder, personality disorders, and eating disorders (James et al., 2018).

Two approaches to define mental illness have been used to assess the nature of mental illness and psychopathologies (Blashfield, 2012). The first approach involves the definition of mental illnesses using diagnostic taxonomies that categorise clusters of symptoms for diagnostic and treatment purposes (Krueger et al., 2018). By this approach, mental illness diagnoses are arrived at by checklists of symptoms and are organised into discrete diagnostic entities. These systems of classification, or nosologies, have been used internationally to standardise diagnoses and inform treatment need and choice of treatment, resulting in diagnostic manuals such as the Diagnostic and Statistical Manual of Mental Disorders (DSM) and International Classification of Diseases (ICD) Classification of Mental and Behavioural Disorders (Regier et al., 2013; Smoller et al., 2019; World Health Organization, 2018). Limitations of the diagnostic approach have been noted in the literature, including heterogeneity within diagnostic categories (Zimmerman et al., 2015), diagnostic co-occurrence of multiple disorders (Ormel et al., 2015; Teesson et al., 2009), and overlooking patients who fall short of diagnostic criteria yet still experience high levels of distress (Kotov et al., 2017).

The second approach to assess and define mental illness is oriented towards a continuous, rather than categorical, approach. This approach relies on empirical evidence supporting mental illness as a range of dimensions that range from normal-range function to psychopathology (Carragher et

al., 2014; Krueger et al., 2018). Despite years of discourse on whether the nature of mental illness is best understood categorically or continuously (Caspi et al., 2014; Kessler, 2002), both approaches are used in psychological research and practice. An example of the dimensional approach has been developed by the Hierarchical Taxonomy of Psychopathology (HiTOP) consortium to act as an evidence-based dimensional classification that is more clinically informative than the traditional diagnostic systems (Kotov et al., 2018). The HiTOP model is hierarchical, whereby more general constructs sit above specific concepts, followed by signs and symptoms of disorder (Kotov et al., 2017). There are a range of arguments for the dimensional approach rather than the categorical, for example the dimensional approach to psychopathology is considered more informative than categorical diagnoses, and have shown greater reliability and validity (Markon et al., 2011). Further, the dimensional approach has been shown to be more useful in clinical research (Andrews et al., 2009; Keyes et al., 2012), and outperforms traditional systems in accounting for functional impairment (Waszczuk et al., 2017). While HiTop has been criticised for its applicability in clinical practice (Haeffel et al., 2022), empirical support of the approach is emerging (Helle et al., 2020) and aspects of the dimensional approach are now included in the categorical diagnostic manuals, such as in autism-spectrum disorder and alcohol use disorder (Helle et al., 2020). Throughout the current thesis, the term ‘mental illness’ will be used to describe the categorical diagnostic approach, whereas ‘psychological distress’ will refer to the continuous spectrum of mental illness.

Positive psychology and mental wellbeing

Positive psychology is a movement that was born of a criticism of modern clinical psychology (Ruini, 2017; Seligman & Csikszentmihalyi, 2000). In his presidential address to the Americal Psychology Association, Martin Seligman (1999) suggested that the field of psychology overly focused on mental illness and treating the mentally ill. Clinical psychology is the branch of psychology most focused on the assessment, formulation, and psychological treatment of mental health. Despite creating knowledge about the aetiology and treatment of mental illness, Seligman and Csikszentmihalyi (2000) argued that clinical psychology and the broader field had generated relatively little evdience about what makes life worth living. Clinical psychology has been criticised for its ‘illness ideology’ (also known as the medical model, e.g. treating a psychological problem is analogous to a biological disease), resulting in the dominant focus on addressing an individual’s deficits (Maddux, 2002).

The emergence of positive psychology in the 2000’s formalised the paradigm shift toward the promotion of mental wellbeing and ‘the good life’ as something separate to mental illness, building on existing foundations in philosophy, literature, art, and academia (Alexandrova, 2012). Positive psychology is defined as the study of the conditions and processes that contribute to the flourishing or optimal functioning of people, groups and institutions (Gable & Haidt, 2005). The movement of

positive psychology drew heavily from humanistic psychology and early clinical psychologists, who focused on the study of positive human experience and posed questions such as, 'what is the good life? When are individuals at their best? What does it mean to be authentic?' (Duckworth et al., 2005). Since the emergence of positive psychology, research into the positive side of mental health has grown exponentially (Donaldson et al., 2015; Rusk & Waters, 2013). This literature has primarily focused on the development of psychological assessment tools (Ackerman et al., 2018; Linton et al., 2016) and interventions (van Agteren, Iasiello, et al., 2021) to measure and promote mental wellbeing.

Models of Mental Wellbeing

Models of wellbeing have been developed in philosophy, economics, and psychology, and cover a very broad range of concepts, from financial stability, to quality of life, literacy, and need satisfaction (Alexandrova, 2012). This thesis is focused on the contribution to the subject of wellbeing stemming from psychology and will furthermore use the term 'mental wellbeing' (or positive mental health in published chapters) to clarify the distinction. Research into the good life or mental wellbeing has been divided into two broad categories, the hedonic and the eudaimonic perspectives (Ryan & Deci, 2001). These perspectives trace back to ancient Greek philosophy, considered the two components of happiness; the central aim of philosophical reflection and virtuous activity (Annas, 1993).

The hedonic tradition has philosophical origins in Aristippus and Epicurus, with a focus on maximising the experience of pleasure in life, minimising pain, and assessing happiness as the sum total of one's hedonic moments (Laertius, 2020; Ryff et al., 2021). Assessment of hedonic wellbeing in the early literature focused on an individual's subjective evaluation of their feelings about their lives (Bradburn, 1969; Flügel, 1925). Seminal reviews of hedonic wellbeing brought significant attention to the construct (Campbell et al., 1976; Diener, 1984), and well-defined concepts and assessment tools were developed including happiness, life satisfaction, positive and negative affect, and subjective wellbeing (Ryff et al., 2021). Subjective wellbeing is the academic concept most associated with hedonic wellbeing, which is described in terms of three separable components, including cognitive judgement of life satisfaction (Diener, Emmons, et al., 1985), and emotional judgements of positive and negative affect (Bradburn, 1969; Watson & Tellegen, 1985). Judgements in life satisfaction are considered dependent on the comparison between one's circumstances with what is considered an expected or appropriate standard (Diener, et al., 1985). Subjective wellbeing, pioneered by Diener (1984) has been assessed around the world in population-based assessments and demonstrated as an important construct for mental health, physical health, ageing, and in a variety of contexts (Diener et al., 1999; Steptoe et al., 2015).

In contrast, the eudaimonic perspective, also refered to as psychological wellbeing, consists of fulfilling one's potential in a process of self-realisation. It traces back to Aristotle's *Nichomachean*

Ethics, which stated that the highest of human good can be achieved by finding personal excellence and what is best within us (Ryff et al., 2021). Aristotle proposed that individuals find meaning and purpose in their life by selecting life goals that align to their inherent nature, or their inner *daimon*, which gave rise to the term Eu*daimoni*a (Waterman, 1993). Many eudaimonic principles were investigated by clinical, developmental, and humanistic psychologists, including Carl Rogers, Abraham Maslow, Henry Murray, Gordon Allport, and Rollo May (Sheldon & Kasser, 2001). Marie Jahoda (1958) argued for the necessity to understand eudaimonic or psychological wellbeing independantly of mental illness, an argument which provides the foundation of modern positive psychology today (Duckworth et al., 2005).

Psychological wellbeing emerged in the academic literature as a supplement to the affective focus of subjective wellbeing, by asking the question 'what does it mean to be well psychologically?' (Ryff & Keyes, 1995). Investigation of psychological wellbeing was theory-driven and integrated a range of subfields of psychology to generate a framework of positive functioning. There are many models and assessment tools available to measure psychological wellbeing (Brandel et al., 2017), however the Ryff (1989) six-factor model of psychological wellbeing is most associated with psychological wellbeing, and which has been operationalised into an assessment tool. This model drew heavily on the humanistic movement as well as clinical psychologists (Allport, 1961; Frankl, 1985; Jahoda, 1958; Maslow, 2013; Neugarten, 1973; Rogers, 1995; Ryff, 1989; Ryff & Keyes, 1995). This model includes "positive evaluations of oneself and one's past life (Self-Acceptance), a sense of continued growth and development as a person (Personal Growth), the belief that one's life is purposeful and meaningful (Purpose in Life), the possession of quality relations with others (Positive Relations With Others), the capacity to manage effectively one's life and surrounding world (Environmental Mastery), and a sense of self-determination (Autonomy)" (Ryff & Keyes, 1995, p. 720).

A range of models of wellbeing which combine subjective and psychological wellbeing have been proposed in the literature, designed to assess overall mental wellbeing by including both hedonic and eudaimonic traditions. Wellbeing is considered to be multi-dimensional, meaning that these concepts consist of many aspects, rather than simply representing one construct (Alexandrova, 2017). There are numerous models of mental wellbeing, as academics have posed certain combinations of characteristics to best reflect the complex concept of mental wellbeing. The most commonly referenced and used models in psychology have been proposed by Seligman (2011), Diener et al. (2010), Huppert and So (2013), and Keyes (2002), which have each been operationalized into measurement tools. These measurement tools overlap by approximately 80% (Hone, Jarden, Schofield, & Duncan, 2014), thus, there is an element of consensus between the models (both theoretical, see Table 1, and in their operationalisation).

Table 1. Four common conceptualisations of wellbeing.

PERMA (Seligman, 2011)	Conceptual Framework Defining Well-Being (Huppert & So, 2013)	Flourishing model of wellbeing (Diener et al., 2010)	Mental Health Continuum (Keyes, 2002)
Positive relationships	Positive relationships	Positive relationships	Positive relationships
Engagement	Engagement	Engagement	Interested in life
Meaning and Purpose	Meaning	Purpose and meaning	Purpose in life
-	Self-esteem	Self-acceptance and self-esteem	Self-acceptance
Positive emotion	Positive emotion	-	Positive affect (happiness)
Accomplishment/ competence	Competence	Competence	-
-	Optimism	Optimism	-
-	-	Social contribution	Social contribution
-	-	-	Social Integration
-	-	-	Social Growth
-	-	-	Social Acceptance
-	-	-	Social Coherence
-	-	-	Environmental mastery
-	-	-	Personal growth
-	-	-	Autonomy
-	-	-	Life Satisfaction
-	Emotional Stability	-	-
-	Vitality	-	-
-	Resilience	-	-

Note: Adapted from Hone et al. (2014).

PERMA

Following Aristotle's eudaimonia, Seligman (2002) originally proposed three pillars of wellbeing or 'authentic happiness' as pleasure, engagement, and meaning. He later extended the description of mental wellbeing, by including relationships and accomplishment. The PERMA model, as developed by Seligman (2011), outlines five essential elements that contribute to a person's sense of well-being. The acronym PERMA represents those elements; Positive emotion, Engagement, Relationships, Meaning, and Accomplishment. The five elements are included in the model as they meet three criteria: first, the element independently leads to well-being; second, the element can be pursued for its own intrinsic value and not as a means to an end; and third, the element can be defined and measured independently of all others (Seligman, 2011). This model is an attempt to explain well-being by its contributory factors, much in the same way as the construct of weather can be described by elements such as temperature, humidity, wind speed, and barometric pressure (Seligman, 2011); or a baseball pitcher's throw could be described by the elements ball speed, rotation, and movement (Seligman, 2018). However, the PERMA model was not intended to be considered an explanatory, empirical model of wellbeing (Seligman, 2018). A measure of the PERMA model, the PERMA profiler, was developed. In Australian samples, the measure reflects a

general wellbeing factor, rather than including the five aspects of mental wellbeing included in the model (Bartholomaeus et al., 2020). Further, (Goodman, Disabato, et al., 2018) demonstrated a very strong correlation between the PERMA profiler and subjective wellbeing (r=.98), hence indicating that the measure may not tap into eudaimonic aspects of wellbeing. For these theoretical and practical reasons, the PERMA model will not be included in the current thesis.

Conceptual Framework Defining Well-Being

Huppert and So (2013) took a similar philosophical position to the PERMA model, but used a different approach to define their model of wellbeing. Their model was derived empirically using the 'mirror opposites' of the symptoms of common mental illness. Huppert and So (2013) analysed the manual of common mental illness disorders and identified 10 mirror opposite or antonyms of these symptoms. This work identified 10 positive features, competence, emotional stability, engagement, meaning, optimism, positive emotion, positive relationships, resilience, self-esteem, vitality. They then validated this approach by identifying items in the European Social Survey which represented these concepts and conducted analysis on them as one scale of wellbeing. The research resulted in a two-factor model, including emotional stability (vitality, optimism, resilience, positive emotion, and self-esteem) and positive functioning (engagement, competence, meaning, and positive relationships). Further, to enable meaningful population-level analysis, Huppert and So created a categorisation of 'flourishing' that followed the procedures for diagnosing mental illness. For example, in diagnostic criteria, not all symptoms need to be present for an individual to be categorised as mentally ill, although the majority must be present. As such, they proposed that an individual be considered flourishing when all but one of the domains of positive characteristics and positive functioning in addition to an item of positive affect be present. This model is inappropriate for use in testing the dual-continua model as it was a priori derived from the 'semantic opposites' of indicators of mental illness. Therefore, the relationship between mental wellbeing and mental illness has been imposed through the process of theory formation.

Flourishing model of wellbeing

Diener is the most prolific researcher in subjective wellbeing, particularly stemming from the seminal work on satisfaction with life. The Diener et al. (2010) Flourishing model of wellbeing was designed to supplemented his existing subjective wellbeing scale (Diener, Emmons, et al., 1985) to create a more eudaimonic measure of 'social-psychological prosperity' to capture human flourishing. This model includes purpose in life, positive relationships, engagement, competence, self-esteem, optimism, and contributions towards the wellbeing of others (Diener et al., 2010). While a measure was developed to assess this model of wellbeing (Diener et al., 2010), it will not be used in the current thesis for two reasons, firstly that the measure (and model) is not commonly used in the literature (van Agteren, Iasiello, et al., 2021), and secondly that the aspects of wellbeing in the model are largely subsumed in the Mental Health Continuum model, described below.

The Mental Health Continuum

The Mental Health Continuum (MHC; Keyes, 2002) was developed to combine subjective wellbeing (Diener, 1984), psychological wellbeing (Ryff, 1989) and include social wellbeing into a single assessment tool and conceptual continuum. Social wellbeing was added to the model to address the overemphasis of wellbeing as a private phenomenon in the literature (Keyes, 1998). Drawing on sociological theory (Durkheim, 2005; Israel, 1971), Keyes (1998) argued that individuals are embedded within social structures and communities, and that their interactions with society is necessary when investigating wellbeing. Social wellbeing was defined as the appraisal of one's circumstance and functioning in society. This research resulted in a five-factor model of social wellbeing, which included the evaluation of the quality of one's relationship to society and community (social integration), the construal of society through the character and qualities of other people as a generalized category (social acceptance), the evaluation of one's social value (social contribution), the evaluation of the potential and trajectory of society (social actualization), perception of quality, organization, and a sense of understanding of the operation of the social world (social coherence) (Keyes, 1998). This model of wellbeing is most appropriate for this thesis, as it was designed independently of mental illness, builds on the most relevant aspects from mental wellbeing literature and assessment tools, has been empirically derived and been operationalised into a well-validated psychological measurement tool which can assess mental wellbeing in both a dimensional or categorical approach (Santini et al., 2020).

Hierarchical Arrangement of Wellbeing

With several models of mental wellbeing available in the literature, (Disabato et al., 2019) developed a hierarchical framework to organise the constructs that fall under the term 'mental wellbeing'. In an approach similar to those taken in intelligence, personality, and psychopathology (e.g., HiTOP), the highest level of the hierarchy is a general wellbeing factor. Disabato et al. (2019) define this factor as 'perceived enjoyment and fulfilment with one's life as a whole', pointing back to the two philosophical traditions of mental wellbeing research of hedonia and eudaimonia. The next level is called 'Lenses' which describe perspectives by which wellbeing is conceptualised (e.g., the MHC's subjective, psychological, and social). Next level refers to Content(s), which are areas that make up the various wellbeing lenses. Finally, the lowest level of the hierarchy, Characteristics, are the clearly defined components which make up the concepts. These levels of the hierarchy are designed to allow for comparable levels of analysis, without preference to one level over the other, akin to the levels of analysis in human biology from the genome to cell function, to psychological systems. Similar hierarchical structures of wellbeing have been proposed in the literature such as Alexandrova (2017) who proposes a similar approach to Disabato et al. 2019, however with direct link to measurement tools and with considerations of 'mid-level theories' which would sit below Disabato's lenses to provide contextualisation to the subsequent contents and characteristics (e.g.,

children wellbeing, national wellbeing, and quality of life with illness). Merging the two hierarchical approaches is demonstrated in Table 2.

Table 2. Combined hierarchical model of wellbeing.

Level of hierarchy	Wellbeing example	Physical health example
Mid-level theory	Adult general wellbeing	Adult health
Lenses	Psychological wellbeing	Psychological systems
Contents	Functioning	Cells
Characteristics	Growth, meaning in life	Genome

Note: Adapted from Disabato et al., (2019) and Alexandrova (2017)

Conceptual Relationships Between Mental Wellbeing and Mental Illness

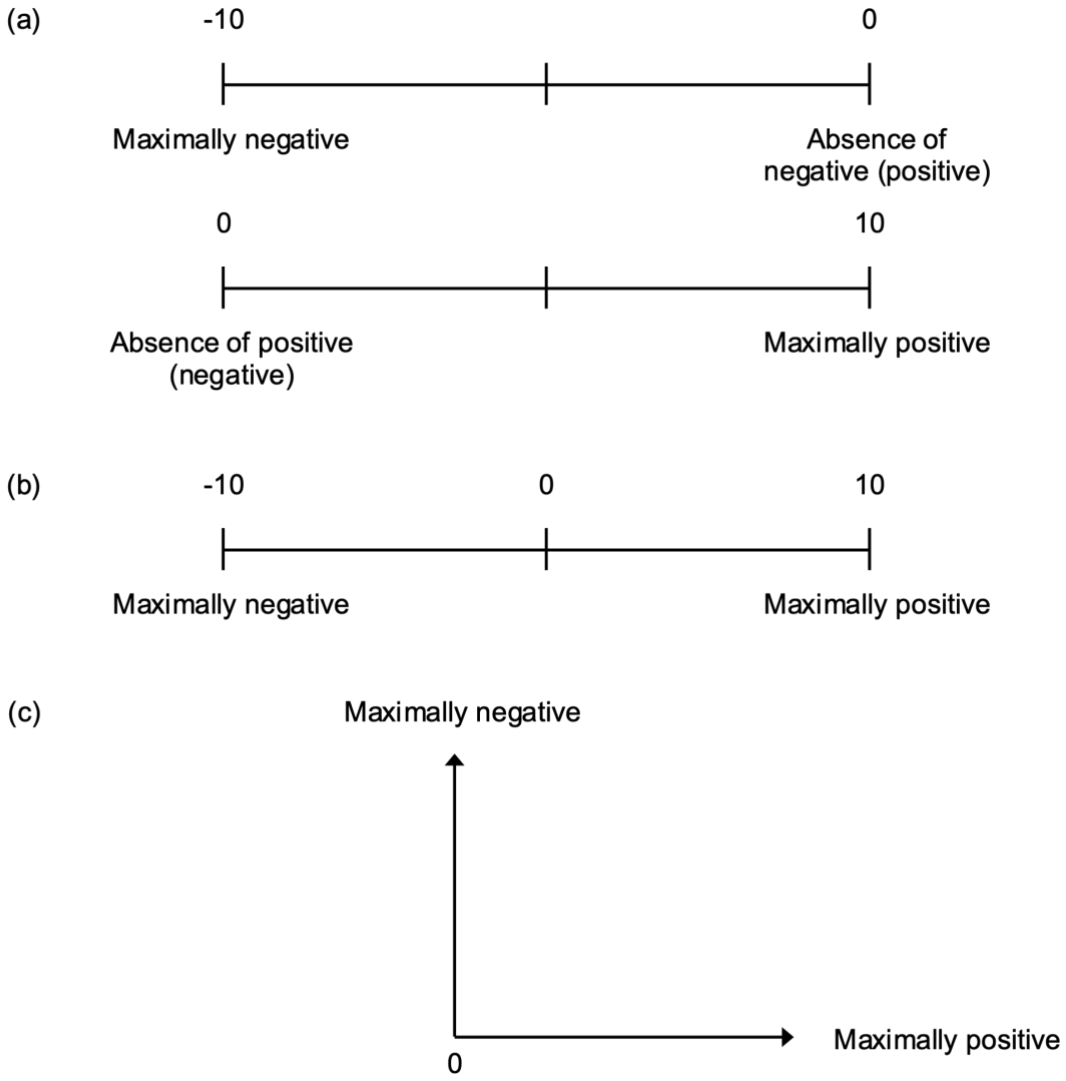
Positive psychology has been criticised for its underemphasis of the negatives in life and symptoms of mental illness (Held, 2002) despite Seligman and Csikszentmihalyi (2000) explicitly stating that this should not be the case. The relationships between 'positive' and 'negative' mental health states remain poorly defined by both clinical and positive psychology. Pawelski (2016) conducted a systematic, philosophical analysis of the use of the term 'positive' in positive psychology, in particular, assessed how the term was used in relationship to 'negative' or mental illness. The author identified three possible philosophical relationships between positive and negative, which will be discussed in relation to models of mental wellbeing as a working definition of mental health is formed for use in this thesis. The first two possibilities orient positive and negative as 'polar concepts' which describe concepts that gain "their identity in part through their contrast with one another" (Blackburn, 1994, p. 94), while the final possibility considers the two terms as distinct.

Possibility 1: Unipolar Positive as the Absence of Negative

This possible relationship describes positive as merely the absence of negative, much like the common place relationship between hot and cold. In thermodynamics, heat is the physical property that exists, and coldness is perceived merely as the absence of heat; thus, heat is the only physical dimension. This relationship indicates that the removal of the negative will result in a gain in the positive. Keyes (2005) suggested that this was the "untested assumption" (p.539) of prevalent mental health systems was that the reduction of mental illness would promote mental wellbeing. Similarly, Huppert and So (2013) suggested that traditional epidemiology has assumed that "well-being would prevail when pathology was absent" (p. 838). If this relationship (illustrated

in Figure 2a) were the case, as Seligman (2002) argued, the modern field of psychology focused on relieving negative states would be sufficient, and a positive psychology would not be required.

Figure 1. Three conceptual relationships between positive and negative.



Note: (a) Unipolar positive as the absence of negative, or unipolar negative as the absence of positive; (b) Bipolar relationship with positive and negative as a single dimension; and (c) Bivariate relationship with positive and negative as distinct dimensions.

The opposite relationship is also a possibility, whereby negative is merely the absence of the positive. In this view, a psychology focused on relieving negative states would not be necessary, and a positive psychology would be the only required. In this vein, notable positive psychologist Christopher Peterson suggested that mental illness may come as a result of the absence of human virtue and strength (Seligman, 2015). However, most positive psychologists point out the importance of mainstream approaches to treating and curing psychopathology and do not seek to replace this work with a focus on the positive (Peterson & Park, 2003).

Possibility 2: Bipolar - Positive and negative as a single dimension

The next possibility suggests that positive and negative are separable and both real, and reflect opposite ends of the same spectrum. This is visualised in Figure 1b, with the example of a number line that stretches from -10 (maximally negative) to +10 (maximally positive). Seligman (2002) suggested that the mental wellbeing and psychological distress are separable by an indifferent zero point, or neutral state. This is observed in the example of positive psychology 'extending' the number line of psychology from -10 to 0, and positive psychology extending from 0 to +10 (Figure 1b). This position is implicit in a range of statements about mental illness and its relationship to mental health, such as Eaton (1951) proposing that mental health "merges imperceptibly and gradually like the colours of the spectrum into mental illness" (p.82).

Possibility 3: Bivariate - Positive and negative as distinct dimensions

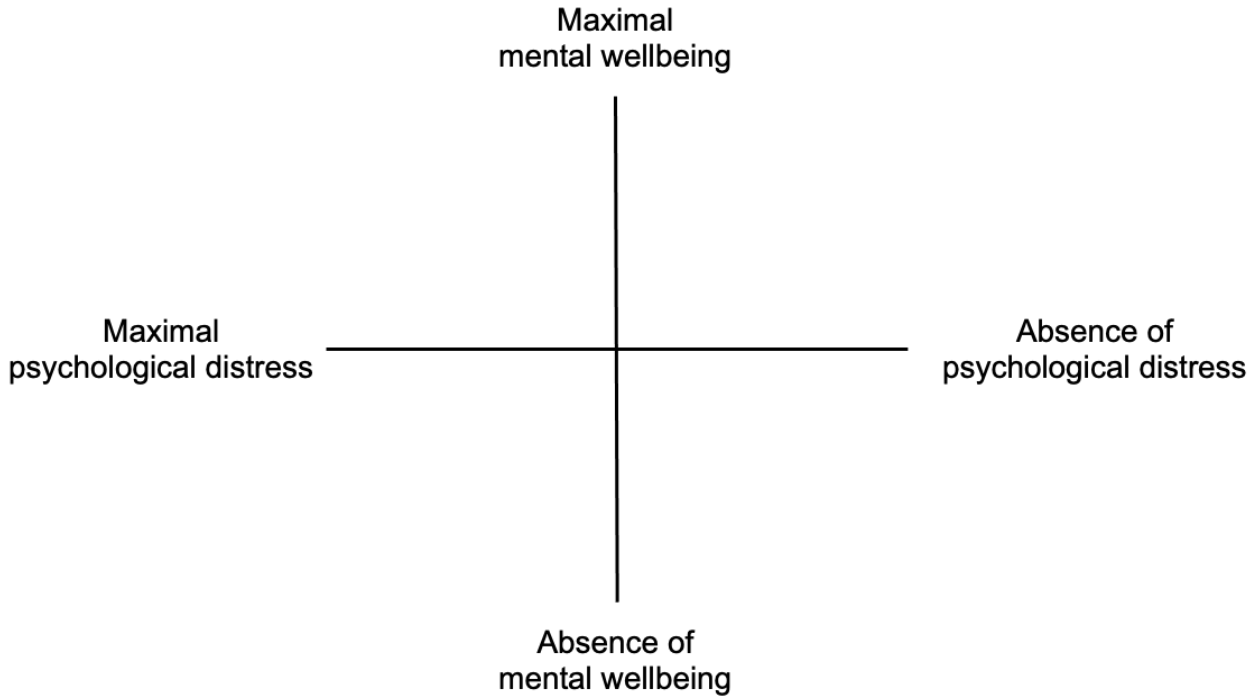
The limitation of the second possible relationship between positive and negative is that it can obscure the important information various contexts, and requires further clarification (Pawelski, 2016). Cacioppo and Berntson (1994) describe that the primary limitation of the bipolar model precisely at Seligman's neutral state; whether this neutral state, or 0 on the number line of Figure 2b is the result of feeling neither positive nor negative, or feeling equal amounts of each. For this reason, they argued for an alternative method for conceptualising the relationship between the positive and negative. They suggest that measures of positive and negative have been based on the assumption than the negative and the positive are reciprocal. Further it is argued that the bipolar model should be replaced with a bivariate one, creating a two-dimension plane (Figure 2c) on which positive and negative values can be recorded independently (Cacioppo & Berntson, 1994). This two-dimensional model is intended to allow for maximum flexibility in describing the complex relationship between positive and negative evaluations, and thus mental health and mental illness.

The dual-continua model of mental health

Reflecting Cacioppo and Berntson (1994), dual-continua or dual-factor models of mental health have been proposed by various authors, postulating that mental illness and mental health reflect separate continua rather than the extreme ends of the bipolar model (Figure 2; Greenspoon & Saklofske, 2001; Jahoda, 1958; Keyes, 2002; Massé et al., 1998; Suldo & Shaffer, 2008). In these models, being diagnosed with any mental illness has a negative correlation with mental wellbeing, however each can be considered independent of one another. Similarly it has been found that characteristics of mental wellbeing are possible despite mental illness, e.g. sense of meaning in life, positive affect, and warm relationships (Goodman, Doorley, et al., 2018), and mental wellbeing can be built in those with diagnosed mental illness which doesn't necessarily improve symptoms

(Fava et al., 1998; Seligman et al., 2006). A neural precedent of the dual-continua has been discovered, and evidence suggests that positive emotions are mediated by separate neural processes to negative emotions, and likely serve distinct evolutionary functions (Fredrickson, 2001).

Figure 2 Dual Continua Model of Mental Health



Herron and Trent (2000) proposed a range of implications that the adoption of the dual-continua-model could have on our mental health care system: (1) it allows a concept (mental health or mental illness) to be described which is independent of other concepts, and so can be tested and measured independently; (2) it allows an individual to be mentally healthy and mentally ill at the same time, and thus facilitates the detection of groups that are impossible under bipolar models; (3) it allows an individual to disclose information about mental health while holding confidential information about mental illness; (4) it provides new avenues for proactive rather than reactive system design in mental health promotion; and (5) it is less reliant on labour-intensive downstream interventions and therefore can be more widely applied. Slade (2010) argued the dual-continua model can reorient the current illness ideology of clinical psychological practice towards one that includes a focus on 'personal' rather than 'clinical' recovery. Clinical recovery emphasises "symptomatology, functioning, relapse prevention and risk management" (Slade, 2010, p. 2). In contrast, personal recovery is focuses on the establishment of "a fulfilling, meaningful life and a positive sense of identity founded on hopefulness and self-determination" (Andresen et al., 2003).

Personal recovery is defined as a "deeply personal, unique process of changing one's attitudes, values, feelings, goals, skills, and/or roles. It is a way of living a satisfying, hopeful, and contributing life, even within the limitations caused by illness. Personal recovery involves the

development of meaning and purpose in one's life as one grows beyond the catastrophic effects of mental illness" (Anthony, 1993, p. 527). Many of the key themes that are linked to personal recovery are related to mental wellbeing rather than psychological distress, including engaging or reengaging with life, striving towards personal goals, and finding a sense of meaning in life (Slade, 2010). These accounts indicates that mental wellbeing can be an important resource to facilitate personal and even clinical recovery in those with a diagnosed mental illness. Most importantly, it suggests that personal recovery and mental wellbeing is a vital target for clinical services to improve quality of life for those with recurrent or chronic mental illnesses, for whom clinical recovery is unlikely (Slade, 2010).

Thesis Aims and Structure

Aims

The burden of mental illness continues to grow in Australia and around the world, amplifying the need for improved approaches to promote mental wellbeing, and prevent, treat, and recover from mental illness. The dual-continua model of mental health may represent an important conceptual framework to integrate a focus of mental wellbeing into currently illness-focused approaches and improve the method of promoting mental wellbeing and the prevention, treatment, and recovery of mental illness. The primary aims of the program of work in this thesis are to:

- Identify the evidence supporting the dual-continua model of mental health;
- Map the extant evidence to the potential implications that the model could have in mental health research and practice;
- Examine the relevance of mental wellbeing in the recovery of mental illness; and
- Investigate conceptual or methodological issues related to the assessment of mental wellbeing in the context of mental illness or psychological distress.

The specific research questions associated with these aims are:

(1) Does extant literature support or contradict the dual-continua model of mental health (Chapter 2)?

1. How has the dual-continua model of mental health been tested in extant literature?
2. Does this evidence support the validity of the dual-continua model?
3. What do the authors of the extant literature consider the potential implications of the dual-continua model for mental health care?

(2) Is mental wellbeing a predictor of clinical recovery from mental illness, and if so, how strong is the relationship (Chapter 3)?

(3) Are there methodological issues that may influence the assessment of the dual-continua model in the general population or clinical populations?

1. Is the factor structure of the Mental Health Continuum – Short Form consistent across clinical and nonclinical populations (Chapter 5)?
2. Is the Mental Health Continuum - Short Form invariant to levels of participant's psychological distress (Chapter 6)?

Structure

The current thesis consists of four published studies: a systematic review, a published longitudinal cohort study, and two cross-sectional psychometric studies. Following the introduction (Chapter 1), the thesis systematically scopes the literature for studies that have investigated the validity of the dual-continua model of mental health by testing the relationship between mental wellbeing and mental illness (Chapter 2). This chapter synthesises the available literature, with a focus on the various methodologies used to test the dual-continua model of mental health, the key findings, gaps in the literature, and the implications of the results that were reported by the original authors.

Chapter 3 investigates one of the main implications of the dual-continua model, which represented a large gap in the literature, the role of mental wellbeing as a predictor of recovery from mental illness. This chapter utilises a nationally representative dataset from the United States of America and demonstrated that mental wellbeing is a relevant predictor in clinical recovery from affective disorders. This study acts as a 'proof-of-concept' to demonstrate the potential utility of the assessment of mental wellbeing in clinical psychological settings. Realising this potential relies on the availability of measures of wellbeing that are appropriate for clinical populations, which is the focus of Chapter 5.

In preparation for the following studies, Chapter 4 summarises the methodological considerations relevant to the assessment of mental wellbeing in the context of clinical populations or psychological distress. This chapter identifies psychometric issues that may influence the validity of assessment of mental illness and mental wellbeing, and which may give the appearance of 'separability' of these two phenomena.

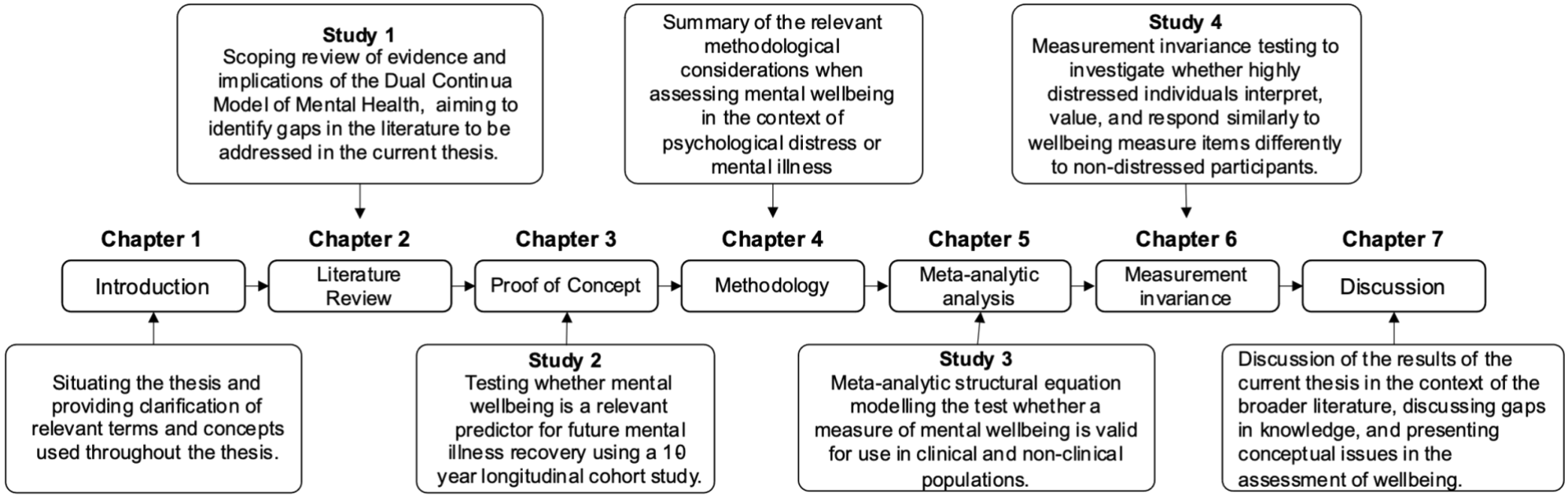
Chapter 5 uses a novel and innovative method to investigate the validity of a measure of mental wellbeing in clinical and non-clinical populations. Using meta-analytic structural equation modelling, a systematic review was used to identify publications that had investigated the validity of a popular measure of wellbeing, the Mental Health Continuum – Short Form (MHC-SF) in clinical and non-clinical populations. Data extracted from the papers identified in the systematic review were used to conduct meta-analytic factor analysis to test the validity of the measure across multiple populations, languages, and across clinical and non-clinical populations in more than 100,000 participants. This study found that the MHC-SF was psychometrically valid in clinical and non-

clinical populations, however it identified that there was a potential issue with the comparison of subscale scores across these two groups. This issue was next investigated in the following study (Chapter 6).

Chapter 6 further investigated the psychometric issue identified in Chapter 5. This study involved measurement invariance analysis of the MHC-SF in a large population of Australian adults, to test whether there are differences in the way that highly distressed and non-distressed participants respond to measure of mental wellbeing. This study found that while the factor structure of the MHC-SF was consistent across both groups, highly distressed participants value, interpret, and respond differentially to some wellbeing items compared to non-distressed individuals. To our knowledge, this is the first time this question has been investigated and reported.

Chapter 7 provides a synthesis of the key findings of thesis, discussion of strengths, limitations, and implications for future research. This chapter acts as a narrative review of the conceptual rationale and empirical evidence of dual-continua model, and the assessment of mental wellbeing in the context of mental illness or psychological distress. It places the results of the current thesis in the wider context of the literature, discussing gaps in knowledge and conceptual issues in the assessment of wellbeing. The structure of the thesis is presented in Figure 3.

Figure 3. Structure of the current thesis



CHAPTER 2: LITERATURE REVIEW

Introduction

Chapter 2 reports the findings from a systematic scoping review of the literature investigating the relationship between mental illness and mental wellbeing. Specifically, the objective of the review was to synthesise the evidence supporting the dual-continua model of mental health, to determine the main focus areas of the literature, and collate the implications of the included studies. Inconsistent terminology and nomenclature are an issue in the literature, as the terms wellbeing, mental health, mental illness and often used interchangeably. Further, a range of names have been coined to describe the dual-continua model of mental health. Therefore, a scoping review method was selected as the most appropriate to systematically review a literature missing precise search terms, supplemented by a snowballing approach to identify citations missed in the original search. This study was supported with a grant from the Australian and New Zealand School of Government (ANZSOG) and published in their peer-reviewed academic journal *Evidence Base*.

Published paper

Iasiello, M., Van Agteren, J, Muir-Cochrane, E. (2020). Mental health and/or mental illness: A scoping review of the evidence and implications of the dual-continua model of mental health. *Evidence Base*, (1). 1-45. https://doi.org/10.21307/eb-2020-001

Abstract

The dual-continua model of mental health suggests that mental illness and positive mental health reflect distinct continua, rather than the extreme ends of a single spectrum. The aim of this review was to scope the literature surrounding the dual-continua model of mental health, to summarise the evidence, highlight the areas of focus for individual studies and discuss the wider implications of the model. A search was conducted in PsycINFO (n=233), PsycARTICLES (n=25), Scopus (n=137) and PubMed (n=47), after which a snowballing approach was used to scope the remaining literature. The current scoping review identified 83 peer-reviewed empirical articles, including cross-sectional, longitudinal and intervention studies, which found overall support for superior explanatory power of dual-continua models of mental health over the traditional bipolar model. These studies were performed in clinical and non-clinical populations, over the entire life-course and in Western and non-Western populations. This review summarised the evidence suggesting that positive mental health and mental illness are two distinct but interrelated domains of mental health; each having shared and unique predictors, influencing each other via complex interrelationships. The results presented here have implications for policy, practice and research for mental health assessment, intervention design, and mental health care design and reform.

Background

Eaton (1951) proposed that mental health 'merges imperceptibly and gradually like the colours of the spectrum into mental illness' (as cited by Herron and Trent, 2000). This description illustrates a bipolar relationship between mental health and mental illness; a relationship and assumption that underpins clinical psychology and mental health care design (Keyes, 2005). The bipolar model implies that mental health and mental illness reflect opposite ends of the same continuum, where an individual 'moves' along the continuum, away from mental illness and towards mental health (Trent, 1992). In this model, individuals are either mentally ill or presumed mentally healthy (Keyes, 2005). As the aetiology and treatment of mental illness was researched and progressed faster than that of mental health, the existence of mental health became virtually synonymous with the absence of mental illness. As such, clinical psychology and psychiatry have primarily focused on the reduction of mental illness symptoms or psychopathology in order to improve mental health.

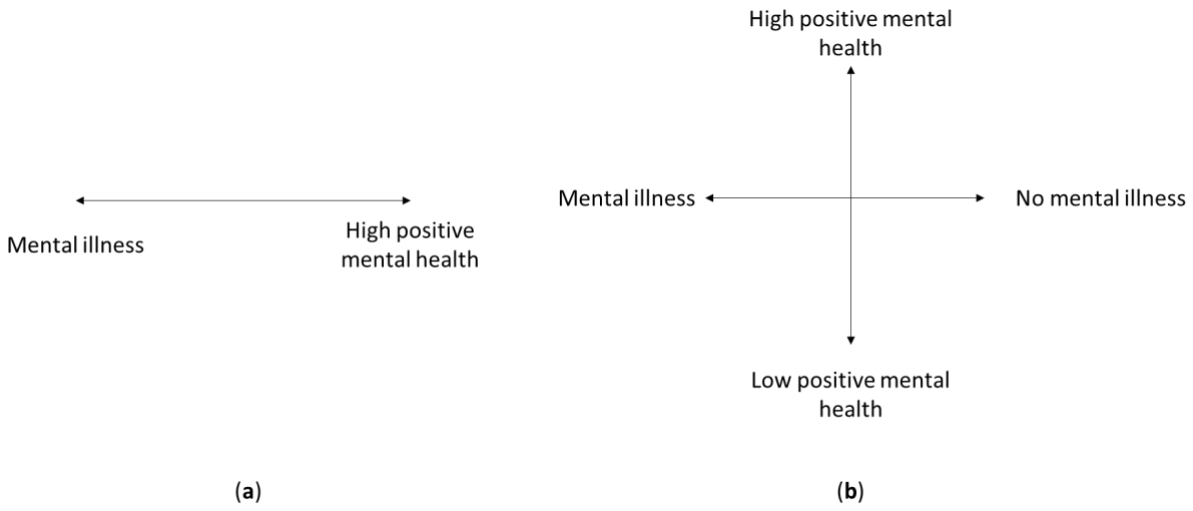
While pervasive, the model is considered an untested assumption, and the philosophical validity of the model has been widely criticised. For instance, many have disparaged the arbitrary point on the continuum where illness transitions to health, the gender and cultural differences that influence this arbitrary point, the impossibility of 'gaining' mental health (if it is defined as the absence/loss of illness), and the futility of improving mental health whilst being diagnosed with a mental illness (Herron & Trent, 2000). Criticisms and rejection of the bipolar model in the context of

mental health were documented as early as 1958 by Marie Jahoda (Jahoda, 1958) who argued that the absence of disorder constituted an insufficient criterion for mental health. Jahoda outlined six dimensions of positive mental health, which would later be operationalised via Carol Ryff's work on psychological wellbeing: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life, and self-actualisation (Ryff, 1989). In combination with Diener's (1984) research into subjective wellbeing, Ryff's seminal work brought the study of positive mental health into mainstream social science (Keyes, 2013).

Drawing on the work of humanistic psychologists such as Rogers and Maslow, the emergence of positive psychology in the 2000's formalised the paradigm shift toward the promotion of mental health as something separate to mental illness. Mental health or positive mental health is since defined as the experience of positive feelings or subjective wellbeing and functioning fully or optimally (Huppert, 2005), encompassing individual resources such as life satisfaction (Diener, 1984), positive emotions (Fredrickson, 2001), meaning and purpose in life (Steger et al., 2006), resilience (Bonanno, 2004), character strengths (Peterson & Seligman, 2004), and interpersonal relationships (Reis & Gable, 2003). While positive psychology has brought more attention to the importance of positive mental health, the main body of work did not focus on the relationship between mental illness and mental health, and has largely been conducted in isolation from mental illness (Payton, 2009).

Dual-continua or dual-factor models of mental health have been proposed by various authors as an alternative to the bipolar model, postulating that mental illness and positive mental health reflect distinct continua rather than the extreme ends of a single spectrum, see Figure 4 for a schematic on both models (Epp, 1988; Greenspoon & Saklofske, 2001; Jahoda, 1958; Keyes & Lopez, 2002; Massé et al., 1998; Suldo & Shaffer, 2008). In the dual-continua model, mental health and mental illness are considered related but distinct constructs, and individuals can experience high levels of positive mental health even with the diagnosis of a mental illness (Keyes, 2005).

Figure 4 Diagrammatic representation of the bipolar (a) and dual-continua (b) models of mental health



A useful analogy for the dual-factor model can be found in the relationship between positive and negative affect. Positive and negative affect were initially assumed bipolar opposites of each other. In-depth statistical analysis of scores on positive and negative affect measures however resulted in the finding that positive and negative affect are in fact independent of each other, despite their 'logical' bipolarity (Bradburn, 1969; Feldman Barrett & Russell, 1998; Nowlis, 1965). Similar to the discourse on positive and negative affect, recent and emerging research indicates that high levels of positive mental health assets are possible despite psychopathology and mental illness diagnosis (Goodman, Doorley, et al., 2018), and positive mental health can be built in those with a diagnosed mental illness (Fava et al., 1998; Seligman et al., 2006). A neural precedent of the dual-continua model has been discovered, and evidence suggests that positive emotions are mediated by separate neural processes to negative emotions, and likely serve distinct evolutionary functions (Davidson, 2000; Fredrickson, 2001)

It has been proposed that widespread and systematic adoption of the dual-continua model would inspire significant reform to the mental health care system, which may better prepare systems for the overwhelming burden of mental illness (Vigo et al., 2016). Herron and Trent (2000) interrogated the dual-continua model from a range of philosophical approaches, and concluded that it had five key implications:

1. It allows a concept (mental health or mental illness) to be described which is independent of other concepts, and so can be tested and measured independently;

2. It allows an individual to be mentally healthy and mentally ill at the same time, and thus facilitates the creation of groups that are impossible under bipolar models
3. It allows an individual to disclose information about mental health while holding confidential information about mental illness;
4. It provides new avenues for proactive rather than reactive system design in mental health promotion; and
5. It is less reliant on labour-intensive downstream interventions and therefore can be more widely applied.

Despite these apparently significant implications to our mental healthcare system and its patients, the validity of the dual-continua model has been questioned by some. For instance, Felicia Huppert argued that while it may be possible to periodically experience flourishing in some mental illnesses such as schizophrenia or personality disorder, it is hard to imagine that an individual with severe depression or anxiety (or common mental disorder) is capable of flourishing (Huppert, 2014). In light of the implications stated by Herron and Trent (2000), the question therefore remains whether the dual-factor model has higher utility and explanatory power compared to bipolar models in general, across different mental illnesses and within different contexts and settings.

This review was designed to scope the scientific literature investigating the validity of the dual-continua model of mental health. This review will summarise the evidence of the model, determine the main focus areas in the literature, and collate the implications of the included studies, with the aim of informing policy, practice and future research.

Methods

This scoping review was designed to identify peer-reviewed scientific articles which specifically tested mental health and mental illness as two distinct constructs and was based on the Joanna Briggs Institute methodology (JBI, 2015). As noted by Payton (2009), terminology and nomenclature remains an impasse to progress in the field of mental health research. Mental health, mental illness, distress and wellbeing are often used interchangeably. Similarly, various names for dual-continua models have been proposed, including the dual-factor model, two-factor, two-continua, the complete state model, and complete mental health. Due to this non-specific and imprecise taxonomy, it was determined that a snowballing approach was most appropriate the search the literature, first beginning with the studies that specifically mention dual-continua or dual factor model of mental health and using reference list screening to effectively scope additional literature. For ease of reading, the current review uses the term ‘dual-continua model’ to describe the models.

A search was conducted in February 2019 of four scientific databases (Pubmed, PyscINFO, PsycARTICLES, and Scopus). The search strategy included all known variations of the dual-

continua model (dual-continua, dual-continuum, dual-factor, two-continua, two-continuum, two-factor, and complete state) AND ‘model’ AND ‘mental health’. Inclusion criteria included: (1) title, abstract, or keywords explicitly mention or implicitly refer to the dual-continua model of mental health, (2) the studies utilized an empirical study design, and (3) the study was published in a refereed journal in the English language. Two reviewers independently screened titled and abstracts, to determine preliminary inclusion status before conducting a full-text screen. Inter-rater reliability was calculated using SPSS v25 (k = 0.88).

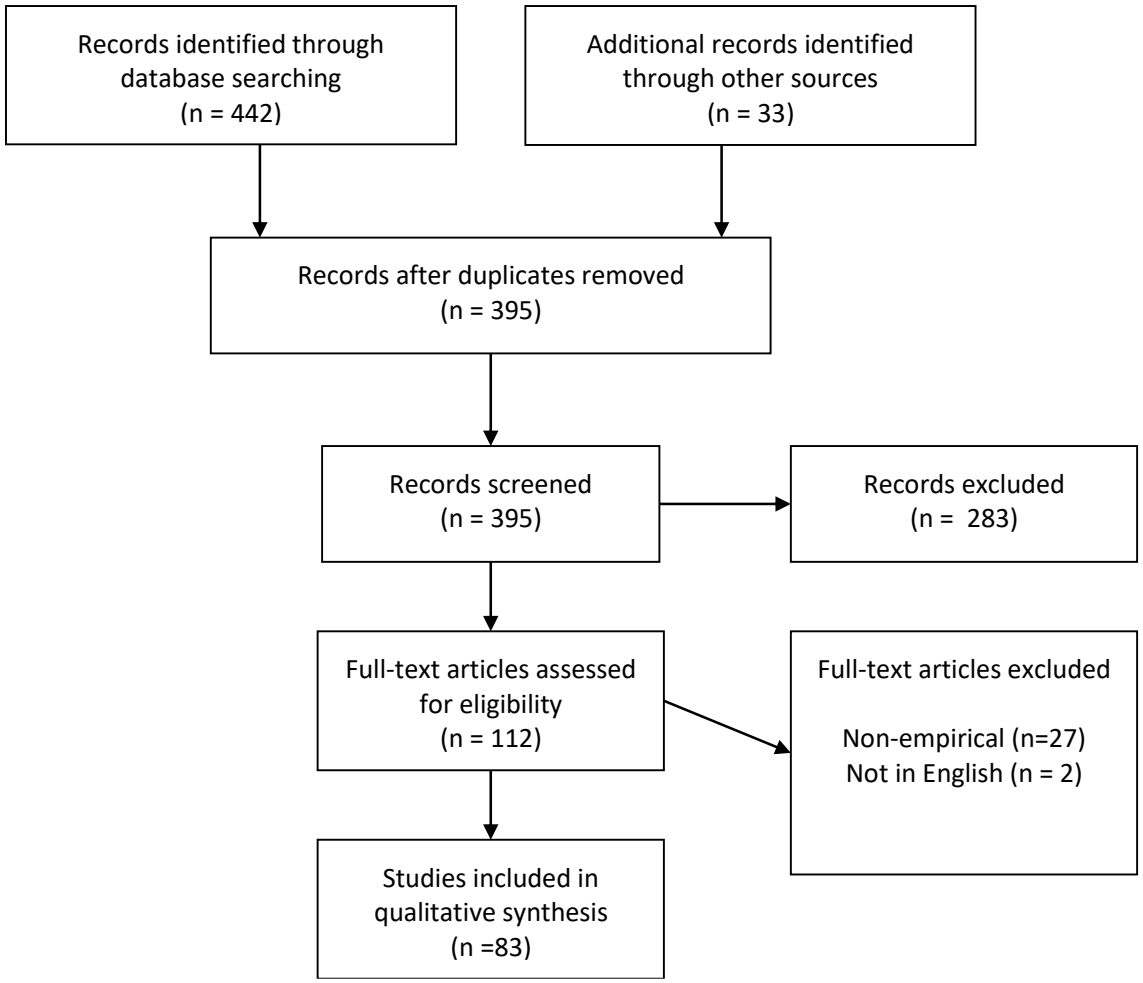
Data extracted included: Author, year of publication, aim of the study, study methodology, sample size, geographical location of participants, gender split, age, types of participants, measurement tools used for mental illness and positive mental health, correlations between measurements (if available), key study results relevant to the dual-continua model, and implications of the results. The results are presented narratively.

Results

Search flow

The search terms across the four databases resulted in 477 articles; PsycINFO (n=233), PsycARTICLES (n=25), Scopus (n=137), PubMed (n=47). After deduplication, 395 original articles were identified. The most common reason for exclusion during the title and abstract screen was no clear reference to a dual-continua model, despite referencing both positive mental health and mental illness. The comprehensive description of the screening process is displayed in the PRISMA statement, which resulted in 83 original articles to be included in the review (Figure 5; Moher et al. 2009). The characteristics of all included studies can be found in Table 16 (Appendix 1).

Figure 5 PRISMA flowchart of the study selection process



Design of included studies

The large majority of studies used an observational design (n=81). Sixty-six studies used a cross-sectional study design using data stemming from large population-level datasets or using data that was gathered prospectively by the researchers. Sixteen studies used a longitudinal observational design, with follow-up ranging between one year and ten years. One study used a mixed-methods design, while only two studies used an experimental intervention design.

Countries

Most studies were conducted in the United States of America (n=31), Netherlands (n=12), Australia (n=7), United Kingdom (n=7), Canada (n=6), China (n=3), Germany (n=3), South Korea (n=2), Russia (n=2), Italy (n=2), and Poland (n=2). Other countries included Spain, Argentina, South Africa, Greece, Sweden, Singapore, Portugal, Turkey, and Serbia.

Study samples and participant characteristics

The study samples consisted of adults (n=55), youth (n=23) or both (n=5). Overall, most studies recruited slightly higher percentage of females (between 50% to 70%). Sample sizes varied between 0-100 (n=3), 101-500 (n=21), 501-1000 (n=12), 1000-5000 (n=23) and 5000+ (n=15). Studies were conducted in populations over the life course, with mean ages ranging from 10.5 for the youngest population to 70.3 for the oldest population.

Most study participants were recruited from the general non-clinical population. Thirteen studies targeted participants with a (history of) mental illness, specifically affective disorders (n=6), substance use disorder (n=1), suicide ideation (n=2), post-traumatic stress disorder (n=1), eating disorders (n=1), or a combination of mental disorders (n=2). One study looked at the application of a dual-continua model in participants with various physical illnesses.

Elementary and high school students were used in all but two studies (89%) that focused on application of dual-factor models in youth. In contrast, only nine adult-focused studies (18%) used student samples. Other populations that were specifically targeted in the recruitment included carers (n=3), older adults (n=1), the LGBTQI community (n=2), immigrants (n=1), siblings of those with a chronic illness or disability (n=1) and medical interns (n=1).

Measures used

Measurement of positive mental health or flourishing was most commonly conducted using the Satisfaction with Life Scale (n=21) or the Mental Health Continuum – Short Form (MHC-SF) (n=23), administered in a range of languages including English, Dutch, Setswana, Polish, Korean, Spanish, Portuguese, and Italian. Five studies combined the use of Bradburn's Positive Affect Balance (Bradburn, 1969), Ryff's Psychological Wellbeing Scales (Ryff & Keyes, 1995), and Keyes Social Wellbeing Scales (Keyes, 1998) to determine the level of positive mental health, which are the same scales that the MHC-SF is based on.

Other commonly used measures included Positive and Negative Affect Schedule for adults or children (n=21), Psychological Wellbeing scale (n=12), Student's Life Satisfaction Scale (n=10), Bradburn's Affect Balance Scale (n=7), Social Wellbeing Scale (n=7), the full or brief Multidimensional student's life satisfaction scale (n=5), and Positive Mental health Scale (n=4).

Mental illness or symptoms of mental illness was most commonly measured using validated scales assessing affective disorders (depression and anxiety), via the Center for Epidemiologic Studies Depression Scale (CES-D) (n=11), Kessler psychological distress scale (n=1), Patient Health Questionnaire (PHQ) (n=3), Depression Anxiety Stress Scale (DASS-21) (n=6), Generalized Anxiety Disorder Scale (GAD) (n=3), Beck Depression Inventory (BDI) (n=2). Several studies

screened for minor or non-psychiatric disorders via the GHQ (n=10), or general psychopathology via the Symptom Check List-90 (SCL-90) (n=2) and Brief Symptom Inventory (BSI) (n=6). Other studies relied on clinical interview diagnosis, using the Composite International Diagnostic Interview (WHO-CIDI) (n=9) or structured interviews using DSM or ICD10 criteria (n=2). A range of studies in the youth context, used scales that measure behavioural or emotional problems, or problems with coping, as their proxy to mental illness, for instance the Behavioural Assessment System for Children (BASC), the Youth Self Report form of the child behaviour checklist, the Reynolds adolescent adjustment screening inventory (RAASI), or the Self-Report Coping Scale (SRCS).

Few studies used unvalidated measures of positive mental health or mental illness, which limited the interpretability of their results. For example, some studies (n=4) used “positive items” of measures that are normally used to measure mental illness, such as the General Health Questionnaire (GHQ). Less commonly used scales, including single-item scales can be found in Appendix 1.

Focus areas of studies

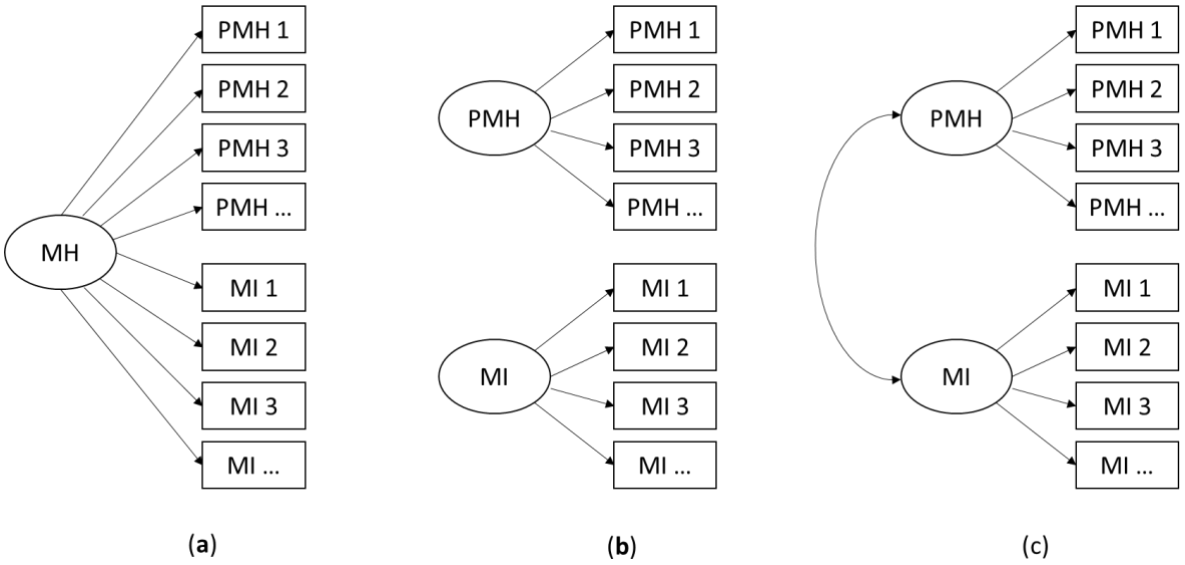
The main focus areas of included studies have been collated and summarised below. The specific aims and results of each individual study are available in Table 16 (Appendix 1).

Investigation of the dual-continua model fit

Reflecting the central aim of this review, the majority of included studies focused on whether the relationship between positive mental health and mental illness reflect a single bipolar continuum or a dual-continua. This was most commonly performed using Confirmatory Factor Analysis; a statistical technique to test the adequacy of a theorised model to represent the data. Three models were commonly tested, single axis (or bipolar), two orthogonal factors (independent and distinct factors), and two oblique factors (independent and related factors), displayed in Figure 6. It was consistently found that the data best fit the two-factor oblique model, indicating the positive mental health and mental illness represent two separate constructs which share a degree of overlap (Keyes, 2005; Kim et al., 2014; Magalhaes & Calheiros, 2017; Massé et al., 1998; Winzer et al., 2014).

The analysis was usually performed in the context of measurement tool validation, in particular validating the MHC-SF (Karas et al., 2014; Keyes et al., 2008; Lamers et al., 2011; Lim, 2014; Lupano Perugini et al., 2017; Petrillo et al., 2015), with other studies investigating the MHI (Heubeck & Neill, 2000; Veit & Ware, 1983), or the potential appropriateness of using the GHQ to capture positive mental health and mental illness (Hu et al., 2007).

Figure 6 The three commonly tested models in Confirmatory Factor Analysis used to test the best model fit for the data

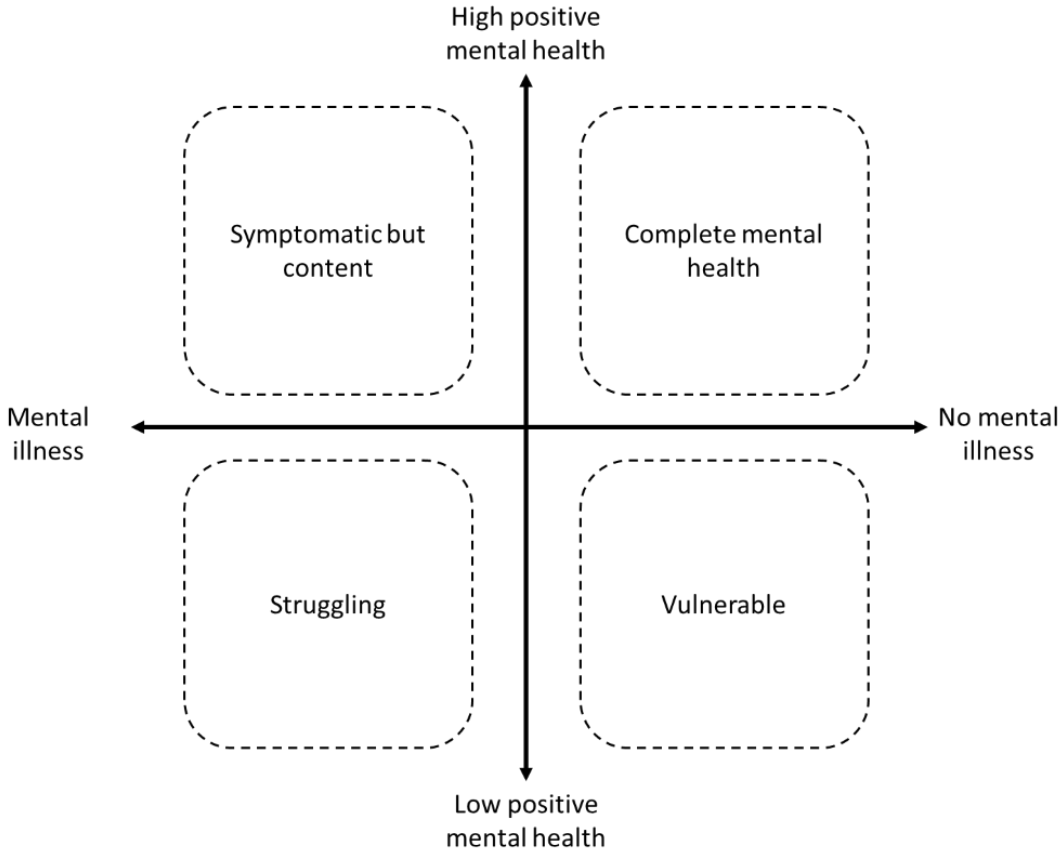


Note: Single axis, (which would indicate the bipolar model (a), two orthogonal factors, independent and distinct (b), and two oblique factors, (independent and related (c). PMH = Positive mental health, MI = mental illness, MH = mental health. Circles indicate latent constructs, and boxes indicate survey items.

Validating sub-groups within dual-continua model

A second focus area of the included studies was to determine whether participant responses on positive mental health and mental illness measures could lead to the identification of distinct groups within the dual-continua model. Many studies divided their participants into four groups, 'Complete mental health' (no mental illness, high positive mental health), 'Vulnerable' (low mental illness, low positive mental health), 'Symptomatic but content' (high mental illness, high mental health), and 'Struggling' (high mental illness, low mental health), displayed in Figure 7. The exact descriptors of each group used in the included studies varied, often depending on the theoretical background preferred by the authors (Greenspoon & Saklofske, 2001; Keyes, 2005; Suldo & Shaffer, 2008). For ease of reading, we will use Keyes' terminology throughout the current review and attached appendices. The apparent validity of these sub-groups was often tested by contrasting sub-group performance on a range of psychological, behavioural, or physical outcomes.

Figure 7 Sub-groups of mental health, as postulated by dual-factor models.



Note: Keyes (2005) terminology to describe the groups is used in throughout this paper to highlight the four mental health groups: 'Complete Mental Health' (no mental illness, high mental health), 'Vulnerable' (low mental illness, low wellbeing), 'Symptomatic but content' (high mental illness, high mental health), and Struggling (high mental illness, low mental health).

Expanding on this were a small number of longitudinal studies that focused on the stability of group members over time, with the aim of determining whether: (1) current levels of positive mental health influence future scores of measures of mental illness, (2) change in levels of positive mental health influence future scores of measure of mental illness, and (3) whether specific sub-groups are more transient or stable than others (Grant et al., 2013; Kelly et al., 2012; Lamers et al., 2015; Wood & Joseph, 2010; Xiong et al., 2017).

Differential predictors of mental illness and positive mental health and correlations with other key outcomes

A third area of focus of included studies was to determine whether positive mental health and mental illness were associated with different predictors variables, and whether they were associated with positive or negative outcomes. This was often performed for two reasons, either to establish whether positive mental health and mental illness are predicted by different factors

(supporting the claim that they are distinct constructs), or to assess whether measures of mental illness or mental health were differentially associated with other psychological or behavioural resources or outcomes (to maximise explanatory power of measurement tools). Examples of specific resources or outcomes that where studied included curiosity (Jovanovic & Brdaric, 2012), personality (Lamers, Westerhof, et al., 2012; Lyons et al., 2013; Spinhoven et al., 2015), self-efficacy (Schonfeld et al., 2016), health-risk behaviour (Venning et al., 2013), genetics (Bartels et al., 2013), risk of cardiovascular disease (Keyes, 2004), coping (Kinderman et al., 2015), positive psychology constructs, and general socio-demographic variables (Huppert & Whittington, 2003; Weich et al., 2011; Westerhof, 2013; Westerhof & Keyes, 2010).

Studies including youth, high school and university students focused on determining the differential associations between mental illness, positive mental health, and educational, behavioural, and developmental outcomes (Antaramian et al., 2010; Eklund et al., 2010; Lyons et al., 2013; Magalhaes & Calheiros, 2017; Renshaw & Cohen, 2014; Rose et al., 2017; Suldo & Shaffer, 2008; Suldo et al., 2016). Examples of these outcomes included grade point average, suspension rates, social adjustment, self-efficacy beliefs, identity development, social support, and school bonding.

The association with predictors and outcomes was also studied in a range of specific and at-risk populations such as carers (Pruchno et al., 1996; Smith, 1996), older adults (Jiang & Lu, 2019), chronically ill people and their siblings (Fontana et al., 1980; Hallion et al., 2018), LBGT community (Bariola et al., 2017; Peter, 2018), migrants (du Plooy et al., 2018), minority populations (Rose et al., 2017), and for specific mental illness diagnoses (Baiden & Fuller-Thomson, 2016; Díaz et al., 2017; Franken et al., 2018; Fuller-Thomson et al., 2016; Seow et al., 2016; Spinhoven et al., 2015; Teismann et al., 2018; van Erp Taalman Kip & Hutschemaekers, 2018).

Impact of interventions

A final area of focus was to determine the effect of interventions of measures of mental illness and positive mental health, in the context of the dual-continua model. Bohlmeijer et al. (2015) assessed the efficacy of Acceptance and Commitment Therapy (ACT) on flourishing in depressed participants and showed that it was possible to improve the level of positive mental health in those with a mental illness. Trompetter, Lamers, et al. (2017) investigated the differential impact of ACT on positive mental health and mental illness for patients who were being treated for anxiety and depression. This statistical approach revealed that 64% of the participants improved on *either* positive mental health or anxiety symptoms post-intervention and 72% improved in *either* depressive symptoms or positive mental health.

Implications of the dual-continua model

The implications of the dual-continua model were often explicitly discussed in the studies included in this review. The implications extracted from each study are available in Appendix 1 and were narratively categorised into three broad themes. The first theme of implications involves the

measurement approaches to determine mental health and mental illness status, and whether assessment of mental health should include measures of both positive mental health and mental illness. The second theme related to intervention design, delivery, and implementation. This was discussed in the context of treatment and prevention of mental illness, as well as the promotion of positive mental health. The final theme of implications of the dual-continua model centred on the opportunities that the model presents to mental health care reform. This discourse included a re-orientation from deficit- or illness-focused services to strength-focused ones, re-conceptualising how mental health is portrayed to reduce stigma of illness, and the inclusion of services specifically focused on improving positive mental health as an early intervention or preventative approach.

Discussion

This scoping review identified a considerable body of empirical research investigating the validity of the dual-continua model, and the overarching notion that positive mental health and mental illness represent two distinct, yet related, constructs.

Evidence supporting the dual-continua model

The evidence found by the majority of the included 83 studies supports the existence of the dual-continua model. A large proportion of studies used CFA to compare whether the data best fit a bipolar model or the two variations of the dual-continua model (where mental illness and positive mental health are either independent of each other or share a degree of overlap; Figure 6). Studies mostly found that the data best fit the 'two oblique factor' model, indicating that mental illness and positive mental health are distinct but related. This finding was replicated across cultures, gender, age, and using different measures of positive mental health and mental illness, thereby supporting the general validity of the dual-continua model (Franken et al., 2018; Keyes et al., 2008; Petrillo et al., 2015).

Another common approach to test the validity of the dual-continua model was to analyse whether various drivers, predictors, or outcomes related similarly to mental illness and positive mental health. This was often done by splitting participants into sub-groups (Figure 7). This approach was used to indicate that the sub-groups existed, and that it was possible for individuals to report high levels of positive mental illness despite mental illness. The existence of these sub-groups was validated by the consistent finding that the groups performed differently across a broad range of psychological and behavioural resources and outcomes. Other studies adopted a more rigorous approach and investigated the predictors that were associated with mental illness and positive mental health using regression analysis. This was best exemplified by Kinderman et al. (2015) who showed that different individual and social factors differentially influence positive mental health and mental illness.

Most of this research was cross-sectional, supported by a smaller number of longitudinal studies. Findings consistently demonstrated that positive mental health and mental illness differentially predict various outcomes (du Plooy et al., 2018; Kinderman et al., 2015). In general, it was found that the absence of illness was not sufficient to predict various desirable outcomes such as academic achievement and interpersonal relationship quality, which were predicted by high levels of or improvements in positive mental health (Suldo & Shaffer, 2008). The fact that mental illness and positive mental health predict or explain different outcomes was a strong indication that the constructs are distinct, and the fact that there was some overlap points to the constructs share some degree of overlap.

Generalisability of the evidence

There was a great degree of variety in the methodology of the studies included in this review, indicating a considerable degree of confidence in the generalisability of the support of the dual-continua model. The studies were conducted in twenty Western and non-Western countries, indicating that the evidence presented is not culturally specific. The most common method of participant sampling was through population-level survey data, producing nationally representative data which has low risk of sampling bias (Banerjee & Chaudhury, 2010). Although this approach ensures appropriate representation across gender and age, there is a possible underrepresentation of groups that are usually excluded from population-level surveys, for instance the most elderly, homeless people, and mental health inpatients. The evidence provided by studies using population-level surveys were supported by a range of studies that specifically recruited minority and at-risk groups, as well as participants with various degrees of mental illness, increasing confidence in the generalisability of the results across societies.

Studies relied on a broad spectrum of validated measurement tools, reducing potential bias introduced by using a specific measurement tool (Egloff, 1998). Mental illness was measured using validated self-report tools designed to measure various disorders continuously, including depression, anxiety, and general psychopathology. Studies using these measures were complemented by research that relied on assessment using clinical interviews (e.g. using CIDI or based on DSM-IV criteria), instilling a high degree of confidence that the dual-factor model is not merely a statistical phenomenon of a particular measurement design.

Similarly, positive mental health assessment relied on assessment using a number of validated measures, targeting different constructs ranging from satisfaction with life and positive affect, to overall flourishing, social wellbeing and psychological well-being. Many articles included in this review were validation papers of the MHC-SF, consistently finding good internal consistency and validity. Unlike all other continuous measures of positive mental health, the MHC-SF is particular because it can be used to either measure positive mental health continuously or to categorically ‘diagnose’ flourishing similar to the DSM-V protocol. Generally, the continuous approach was used

in confirmatory factor analysis, while the categorical approach was used to create sub-groups and analyse group differences. Renshaw et al. (2016) compared the categorical and continuous approaches, albeit using measures other than the MHC-SF, and found that each approach resulted in conflicting interpretations. This implies that the method used to investigate the single- versus dual-continua models can influence assessment results in practice. While categorical assessment may be criticised for a lack of discriminative power (Doll, 2008), it is closest to the current way that individual mental illness assessment and population-based screening work in practice, thereby supporting the applicability of its use in practice.

Generalisability across mental illness

High levels of positive mental health assets are attainable in individuals diagnosed with a mental illness, demonstrated across major depressive disorder, bipolar disorder, social anxiety, schizophrenia, and trauma-related disorders (Goodman, Doorley, et al., 2018). Of the studies included in the current review, the dual-continua model was investigated across a range of mental illnesses and related concepts, including participants experiencing suicidal ideation, general psychopathology and psychological distress, depression, anxiety, stress, trauma, loneliness, and eating disorders. Of the studies that focused on recruiting patients with a mental illness, as opposed to using general populations, the large majority supported the validity of the dual-continua model, particularly when looking at patients with mild to moderate mental illness.

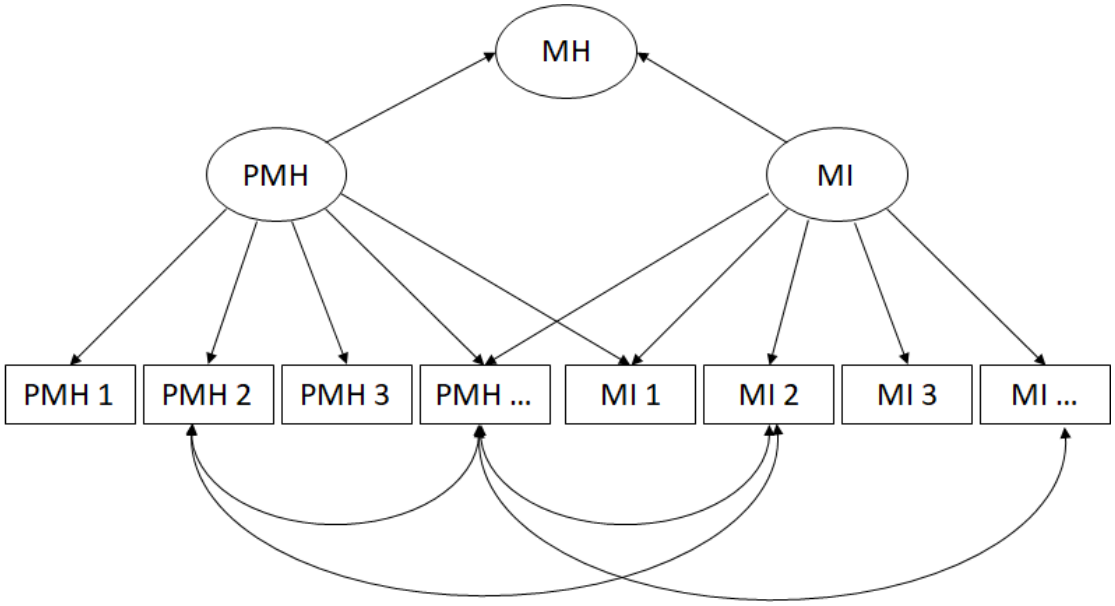
Results for populations of patients with severe to extremely severe mental illness are less convincing. van Erp Taalman Kip and Hutschemaekers (2018) found that mental illness and positive mental health were highly negatively correlated (r=-.071) in severely mentally ill populations, with positive mental health contributing significantly less to a two-factor model compared to the symptoms of mental illness. Other research found high correlations between mental illness and mental health in mentally ill, particularly in depressed patients (Bartels et al., 2013), and supported the researchers finding differential levels of positive mental health depending on mental illness diagnosis, e.g. depression versus anxiety (Franken et al., 2018; Seow et al., 2016). These results imply that in extremely severe psychopathology, particularly in common mental disorder, positive mental health constructs may be highly correlated with mental illness symptoms and patients may exhibit difficulty distinguishing mental illness symptoms from symptoms of positive mental health. There is evidence to suggest that the precision of positive mental health measures may change across the range of scores, and this may also be true for level of psychopathology (Abbott et al., 2010).

The notion that it is possible to have a high level of positive mental health and common mental illness at the same time has been contested in the literature. Huppert (2005) argued that it was difficult to imagine a situation where an individual diagnosed with severe depression is able to function well psychologically. We suggest that this criticism is influenced by the ‘observational

window' and measurement approaches considered, or in other ways in the way we measure both outcomes. Asking someone to judge their positive mental health and mood symptoms in the moment, or asking them to reflect back over their mood and positive mental health over a longer period, will lead to different subjective interpretations. Similarly, using measures that consist of a large number of the same items, as is the case for depression measures, will lead to large overlap. For example, ratings on a meaningful life are often asked in wellbeing questionnaires, whether ratings on life being meaningless are often included in depression measures. Feldman Barrett and Russell (1998) recommended that such 'bipolar antonyms' can be misleading in analysis of independence or bipolarity, and can be avoided by ensuring that measurement tools include items that adequately represent the breadth of each construct. In this context, this would include measuring a diverse range of psychological illness constructs, as well as a range of psychological well-being constructs.

Massé et al. (1998) provided an example of this approach, albeit with constructs that are no longer considered central to either positive mental health or mental illness. This study used CFA to test the model fit of mental health as a second order structure, underpinned by distinct but related latent factors positive mental health and mental illness. As visible in Figure 8, they included a range of constructs under positive mental health and mental illness, some of which relate to both positive mental health and mental illness. Following the depression example, if only happiness and anhedonia were used as indicative measures of positive mental health and mental illness, then a bipolar model would become easily apparent. However, using a broader, multifaceted approach to positive mental health (e.g. using the MHC-SF) and mental illness (e.g. using the BSI), the dual-continua model would emerge as a more appropriate fit of the data.

Figure 8 Higher order theoretical relationship between mental illness (distress) and positive mental health (wellbeing)



Note: Adapted from the model presented in Masse et al. (1998). PMH = Positive mental health, MI = mental illness, MH = mental health. Circles indicate latent constructs, and boxes indicate survey items.

Overall, there is sufficient evidence to support the validity of the dual-continua model of mental health. Longitudinal and cross-sectional data from around the world indicates that positive mental health and mental illness reflect two distinct, yet related phenomena. The validity of the dual-continua model may however be relative to the window of time and by the definitions and assessment methods of positive mental health and mental illness. In particular, more work should be conducted to investigate whether the dual-continua is appropriate in severe forms of psychological distress or mental illness.

Implications of the dual-continua model for policy, practice, and research

The validity of the dual-continua model has important implication for policy, practice, and research and the current scoping review extracted the implications discussed by the authors of included studies. Across the eighty-three publications, the implications were relatively convergent and overlapping, and were collected into three broad themes; implications for mental health measurement and assessment, mental health treatment and intervention design, and mental health care system reform.

Mental health assessment

Study authors strongly advocated to assess positive mental health and mental illness together, rather than using only one or the other. There was a consensus, based on their research results, that a focus on either positive mental health or mental illness alone would not provide a complete

image of the mental health status of an individual or population. It is well established in positive psychology that the absence of mental illness does guarantee optimal mental health (Slade, 2010). The dual-continua model would equally suggest that high levels of positive mental health do not guarantee the absence of mental illness. Studies found percentages of up to 36% of participants who displayed high levels of positive mental health with symptoms of mental illness (Venning et al., 2013).

At a population level, the inclusion of positive mental health measures with existing indicators of mental illness enables researchers to understand the economic, social, and individual drivers of both positive and mental illness. It was shown that these drivers are not necessarily the same, although there is some overlap (Kinderman et al., 2015). This degree of insight is not available in most population-level research, as positive mental health measures are often not included.

At the individual level it enables professionals in various settings to identify previously invisible sub-groups. For example, research in schools commonly constructed the four sub-groups ('Complete Mental Health', 'Vulnerable', 'Symptomatic but content' and Struggling' groups) and would continue to assess group-membership on educational, behavioural, cognitive and emotional outcomes. Across the studies, participants in the 'Complete Mental Health' group outperformed the other groups, while the 'Vulnerable' group scored significantly worse than those with Complete Mental health, being consistently associated with poor performance across the studies (Antaramian, 2015; Renshaw & Cohen, 2014; Suldo & Shaffer, 2008). In traditional assessment (mental illness only), the 'Vulnerable' and 'Complete mental health' group would have been combined as a 'no mental illness' category, despite the fact that these two groups show different performance on a range of education, behavioural, cognitive, and emotional outcomes.

One of the most striking examples of the importance of capturing the sub-groups, and thereby identifying at-risk individuals, comes from studies that investigated the role of positive mental health as a predictor of mental illness risk. Keyes et al. (2010) conducted a longitudinal study of mentally healthy participants (without a diagnosis of mental illness) of the 1995 and 2005 waves of the Midlife in the United States (MIDUS) National Study of Health and Well-being. The study showed that participants who gained or maintained high levels of positive mental health over the 10-year period had a decreased risk of developing a mental illness (being depression, anxiety, and panic disorder), and that participants whose positive mental health declined or remained low had significantly increased risk of developing mental illness. Similar results were observed by Wood and Joseph (2010), who found that people with low levels of positive mental health were several times more likely to be depressed 10 years later. Grant et al. (2013) and Lamers et al. (2015) supported these findings, finding that low levels of positive mental health predicted risk of higher depressive symptoms within one year. There is also evidence to suggest that high levels or

increased levels of positive mental health dramatically improve the likelihood of recovering from a mental illness (Iasiello et al., 2019).

Positive mental health and mental illness, need to be assessed together when trying to establish a picture of an individual's or population mental health status. This must be done using measurement tools specifically designed to capture either construct in a representative manner; as simply using positive items of mental illness questionnaires is not a valid measurement approach (Winzer et al., 2014). Failing to use fit-for-use measurement tools for both mental health and mental illness when performing mental health assessments will lead to suboptimal explanatory power of drivers and outcomes and does not allow for the identification of key at-risk groups.

Intervention design and evaluation

A second key theme of implications relates to mental health intervention design, with the recurring finding that interventions that improve positive mental health and reduce mental illness can be complementary but different (Kinderman et al., 2015). Further, it was found that a positive response in one continua does not exclude, nor guarantee a positive response in the other. Instead, interventions and mental health promotion programs will benefit from targeting both the reduction of illness symptoms and improvement of positive mental health.

The efficacy of mental health interventions is generally evaluated using average change in positive mental health or mental illness of the entire group. However, research using the dual-continua model suggested that while an intervention may improve overall positive mental health and reduce mental illness on average, more complex interactions may be occurring at the individual level. In particular, Trompetter, Lamers, et al. (2017) re-evaluated a randomized controlled trial of an ACT intervention that measured dimensions of both mental illness and positive mental health (n=250). While this RCT revealed average improvements in positive mental health and reductions in mental illness at the group level, using reliable change analysis it was found that the majority of individuals improved in *either* mental illness or positive mental health. The traditional bipolar model would suggest that an improvement in positive mental health and a reduction in mental illness signify the same outcome. Instead, through the dual-continua model, when an intervention focuses on or can address both positive mental health and mental illness, a failure to see an effect in outcomes does not mean that the intervention did not have a positive effect for the participants.

The authors commented on the utility of ACT in relation to the dual-continua model, as it is a commonly used treatment paradigm that can be used to reduce psychopathological vulnerabilities and build resources for improving positive mental health. Other clinical interventions have been designed to improve the wellbeing of individuals with psychopathology including Wellbeing Therapy (Fava et al., 1998) and Positive Psychotherapy (Seligman et al., 2006), which all fall under the larger umbrella of Positive Clinical Psychology (Wood & Tarrier, 2010). Using traditional clinical techniques such as cognitive restructuring, scheduling of activities, assertiveness training, and

problem solving, these interventions aim to improve positive mental health assets such as Ryff's domains of psychological wellbeing (Duckworth et al., 2005; Fava et al., 1998), while also treating mental illness. These interventions and treatment paradigms have implicitly or explicitly adopted the dual-continua model, by designing program components that improve wellbeing, despite the client's diagnosis of mental illness.

Greater sophistication should be employed to understand which individuals might benefit most from interventions specifically designed to improve positive mental health and reduce mental illness, whether delivered simultaneously or consecutively (Schueller, 2014). An example of this sophistication comes from Jans-Beken et al. (2017) who investigated the dual-continua model in a longitudinal study of gratitude, psychopathology, and subjective wellbeing. This study found that practicing gratitude may positively impact an individual's future level of positive mental health and psychopathology, but is less likely to ameliorate symptoms of psychopathology when they are present. This indicates that interventions to improve traits such as gratitude should be carefully designed to consider the trait dynamics with both mental illness and mental health.

Adoption of the dual-continua model on intervention design has significant potential, especially when combined with the ability to identify at-risk subgroups. At the individual level this can inform better intervention design, while at the community and society level, it may allow governments to prioritise policies and created more targeted interventions. The evidence to drive this change does not just need to come from future studies; there is a substantial literature of randomised controlled trials which have measured both positive mental health and mental illness. Secondary analysis of these data using the aforementioned method proposed by Trompetter, Lamers, et al. (2017) would provide much needed insight into the efficacy of interventions through the dual-continua model lens, and will provide greater clarity for intervention design by identifying 'for whom' interventions are most effective.

Reform to the health care system

The final theme of implications of the dual-continua model of mental health is related to mental health care system reform, where a need to integrate and unify traditional psychotherapy and positive psychology was commonly advocated; a call that is not new (Wood & Tarrier, 2010), but certainly has not yet gained traction. Current approaches are deficit-focused and preference the reduction of mental illness symptoms, resulting in reactive health care (Herron & Trent, 2000). Hence, the specific inclusion of positive mental health initiatives into the health care system to complement current services was commonly cited as a much desired reform to the mental health care system. In addition to aforementioned changes in relation to measurement and intervention, two specific treatment approaches that could benefit from examining the evidence provided for dual-factor models are integrated care approaches and stepped-care approaches.

Integrated care strives to achieve optimal outcomes for patient, provider and system (Kodner & Spreeuwenberg, 2002); overlooking the important role that positive mental health plays would be detrimental to outcomes for integrated care, regardless of whether the main presenting symptoms are mental or physical. An important precedent for successful implementation of positive mental health into integrated mental health care has already been established through interventions such as Wellbeing Therapy and Positive Psychotherapy, and overarching fields such as positive clinical psychology and positive psychiatry (Jeste et al., 2015; Wood & Tarrier, 2010). These therapies have been designed to broaden the scope of traditional psychopathology with the central thesis that building positive mental health assets, in addition to treating symptoms, is effective and may engender more meaningful recovery and reduce the likelihood of relapse (Slade, 2009). Research found in this review indicated that individuals who have had severe depression or suicidal ideation can achieve complete mental health (Baiden & Fuller-Thomson, 2016), that positive assessments of wellbeing and strengths may transform how clients view themselves and their satisfaction with clinical assessment (Macaskill, 2012). Positive mental health assets such as character strengths may provide clinicians new resources to help individuals manage their illness (Macaskill & Denovan, 2014). The systemic neglect of functioning after depression is emerging in the literature (Rottenberg et al., 2018), and positive mental health and the dual-continua of mental health could facilitate the shift in recovery narrative (Slade, 2010).

In a stepped-care model of mental health care, prevention and health promotion precede self-guided help and low-resource intensive interventions, before clinical intervention is required. Longitudinal research identified in the current review indicated that positive mental health is an important resource to reduce the incidence of mental illness (and other physical illness) and therefore should be a primary focus of public policy and health promotion (Keyes et al., 2010; Lamers et al., 2015; Schotanus-Dijkstra et al., 2017; Wood & Joseph, 2010). This will subsequently or conjointly lead to improvements in other crucial areas such as health risk behaviour (Venning et al., 2013). An important key group that needs to be targeted, in both preventative and early intervention efforts are those who reside in the ‘Vulnerable’ group; this group is the most transient (Kelly et al., 2012; Xiong et al., 2017) and across studies associated with worse outcomes than participants with ‘Complete Mental Health’.

Limitations

Despite identifying a broad range of publications investigating the dual-continua model of mental health, our ability to effectively scope the literature was restricted by imprecise taxonomy and nomenclature that is pervasive throughout wellbeing and positive psychology literature (Dodge et al., 2012; Salvador-Carulla et al., 2014). This is an avoidable impasse, but will require consolidation, collaboration, and standardised use of language between positive mental health and mental illness researchers.

Conclusion

There is a sufficient body of evidence to suggest that positive mental health and mental illness are not the opposite ends of the same continuum, and instead reflect two distinct yet related continua. The current review identified 83 publications, which were conducted in clinical and non-clinical populations, over the entire life-course and in Western and non-Western cultures. The review summarised the evidence that positive mental health and mental illness are two distinct but interrelated domains of mental health; each having shared and unique predictors, influencing each other via complex relationships. Further research should be conducted to understand whether the dual-continua model of mental health is valid in the most severe mental illness, particularly depression.

The authors of included studies strongly advocated for the adoption of the dual-continua model in policy, research, and practice. The main implications of the adoption of the dual-continua model were related to the inclusion of positive mental health measurement into mental health assessment, utilising interventions to improve positive mental health to promote mental health and prevent mental illness, and the addition of positive mental health measurement and intervention to complement the traditional approaches to inspire mental health care system reform.

Summary

The review identified more than 80 empirical studies supporting the validity of the dual continua model, indicating that mental wellbeing and psychological distress or mental illness represent distinct, yet related, continua. These studies were conducted in a range of populations, languages, and cultures, using diverse method, assessment tools and study designs.

The validity of the dual-continua was demonstrated psychometrically, using factor analysis techniques to demonstrate that the data best fit an oblique two-factor model rather that a bipolar model. This finding was replicated different measures mental wellbeing and assessment tools for a range of mental illnesses. It was also shown that mental wellbeing and mental illness related differently to various drivers, predictors, or outcomes, where it was shown that the absence of illness was not sufficient to predict various desirable outcomes. The fact that mental illness and positive mental health predict or explain different outcomes was a strong indication that the constructs are distinct, and the fact that there were similarities supports a degree of overlap between the constructs.

The review identified a range of implications of the dual-continua model, which came from the empirical evidence identified in the literature. These were primarily sorted into three broad themes, implications for mental health assessment, treatment of mental illness, and health care system reform. The concurrent assessment of mental wellbeing and distress enables the identification of risk profiles of individuals or populations, which can provide valuable information for the prevention

and treatment of mental illness. The review identified a gap in the literature pertaining to the role of mental wellbeing as a predictor of recovery in mental illness, which is investigated in the following chapter. The findings in the current chapter suggest that a range of improvements to mental health research and practice can be realised with the dual-continua model, which relies on accurate wellbeing assessment in clinical and non-clinical populations; the focus on chapters 5 and 6.

Update of the Evidence

Since the publication of the current Chapter, a number of studies have continued to demonstrate support for the dual-continua model of mental health, lending further support to the claims of the validity and utility of the model. Studies continued to investigate the dual-continua model across a range of settings including university staff (Kirby et al., 2022), health care workers during the COVID-19 pandemic (Blasco-Belled et al., 2022), across African nations (Khumalo et al., 2022), following intervention (van Agteren, Ali, et al., 2021), and in relation to other variables such as fear of happiness (Blasco-Belled et al., 2021).

Of note, Kraiss et al. (2022) found evidence of the dual-continua model using a novel data collection that was not included in the current Chapter. Using experience sampling, this study demonstrated that the dual-continua model remains valid at the within-person level in addition to the between-level of analysis that has been more commonly used in the past. In contrast, Zhao and Tay (2022) demonstrated a bipolar (rather than dual-continua) relationship between mental wellbeing and mental illness. This finding was very similar to that reported by van Erp Taalman Kip and Hutschemaekers (2018) and discussed in the above Chapter. The results again demonstrate that in severe distress, particularly in depression, mental wellbeing constructs may be highly correlated with mental illness symptoms and individuals may exhibit difficulty distinguishing mental illness symptoms from symptoms of mental wellbeing. A commentary on Zhao and Tay (2022) is forthcoming (Iasiello et al., in press), using empirical and theoretical arguments which are presented in the current thesis (from Chapters 2 and 4, respectively).

CHAPTER 3: MENTAL WELLBEING AS A PREDICTOR OF RECOVERY FROM MENTAL ILLNESS

Introduction

The review of Chapter 2 identified that the conceptualisation of mental wellbeing and mental illness as two distinct concepts can lead to a range of improvements in mental health research and practice. One important potential implication, which was remained a gap in the literature was in the domain of recovery from mental illness. It was demonstrated that change in mental wellbeing over time predicted protection or risk of a future mental illness (Keyes et al., 2010), and the current study was designed to investigate whether change in mental wellbeing would predict recovery from an affective disorder. The study used an existing representative dataset from the United States of America, which followed participants after a 10-year period. This study was published in the Journal of Affective Disorders, in collaboration with Professor Corey Keyes, who has published notably on the dual-continua model and its role in protection and promotion of mental health.

Published paper

Iasiello, M., van Agteren, J., Keyes, C. L., & Muir-Cochrane, E. (2019). Positive mental health as a predictor of recovery from mental illness. *Journal of Affective Disorders*, *251*, 227-230. https://doi.org/10.1016/j.jad.2019.03.065

Abstract

Background. High levels of positive mental health protect individuals from mental illness. This study investigates longitudinal change in positive mental health as a predictor of mental illness recovery in a cohort group.

Methods. Using data from the 1995 and 2005 Midlife in the United States cross-sectional surveys (n=1,723), logistic regression was used to estimate the odds ratio that individuals diagnosed with a mental illness in 1995 would have recovered in 2005 based on whether their level of positive mental health changed over the 10-year period.

Results. Individuals who maintained or gained the highest levels of positive mental health were more than 27.6 and 7.4 times, respectively, more likely to recover when compared to those who maintained the lowest level of positive mental health. Those who maintained or gained moderate levels of positive mental health had more moderate likelihood of recovery, and those whose positive mental health declined to the lowest levels had no significantly different likelihood of recovery compared to participants whose positive mental health remained low.

Limitations. This study was limited by the age of the data, and replications of these result are recommended using more contemporary data.

Conclusions. This study suggests that positive mental health may be an important resource for individuals to recover from mental illness and stay mentally healthy. Results point to the need to include positive mental health assessment and interventions into mental health care systems.

Introduction

There has been little progress in reducing the burden of mental illness around the world, prompting calls for improved access to quality mental health care and assessment of mental disorders and for "programs to prevent mental disorders and promote mental health" (U. S. Burden of Disease Collaborators et al., 2018; Vigo et al., 2016). The distinction between mental *disorder* and mental *health* is a fundamental underlying element of this call for improvement, but this important distinction is often misunderstood.

Mental illness and mental health are traditionally conceptualised as opposite ends of the same continuum, and modern mental health care systems are primarily designed to reduce mental illness to concurrently improve mental health. It has been argued that health care systems designed this way risk providing 'reactive' health care and creating avoidance, fear, and stigma of

the pathology (see Herron and Trent (2000) for a review). However, evidence indicates that positive mental health and mental illness are distinct, yet interrelated, constructs that reflect separate continua (Keyes, 2005; Suldo & Shaffer, 2008).

Growing evidence suggests that high levels of positive mental health protects individuals from mental illness, and that low levels of positive mental health is a risk factor for mental illness. (Westerhof & Keyes, 2010) conducted a longitudinal study of mentally healthy participants (without a diagnosis of mental illness) of the 1995 and 2005 waves of the Midlife in the United States (MIDUS) National Study of Health and Well-being. The study showed that participants who gained or maintained high levels of positive mental health over the 10-year period had a decreased risk of developing a mental illness (defined as depression, anxiety, and panic disorder), and that participants whose positive mental health declined or remained low had significantly increased odds of developing mental illness. Similar results were observed by Wood and Joseph (2010), who found that people with low levels of positive mental health were several times more likely to be depressed 10 years later. Grant et al. (2013) and Lamers et al. (2015) supported this bidirectional relationship between positive mental health and psychopathology, finding that low levels of positive mental health predicted risk of higher depressive symptoms within one year. This research indicates that mental health protection and promotion should become a mental health care priority to reduce the burden of mental illness, and that building and maintaining high levels of positive mental health is fundamental to this cause (Keyes, 2013).

Positive mental health is also proposed as an important resource for recovery *from* mental illness and therapies have been designed specifically to improve the positive mental health of individuals with diagnosed mental illness (Slade et al., 2017). However, there has been little to no research on whether positive mental health is associated with recovery (Seow et al., 2016). Investigating whether positive mental health is a resource for recovery can provide evidence necessary to develop better models of mental health care (Keyes, 2014). In the current study, we extend the (Keyes et al., 2010) study, using the same large dataset, instead focusing on participants diagnosed with a mental illness in 1995. We hypothesise that gains in positive mental health from 1995 to 2005 are associated with greater odds of 'recovering' from that mental illness in 2005, and that losses in positive mental health will be associated with lesser odds of recovery 10 years later. We acknowledge the important discourse between clinical and personal recovery, and use recovery here to indicate an individual that was assessed with depression, anxiety, or panic disorder in 1995 and not in 2005.

Methods

This study replicates the methodology used in the original (Keyes et al., 2010) study. A representative sample of U.S. adults above the age of 18 who participated in the MIDUS study provided data on their mental illness and positive mental health in 1995 and 2005 (n=1,723).

Although the 2015 MIDUS wave is available, the sample size was unsuitable for this analysis. The 12-month prevalence of mental illness (major depressive episode, generalized anxiety, and panic disorder) for both time-points was determined using the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition Text Revised* (DSM-IV-TR) criteria through the *Composite International Diagnostic Interview-Short Form* (CIDI-SF) scale. The degree of positive mental health (flourishing, languishing, or moderate mental health) was based on their scores on emotional, psychological and social well-being scales (Keyes et al., 2010). To be defined as flourishing, individuals exhibited high levels (scores in the upper tertile) on 1 of the 2 measures of emotional well-being and at least 6 or more of the 11 scales of psychological and social well-being. To be defined as languishing, individuals exhibited low levels (scores in the lower tertile) on 1 of the 2 measures of emotional well-being and 6 or more of the 11 scales of psychological and social well-being. Individuals that did not fit the criteria for flourishing or languishing were categorised with moderate mental health.

Logistic regression was performed using SPSS v.25 (SPSS Inc, Chicago, IL) to generate prevalence Odds Ratios (OR) of mental illness in 2005 as a function of change in mental health levels between 1995 and 2005, along with baseline mental illness (1995) and covariates (age, gender, race/ethnicity, education, employment status, marital status, physical illness). For prevalence- and incidence-based analyses, we created a categorical variable that measured change in positive mental health between 1995 and 2005. These categories included: individuals who (1) stayed flourishing, (2) improved to flourishing, (3) declined to moderate, (4) stayed moderate, (5) improved to moderate, (6) declined to moderate, (7) stayed languishing. The latter category was used as the reference group.

Results

Table 3 reports the outcomes of the binary logistic regression analysis. Participants who were flourishing at both time points, and participants who improved from languishing or moderate mental health to flourishing, demonstrated significantly higher odds of recovering from their mental illness, OR = 27.617 and OR = 7.444 respectively. While marginally non-significant, those who declined from flourishing to moderate positive mental health kept a higher odds of recovery (OR=2.931; p=.067) as those who stayed languishing. Those who maintained moderate positive mental health or improved to moderate demonstrated significantly higher odds (OR = 1.839, p=.011 and 1.771, p=.048 respectively). Participants who declined to languishing over the 10 years were no more likely to have recovered from their mental illness than those who stayed languishing.

Table 3 Adjusted prevalence odds ratio (OR) of any mental illness in 2005 by change in mental health level between 1995 and 2005

	1995-2005		
	OR (95% CI)	Sig	n
Stayed flourishing	27.617 (3.468, 219.902)	.002	25
Languishing or moderate to flourishing	7.444 (2.719, 20.378)	.000	42
Flourishing to moderate positive mental health	2.931 (0.927, 9.271)	.067	26
Stayed moderate positive mental health	1.839 (1.152, 2.935)	.011	234
Languishing to moderate positive mental health	1.771 (1.004, 3.124)	.048	106
Flourishing or moderate to languishing	0.831 (.408, 1.692)	.610	58
Stayed languishing (REF)	1	-	144

Note: CI = confidence interval, REF = reference category. ORs are adjusted for demographic variables (age, gender, race/ethnicity, education, marital status, and employment in 2005) and whether respondents had any physical health conditions in 1995.

Discussion

This study provides evidence that individuals with diagnosed mental illness who gain or maintain high levels, and those who gain or maintain moderate levels, of positive mental health over a 10-year period have much greater odds of recovering than those with low levels of positive mental health. No difference in odds of recovery was observed among participants who declined from flourishing or moderate positive mental health to languishing. The results indicate that positive mental health may be an important resource for individuals to recover from a mental illness and stay mentally healthy. It also adds to existing evidence highlighting the importance of change in psychopathology and positive mental health over time, as opposed to their respective absolute levels at any given time (Lamers et al., 2015). These results, particularly in combination with Keyes et al. 2010 imply that governments should focus on promoting and protecting positive mental health, irrespective of a diagnosis of a mental illness. The current study adds to the growing academic literature advocating for the inclusion of positive mental health intervention and assessment into mental health care (de Cates et al., 2015; Provencher & Keyes, 2011; Siddaway et al., 2017; Slade, 2010).

Interventions to improve positive mental health have been designed and tested in a range of modalities, including one-on-one, group-based, and in online format, but predominantly for healthy populations (Bolier et al., 2013). Investigation of evidence-based interventions in mentally ill populations and clinical settings is developing rapidly (Fava et al., 2017; Rashid & Seligman, 2018), and adoption of positive mental health strategies in mental health practice and policy, for instance the inclusion of positive mental health assessment when patients present with mental health problems, should be explored to help reduce the burden of mental illness.

The strength of this study was its longitudinal cohort design. The large sample size enabled sufficient power to detect meaningful temporal associations and most known predictors of mental illness were controlled for, thus eliminating their confounding effect on the results. This study was limited by the age of the data, and replications of these result are recommended in more contemporary data.

Conclusion

It was found that positive mental health is an important resource for minimise the risk of developing an affective disorder. This study provides evidence that positive mental health is also an important resource for recovery from depression, anxiety, and panic disorder. This study contributes to the growing body of evidence advocating for the inclusion of positive mental health interventions and assessment into mental health care system to reduce the burden of mental illness around the world.

Summary

While this study used an observational design, it demonstrated that improvement in wellbeing over time can be an important predictor for recovery from a mental illness, while those with lower levels are less likely to recover. The findings of the current study indicate the need for the assessment of mental wellbeing to completement assessment of symptoms or disorder, to identify the potential wellbeing needs of clients and to evaluate interventions to improve wellbeing in clinical populations. Hence, there is a need for scales of mental wellbeing that are valid in clinical populations or in the context of psychological distress. This need is the focus of the next two studies, which investigate the performance of the MHC-SF in clinical and general settings. These studies are preceded by a methodology chapter which considers the appropriate approaches to assessment mental wellbeing and mental illness concurrently.

CHAPTER 4: METHODOLOGICAL CONSIDERATIONS FOR ASSESSING THE DUAL-CONTINUA MODEL OF MENTAL HEALTH

This chapter considers the conceptual rationale for assessing mental wellbeing and mental illness separately, drawing on a seminal review of the importance of bivariate assessment by Cacioppo and Berntson (1994). The review argues for the necessity of assessing positive and negative attitudes, and that conducting assessments that allows for positive and negative to be separated enables significant benefits for research. These conceptual arguments support the empirical findings identified in Chapters 2 and 3. Finally the chapter concludes with methodological considerations that are required to ensure the separability of positive and negative constructs, and therefore in the assessment of mental wellbeing and psychological distress.

Argument for Bivariate Over Bipolar Assessments

Research on the processes that drive an individual's formulation of an attitude is a well-established literature, and one that has specifically focused on the optimal approach to conceptualising the nature of the relationship between positive and negative attitudes towards a stimulus, topic, or idea (Cacioppo & Berntson, 1994). Like the case of mental health research, the relationship between positive and negative assessments were traditionally conceptualised as a bipolar one (Eaton, 1951). The bipolar conceptualisation suggests that an individual's feelings or attitudes can range anywhere between two end points, maximally positive and maximally negative. For this reason, assessment tools of attitudes utilised bipolar rating scales, which reflect positive and negative attitudes as opposite ends of the same spectrum (Thurstone, 1949). As bipolar rating scales became widely accepted and commonly used to assess attitudes, certain assumptions inherent in the bipolar model were overlooked. This chapter will discuss these assumptions and the benefits of a bivariate approach as a theoretical parallel of the dual-continua model of mental health, where positive and negative attitudes are akin to mental wellbeing and mental illness or psychological distress respectively.

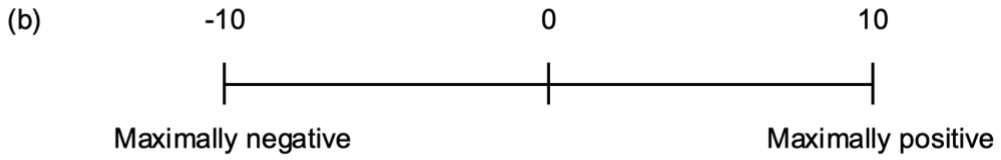
Cacioppo and Berntson (1994) identified limitations inherent in the bipolar model which hindered the understanding of attitudes, and provided a rationale for a bivariate model to better progress the future of attitude research. The primary issue is that the bipolar rating scale assumes that an attitude can be reduced to the "net difference between positive and negative valent processes aroused by a stimulus" (Cacioppo and Berntson, 1994, p.401). Under this assumption, assessments of attitude reflect the net difference between positive and negative processes. In the context of the dual-continua model, the bipolar assessment assumes an individual's assessment of their mental health is reducible to the net difference between their mental wellbeing and their

psychological distress, i.e., although I am very sad, I am more happy than sad, therefore I am mildly happy. This assumption can be divided into three principles (as outlined by Cacioppo and Bernston, 1994), which are of vital importance to the conceptualisation between positive and negative attitudes, and therefore to the relationship between mental wellbeing and psychological distress:

(1) The *principle of evaluative activation* suggests that an attitude is a joint function of positively and negatively valent activation functions. In the context of mental health assessment, this principle indicates that an individual's assessment of their overall mental health consists of the relationship between how *mentally well* and how *mentally distressed* they feel.

(2) The *principle of opposing evaluative activations* suggests that positive and negative activation functions have generally opposing effects on an attitude. In the context of mental health, this would suggest that the 'units' of feeling mentally well and mentally distressed cancel each other out. Like the number line represented in Figure 1b (reproduced below from Chapter 1), this principle would suggest that the amount someone feels mentally distressed could be subtracted from the amount that someone feels mentally well, to provide an overall assessment of their mental health.

Figure 1b. Bipolar relationship between positive and negative as a single dimension (reproduced from Chapter 1 of the current thesis)

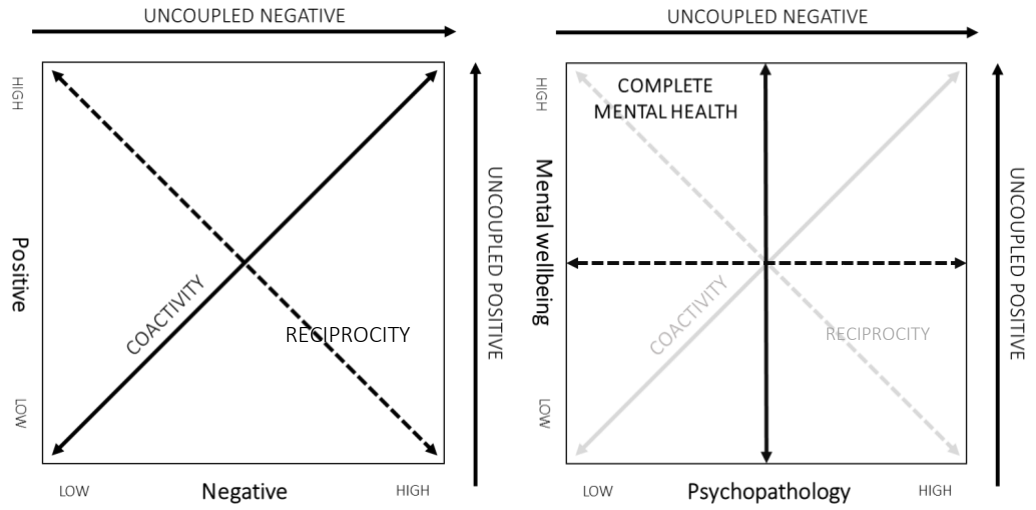


(3) Finally, the *principle of reciprocal evaluative activation* suggests that positive and negative valent activation functions are reciprocally controlled. In other words, this suggests that as a positive valanced activation increases, the negatively valanced activations will reciprocally decrease. This would suggest that the more someone feels mentally well, the less they will feel mentally distressed. This principle has been the limitation of the bipolar model discussed extensively in the literature of the dual-continua model, with researchers finding the phenomena of individuals reporting high levels of mental wellbeing despite high levels of psychological distress or the diagnosis of a mental illness.

The first tests of the principle of reciprocal evaluative activation came from behavioural theory, as researchers assessed positive and negative evaluations separately, rather than relying on bipolar

assessment methods (Masterson & Crawford, 1982). The separation of positive and negative attitude assessment allowed researchers to investigate the unique and shared antecedents and consequences of each attitude, and to investigate the conditions that might lead to the coupled (each assessment activated reciprocally) or uncoupled (one assessment activated independently of the other) activation of both processes. Cacioppo and Berntson (1994) suggested that attitude theory and measurement would particularly benefit from redefining the final principle as "the uncoupled modes of evaluative activation are represented as vectors lying along the axes" (p.402). Put simply, this redefined principle suggests that research would benefit from the conceptualisation that positive and negative attitudes are distinct, and that this remains true even in the conditions where the positive and negative are truly bipolar. This principle is represented graphically as a bivariate structure in Figure 9, which is overlaid with the dual-continua model to demonstrate the theoretical similarities. Cacioppo and Berntson (1994) discuss the benefits of this redefined principle, suggesting that this would allow for: "(i) separable activation of positive and negative evaluative processes, (ii) investigation of the unique antecedents and consequences, and (iii) examination of the psychological and physiological constraints that produce their reciprocal activation" (p.402).

Figure 9. Schematic diagram of the bivariate evaluative plane



Note: Left; adapted from Cacioppo & Berntson (1994), Right; a variation with the dual-continua model of mental health overlaid

In the bivariate evaluative plane (Figure 9), the line of reciprocity graphically represents a possible condition between positive and negative evaluation processes that act like they would in the bipolar model. In this condition, the activation of one process results in the deactivation of the other. It

suggests that as positive evaluative processes decrease, the negative evaluative processes must necessarily increase, and vice versa. In the context of mental health assessment, this is an assumed process that occurs in a bipolar conceptualisation between mental wellbeing and psychological distress. After an intervention or therapy, it can easily be conceived that as psychological distress is reduced, mental wellbeing is reciprocally increased. Many positive psychology interventions have measured both psychological distress and mental wellbeing, and found this to be the case (Bolier et al., 2013; Sin & Lyubomirsky, 2009).

As suggested by Cacioppo and Berntson (1994), while reciprocal activation may be common, it is not the only theoretical possible relationship between the positive and negative activation. This is the fundamental limitation of the bipolar perspective; while it may capture the common relationship between positive and negative assessments, it excludes the possibility of understanding any other alternatives. Therefore, even in conditions where a bipolar relationship between the positive and negative evaluative processes exists, researchers are hindered by the bipolar model of assessment. To illustrate an alternative outcome, the line of coactivity is presented in Figure 9, which represents the simultaneous activation (or deactivation) of positive and negative evaluative processes. In mental health, some instances may cause both mental wellbeing to improve while levels of psychological distress also increase. For example, a student preparing for a test or exam may experience increased levels of distress (negative evaluative activation) as the test looms, however the progress towards achieving a goal or milestone may also stimulate a sense of meaning and achievement (positive evaluative activation). Researchers of the dual-continua model have similarly, yet implicitly, identified the limitations of the bipolar conceptualisation of mental health outlined above, and have realised some of the research benefits described by Cacioppo and Berntson (1994).

Related to benefit (i) the '*separable activation of positive and negative evaluative processes'*, it has been shown that following a psychological intervention, participants may experience improved wellbeing and reduced psychological distress, either reciprocally or as uncoupled processes (Figure 9). Trompetter et al. (2017) conducted secondary analysis of a randomised controlled trial of an Acceptance Commitment Therapy intervention, with conceptualisation of mental wellbeing and psychological distress as bivariate outcomes, rather than bipolar ones as was originally conducted. This conceptualisation of the assessment outcomes illustrated that while between-group differences in participants demonstrated improvements in mental wellbeing and psychological distress (reciprocal activation), analysis within-individuals showed that participants were more likely to improve in one outcome or another (uncoupled activation). This analysis demonstrated the benefit of the bivariate approach, and provided novel evidence that individuals experience differential outcomes in response to the same intervention and has been replicated in other intervention studies (van Agteren, Ali, et al., 2021). These studies conclude that mental wellbeing and psychological distress must be measured separately to evaluate future mental

health interventions such that the conditions that lead to coupled or uncoupled activation can be best understood to improve intervention design and efficacy (Trompetter, Lamers, et al., 2017).

Examples of benefit (ii) 'investigation of the unique antecedents and consequences' are also available. For example, Kinderman et al. (Kinderman et al., 2015) investigated predictors and antecedents of mental wellbeing and psychological distress using the bivariate conceptualisation. Using population-level data, their analysis revealed that various social and personal predictors were differential associated with uncoupled mental wellbeing or psychological distress – indicating that public policy or interventions to improve mental wellbeing or reduce psychological distress should be complementary but different. The analysis revealed the antecedents of wellbeing (e.g., financial equity, local community strength, coping ability) were different to those of psychological distress (traumatic life events, rumination, abuse). Again, these findings are not possible when the relationship between mental wellbeing and psychological distress or mental illness are considered as bipolar ends of the same continuum.

Finally, an exemplar of benefit (iii) 'examination of the psychological and physiological constraints that produce their reciprocal activation' can also be illustrated. Van Erp Taalman Kip and Hutschemaekers van Erp Taalman Kip and Hutschemaekers (2018) investigated the validity of the dual-continua model of mental health in a clinical population with severe depression. Their analysis indicated that assessment tools of mental wellbeing and psychological distress appeared bipolar, and used this as evidence against the validity of the dual-continua model. Considering the discussion of Cacioppo and Berntson (1994), this conclusion could be reframed that the context of severe depression may be a constraint which commonly produces reciprocal activation of mental wellbeing and psychological distress, however this does not preclude the possibility of uncoupled activation of either outcome following intervention. In other words, severe clinical groups may still benefit from particular interventions aimed to improve their mental wellbeing (uncoupled activation) despite the fact that assessment tools may appear bipolar. Under this approach it is possible to describe the ambition of personal recovery (to improve their mental wellbeing without a necessary focus of reducing mental illness) (Leamy et al., 2011) to be represented as uncoupled positive activation in individuals with a diagnosis of mental illness or high levels of psychological distress. This is yet another demonstration of the benefit of the bivariate model, as the process of striving for personal recovery is not theoretically possible under the bipolar conceptualisation.

The final limitation of the bipolar conceptualisation is related to the assessment of neutrality. In the bipolar model of assessment, it is not possible to distinguish whether an individual at point zero (Figure 1b; Chapter 1) is indicating neither mental wellbeing nor psychological distress, or that they are experiencing equal levels of each construct (which would cancel each other out back to zero under the assumption of opposing evaluative actions). The bivariate model clarifies this ambiguity (Cacioppo & Berntson, 1994), and allows for all possible combinations of positive and negative

states to be reported. In terms of the dual continua model, this relates to the practice identified in Chapter 2 of forming subgroups within a population, whereby individuals can have many combinations of mental wellbeing status and psychopathology. In the bivariate model, the state of neutrality, which describes low activation of both positive and negative evaluative processes, which represents low wellbeing and low psychological distress. These are individuals most likely to develop a mental illness over time (Keyes et al., 2010; Wood & Joseph, 2010). There is also the state of maximal conflict, which describes high activation of positive and negative evaluative processes – which represent individuals with high levels of mental wellbeing and psychological distress. These are individuals most likely to recovery from a mental illness, as demonstrated in Chapter 3 (Iasiello et al., 2019). The ability to identify these risk groups is important for prevention and recovery, however they would both be considered neutral in a bipolar model, and only distinguishable in the bivariate or dual-continua approach.

Assessment Approaches for Measuring Mental Wellbeing, Psychological Distress, and Clinical Symptoms

Combining Measures of Mental Health and Mental Illness

This chapter has presented a rationale for the use of the bivariate or dual-continua model to conceptualise and assess overall mental health, indicating the need to assess mental wellbeing and psychological distress concurrently. Joseph and Patterson (2016) detailed three approaches to assessing the mental wellbeing and mental illness concurrently, which will be discussed in the context of the current thesis below.

The first approach is to simply combine measures of mental wellbeing alongside clinical scales or assessment tools. While this has been the most used approach by those assessing both constructs, Joseph and Patterson (2016) note that this approach can be problematic, particularly when there is a clash of meta-theory that underpins each of the constructs. For example, a clash between the medical model approach that underpins some clinical assessment may be theoretically unsuited to be paired with a humanistic wellbeing measurement tool (Joseph & Wood, 2010). The second form invited clinical psychologists to re-evaluate existing clinical tools for the existence of any positive or wellbeing assessments. There is evidence that some measures of psychological distress which were originally thought to only measure negative evaluative processes may be recoded to include positive evaluative processes. The example provided is of the CES-D tool, which asks positively worded questions such as “I felt happy, and I enjoyed life”. Re-analysis of this tool indicated that it can be used to measure both dimensions of happiness and depression, however there are limitations related to reverse coding and question ordering (Marsh, 1996; Siddaway et al., 2017). While this is a valid approach, it is limited by the relatively few indicators of psychopathology that include positive dimensions. The final approach recommended was to develop entirely new scales, specifically for positive clinical psychology, that could shift the

field away from taxonomic and diagnostic terminology, and toward new, humanistic, person-centred, understandings of mental health and wellbeing (Joseph & Patterson, 2016).

Maximising the Separability of Mental Health Assessment

Most of the work testing the relationship between mental wellbeing and psychological distress has investigated the statistical independence of assessment tools reflecting the two constructs. The significant majority of these studies have demonstrated that, while related, mental wellbeing and psychological distress are distinct from each other (Franken et al., 2018). Statistical independence, often referred to stochastic independence, describes the relationship between two events in which "the probability of their joint occurrence is equal to the product of the probabilities of the occurrence of each event alone" (Tulving, 1985, p.393). In the context of the dual-continua model, stochastic independence would mean that an individual's wellbeing and psychopathology are completely uncorrelated (r = .0), which a growing body of evidence shows to be unlikely. For this reason, Cacioppo and Berntson (1994), referred to the 'separability' of positive and negative attitude assessment, rather than stochastic independence. The authors described functional independence as the "relationship between two dependent variables in a situation in which one does, and one does not vary as a function of an independent variable" (Tulving, 1985, p. 394). For example, functional independence would describe the state where some variables influence mental wellbeing and not mental illness, or vice versa, as described above and illustrated in studies identified in Chapter 2 (Kinderman et al., 2015; Trompetter, Lamers, et al., 2017). Importantly, functional independence can exist even when stochastic independence cannot (Tulving, 1985), and the benefits of the bivariate model can still be realised when the positive and negative evaluations are functionally independent (Cacioppo & Berntson, 1994).

Therefore, it is ideal for future research to enable the bivariate model by focusing on the separability of mental wellbeing and psychological distress and confirming functional independence, rather than stochastic independence. Affective research is a well-developed literature in testing the independence or bipolarity, particularly between positive and negative affect. The nature of the relationship between positive and negative affect has been contested for decades, with a long history of conflicting results (Bradburn & Caplovitz, 1965; Feldman Barrett & Russell, 1998; Green et al., 1993; Nowlis, 1965; Watson & Clark, 1997). This body of research has uncovered valuable methodological lessons that can be applied to the research of the dual-continua model. Feldman-Barrett and Russell (1998) reviewed this literature, and summarised useful considerations for the investigation of bipolarity or independence between positive and negative constructs to ensure that results are not influenced by methodological or measurement error.

The first consideration related to the clear definition of bipolarity, such that it could be accurately tested. Feldman-Barrett and Russell (1984) remind us that items selected to represent positive and

negative evaluations should *actually* be hypothesised semantic opposites. Not every individual item that reflects psychological distress will necessarily be the semantic opposite of every item representing mental wellbeing. For example, negative mood may be the semantic opposite of happiness, but it's not the opposite of other components of mental wellbeing such as a sense of meaning or positive relationships (although it may be related). The degree to which there is a divergence of semantic opposite items in each mental wellbeing and psychological distress will directly bias the analysis of bipolarity. This is demonstrated in the Happiness-Depression Scale (two semantically opposite constructs), which has demonstrated statistical bipolarity (Joseph & Lewis, 1998), whereas assessment of mental wellbeing and eating disorders (which contain less semantic opposite items) display much greater independence (Tomba et al., 2014).

Building on this notion, the second consideration was related to the selection of items used to represent the positive and negative terms themselves. Drawing on the example of sampling bias, testing of independence or bipolarity can be biased if the items are not representative of the latent construct itself. Thus, for the above examples, neither happiness, depression, nor the assessment of an eating disorder adequately represent the broader concepts of mental wellbeing or psychological distress (of course they were not intended to), and therefore will influence assessment of bipolarity or independence.

Finally, Feldman-Barrett and Russell (1984) warned against focusing exclusively on the valence of affect which led researchers to overlook other components of affect such as activation and deactivation. This focus of activation and deactivation is said to be the cause of the extreme independence of the Positive and Negative Affect Scale (PANAS), which was not observed in other scales of positive and negative affect (Terraciano et al., 2003). Semantic components such as activation/deactivation have not been assessed in the research of the independence or bipolarity between mental wellbeing and psychological distress, however it is likely that other assessment features such comparing intensity or frequency of evaluations of mental wellbeing or distress will similarly influence the results (Diener, Larsen, et al., 1985).

Positive and negative affect can be functionally independent; however, the degree of separability between the two constructs can be influenced by measurement error (Russell, 1979), a finding that has been replicated in other domains of psychological assessment (Dohrenwend et al., 1980). Ross and Mirowsky (1989) suggested that controlling for sources of measurement error increases the correlation between illness and health, while Green et al. (1993) found that random and systematic measurement errors can result in the incorrect conclusion of independence between two constructs. In addition to the possible sources of error described above, a range of systematic and random sources of measurement error when testing bipolarity/independence have been collated in Table 4.

Table 4. Sources of measurement error impacting separability of positive and negative evaluations

Source of error	Description
Extremity response styles (Bentler, 1969)	Increase the potentially high negative correlation between polar oppositional terms.
Asymmetrical bipolar rating scales (Meddis, 1972)	Supress negative correlations and prejudice research against the discovery of bipolar factors.
Proximity Error - Long response windows (Diener & Emmons, 1984; Russell, 1979)	Longer recall, more likely to find independence.
Non-random error covariation stemming (Green et al., 1993; Russell, 1979) Also Adjusting for statistical anomalies that can occur from the use of negatively- and positively-worded items(Marsh, 1996; Schmitt & Stuits, 1985)	Items in close proximity on the scale often show inflated intercorrelations. Factors comprising of entirely positive or negative words may not be purely substantive and may be a result of measurement artefact.
Underrepresentation of one or the other bipolar scale (Green et al., 1993; Meddis, 1972; Russell, 1979)	Sample of items underrepresent one end of the continuum
Acquiescence (Russell, 1979)	Tendency for a participant to agree or disagree with an item regardless of its content, and has been shown to mask bipolarity.
Statistical analysis of independence (Joshanloo, Jose, et al., 2017)	Majority of studies to test the dual-continua model have relied on Confirmatory Factor Analysis (CFA), however this approach does not allow for intercorrelation between the latent variables.

Assessment in the Current Thesis

The next chapters are focused on the appropriate use of measures of wellbeing in the context of mental illness. Mental illness will be defined using both diagnostic (Chapter 5) and continuous

(Chapter 6) approaches. The measure of wellbeing used in the following two chapters is the MHC-SF, which was used in many of the studies identified in systematic review of Chapter 2 as related yet distinct from indicators of mental illness. As discussed in Chapter 1, the mental health continuum model (which underpins the MHC-SF) of mental wellbeing has a strong empirical and theoretical basis, covering many aspects of mental wellbeing from subjective, psychological, and social wellbeing. A large literature supports the validity of the MHC-SF and has a well-replicated factor structure.

Conclusion

Most of the previous research on the dual-continua model of mental health asks whether mental wellbeing and psychopathology are independent of each other. However, Cacioppo and Berntson (1994) are offering an alternative approach: that mental health theory and measurement "might be fostered by a framework and measurement strategies in which the antecedents and consequences of positive and negative evaluative processes could be investigated separately" (p.403). This chapter has provided a rationale that the bivariate or dual-continua conceptualisation is the most appropriate model for research progress, such that researchers can begin to understand the complexity of the relationship between mental wellbeing and psychological distress, however defined. The chapter identified a range of methodological and statistical issues that can bias the results when testing for bipolarity or independence, and approaches to assess mental wellbeing in the context of distress or mental illness, which will inform the subsequent chapters of this thesis.

CHAPTER 5: ASSESSING MENTAL WELLBEING USING THE MENTAL HEALTH CONTINUUM – SHORT FORM: A SYSTEMATIC REVIEW AND META-ANALYTIC STRUCTURAL EQUATION MODELLING.

Introduction

The importance of the assessment of mental wellbeing in clinical settings has been demonstrated in Chapters 2 and 3. Not only can wellbeing be an important resource for recovery from mental illness, but it also allows us to understand the unique antecedents of distress or symptoms or mental wellbeing, leading to more tailored interventions and care. This study aimed to test whether the theoretically proposed factor structure of the MHC-SF is the best fit of the data in clinical and non-clinical settings. The study uses a novel analysis technique, called meta-analytic structural equation modelling (MASEM), and utilised a systematic review to identify studies that have tested the factor structure of the MHC-SF in the literature. This study was published in Clinical Psychology: Science and Practice, in collaboration with Prof Gerben Westerhof and Associate Professor Marijke Schotanus-Dijkstra, who have published extensively on the dual-continua model of mental health and the MHC-SF.

Published paper

Iasiello, M., van Agteren, J., Schotanus-Dijkstra, M., Lo, L., Fassnacht, D. B., Westerhof, G. 2022. Assessing mental wellbeing using the Mental Health Continuum – Short Form: a systematic review and meta-analytic structural equation modelling. *Clinical Psychology: Science and Practice*, 29(4), 442–456. https://doi.org/10.1037/cps0000074.

Abstract

Mental wellbeing is an increasingly relevant outcome in clinical psychology, and rigorous measurement tools are required to ensure high quality data. This study aimed to systematically review and meta-analyse the factor structure of a popular measurement tool of mental wellbeing, the Mental Health Continuum – Short Form (MHC-SF). The systematic review identified 46 studies which investigated the performance of the MHC-SF, which consistently supported the psychometric properties of the scale. Meta-analytic structural equation modelling (MASEM) was used with data extracted from 26 studies (n=108,603). MASEM indicated support for the original tripartite structure of the MHC-SF, as well as a hierarchical model and a bifactor model. The hierarchical model (and the nested tripartite model) was supported theoretically and performed similarly across clinical and general populations. The current study demonstrates that the MHC-SF is a valid measure of general mental wellbeing, which taps into concepts of emotional, social, and psychological wellbeing in general and clinical populations. Caution may be required when comparing scores across clinical and non-clinical cohorts.

Keywords: assessment, mental health, Mental Health Continuum—Short Form, meta-analytic structural equation modelling, well-being

Background

Wellbeing is an increasingly relevant outcome for clinical psychology research, policy, and practice (Howell et al., 2007; Jankowski et al., 2020). While psychology has long included a focus on wellbeing or positive functioning, e.g., fully functioning (Rogers, 1995), self-actualisation (Maslow, 2013), positive mental health Jahoda (Jahoda, 1958), the clinical field has been primarily focused on the assessment and management of dysfunction and distress (Wood & Tarrier, 2010).The recent increase in attention to mental wellbeing or positive functioning, often linked to the rise of positive psychology (Hendriks et al., 2018; Rusk & Waters, 2013), has reoriented various disciplines of psychology back toward positive functioning in addition to a focus on distress and impairment (Jeste et al., 2015; Leamy et al., 2011; Ruini & Fava, 2012; Wood & Tarrier, 2010).

Scholars have argued for the relevance of mental wellbeing in clinical practice (Seligman et al., 2006; Slade, 2010), with Joseph and Wood (2010, p. 831) positing three rationales for the assessment of positive functioning in clinical practice: to "(1) ascertain the extent to which clinical psychology is already engaged in the practice of increasing positive functioning; (2) develop new approaches which actively serve to promote well-being; and (3) increase the ability to treat distress and dysfunction". These rationales are increasingly being incorporated in the way psychologists treat and intervene. Mental wellbeing is becoming progressively integrated into clinical practice,

with the development of wellbeing-based therapies (Fava & Ruini, 2003) and approaches (Wood & Tarrier, 2010) to transform a deficit-focused approach towards a more strength- and human potential-based one (Maddux et al., 2004). Wellbeing interventions have demonstrated efficacy at improving psychological distress in general and clinical populations (Chakhssi et al., 2018; Spijkerman et al., 2016; van Agteren, Iasiello, et al., 2021), and addressing wellbeing specifically may be an important element in recovery from mental illness (Iasiello et al., 2019) Schotanus-Dijkstra (Schotanus-Dijkstra et al., 2019; Slade, 2010).

As a result, the measurement of subjective experiences of mental wellbeing - or positive mental health - has gained traction in research, practice, and policy. A developing body of evidence of the relationship between mental wellbeing and psychological distress or mental disorder, measuring well over 80 empirical studies suggests that these constructs typically are distinct enough to warrant being assessed separately (Iasiello et al., 2020). While research on measurement of wellbeing is still developing, findings suggest that addition of measures of mental wellbeing has relevance in clinical settings (Bohlmeijer & Westerhof, 2021). While studies have demonstrated that strong associations between mental wellbeing and severe levels of psychopathological complaints exist (van Erp Taalman Kip & Hutschemaekers, 2018), measures of mental wellbeing and clinical disorders appear distinct (Franken et al., 2018). Importantly, the association between measures of mental wellbeing and psychopathology varies depending on the disorder and depending on the current level of distress, i.e., wellbeing measures may be most relevant outside of episodes of severe symptoms (Franken et al., 2018; van Erp Taalman Kip & Hutschemaekers, 2018). Subsequently, researchers have called for more research to understand how the *design* in mental wellbeing and psychopathology scales may influence the association between them: for example, the influence of positive- or negative-worded items (Franken et al., 2018), or the degree to which positive- or negative-worded items are 'bipolar antonyms' of each other (Feldman Barrett & Russell, 1998). While more research is needed, an emerging body of evidence support the use of measures of mental wellbeing in clinical practice to demonstrate clinically relevant outcomes that may contribute to clinical recovery or relapse prevention (de Vos et al., 2017; Fava & Ruini, 2003; Leendertse et al., 2021; Trompetter, de Kleine, et al., 2017).

A wide variety of wellbeing measures exist that aim to capture wellbeing, either as an overarching wellbeing construct, as sub-types of wellbeing, or both combined (Linton et al., 2016). The large diversity in measurement of wellbeing is partly due to a lack of consensus on the structure and components of wellbeing in the scientific literature, leading to the development of a range of measures, each aligned to different underpinning models (Hone et al., 2014). While the number of measures continue to grow, researchers have prioritised the creation of new tools rather than validating or improving existing ones (Ackerman et al., 2018). Despite being widely used, these measures are not always accompanied by robust studies examining psychometric properties, including reliability and aspects of validity, such as replication of the supposed factor structure. In

this paper, we set out to conduct such a study, by undertaking a systematic review and meta-analysis on the factor structure of one of the most commonly used measures of wellbeing (van Agteren, Iasiello, et al., 2021), the Mental Health Continuum – Short Form in both general and clinical populations.

The Mental Health Continuum – Short Form (MHC-SF) is a multi-dimensional 14-item self-administered assessment of positive functioning and mental health, which has been studied in clinical and non-clinical populations and translated into a range of Western and non-Western languages (Joshanloo et al., 2013; Keyes et al., 2008; Lamers et al., 2011; Petrillo et al., 2015). It has been demonstrated to be sensitive to change (Weiss et al., 2016), and has shown good psychometric qualities across cultures (Joshanloo et al., 2013; Lamers, Glas, et al., 2012).

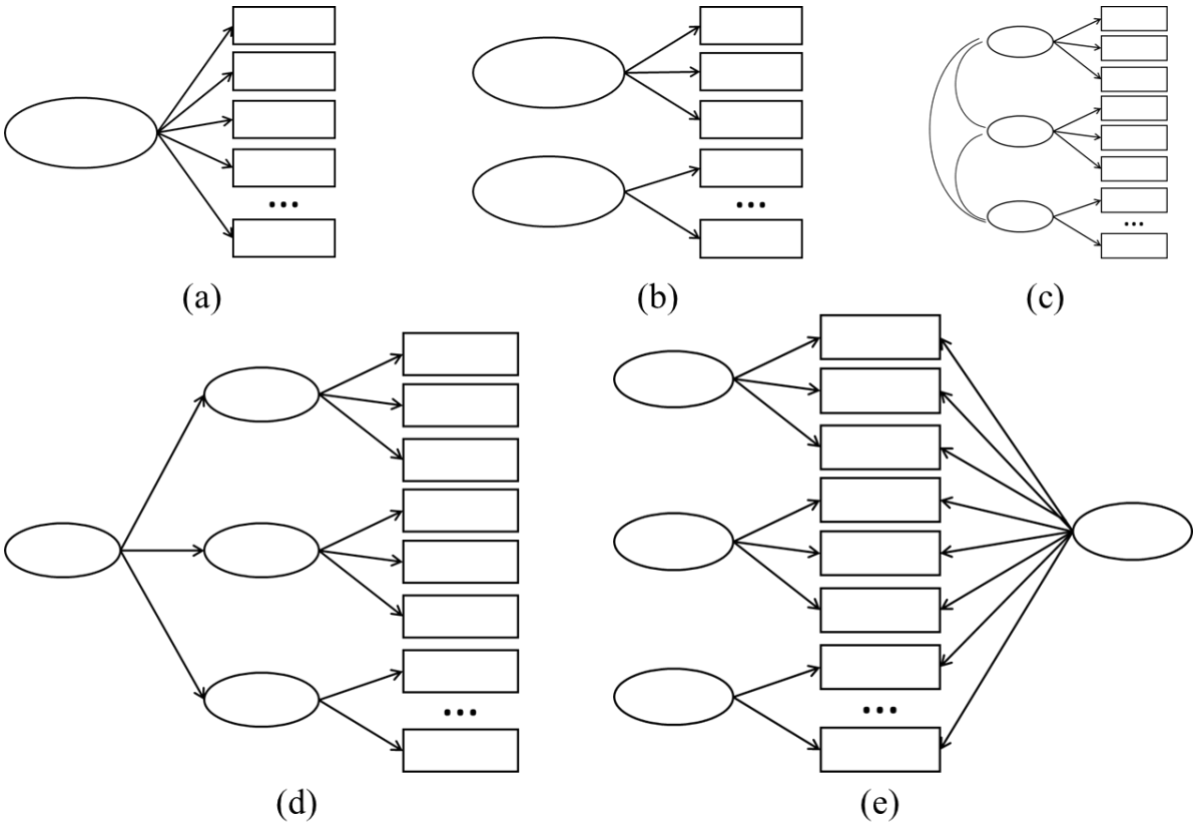
The MHC-SF was designed to have a tripartite structure drawn from thorough reviews of the psychological and sociological literature, based on over 40 years of theoretical and empirical research into emotional (hedonic), social and psychological (eudaimonic) wellbeing. Hedonic or subjective wellbeing typically includes cognitive judgement of life satisfaction (Diener, Emmons, et al., 1985), as well as positive and negative affect (Bradburn, 1969; Watson & Tellegen, 1985). While the MHC-SF includes a focus on satisfaction with life and positive affect, it does not measure negative affect. For this reason, the current paper will refer to this factor as 'emotional wellbeing' for conceptual clarity. Psychological wellbeing measures 'positive functioning', which is an integrated construct stemming from a range of subfields of psychology (Allport, 1961; Jahoda, 1958; Maslow, 2013; Neugarten, 1973; Rogers, 1995) such as self-acceptance, personal growth, purpose in life, positive relations with others, environmental mastery, and autonomy (Ryff, 1989). Finally, social wellbeing integrates public life and social health, as discussed by Durkheim (2005) and Marx (Israel, 1971), and includes social integration, acceptance, contribution, actualization, and coherence (Keyes, 1998).

The MHC-SF items were created by integrating validated measures or items belonging to measures of subjective (Diener, Emmons, et al., 1985), psychological (Ryff & Keyes, 1995), and social wellbeing (Keyes, 1998). The measure provides an overall score as well as scores for each of three sub-types of wellbeing. It furthermore facilitates a 'diagnosis of wellbeing' allowing people to be categorized as either flourishing (i.e., high wellbeing), having moderate wellbeing or being languishing (i.e., low wellbeing) (Keyes, 2007). Several representative population studies have shown that only a minority of the population report flourishing despite high levels of population happiness (Hone et al., 2014; Huppert & So, 2013; Santini et al., 2020; Schotanus-Dijkstra et al., 2016). Combining continuous scoring of the scale and subscales with a categorical classification approach is advantageous and often used in clinical practice (Morey & Hopwood, 2020), In combination with strong psychometric properties, the MHC-SF is an attractive tool for researchers and practitioners to assess wellbeing either in isolation or conjointly with the assessment of

psychological distress. While the discriminant validity of the categorical approach has demonstrated clear differences between the three well-being categories (Kim, 2017), there is still discrepancy in findings of research into the measure's overall factor structure.

Studies often used Structural Equation Modelling (SEM), a technique used in psychology and the social sciences to test hypothesised relationships between observed and latent variables (Cheung & Chan, 2005). Confirmatory Factor Analysis (CFA), a special model of SEM, has commonly been used to test the structure of the MHC-SF. Testing the model fit of the MHC-SF has reflected ongoing debate in the literature of the structure of mental wellbeing. Some have posited a distinction between hedonic and eudaimonic wellbeing (Delle Fave et al., 2011), others, have disputed this by claiming the existence of a general factor (Disabato et al., 2016), while Keyes posited a tripartite structure, consisting of emotional, psychological, and social wellbeing (Keyes, 2002). Hence, various models of the factor structure of the MHC-SF have been contrasted in the literature and tested: for example, a single-model factor (general wellbeing), a two-factor model (hedonic and eudemonic wellbeing), or a tripartite model (emotional, psychological, and social wellbeing). It should be noted that the definitions of these latent variables and the items that should theoretically load onto them have been consistent across studies assessing the factor structure of the MHC-SF. Furthermore, other models tested in previous studies come from more psychometric origins, including a second-order hierarchical model (tripartite structure with a second order wellbeing factor), and a bifactor model (a general factor loading on all items in addition to the tripartite structure; models depicted in Figure 10). Both models were used in previous research to test whether a general factor of mental wellbeing exists in the MHC-SF; the hierarchical model describes a second-order general factor that sits above the tripartite model, while the bifactor model describes a latent variable that allows all items to load onto a general factor while also loading onto the tripartite model (Figure 10).

Figure 10 Diagram of the models tested; (a) single factor model, (b) two factor model, (c) tripartite model, (d) hierarchical model, (e) bifactor model.



Note: Latent variables are displayed as ovals while abridged items are displayed as rectangles.

To date, the reporting of the most appropriate factor structure of the MHC-SF are discrepant as individual studies have not consistently investigated all of the above proposed models. Most study findings support either the tripartite, hierarchical or bifactor model, however, results depend on which models were tested in the studies. While the bifactor model commonly demonstrates the best model fit above all others, scholars have contested the validity of the superior fit of the bifactor model of the MHC-SF, due to lack of theoretical justification and potential statistical artefacts generated by the model (van Zyl & Olckers, 2019).

Differences between models studied aside, a greater number of consistent CFA studies does not necessarily indicate improved strength of the evidence for the proposed factor structure. For instance, SEM may be too powerful to reject incorrect SEM models if sample sizes are too small, and researchers may be reluctant to test alternative models if their theories are supported (MacCallum & Austin, 2000). Meta-analysis techniques can be used to infer stronger predictions (i.e., by having stronger predictive power) on the validity of measurement tools. Meta-analytic SEM (MASEM) is a technique that combines meta-analysis and SEM to synthesise studies using SEM,

and has been proposed as a solution to the limitations of multiple replication studies and overpowered SEM, described above (Cheung & Hong, 2017; M. W.-L. Cheung, 2015). Meta-analytic SEM has been well described (Cheung & Chan, 2005) and utilised to meta-analyse CFA and Exploratory Factor Analysis (EFA) in previous studies of psychological measurements such as the General Health Questionnaire (Gnambs & Staufenbiel, 2018), the Depression, Anxiety, Stress Scale (DASS), the Hospital Anxiety and Depression Scale (HADS), and measures of posttraumatic stress disorder (Norton et al., 2013; Yeung et al., 2020; Yufik & Simms, 2010). By pooling data from relevant studies, MASEM can be used to conduct SEM across studies that have been conducted in various populations and different languages. Thus, its findings provide stronger evidence than relying on individual studies (M. W. L. Cheung, 2015) and could underscore the validity of the factor structure of the MHC-SF for use in clinical practice, intervention, and epidemiological studies.

The current study aimed to systematically review and evaluate the factor structure of the MHC-SF, and to test empirically the most appropriate factor structure (as proposed in the literature) by conducting meta-analytic structural equation modelling. The second aim of the study was to examine whether the factor structure of the MHC-SF is stable between general and clinical populations.

Materials and Methods

The systematic review and meta-analysis was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines. The review protocol was registered to PROSPERO (CRD42020144650), available from: https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020144650

Search Strategy

A systematic search was conducted in the databases PsycINFO, PsycARTICLES, Scopus, PubMed, and Web of Science (up to date until December 2020). Web of Science was used to conduct a cited reference, starting with the initial validation paper of the MHC-SF (Keyes et al., 2008). The search included keywords related to both the MHC-SF and psychometric analyses. Terms related to the MHC-SF included “mental health continuum*” OR “MHC-SF”, and terms related to psychometric analysis included “valid*”, “reliabil*” “psychometric”, “factor”, “structure”, “eval*” OR “assess*”. The two sets of terms were then aggregated using the Boolean operator “AND”.

Inclusion Criteria

Studies were evaluated for inclusion in the current systematic review based on the following criteria: (1) the studies must have conducted factor analysis (CFA, EFA or Exploratory Structural Equation Modelling, ESEM) of the MHC-SF, (2) studies must be empirical investigation published

as a full journal article in a language understood by the authors (i.e., English, French, German, Dutch, or Italian). Studies were excluded if they did not meet all of the inclusion criteria.

Screening

Two authors independently screened titles and abstracts for studies eligible for inclusion and excluded studies that did not meet the inclusion criteria. Then, the same authors performed a full-text screening of the remaining studies, excluding again studies that did not meet the inclusion.

Extraction

Data was extracted into a custom-made systematic review form in Microsoft Excel, based on formats used by the research team in previously completed reviews (van Agteren, Iasiello, et al., 2021). Extracted information included: study characteristics (sample size, age range, gender %, target population(s) sampled, countries sampled from, language of the MHC-SF used) and study methodology (factor analytic analysis, factor retention criteria, number of factors, estimation method, models tested, and model supported). For the meta-analysis, inter-item correlation matrices were extracted from each study, where possible, otherwise the correlation matrices were implied using the factor loading matrix and latent factor correlation matrix (Gnambs & Staufenbiel, 2016). Where neither of these options were available in the original publication, the corresponding author was contacted by email.

Assessment of Methodological Quality

The methodological quality of included studies was assessed using the COSMIN Risk of Bias Checklist (Mokkink et al., 2018; Terwee et al., 2018). The checklist assesses 10 features, including patient-reported outcome measure (PROM) development, content validity, structural validity, internal consistency, cross-cultural validity/measurement invariance, reliability, measurement error, criterion validity, hypotheses testing for construct validity, and responsiveness. The COSMIN checklist includes criteria for good measurement properties based on previous reviews (Prinsen et al., 2016; Terwee et al., 2018). Each study was scored by one author and checked by another across all of the 10 features listed above, as either sufficient, insufficient, or indeterminate. As these features were assessed using clear thresholds (see Mokkink et al., 2018, pp. 28-29), inter-rater reliability was not assessed for this step.

Statistical Analysis

All statistical analyses were performed in R (R Core Team, 2018), using the psych (Revelle, 2019), OpenMx (Neale et al., 2016) and metaSEM (M. W. L. Cheung, 2015) packages. An R script for subgroup analysis (clinical vs non-clinical) was used from http://www.suzannejak.nl/subgroup.functions.R. To test the factor structure of the MHC-SF, meta-analytic CFA using two stage structural equation modelling (TSSEM) was used (Cheung & Chan, 2005). The first stage of this analysis is to estimate a pooled correlation matrix, extracted from the

included studies. A fixed-effects model was used to combine correlation matrices, due to heterogeneity of the MHC-SF and acceptable fit of the Stage 1 model indicating acceptable homogeneity of results between studies to proceed to Stage 2 (M. W.-L. Cheung, 2015; Jak, 2015). As this stage uses the correlation matrices from the original studies, the resultant pooled matrix is not affected by any discrepancies in the models tested in the included studies.

The second stage of TSSEM involves fitting CFA models to the pooled correlation matrix using a weighted least squares estimator with the asymptotic covariance matrix as the weight matrix. Factor models identified in reviewed studies were compared, based on root mean square error of approximation (RMSEA), standardized root mean square residual (SRMR), comparative fit index (CFI), Tucker-Lewis index (TLI), Akaike information criterion (AIC) and Bayesian information criterion (BIC). Good model fit was indicated by RMSEA ≤ 0.05, SRMR ≤ 0.05, CFI ≥ 0.97 (Schermelleh-Engel et al., 2003). The model with the lowest AIC and BIC, and highest TLI respectively indicated best model fit (Schermelleh-Engel et al., 2003).

Models tested included the single factor, the two-factor, tripartite, hierarchical, and bifactor models (Figure 10). Sensitivity analysis was conducted by assessing data extracted from one study which contributed 38 unique samples to the meta- analysis (Zemojtel-Piotrowska et al., 2018). Sensitivity analysis showed no difference in the results; therefore, the data was included in the current study.

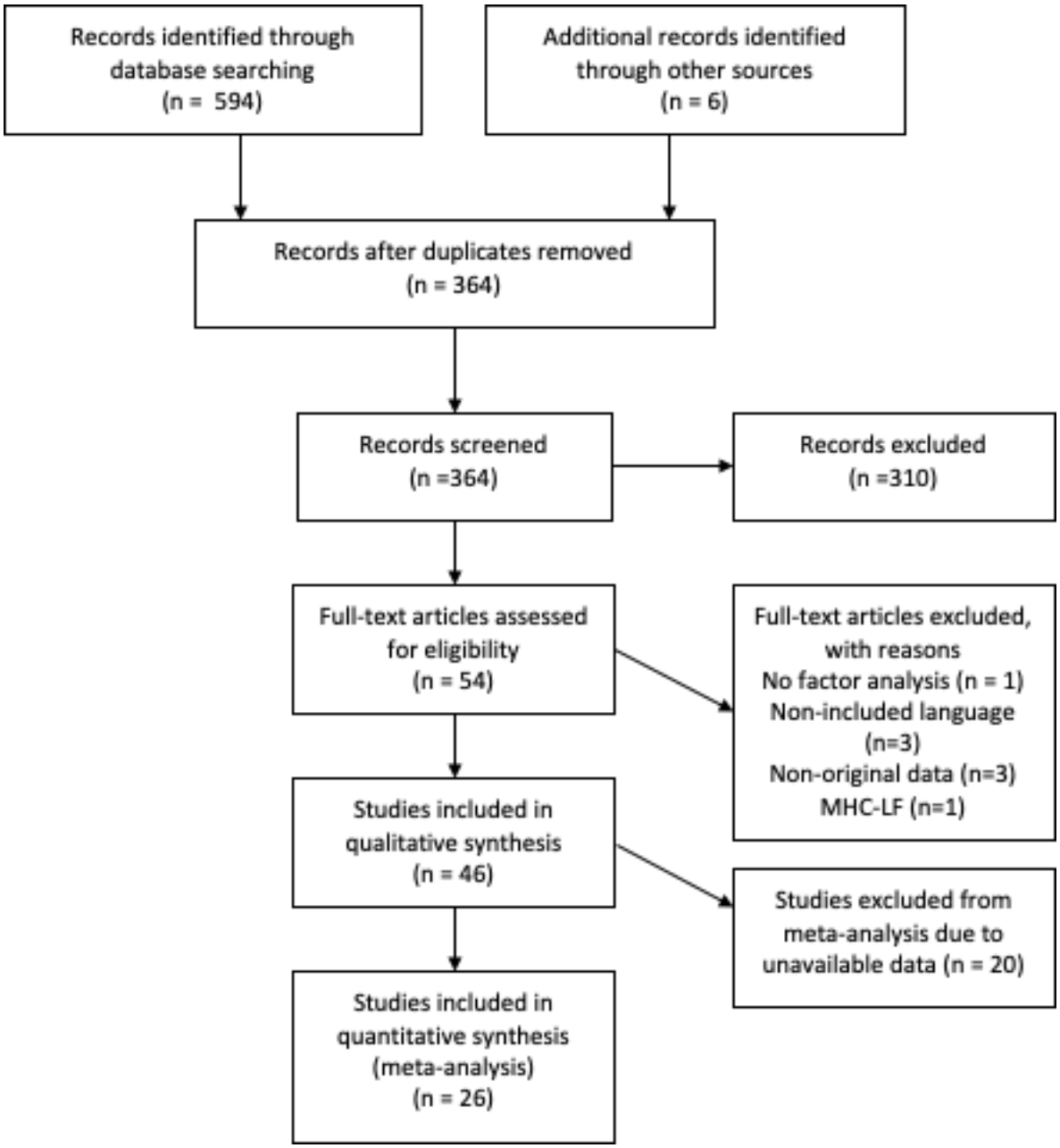
Sub-group analysis was performed to compare the model fit of the MHC-SF factor structure in general and clinical populations. This was achieved by testing the equality of factor loadings of the items across each factor identified in the tripartite model (Jak & Cheung, 2018). The tripartite model was selected as it met the criteria for good model fit and was theoretically proposed. Separate pooled correlated matrices were first formed using Stage 1 protocol described above for the clinical and general populations. Model fit was then estimated with freely estimated factor loadings and with equality constraints on particular sets of factor loadings (Jak & Cheung, 2018). This was conducted with equality constraints for item loadings on each of the latent factors (i.e., emotional, social, and psychological), and compared using χ^2 ratio tests against the unconstrained model.

Results

Study Characteristics

The results of the screening process are represented in the PRISMA diagram in Figure 11 (Moher et al., 2009). The systematic review identified 594 records, resulting with 364 records after duplicates were removed. After screening, 54 records were retained assessed for eligibility via full-text assessment. Inter-rater reliability was calculated for the full-text screening using Cohen's kappa. (*kappa* = .89).

Figure 11 PRISMA diagram of identified studies



Systematic Review

The systematic review identified 46 unique studies that investigated the factor structure of the MHC-SF in 103 independent samples. The large discrepancy in the number of studies compared to the number of samples was due to one study investigating 38 unique samples (Zemojtel-Piotrowska et al., 2018). Included studies were published between 2008 and 2020 and had a median of 1,063 participants per study (in total, 222,135 included participants; min = 120; max = 90,113), with a mean age of 34.8 years and 59.9% female respondents. Studies were conducted in 53 countries, with most samples coming from the Netherlands and South Africa (*n* = 6), Portugal

and Serbia (*n* = 5), and Iran and the United States of America (*n* = 4). In studies using CFA, the majority tested the tripartite model structure (*n* = 51), followed by the single-factor model (*n* = 32), the two-factor model (*n* = 25), the bifactor model (*n* = 17), the hierarchical model (*n* = 6), and a model with four orthogonal factors (*n* = 1). In studies using ESEM, the majority tested the tripartite model (*n* = 17), followed by the bifactor model (*n* = 9), and the single- (*n* = 2) and two-factor models (*n* = 2). EFA was conducted in 5 studies.

The characteristics and summary of results for each study are detailed in Table 5. Details on the analysis protocols of the included studies are summarised in Table 17 (Appendix 2). Inconsistency in the combinations of models tested across studies made interpretation challenging. However, we were able to extract a clear pattern. In studies using CFA, the tripartite model emerged commonly as the best fitting model (*n* = 19). However, when the bifactor model was included in the analysis it consistently outperformed the tripartite model (*n* = 7). In studies using ESEM, a similar pattern of results emerged; studies found appropriate model fit when the tripartite model was included (*n* = 9), however better fit when bifactor model when included in analysis (*n* = 9). The hierarchical model was not commonly tested but was shown to perform very similarly to the tripartite model (n = 1). Model fit was consistently stronger in studies using ESEM compared to CFA.

Table 5 Descriptive summary of identified studies in systematic review

	Study Characteristics					
Study	n	Age	Gender, % female	Target population	Country	Language
Carvalho 2016 - sample 1	208	8 (0.65)	43.9	Elementary school children	Portugal	Portuguese
Carvalho 2016 - sample 2	216	11 (1.21)	68.5	Middle school youth	Portugal	Portuguese
de Bruin 2015	902	21.1 (2.7)	-	College students	South Africa	English
Donnelly 2019*	229	15.87 (2.51)	62	Youth mental health service users	Ireland	English
Doré 2017*	1485	18.4 (2.4)	58	Post secondary students	Canada	French
Echeverria 2017	3355	33.8 (12.2)	71	General population adults	Chile	Spanish
Ferentinos 2019* - sample 1	203	50.8 (11.3)	69.5	Clinical sample with affective disorder		

Ferentinos 2019* - sample 2	163	40.3 (11.9)	53.4	Relatives of clinical sample	Greece	Greek
Franken 2018*	472	40.0 (11.6)	59.5	Psychiatric outpatients	Netherlands	Dutch
Fonte 2020	1448	33.15 (16.3)	70.1	Convenience sample	Portugal	Portuguese
Guo 2015	5399	15.13 (1.56)	51.1	Middle school students	China	Chinese
Hides 2016	2220	20.2 (2.5)	64	General population youth	Australia	English
Joshanloo 2013 - sample 1	308	21.6 (5.04)	66.6	University students	Netherlands	Dutch
Joshanloo 2013 - sample 2	328	20.8 (1.59)	78.6	University students	South Africa	English
Joshanloo 2013 - sample 3	484	21.7 (2.21)	59.3	University students	Iran	Persian
Joshanloo 2016a* - sample 1	387	21.86 (3.29)	55.8	University students	Iran	Persian

Joshanloo 2016a* - sample 2	395	18-30	65.8	University students	America	English
Joshanloo 2017a*	23674	18-30	62	University students	America	English
Joshanloo 2017b*	562	20.42 (2.48)	65.1	University students	South Korea	Korean
Joshanloo 2017c*	1883	27.91 (14.49)	65.6	High school students, undergraduate students, and adults	Serbia	Serbian
Joshanloo 2017d* - sample 1	2248	41.56 (16.15)	67.38	Convenience sample	Italy	Italian
Joshanloo 2017d* - sample 2	1439	47.13 (19.55)	51.5	Convenience sample	Italy	Italian
Joshanloo 2017e*	456	21.2 (5.6)	70.2	University students	New Zealand	English
Jovanovic 2015* - sample 1	1095	21.2 (1.86)	73	Students	Serbia	Serbian
Jovanovic 2015* - sample 2	325	43.76 (8.73)	52	General population adults	Serbia	Serbian

Karaś 2014*	2115	28.89 (10.62)	55.6	General population adults and high school students	Poland	Polish
Kennes 2020*	459	14.34 (1.97)	61.8	Secondary students	Netherlands	Dutch
Keyes 2008	1041	30+	62.3	Household study participants	South Africa	Setswana
Khumalo 2011	459	Range: 18-80	69.3	Convenience sample	South Africa	Setswana
Lamborn 2018*	43020	12-80+	54.6 - 56.0	Household study participants	Canada	English
Lamers 2011* Joshanloo 2016c	1662	47.6 (17.7)	50.2	Online household study participants	Netherlands	Dutch
Lim 2014	547	16.08 (0.34)	57	High school students	South Korea	Korean
Longo 2017	Total: 7521	From Lamers (2011), Jovanovic (2015), de Carvalho (2016),	From Lamers (2011), Jovanovic (2015), de Carvalho (2016),	From Lamers (2011), Jovanovic (2015), de Carvalho (2016),	Netherlands, Poland, Portugal, Serbia	Dutch, Polish, Portugese, Serbian

		Karas (2014)	Karas (2014)	Karas (2014)		
Luijten 2019	1175	13.7 (1.1)	53	High school students	Netherlands	Dutch
Lupano Perugini 2017*	1300	40.28 (13.59)	50	General population	Argentina	Spanish
Machado 2015	686	33.9 (11.3)	72.7	General population	Brazil	Portuguese
Monteiro 2020*	882	31.97 (4.78)	100	Postpartum women	Portugal	Portuguese
Orpana 2017	90113	47.2	Approximately 50	Household population survey	Canada	English and French
Petrillo 2015	1438	47.12 (19.56)	51.5	General population	Italy	Italian
Rafiey 2017	600	352 (12.8)	33.8	Earthquake survivors	Iran	Persian
Reinhardt 2020*	1572	15.39 (2.26)	51	Adolescent sample	Hungary	Hungarian

Rogoza 2018*	2741	Sample 1: 15.98 (1.39) Sample 2:20.23 (1.12) Sample 3: 45.74 (5.86)	Sample 1: 58 Sample 2: 65.2 Sample 3: 50.7	Adolescents, students, and adults	Vietnam	Vietnamese
Salama-Younes 2011	339	14.8 (3.6)	36	Adolescent athletes	Egypt	Arabic
Salama-Younes 2011a	643	65.85 (4.36)	78.4	Older adults	France	French
Santini 2020*	3508	16-55+	52.8	General population	Denmark	Danish
Schutte 2017	1058	20.6 (3.9)	68	University students	South Africa	English, Afrikaans, Setswana
Singh 2016	1148	Range 18-30	70.2	NR	India, Czech Republic, USA	Hindi, Czech, Englihs
Singh 2017	Sample 1: 591 Sample 2: 498 Sample 3: 120	Sample 1: 14.97 (1.43) Sample 2: 16.39 (1.14) Sample 3: 16.71	Sample 1: 46.7 Sample 2: 50.6 Sample 3: 45.8	High school children	Indian	English and Hindi

		(3.44)				
Skrzypiec 2018*	2756	Range 10-15	nr	Middle school children	China	Chinese
van Erp Taalman Kip 2018*	1069	42	63	Clinical population	Netherlands	Dutch
van Zyl 2019*	624	19-50+	54.3	Convenience sample	South Africa	English
Yin 2013*	2021	20-60+	55.6	Convenience sample	China	Chinese
Żemojtel-Piotrowska 2018*	8066	21.55 (4.37)	61.73	University students	38 Country	na

Note: * Indicates studies included in the meta-analysis

Methodological Quality

Studies identified in the systematic review were analysed for methodological quality using the COSMIN criteria. The results of the COSMIN scoring for each individual study are included in Table 18 (Appendix 2). Identified studies assessed the performance MHC-SF in respect to structural validity, internal consistency, construct validity, and cross-cultural validity/measurement invariance. The MHC-SF consistently demonstrated sufficient structural validity, meeting the criteria of model fit and aligning to hypothesised models, and good to excellent internal consistencies. Furthermore, the MHC-SF was demonstrated regularly to be invariant to a range of demographics, including age, gender, and culture/nationality.

Included studies did not test other forms of reliability included in COSMIN (e.g., test-retest), divergent validity, with one study investigating sensitivity to change of the MHC-SF. Few studies (n = 3) tested criterion validity by comparing the MHC-SF with another 'gold standard' measure of overall wellbeing, showing adequate associations ($r \geq 0.7$). While numerous studies compared correlations of the MHC-SF with other indicators of wellbeing, these were often closely aligned to either subjective or psychological wellbeing constructs, rather than a general wellbeing construct.

Meta-analysis

Data from 26 studies were included in the meta-analysis: 78 independent samples with a total of 108,603 participants (n = 106,630 from the general population, n = 1,973 from clinical samples). Studies with clinical samples were defined as participants recruited specifically from mental health care institutions. As per Stage 1 of MASEM, the correlation matrices from these samples were pooled, providing an approximate fit to the original matrices within acceptable limits (RMSEA = 0.054, SRMR = 0.077, CFI = 0.960, TLI = 0.960). Inter-item correlations ranged from 0.30 to 0.66. Pooled inter-item correlations are available in Table 6.

Table 6 Inter-item pooled correlation matrix

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13	Item 14
Item 1	1													
Item 2	.63	1												
Item 3	.64	.66	1											
Item 4	.36	.39	.40	1										
Item 5	.35	.37	.38	.46	1									
Item 6	.35	.35	.39	.42	.46	1								
Item 7	.34	.35	.36	.35	.38	.48	1							
Item 8	.30	.31	.34	.34	.36	.54	.47	1						
Item 9	.43	.45	.47	.36	.35	.37	.38	.35	1					
Item 10	.39	.42	.45	.32	.30	.32	.32	.30	.51	1				
Item 11	.43	.44	.45	.33	.37	.33	.37	.30	.48	.47	1			
Item 12	.36	.39	.38	.39	.33	.35	.32	.30	.43	.41	.46	1		
Item 13	.38	.41	.40	.35	.33	.31	.31	.28	.47	.45	.46	.46	1	
Item 14	.47	.51	.53	.41	.38	.38	.36	.34	.51	.49	.50	.50	.53	1

Using Stage 2 MASEM, the model fit of the following models were tested using the pooled correlation matrix produced in Stage 1 (Table 7): single factor, two-factor, tripartite, hierarchical, and bifactor models (see Figure 10). Results reflected findings from individual studies included in the systematic review. The single factor and two factor models demonstrated the poorest model fit (e.g., RMSEA = 0.072 and 0.059 respectively). Both the tripartite and bifactor models fell within the constraints of good model fit (e.g., RMSEA = 0.042 and 0.037 respectively), while the hierarchical model performed similar to the tripartite model, suggesting good model fit (e.g., RMSEA = 0.04). As with the results of the individual studies identified in the systematic review, the bifactor model demonstrated superior model fit compared with the tripartite and hierarchical models (Table 7). Hence, further analysis continued with the tripartite factor model, as it was the originally theorised model, is nested within the hierarchical model, and due to theoretical limitations of the bifactor model, discussed below.

Table 7 Model fit of proposed factor structures of the MHC-SF

	χ^2	df	RMSEA	SRMR	CFI	TLI	AIC	BIC
Single factor model	43371	77	0.072	0.139	0.881	0.859	43217	42478
Two factor model	28544	76	0.059	0.098	0.921	0.906	28392	27663
Tripartite model	14059	74	0.042	0.047	0.961	0.953	13911	13201
Hierarchical model	12072	74	0.040	0.044	0.963	0.960	11924	11219
Bifactor model	9232	63	0.037	0.032	0.975	0.964	9106	8501

Next, the proportions of common and total variance explained by the factors of the best fitting models were examined. This analysis included the factor loadings and coefficients of determination (R^2, explained variance) of each item, which is presented for each of the two populations (non-clinical vs clinical) in Table 8. Results for the hierarchical and bifactor models are available in Tables 19-20 (Appendix 2). While the tripartite factor structure appeared stable in each of the clinical and general populations, there were apparent differences in the factor loadings compared between both groups.

Table 8 Factor loadings of the tripartite structure

General population	Subjective	Social	Psychological	R^2
Item 1: happy	0.77			0.61
Item 2: interested in life	0.81			0.65
Item 3: satisfied with life	0.84			0.70
Item 4: social contribution		0.66		0.44
Item 5: social integration		0.67		0.45
Item 6: social actualisation		0.75		0.56
Item 7: social acceptance		0.67		0.45
Item 8: social coherence		0.68		0.46
Item 9: self-acceptance			0.73	0.53
Item 10: environmental mastery			0.68	0.46
Item 11: positive relations with others			0.70	0.49
Item 12: personal growth			0.67	0.45
Item 13: autonomy			0.69	0.47
Item 14: purpose in life			0.78	0.61
Common variance explained	26.7%	32.2%	41.2%	
Total variance explained	14.0%	16.8%	21.6%	

Clinical samples	Subjective	Social	Psychological	R^2
Item 1: happy	0.86			0.74
Item 2: interested in life	0.91			0.82
Item 3: satisfied with life	0.87			0.75
Item 4: social contribution		0.66		0.44
Item 5: social integration		0.75		0.57
Item 6: social actualisation		0.81		0.66
Item 7: social acceptance		0.78		0.61
Item 8: social coherence		0.75		0.57

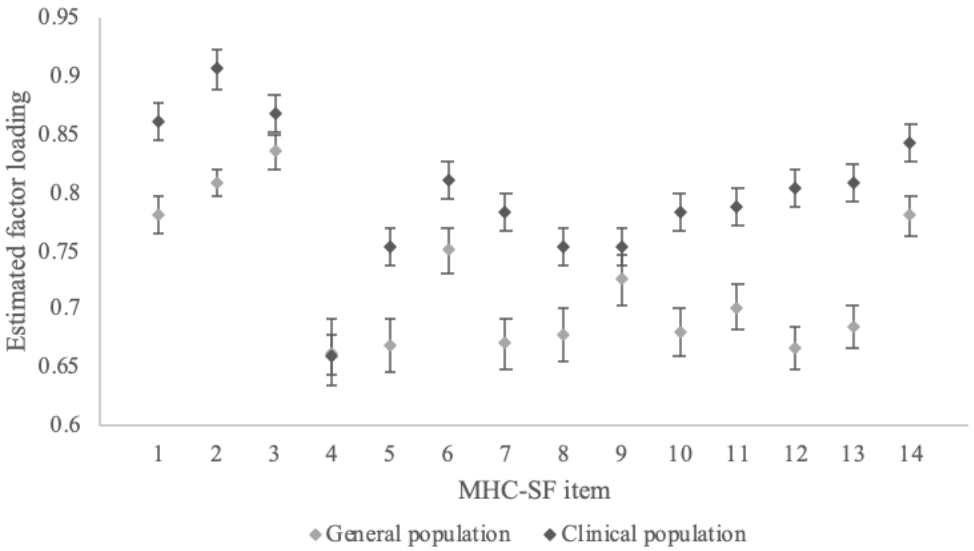
Item 9: self-acceptance			0.75	0.57
Item 10: environmental mastery			0.78	0.61
Item 11: positive relations with others			0.79	0.62
Item 12: personal growth			0.8	0.65
Item 13: autonomy			0.81	0.65
Item 14: purpose in life			0.84	0.71
Common variance explained	26.0%	31.6%	42.4%	
Total variance explained	16.6%	20.2%	27.1%	

To investigate differences in factor loadings between the two populations, moderation analysis was conducted. The fit of the tripartite model with freely estimated factor loadings and equality constraints on each of the factor loadings can be found in Table 9. While RMSEA was consistent across the tested models (RMSEA = 0.041-0.042), there were significant differences in χ^2 indicating that the factor loadings cannot be considered equal across any of the three latent factors. Figure 12 demonstrates the estimated factor loadings of each of the items on their respective latent variable across general and clinical populations, indicating again that there were clear differences between the two subgroups, with general populations consistently demonstrating weaker loadings on each factor across the scale. The factor loadings of items 3, 4, and 9 appeared the most consistent across the two groups.

Table 9 Overall fit and difference in fit of the factor model with different equality constraints across clinical and general population.

	χ^2	df	RMSEA	SRMR	CFI	Δdf	$\Delta\chi^2$	p
No constraint	14280.8	148	0.042	0.048	0.961			
Λ Emotional factor equal	14564.7	151	0.042	0.036	0.961	3	283.9	<.001
Λ Social factor equal	14434.1	153	0.041	0.037	0.961	5	153.3	<.001
Λ Psychological factor equal	14579.0	154	0.042	0.049	0.961	6	298.2	<.001

Figure 12 Estimated factor loadings of the items across both general and clinical samples in the tripartite model



Note: items 1-3 load on the emotional wellbeing factor, items 4-8 load on the social wellbeing factor, and items 9-14 load on the psychological wellbeing factor.

Discussion

Since positive states of mental health attract greater attention in clinical research, public policy and practice, it becomes increasingly important to assess mental wellbeing using well-validated and theoretically justified measures. This study was conducted to investigate the factor structure of a commonly used tool, the MHC-SF, using meta-analytic structural equation modelling in general and clinical populations.

The current systematic review identified 46 studies which investigated the factor structure of the MHC-SF using EFA, CFA, or ESEM. These studies were conducted in a range of contexts and demographics, languages, and countries. Commonly tested models included a single factor (general wellbeing), two-factor model (differentiating between hedonic and eudaimonic wellbeing), tripartite model emotional, social, and psychological wellbeing), and bifactor model (general wellbeing factor which loads on all items in addition to the tripartite structure). A hierarchical model was also proposed which included a second-order general wellbeing factor sitting above the tripartite structure. Both the tripartite and bifactor models consistently demonstrated appropriate model fit, with the bifactor model outperforming the tripartite when compared in the analysis.

MASEM was conducted on 26 studies (n = 108,603) identified in the systematic review, to estimate the model fit of different factor structures of the MHC-SF identified in the literature. The analysis indicated that the tripartite, hierarchical, and bifactor models all fell within acceptable limits of good model fit, while the single- and two-factor model showed poorer fit. These results demonstrate that

the factor structure of the MHC-SF, from a purely statistical point of view, is best explained by a bifactor model, suggesting that the MHC-SF is saturated by the presence of a strong general factor, accounting for over 75% of the common variance. While items in this model also loaded onto the three domains of mental wellbeing as originally proposed, these domains accounted only for a modest additional proportion of the variance (Table 19; Appendix 2). The bifactor model would suggest that the MHC-SF is a strong measure of overall wellbeing, with individual items covering a broad range of aspects of mental wellbeing. However, there is strong theoretical ground to question whether the bifactor model is the most appropriate for the MHC-SF (van Zyl & Olckers, 2019).

The dominance of the general factor in the bifactor model raises the question as to why such a poor fit was found for a single factor model. Longo et al. (2020) provides an explanation for these findings, arguing that a poor fitting single factor model could be due to the number of items in the questionnaire, and the breadth of wellbeing concepts measured with these items. Generally, single item factors rarely fit scales with large numbers of items, and broad constructs suggesting multidimensionality make a single factor model unlikely to fit appropriately (Reise et al., 2014). This is certainly the case in the MHC-SF which was intentionally designed to capture a broad continuum of the multi-dimensional wellbeing construct.

Bifactor models have grown in use across a range of psychological fields, particularly intelligence and psychopathology, consistently showing greater model fit than conventional models and considered to show subscale scores of latent variables after accounting for the variance of a general factor (Rodriguez et al., 2016). However, analysis of bifactor models are considered unlikely to yield a better understanding of the actual structure of items except under highly specific theoretical circumstances (Sellbom & Tellegen, 2019). Sellbom and Tellegen (2019). define the bifactor model as “a major dimension underlying all test items, with group factors representing orthogonal residual variances ‘left over’ once the general factor has been accounted for” (p. 1436). This raises the question whether a general factor in the bifactor model of the MHC-SF is in fact assessing a general wellbeing latent factor.

In the context of psychometric research, it is recommended to follow theoretical guidance rather than utilising fit indices alone (Sellbom & Tellegen, 2019). Numerous authors have cautioned the use of the bifactor model, despite its better fit than unidimensional or correlated models (Luciano et al., 2020; van Zyl & Olckers, 2019), as it is the least restrictive of all plausible models, and “accommodate implausible and possibly invalid response patterns” (Reise et al., 2014, p. 19). Bifactor models ignore cross-loadings which may result in biased estimates, prompting claims that bifactor models are unsuitable for validating instruments, particularly in comparison with CFA (Joshanloo & Jovanovic, 2017; van Zyl & Olckers, 2019). Furthermore, the general factor estimated in bifactor models should not be interpreted as a “true” general factor, but rather acts to

superficially inflate model-fit (Morgan et al., 2015). In the context of the MHC-SF, this suggests that the general factor found in the bifactor model may not necessarily capture general wellbeing, and instead is responsible for the superior model fit observed.

The concern around the appropriateness of the bifactor model, despite superior model fit, have already been discussed in measures of psychopathology (Snyder et al., 2017). The main concern related to the bifactor model related to difficulties interpreting the results and the lack of theoretical rationale (Bonifay et al., 2017; Luciano et al., 2020; Sellbom & Tellegen, 2019). To paraphrase the critique by Sellbom and Tellegen (2019) in the context of the MHC-SF, we may ask, 'what is the nature of emotional, social, and psychological wellbeing once the general wellbeing factor has been accounted for? Are such domains of wellbeing truly orthogonal to the general sense of mental wellbeing?'

Sellbom and Tellegen (2019) recommend that analysis of unidimensionality versus multidimensionality are the most relevant for psychometric measures, only examining bifactor models when theoretical reasonable. This recommendation, coupled with the theoretical limitations of the bifactor model, point towards the appropriateness and preference of the tripartite and hierarchical factor structure, which also fell within acceptable limits. Thus, in addition to being theoretically supported, these related factor structures demonstrated appropriate model fit. Unlike the bifactor model, the hierarchical factor structure (and the nested tripartite structure) was identified as the most appropriate model in a range of methods in additional to traditional factor analysis, including measurement invariance in cross-sectional (Joshanloo, 2019), longitudinal analysis (Joshanloo, 2020a), multidimensional scaling (Joshanloo, 2020b), and discriminant validity (Joshanloo, Capone, et al., 2017). Authors have commented on the strong correlations between the three second order factors, however, this is attenuated when using ESEM rather than CFA (Joshanloo, Jose, et al., 2017). As ESEM allows for cross-loadings (allowing all items to load on all factors), it leads to more accurate estimated factor intercorrelations. For this reason, ESEM has been recommended as a more appropriate analytical technique compared to traditional CFA in assessing the structure of multidimensional constructs such as wellbeing (Joshanloo, Jose, et al., 2017; Marsh et al., 2014; Marsh et al., 2011).

To test the second aim of the study, moderation analysis was conducted to empirically test whether there were differences in the model fit of the MHC-SF between clinical and general populations. While the structural model was consistent across both groups, there were significant differences in strength of item loadings on each of the factors across the two populations. Factor loadings were consistently weaker in the general population than the clinical population, suggesting metric invariance, which signifies that noninvariant items are less closely related to the latent factor in general populations compared to the clinical populations. For example, items on personal growth (# 12) and autonomy (#13) appeared to show the greatest difference in factor loading across the

two groups, suggesting that personal growth and autonomy are less central to the latent construct of psychological wellbeing in the general population compared to clinical groups (Putnick & Bornstein, 2016). This finding suggests that while the factor structure was retained in each population, there are differences in the way that items load on each factor between the clinical and non-clinical samples. As an implication, comparisons in the total and the three subscales scores across clinical and non-clinical groups should be used with caution.

The differences in factor loading across the two samples may be explained by the impact that states of distress and pathology have on subjective perception of wellbeing. For instance, van Erp Taalman Kip and Hutschemaekers (2018, p. 1725) demonstrated that higher severity of distress may make it difficult for individuals to distinguish between mental wellbeing and their distress, concluding that "people can only differentiate positive health or wellbeing from negative health if psychopathology does not dominate their entire internal life." Similarly, differentiating between whether living a fulfilling life (i.e., psychological wellbeing) or feeling well and being supported within a community (i.e., social wellbeing) may be more difficult to differentiate from a general sense of wellbeing when feeling severely distressed.

In summary, these results indicate that the MHC-SF captures a general wellbeing factor, which is composed of a range of first-order constructs including emotional, social, and psychological wellbeing, whether assessed in clinical or general populations. The findings also indicate that it is appropriate to use the total score for the MHC-SF, as commonly used in intervention studies (Chakhssi et al., 2018; van Agteren, Iasiello, et al., 2021), in addition to estimating the effect on the first-order constructs of emotional, psychological and social wellbeing. However, due to differences in factor loadings, caution is required when comparing differences in total score or latent factor scores across clinical and general populations.

The hierarchical factor structure of the MHC-SF supported in the current study aligns to a theoretical hierarchical framework of wellbeing that has been recently proposed (Disabato et al., 2019). This framework describes five hierarchical levels of wellbeing, including general wellbeing, followed by second order 'wellbeing lenses'; it could be argued that the structure of the MHC-SF supports this hierarchical framework, including three second-order wellbeing lenses (i.e., emotional, social, and psychological wellbeing). The fourth level of the hierarchy is described as 'characteristics of wellbeing', referring to components of the wellbeing lenses, which in the case of the MHC-SF, may relate to items grouped under each second order construct (e.g., happiness, social acceptance, and purpose in life). While many characteristics of wellbeing will strongly negatively correlate with aspects of psychopathology (e.g. happiness and depressive symptoms; Joseph & Lewis, 1998), the multi-dimensional nature of wellbeing suggests that many characteristics will still be relevant across a range of psychiatric disorders (Franken et al., 2018).

Limitations

This study was limited by availability of data that could not be extracted from identified studies. MASEM requires inter-item correlations, which are rarely published in academic articles. Despite this limitation, the study was able to amass a significant sample size of over 100,000 participants thanks to the generous supply of original data from several authors. It was also possible to impute the data using factor loadings and factor correlations; however, this is an estimation which may affect the accuracy of inter-item correlation table produced in Stage 1 MASEM. Further, analysis was based on Pearson's correlation matrices, which assume normal distribution (Norton et al., 2013). As the MHC-SF responses are sometimes skewed (Lamers et al., 2011), the factor loadings and total variance explained should be considered conservative (Norton et al., 2013). Finally, it should be noted that this study systematically reviewed and meta-analytically analysed the factor structure of the MHC-SF, while other psychometric properties such as construct validity, divergent validity across measures of psychopathology, and reliability were not meta-analytically tested; all areas which would benefit from future research (Luciano et al., 2020).

Conclusion

This study evaluated the factor structure of the MHC-SF using meta-analytic structural equation modelling of available data identified via a systematic review. While the bifactor model demonstrated the best model fit, there is a theoretical and statistical rationale to suggest that the hierarchical model (and nested, original tripartite structure) should be recommended. These findings were replicated across multiple countries, cultures, and languages. The results indicate that the MHC-SF measures three lenses of mental wellbeing, namely emotional, psychological and social wellbeing, each of which can be reliably scored and interpreted, and indicate that it is appropriate to use the tool to generate overall wellbeing scores in clinical and non-clinical populations. Due to differences in factor loading, caution is required when interpreting total or latent scores between clinical and nonclinical populations.

Summary

The initial systematic review identified 46 studies which tested the factor structure of the MHC-SF, in a range of countries, languages, and populations. While there were an inconsistent set of factor structures tested in the literature, it was commonly found that the bifactor model was the strongest fit, while the hierarchical and tripartite structure also demonstrated appropriate fit when tested. These results were observed consistently in both clinical and non-clinical populations. The MASEM analysis was conducted using data from 26 studies (n= 108,603) supported these findings, that the hierarchical, tripartite, and bifactor models all showed good model fit. The hierarchical model was supported empirically and argued as the most appropriate theoretical fit, and was used to test moderator analysis across clinical and non-clinical populations. While it was demonstrated that the hierarchical model fit well in both populations, moderation analysis indicated that there were

significant differences in the strength of the item loading on the latent wellbeing variables. This result indicates an issue with metric invariance, which lead to the study in Chapter 6.

CHAPTER 6: THE EFFECT OF PSYCHOLOGICAL DISTRESS ON MEASUREMENT INVARIANCE IN MEASURES OF MENTAL WELLBEING

Introduction

The previous chapter indicates that the Mental Health Continuum Short Form is a reliable measure of mental wellbeing and psychological distress in both clinical and general populations. However, it indicated that the factor structure of the measure may not be consistent across both groups, indicating a potential issue with the scale's measurement invariance to mental illness. The current chapter investigates this issue using an Australian sample, and measurement of psychological distress rather than clinical diagnosis (as was used in Chapter 5). The study was published in the International Journal of Public Health and Environmental Research.

Published paper

Iasiello, M., Muir-Cochrane, E., van Agteren, J., & Fassnacht, D. B. (2022). The Effect of Psychological Distress on Measurement Invariance in Measures of Mental Wellbeing. International Journal of Environmental Research and Public Health, 19(16), 10072. http://dx.doi.org/10.3390/ijerph191610072

Abstract

A growing literature supports the expansion of mental health assessment to include indicators of mental wellbeing; however, the concurrent use of measures of wellbeing and distress introduces potential sources of measurement error. The current study examines whether the mental health continuum short form is invariant to the level of participants' psychological distress. Measurement invariance testing was conducted within an Australian population (n = 8406) who participated in an online survey. The depression anxiety stress scale was used to construct a non-distressed group (n = 6420) and a severe-distress group (n = 1968). Results showed that metric invariance was not observed, as item loadings on the latent variables were significantly different between the groups. This signifies that wellbeing items may be interpreted and valued differently by distressed and non-distressed individuals. Metric non-invariance indicates that total and subscale scores may not be equivalent, and caution is required when making comparisons between these groups.

Keywords: measurement invariance, wellbeing, psychological distress, assessment

Background

A growing literature supports the need to expand the scope of traditional mental health assessment from its predominant focus on symptoms and distress to include positive states of mental health and wellbeing. By adding this focus on wellbeing, our comprehension of a person's overall mental health is significantly improved and, subsequently, facilitates better decision-making regarding the mental health needs of the respondent. There has been academic interest in the relationship between mental wellbeing and psychological distress from as early as the 1950s when Jahoda (1958) argued that the absence of disorder constituted an insufficient criterion for mental health. Empirical evidence supported this position from as early as the 1980s, with Fontana et al. (1980) demonstrating that psychological health makes a unique contribution to overall mental health, independent of an individual's degree of psychological impairment. While studies in subsequent decades continued to provide empirical support (Greenspoon & Saklofske, 2001; Massé et al., 1998), the notion that mental wellbeing and mental illness reflect distinct continua gained significant attention following a seminal study using nationally representative data in the United States of America (Keyes, 2005).

Keyes (2005) set out to test the assumption that mental wellbeing and mental illness reflect a single bipolar dimension. Results showed that mental wellbeing and mental illness did not represent a single bipolar dimension but rather were two related yet distinct constructs. This finding has since been reproduced and replicated in more than 80 studies from around the world, using diverse assessment methods, various study methodologies, cultures, population types, and has been tested in different languages (Iasiello et al., 2020). The implications of this new model of

mental health stipulate the need for a concurrent focus on both mental wellbeing and mental illness and has profound implications for the way we assess mental health, promote mental wellbeing, and prevent mental illness (Grant et al., 2013; Keyes, 2007; Slade, 2010).

The concurrent assessment of mental health and psychological distress introduces new considerations and challenges for anyone involved in measurement practice (Joseph & Wood, 2010). For example, some scales of psychological distress may already capture some aspects of mental wellbeing, and vice versa. For example, Wood et al. (2010) demonstrated that a popular measure of depressive symptoms, the Centre for Epidemiologic Studies depression scale (CES-D), captures a single continuum from happiness to depression and could therefore be used to assess either construct. In the current study, we aim to investigate another consideration, which is highly relevant to the concurrent assessment of mental disorder and wellbeing, namely whether measures of mental wellbeing are invariant to participants' level of psychological distress. Measurement invariance refers to a quality of a scale whereby "subjects from different groups with the same level on the latent variable have the same probability of obtaining equal test score" (Blanco-Canitrot et al., 2018). In other words, measurement invariance indicates whether a measurement captures the same construct (e.g., IQ) across different groups (e.g., males and females). For psychological research, the assumption of measurement invariance is vital as it is a prerequisite for comparing group means (Putnick & Bornstein, 2016). In the context of the dual-continua model, measurement invariance refers to the ability of measures of wellbeing to accurately assess mental wellbeing across those with or without levels of psychological distress such that scores between the two groups can be compared and meaningfully interpreted.

Measurement Invariance of the Mental Health Continuum Short Form

A popular assessment tool for mental wellbeing is the mental health continuum short form (MHC-SF). This measure is most commonly used in validation studies of the dual-continua model and is often used in combination with measures of psychological distress or mental illness. Previous studies have investigated the performance of the MHC-SF across demographic variables such as age, gender, and ethnicity, showing that the scale was largely invariant to these demographics e.g., (Fonte et al., 2020; Joshanloo et al., 2013; Santini et al., 2020). To date, however, the invariance of the MHC-SF between respondents with or without psychological disorders/high distress has yet to be tested.

Measurement non-invariance occurs when different groups place different meanings on items within a scale (Bornstein, 1995; Putnick & Bornstein, 2016). Therefore, it is reasonable to hypothesize that measures of mental wellbeing may be non-invariant to psychological distress, as mental wellbeing research is inherently value-laden (Prinzing, 2021). Further, there may be discrepancies in the ability for effective recall between those experiencing distress or not (Wilson & Gilbert, 2003) or differences in post-facto evaluations of experiences. There may be differences in

the ‘snap judgements’ of distressed or non-distressed participants, who are participating in the assessments rather than considered evaluations (Haybron, 2011). Prinzing (Prinzing, 2021) argued that “conceptions of wellbeing change dramatically even with just a little time spent in careful reflection”, which, again, could point to a difference between those experiencing psychological distress or not.

To determine measurement invariance, one moves through four levels of analysis (Widaman & Reise): configural invariance (i.e., related to consistent factor structures between groups), metric invariance (i.e., equality of factor loadings between groups), scalar invariance (i.e., equality of factor loadings and intercepts between groups), and strict invariance (i.e., equality of factor loadings, intercepts, and residuals) (Blanco-Canitrot et al., 2018). These levels of invariance are assessed sequentially, from the least constrictive, i.e., configural invariance, to the most constrictive, i.e., strict invariance.

Configural invariance is the least constrictive level of measurement invariance and tests whether a measurement tool has a similar factor structure between the two groups. If the MHC-SF does not demonstrate configural invariance, which is referred to as being non-invariant, it would indicate that the measure is tapping into different latent variables between the two groups, or that different items are loading in a different pattern on the latent variables (Putnick & Bornstein, 2016). In the case of the MHC-SF, there are three latent variables: emotional, psychological, and social wellbeing. This factor structure has been well documented in the literature, with studies demonstrating a consistent factor structure, regardless of the clinical status of the population (Ferentinos et al., 2019; Franken et al., 2018).

If configural invariance is supported, metric invariance, the next level of measurement invariance, is assessed. This tests the degree to which individual items load on their respective latent factors. Metric non-invariance occurs when there is a significant degree of difference between the loading of the items on latent factors between the two groups. In the case of the MHC-SF, it could mean, for instance, that the item ‘During the past month, how often did you feel interested in life’ is more or less relevant to the overall ‘emotional wellbeing’ factor for clinical versus non-clinical respondents, or vice versa.

The dual-continua model provides a clear rationale for the concurrent assessment of mental wellbeing in addition to the measurement of distress and disorder. In order to do so, it is important to understand whether extant assessment tools of mental wellbeing are invariant across levels of distress such that their scores can appropriately be interpreted in both clinical and non-clinical populations. This study aims to determine measurement invariance in one such measure of wellbeing, the MHC-SF, between individuals who are highly distressed and individuals who do not display current distress. A large meta-analytic structural equation modelling study of the MHC-SF, using data from more than 100,000 participants (Iasiello et al., 2022), found an overall consistent-factor structure for the MHC-SF across clinical and non-clinical groups. However, there were discrepancies between item loadings for all three latent factors (i.e., emotional, psychological, and

social wellbeing) of the MHC-SF in clinical and non-clinical populations, providing preliminary evidence of metric invariance within the MHC-SF. Therefore, it is hypothesized that configural invariance will be observed but that metric invariance, however, will not.

Methods

Participants and procedures

Participants were adults who engaged with services offered by the South Australian Health and Medical Research Institute (SAHMRI), based in Adelaide, Australia. SAHMRI is a medical health and research institute which has mental health and wellbeing as one of its focus areas. As part of its operations, it provides various wellbeing services, including internet-based measurements of mental health and wellbeing, and delivers non-specific psychological interventions to the general community.

This study relied on secondary data analysis of data collected from various SAHMRI wellbeing projects between February 2019 and April 2021. Data was collected via two recruitment streams. First, data were collected from respondents who registered for a free online mental health and wellbeing assessment via one of SAHMRI's mental health and wellbeing websites: an online platform called the Be Well Tracker. Second, data were collected via participants who participated in SAHMRI wellbeing intervention projects, where participants could pre-register and complete the same mental health and wellbeing measurement described within the first stream prior to commencing their training. Participants for the training included individuals from the public who sought out the training via their own accord as well as people recruited for specific wellbeing projects, for example, wellbeing training provision to workforces (e.g., the private, public, or NGO sectors). The data were collected with approval by the local Human Research Ethics Committee (# 2239).

After registration, participants completed the measurement online via internet-enabled devices. It took participants approximately 10–15 min to complete the measurement, which included a range of validated mental health questionnaires, including the measures of wellbeing and distress used for this study (see 'measures' section below for detail). The measurement captured basic demographic information such as gender, age, employment, and study status. After completing the measurement, participants were automatically provided with their own scores and an individualized online report that explained the results and provided information about subsequent options to improve their mental health, as well as information on mental health services in case of immediate need.

A total of 8406 participants provided data for mental wellbeing and psychological distress. The mean age of the total sample was 42.1 years old (SD 13.4), with 20.4% being unemployed, while 11.4% were currently studying, as shown in Table 10. The distressed subgroup was younger than

the non-distressed group and were more likely to be unemployed ($\chi^2(1, 8406) = 181.66, <0.001$) and/or studying ($\chi^2(1, 8406) = 46.50, <0.001$).

Table 10 Summary demographics of participants, by distressed and non-distressed group

	Total (*n* = 8406)	Non-Distressed (*n* = 6420)	Distressed (*n* = 1986)
Age (years), mean (SD)	42.1 (13.4)	43.5 (13.4)	37.7 (13.4)
Gender (female), *n* (%)	4104 (48.8)	3183 (49.6)	920 (46.3)
Unemployed, *n* (%)	1716 (20.4)	1099 (17.1)	617 (31.1)
Studying, *n* (%)	959 (11.4)	649 (10.1)	311 (15.7)

Measures

Mental wellbeing was measured using the MHC-SF (Keyes et al., 2008). The MHC-SF is a valid and reliable measure of mental wellbeing, providing a continuous measure of three key domains of wellbeing (i.e., emotional, psychological, and social well-being). The measure also facilitates an overall categorical score on whether someone has high, moderate, or low wellbeing.

Psychological distress was measured using the depression, anxiety, and stress scale-21 items (DASS-21) (Henry & Crawford, 2005). The DASS-21 offers reliable cut-off points for symptom severity (i.e., “mild”, “moderate”, “severe”, and “extremely severe” symptoms). Analyses were conducted using total scores for each of the three domains; internal consistencies for depression (α = 0.92), anxiety (α = 0.84), and stress (α = 0.87) were good. Participants were classified into the ‘psychological distress’ group if they scored moderate or greater distress in at least one of the three domains (i.e., Depression >7, Anxiety > 6, Stress > 10) (Crawford & Henry, 2003).

Exploratory and Confirmatory Factor Analysis.

All statistical analysis was conducted in SPSS v27 and AMOS v27. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were first conducted to explore and confirm the factor structure of the MHC-SF in the current sample. Data were randomly separated into two groups for EFA (n = 4233) and CFA (n = 4173). EFA was used on the first random sample to investigate the optimal factor structure of the MHC-SF. Parallel analysis and Scree plot inspection were used to estimate the number of factors (O’connor, 2000). EFA was conducted using principal axis factoring and Oblim rotation.

CFA was used on the second half of the sample to confirm the MHC-SF factor structure identified using EFA. Models tested included the original theoretical MHC-SF structure and the model identified by EFA. A good model fit was indicated by root mean square error of approximation (RMSEA) $>$ 0.05, comparative fit index (CFI) $<$ 0.97, and the highest Tucker–Lewis index (TLI) (Schermelleh-Engel et al., 2003).

Invariance Testing.

Invariance testing was conducted on the full sample following the protocol outlined by (Byrne, 2016). This included beginning from the most relaxed model fit and testing invariance between the groups in increasingly strict models. CFA was used on the full sample; this time, to test that the factor structure was appropriate for non-distressed and distressed groups. The sample was split into a non-distressed (n= 6420) and distressed (n= 1968) sample, based on participants' levels of psychological distress, who met the criteria for severe distress or greater for any of the domains on the DASS-21. Significant differences in the model fit of the distressed and non-distressed groups would violate an assumption of further invariance testing.

Configural Invariance Testing

Configural testing–testing whether a measurement tool has a similar factor structure between two groups–was performed using AMOS by testing the model fit across the two groups. The test results for a single model were tested using RMSEA, CFI, and TLI to indicate good fit (pointing to configural measurement invariance) or not (pointing to non-invariance). The model was conducted by constraining the basic factor model to one of equality across the groups. In other terms, the number of factors and their proposed indicators were held constant across the groups. All other constraints are freely estimated in each group. This model served as the baseline against which the metric invariance is compared with to test whether there is evidence of non-invariant factor loadings. In this step, the AMOS option, Emulisrel6, was selected, as suggested by (Byrne, 2016).

Metric Invariance Testing

Factor loadings were constrained across groups to test whether factor loadings were invariant across the groups. Differences in factor loading scores were compared using $\Delta\chi^2$ and Δgamma hat and ΔMcDonald's NCI. Changes in gamma hat and ΔMcDonald's NCI are not included in AMOS; therefore, they were calculated using the calculator provided by (Pirritano, 2018). Δgamma hat (≤0.001) and ΔMcDonald's NCI (≤0.02) were used to indicate substantial decrements in model fit after the imposition of the equality constraints, based on the recommendations of (Cheung & Rensvold, 2002).

Further steps of invariance testing did not commence, as metric invariance was not observed. Instead, possible sources of non-invariant loadings were explored by relaxing equality constraints in a stepwise way (Putnick & Bornstein, 2016). This involves testing a series of models where the

equality constraint of each item is relaxed, and model fit is compared against the full metric invariance model.

Results

Exploratory Factor Analysis

Parallel analysis and Scree plots of the MHC-SF both suggested a three-factor model was present in the data. The pattern matrix (Table 11) was similar to the theoretically proposed solution of the MHC-SF; however, two of the social wellbeing items loaded more strongly on the psychological wellbeing factor (item 4 [social contribution] and 5 [social integration]) loaded 0.61 and 0.41 onto psychological wellbeing compared with 0.09 and 0.21 on social wellbeing, respectively. A high degree of association was observed between the three factors: emotional and social wellbeing (r = 0.71), emotional and psychological wellbeing (r = 0.85), and psychological and social wellbeing (r = 0.67).

Table 11 Exploratory factor analysis pattern matrix results in random sample of participants (n=4233).

Item	Emotional Wellbeing	Social Wellbeing	Psychological Wellbeing
1 happy	0.82		
2 interested in life	0.73		
3 satisfied with life	0.74		
4 that you had something important to contribute to society			0.56
5 that you belonged to a community (like a social group, or your neighbourhood)			0.32
6 that our society is a good place, or is becoming a better place, for all people		0.82	
7 that people are basically good		0.74	
8 that the way our society works makes sense to you		0.80	
9 that you liked most parts of your personality			0.72
10 good at managing the responsibilities of your daily life			0.66
11 that you had warm and trusting relationships with others			0.61
12 that you had experiences that challenged you to grow and become a better person			0.73
13 confident to think or express your own ideas and opinions			0.81
14 that your life has a sense of direction or meaning to it			0.66

Confirmatory Factor Analysis

CFA was used to confirm the results identified in the EFA. Models tested included the modified EFA model, as well as the originally proposed model of the MHC-SF. The original theoretical model of the MHC-SF did not fit well according to fitting indices, χ^2 = 2785.46 (74), RMSEA = 0.094, CLI = 0.93, and TLI = 0.92, while the EFA model fit was better and within the thresholds of strong fitting, χ^2 = 1267.14 (74), RMSEA = 0.062, CLI = 0.96, and TLI = 0.97. An adequate model fit is required to progress to the next stage; therefore, due to stronger model fitting, the modified EFA model was retained for subsequent analysis. However, please note that subsequent analyses were also conducted with the theoretically proposed model, which may be more clinically relevant, with very similar results to those reported in the main manuscript (see Table 22; Appendix 3).

Invariance Testing

The modified EFA model of the MHC-SF was tested next, with a separate CFA in the distressed vs. non-distressed groups; the results suggested that in the non-distressed sample there was a better model fit (χ2 = 1723.34 (74), RMSEA = 0.059, CFI = 0.97, TLI = 0.96), compared to the distressed group (χ2 = 709.48 (74), RMSEA = 0.066, CLI = 0.95, TLI = 0.94). While differences in χ2 are likely influenced by differences in sample size, RMSEA displayed substantial differences, with the distressed group showing a poorer fit (and no longer within the recommended level). However, CFA and TLI were reasonably similar and close to recommended thresholds for good fitting, allowing progression to the next stage of analysis.

Configural Invariance Testing

Next, the configural model was tested, which estimates the model fitting with consideration of the two groups. The results are provided in Table 12. The results indicate that the model fits the data well, RMSEA = 0.043, CFI = 0.96, TLI = 0.95, indicating that the test for configural invariance was passed; the MHC-SF factor structure was similar in both the distressed and the non-distressed groups.

Table 12 Results of measurement invariance testing in the modified MHC-SF factor structure

Model	χ^2	RMSEA	CFI	TLI	$\Delta\chi^2$
Configural	2138.50 (148)	0.043	0.96	0.95	59.41
Metric	2197.91 (159)	0.042	0.96	0.96	$p < 0.001$

Metric Invariance Testing

Metric invariance was subsequently assessed by constraining factor loadings to be equal across the groups. Changes in χ^2 were significant between the metric and configural models: $\Delta\chi^2$ =108.98, df = 11, and p value < 0.0001. This indicated that there was a significant decrease in model fitting,

suggesting that at least some factor loadings were non-invariant. This finding was supplemented by changes in gamma hat and McDonald's NCI, which were 0.02 and 0.005, respectively, and were, therefore, within the recommended thresholds for significant change. The item loadings onto each factor across the two groups are displayed in Table 13.

Table 13 Item loadings on the modified EFA MHC-SF factor structure in highly distressed and non-distressed groups.

Item	Factor	Item Loading	
		Non-Distressed	Distressed
1	Emotional wellbeing	0.75	0.73
2	Emotional wellbeing	0.80	0.83
3	Emotional wellbeing	0.83	0.83
4	Psychological wellbeing	0.84	0.85
5	Psychological wellbeing	0.78	0.69
6	Social wellbeing	0.79	0.75
7	Social wellbeing	0.73	0.71
8	Social wellbeing	0.66	0.64
9	Psychological wellbeing	0.73	0.68
10	Psychological wellbeing	0.61	0.54
11	Psychological wellbeing	0.69	0.65
12	Psychological wellbeing	0.63	0.69
13	Psychological wellbeing	0.68	0.63
14	Psychological wellbeing	0.82	0.81

To identify the items contributing to non-invariant factor loadings, the sequential analysis of model fit was tested, whereby all constraints were retained except for a single item. This process was repeated sequentially until all items were tested. Models were statistically compared to the configural model. The results are displayed in Table 14. Multiple items showed non-invariant factor loadings. These include items in the emotional wellbeing domain (items 2 [interested in life] and 3 [satisfied with life]) and the modified psychological wellbeing domain (items 4 [social contribution], 5 [social integration], 11 [positive relations with others], and 12 [personal growth]). Invariance testing was concluded at this point due to the high proportion of non-invariant factor loadings,

particularly as two-thirds of the items of the emotional wellbeing latent factor and 50% of the items on the modified psychological wellbeing factor were non-invariant.

Table 14 Identification of the source of metric invariance in the modified MHC-SF factor structure.

Relaxed Item:	χ^2	df	$\Delta\chi^2$	Δdf	*p*
1	2196.24	158	1.66	1	0.198
2	2179.20	158	18.70	1	<0.001
3	2189.50	158	8.40	1	0.004
4	2193.98	158	3.92	1	0.048
5	2182.95	158	14.95	1	<0.001
6	2196.90	158	1.00	1	0.317
7	2197.80	158	0.10	1	0.752
8	2197.90	158	0.00	1	1.000
9	2196.94	158	0.96	1	0.327
10	2197.90	158	0.00	1	1.000
11	2192.85	158	5.05	1	0.025
12	2180.50	158	17.40	1	<0.001
13	2197.40	158	0.50	1	0.479
14	2197.50	158	0.40	1	0.527

Discussion

The current study assessed the measurement invariance of the MHC-SF for distressed versus non-distressed individuals. The results suggest that while the tripartite factor structure of the MHC-SF is consistent across those who had moderate–severe psychological distress (configural invariance), the degree to which the items were loaded onto the latent factors was different between those with low versus high levels of distress (metric non-invariance).

While EFA and CFA supported the originally proposed three-factor model of the MHC-SF (Keyes et al., 2008), two items (assessing social contribution and social integration) from the original social wellbeing scale loaded more strongly onto the psychological wellbeing scale. There is apparent face validity to this result, as the two items could be understood as psychological functioning within the community (e.g., item 4, “I have something to contribute to society”), whereas the remaining three social wellbeing items were more akin to the objective evaluation of society in general and whether it is ‘just’ to its members (e.g., “Society is a good place”). As the majority of

studies on the relationship between mental illness and mental health assume the theorized factor structures of scales used, e.g., those within (Hides et al., 2020), this is a precautionary reminder that model fitting can change between samples; even in a tool as widely validated as the MHC-SF.

The modified factor structure was supported by CFA in both the distressed and non-distressed groups. While the fit was poorer in the distressed group, it was still within the acceptable limits. This finding indicates that the MHC-SF displayed configural invariance across the two groups, meaning that the same factor structure was retained across both samples. This is in line with prior research demonstrating that the factor structure of the scale is similar across both clinical and non-clinical groups (Ferentinos et al., 2019; Franken et al., 2018; Iasiello et al., 2022). Despite the finding of metric non-invariance (discussed below), responses from distressed and non-distressed individuals indicated the presence of emotional wellbeing, psychological wellbeing, and social wellbeing.

This study is the first, to our knowledge, to go a step further from configural invariance and investigate metric invariance between the two groups. The findings showed that several items contributed to metric non-invariance, meaning that their degree of loading onto their respective factors was different between the two groups. Importantly, this does not suggest that the actual responses differed between distressed versus non-distressed groups (i.e., being higher or lower between groups) but that the pattern of participants' scores was different across the two groups (i.e., being interested in life is more relevant for emotional wellbeing in non-distressed individuals compared with distressed ones). This is an important finding, as previous studies concluded that measures are appropriate in both clinical and non-clinical groups based on the factor structure alone, while this study demonstrates that a measure may be non-invariant, even when the factor structure fits in both groups.

Measurement invariance is not a black and white issue, and it is possible for scales to be considered 'partially invariant'. Standards of partial invariance vary in the literature, with recommendations suggesting that the use of scales remains appropriate when, ideally, more than half of the items loading onto a factor should be invariant (Putnick & Bornstein, 2016; Steenkamp & Baumgartner, 1998). In this study, metric invariance was found within a large number of items, affecting the majority of items in the emotional wellbeing and psychological wellbeing factors. For this reason, we conclude that, in this sample, and with the modified factor structure, the MHC-SF should not be considered partially invariant.

Our analyses worked with a modified factor structure, as the EFA indicated a superior fit compared to the original factor structure by letting two items load onto a different factor. Metric invariance was also tested in this sample using the original factor structure of the MHC-SF (Table 21; Appendix 3). While the results for the analyses using the original model suggested that partial invariance may be acceptable, as a minority of items per factor were non-invariant, this analysis should be conducted within populations where the original model represents the most appropriate fit (Byrne, 2016).

The results of this study have important implications for interpretation of the scores of the MHC-SF. Chen (Chen, 2008) showed that bias in the latent variable means increases as the percentage of non-variant items loading onto a latent factor increases; therefore, caution should be considered when interpreting and comparing latent mean scores between the groups with and without psychological distress. Metric invariance is an issue for comparing latent variable scores between different groups but also affects the accuracy of categorical and predictive scoring (Blanco-Canitrot et al., 2018). For example, the impact of metric invariance has been assessed using Monte Carlo simulation, suggesting that metric invariance has significant negative effects on the predictive validity of scales (Blanco-Canitrot et al., 2018). Results showed that the reliability of the scale decreased due to non-discriminating items (metric non-invariant items), which in turn affected the likelihood that cut-off points and diagnoses become inaccurate. This may likely affect the categorical accuracy of the MHC-SF when comparing groups of distressed and non-distressed participants, as the emotional wellbeing items (which were mostly non-invariant) are very influential in the categorization scoring process.

Metric non-invariance, as observed in the current study, signifies that there is a difference in the loading of items onto their latent factor between two different groups. This can be due to different values being placed on the items between groups. Metric non-invariance in the current study might be related to the value-laden nature of the wellbeing items and that these items were answered differentially across the groups. For the emotional wellbeing latent variable, the largest source of metric invariance was the second item, which asked participants how often they felt “interested in life”; this suggests that for emotional wellbeing participants (with vs. without high levels of distress) responded to this item most differentially. Specifically, the item of being ‘interested in life’ was more strongly relevant to emotional wellbeing for those with high psychological distress than those without. On the modified psychological scale, causes of metric invariance mainly came from items related to personal growth (“that you had experiences that challenged you to grow and become a better person”), relationships with others (“that you had warm and trusting relationships with others”), and from the two items from the original factor model social wellbeing variable about contribution (“that you had something important to contribute to society”), and belonging (“you belonged to a community, like a social group, or your neighborhood)”.

The current study was not designed to investigate the reasons for metric invariance in these items, although various potential explanations can be given. First, it has been commented that wellbeing items are inherently value-laden (Prinzing, 2021), and therefore it stands to reason that those experiencing psychological distress place a differential weight on certain items than those not experiencing distress. Growth, relationships with others, contribution, and belonging are certainly value-laden and central to concepts such as psychological safety (Newman et al., 2017), psychological needs (Ryan, 1995), and self-determination theory (Deci & Ryan, 2012); however, this potential cause does not sufficiently explain why some items were found to be non-invariant

and not others. The relevance of mental wellbeing has been investigated in individuals experiencing mental illness (Leamy et al., 2011; Mjøsund et al., 2015), and future research could apply these findings to improving scale performance in the future.

Second, the metric invariance of these items may be influenced by affective recall bias, as it has been established that people are inaccurate in their recollection of past affective experiences in the context of distress (Wenze et al., 2012). Colombo et al. (Colombo et al., 2020) used ecological momentary analysis to demonstrate that those with mild depressive symptoms tended to overestimate negative affective experiences, while those without distress overestimated positive affective experiences. It is possible that this bias impacted metric invariance in the current study, as it is possible that many of these items have a positive valence which could be under or overestimated, depending on current levels of psychological distress.

Third, it has been demonstrated that non-effortful reporting is associated with errors in measurement invariance testing (Rios, 2021). Non-effortful reporting, as measured by the time taken to complete a survey tool, can lead to biased factor loading estimates that directly impact metric invariance (Rios, 2021). There may be an issue in how much time is spent considering the items of a wellbeing scale between those experiencing distress and those who are not. It is reasonable to consider that some items related to concepts as psychologically important as growth, relationships, and belonging may be sensitive topics for someone experiencing psychological distress, which leads to less time being spent considering them.

Implications for Theory.

The current study has important implications for wellbeing and measurement theory. First, there is a need to consider the impact of psychological distress on the validity of latent variable scores in wellbeing measures. Differences in the pattern of responses, due to metric-invariance, can influence the latent scores across the two groups. As a result, hesitation and caution may be required when comparing latent variable scores from groups with different psychological distress or mental illness profiles. For example, researchers may notice differences in the wellbeing of two groups which are artifacts of the level of distress in the two groups. While the results from this study support those identified at the meta-analytic level for the MHC-SF (Iasiello et al., 2022), more research is needed to confirm if measurement invariance is an issue in other populations using different measures of wellbeing and distress. Further research is required to understand the primary source(s) of metric invariance between clinical or distressed and non-distressed groups. As discussed above, these sources may derive from the value-laden nature of wellbeing surveys, affective recall bias, or non-effortful reporting.

The findings from this study support previous research, confirming the factor structure of MHC-SF into emotional, psychological, and social factors, regardless of psychological distress (Iasiello et al., 2022). This suggests that the assessment of mental wellbeing is relevant despite the presence of distress, and scales such as the MHC-SF could be used to assess changes in these aspects of

wellbeing in clinical settings. Finally, the results from the EFA and CFA present a reminder that the factor structure of even well-validated scales may not be present in particular samples and should be tested rather than assumed.

Limitations and Future Directions

This study was limited by the sample and assessment tools utilized. The study was conducted in the general community using a general measure of psychological distress; therefore, the results of the 'distressed group' cannot necessarily be generalized to clinical populations. Further, the use of the DASS cut-points to divide participants into those with low vs. high levels of distress is arbitrary; thus, future studies need to replicate these findings in populations that are known to be highly distressed. While the cut-points lead the differently sized samples, previous research has demonstrated that sample sizes over 400 show uniformly high precision of estimated-factor-loading differences; therefore, differences in sample sizes are not anticipated to cause an issue (Meade & Bauer, 2007). It is possible that non-invariance becomes stronger with greater distress or in clinical populations, as observed by Iasiello et al. (2022). The study was not designed to investigate the causes of the observed non-invariance, and features of the sample may have acted as confounding factors. For example, the online, self-selecting recruitment method may disproportionately identify participants who are more interested or motivated to focus on their mental health, excluding older participants and explaining the demographic differences between the two groups (in particular, the fact that distressed groups were more likely to be students). Future studies could also endeavor to modify problematic items that lead to measurement non-invariance in distressed samples by potentially clarifying or reducing the degree to which they are 'value-laden'. Alternatively, different analysis techniques could be used on appropriate datasets, such as multi-level CFA modelling or multi-group measurement invariance analysis. Future studies should investigate the potential causes of metric invariance in these groups such that wellbeing measures can be modified and improved to avoid this source of measurement error.

Conclusions

The current study aimed to test the measurement invariance of the MHC-SF between individuals experiencing high levels of psychological distress and non-distressed individuals. In both groups, it was found that the MHC-SF taps into three domains of mental wellbeing: emotional, psychological, and social wellbeing. However, it was identified that there were differences in the item loadings on each of these latent variables between the two groups. This signifies that there may be differences in the way that these items are valued or interpreted, and that caution is needed when comparing wellbeing scores between groups who are experiencing psychological distress or not.

Summary

This study was formulated to investigate an issue which was identified in the previous Chapter, that there may be differential patterns of responding in those with and without a diagnosed mental illness. A large Australian sample (n=8,406) was used to demonstrate that the MHC-SF is metric non-invariant to levels of psychological distress, indicating that wellbeing items may be interpreted and valued differently in distressed and non-distressed individuals. This finding, in combination with results in Chapter 5 indicate that total and subscale scores of the MHC-SF may not be equivalent between clinical or distressed and non-clinical populations, and caution is required when making comparisons between them. While this finding does not invalidate the dual-continua model of mental health, it points to an element of wellbeing assessment that should be improved for accurate assessment of mental wellbeing in the context of psychological distress.

CHAPTER 7: CONCLUSION

The dual-continua model of mental health posits that mental wellbeing and mental illness reflect two distinct continua, rather than occupying opposite ends of the same spectrum. This thesis contributes to essential knowledge about the evidence of the dual-continua model, the implications it could have for mental health research and practice, and considerations required when assessing mental wellbeing in the context of mental illness or psychological distress. As a concluding chapter, Chapter 7 commences with a summary of the key findings of the thesis, places them in the context of previous research, and discusses the strengths and limitations of the current work. The chapter concludes with a consideration of the implications of the work for research and practice, and posits a consolidation of the dual-continua model with hierarchical and dimensional models of mental wellbeing and mental illness.

Summary of Key Findings

The systematic review in Chapter 2 was the first to synthesise the evidence of the dual-continua model of mental health. Prior to its publication, many studies had tested the relationship between mental illness and mental wellbeing, using a wide variety of assessment techniques. Many theorised implications of the dual-continua model had been discussed in the literature (Herron & Trent, 2000) but had not been systematically mapped to the extant evidence. The systematic review identified more than 80 publications that consistently found that the data best fit a two-factor oblique model, indicating that mental wellbeing and mental illness represent two separate constructs which share a degree of overlap. These studies included samples from around the world, using different indicators of mental wellbeing and mental illness, in a variety of languages, cultures, and populations.

The review identified a range of implications of the dual-continua model of mental health, which are discussed below and summarised in Table 14. One of the most important gaps identified in the literature related to the hypothesised role of mental wellbeing to facilitate personal and clinical recovery from mental illness (Slade, 2010). This identified gap led to the development of Study 2 (Chapter 3), which investigated the role of mental wellbeing as a predictor of recovery from mental illness. This study was the among the first to examine the role of mental wellbeing in clinical recovery from mental illness, making use of an existing nationally representative dataset. The finding that wellbeing is an important predictor of clinical recovery reinforced the claims of studies identified in the systematic review (Chapter 2) that the assessment of mental wellbeing is important in the assessment of mental health in clinical and non-clinical settings.

The methodological considerations required when assessing mental wellbeing in the context of psychological distress or mental illness were reviewed in Chapter 4. Drawing on a conceptual review by Cacioppo and Berntson (1994), Chapter 4 argues that the dual-continua measurement approach enables the greatest potential for understanding unique or shared predictors, antecedents, and consequences of mental wellbeing and psychological distress, that are not possible under alternative conceptualisations of mental health. This argument is supported by empirical literature identified in Chapter 2, which demonstrated that the assessment of either mental wellbeing or distress/clinical symptoms alone is insufficient to assess an individual's evaluation of their own mental health. Importantly, Chapter 4 argued that the dual-continua approach to mental health assessment is relevant even in the situation where mental wellbeing and mental illness appear to hold a single bipolar relationship. This methodological chapter summarised the considerations required when assessing mental wellbeing and distress simultaneously, which together with the notion that mental wellbeing is a relevant concept in clinical settings (identified in Chapters 2 and 3), lead to further investigation in Chapters 5 and 6.

Chapter 5 used an innovative analysis technique to assess the structural validity of a popular measure of mental wellbeing, the Mental Health Continuum Short Form (MHC-SF), to assess whether the measure's factor structure was consistent across both clinical and non-clinical populations. This approach used a systematic review to identify validation studies of the MHC-SF in the literature and extracted data for use in meta-analytic structural equation modelling (MASEM). The combined dataset from the systematic review included over 100,000 participants in the study. This study is the first of its kind to apply this method to a measure of mental wellbeing, and among few studies of any psychological tool. The study demonstrated that the MHC-SF has a consistent factor structure across both clinical and non-clinical populations, which tapped into three aspects of mental wellbeing, emotional (subjective), psychological, and social wellbeing as well as a second-order general wellbeing factor. It supported the hierarchical factor structure as described by (Disabato et al., 2019) as the most appropriate fit both theoretically and psychometrically. Moderator analysis was conducted to assess the factor structure fit across clinical and nonclinical samples, which demonstrated that there were differences in the way items loaded on the latent wellbeing variables – indicating that there are differences in the way clinical and non-clinical participants respond to measures of mental wellbeing. This result pointed to a measurement invariance issue in the measure of mental wellbeing in the context of mental illness, which was investigated in Chapter 6.

Chapter 6 investigated whether the MHC-SF was invariant to participant's level of psychological distress. This study recruited a general population sample and continuous assessment of psychological distress, rather than the clinical categorical approach of the previous chapter. This study used measurement invariance analysis and was the first to test whether a measure of wellbeing is invariant to level of distress experienced by a participant. This study confirmed the

findings from the previous chapter, that while the MHC-SF displayed structural invariance (meaning that the factor structure was consistent across both groups), there were differences in the strength of the item loadings on mental wellbeing factors indicating metric non-invariance. This finding, taken together with the results from Chapter 5, indicate that there are differences in the way that psychologically distressed or clinically mentally ill participants interpret or value wellbeing items of the MHC-SF. Metric non-invariance indicates that caution is required when comparing the subscale or even total scores of the MHC-SF across clinical and non-clinical populations. The issue is of vital importance to research and practice that is informed by the dual-continua model of mental health and indicates that more work is required to understand wellbeing assessment in the context of distress or mental illness, which will be discussed below.

Assessment of Wellbeing in the Context of Psychological Distress or Mental Illness

Realising the implications of the dual-continua model relies primarily on accurate assessment of mental wellbeing in the general population and in the context of mental illness and psychological distress. Chapters 5 and 6 investigated the performance of a common measure of mental wellbeing, the MHC-SF, in participants with a diagnosed mental illness (Chapter 5) or psychological distress (Chapter 6). Both studies demonstrated that the MHC-SF is appropriate for use in clinical or distressed participant groups, but that caution is required when comparing scores across those with distress or clinical illness and those without. These findings are important for a number or reasons, primarily in the accurate assessment of mental wellbeing in populations, and for the comparison of levels of wellbeing in clinical and non-clinical groups. Indicators of mental wellbeing are commonly used to complement objective measures of quality of life and economic progress in population surveys to enhance public policy design and evaluation (Adler & Seligman, 2016). The psychometric issues identified in Chapter 5 and 6 indicate that comparisons of wellbeing in two populations could be biased by the proportion of psychological distress or mental illness in the populations, influencing subsequent policy decisions that could be made based on these data. Further, this issue affects the interpretation of wellbeing scores across clinical and non-clinical populations. A clinician may endeavour to improve the wellbeing of their clients to levels observed in the general population, however, these comparisons cannot be made with certainty based on the issues identified in the current thesis.

Understanding the reason that there may be discrepancies between the way individuals experiencing psychological distress or mental illness interpret or value wellbeing items is important to realise the potential of the dual-continua model. The potential sources of metric invariance are discussed in Chapter 6, including the value-laden nature of wellbeing items (Prinzing, 2021), affective recall bias (Colombo et al., 2020), and non-effortful reporting (Rios, 2021). The issues identified in the current thesis, particularly Chapters 5 and 6 allude to a larger issue, which is that measures of wellbeing are usually designed for use in general populations, are retrospectively

tested in clinical populations without consideration of the limitations of use in this unique population.

The Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) is an initiative to advance the science and application of health outcome measurement. Chapter 5 included a COSMIN risk of bias assessment of the publications included in the systematic review that had investigated the factor structure of the MHC-SF. One of the COSMIN criteria for health outcome measures is concept elicitation, whereby gold standard includes using qualitative methods to work with a study population to identify relevant items for a measurement tool (Mokkink et al., 2018). Similarly, gold-standard psychological tool development processes include cognitive interviews, which involves providing a study population with draft survey items and asking them to verbalise the mental process that entailed their responses (Boateng et al., 2018). This process allows for items to be modified and clarified to fit the survey population (Beatty & Willis, 2007). There are no evidence of face-validity or cognitive interviews in clinical populations in the MHC-SF literature, or any measures of wellbeing for that matter.

This may be a future research direction to understand the root cause of the measurement invariance observed in the MHC-SF between clinical and non-clinical populations. Each of these techniques get to the lived experience of someone experiencing wellbeing despite mental illness or psychological distress. Recall that lived experience is fundamental to the personal recovery movement, where many participants have expressed a range of positive mental wellbeing aspects that are fundamental for their personal recovery, which resulted in the CHIME framework. Qualitative research, which describes the methodical scientific practices to produce knowledge about the nature of experiences, may be useful to better understand the experience of wellbeing despite mental illness (Levitt et al., 2017). In particular, methods relying on phenomenology would be valuable, as this method investigates the subjective experience of individual living in the world (phenomenological practices), rather than focusing on their observable interactions with the world (behavioural practices) (Lundh, 2020). Techniques such as Interpretative Phenomenological Analysis (IPA) are available to researchers to focused on in-depth exploration of the lived experience, and particularly on the individual's sense making of that experience (Smith & Shinebourne, 2012). IPA aims to "explore in detail the processes through which participants make sense of their own experiences, by looking at the respondent's accounts that they have been through and seek to utilize an assumed existing universal inclination towards self-reflection" (Chapman & Smith, 2002). Such techniques could hold the key to understanding participant's experiences of strong, yet differently valanced emotions, to improve the quantitative assessment of mental health and wellbeing in the context of distress or mental illness.

Other theories have been established to understand how the presence of distress impact an individual's ability to discern wellbeing. The dynamic model of affect (DMA) (Zautra & Smith, 2001)

suggested that as heightened pain narrowed the range of emotional experiences, leading to the narrowing of the negative relationship between positive and negative affect. Keyes (2000) found a similar result in the context of perceived change in roles as a spouse, worker, and parent, the correlation between positive and negative affect was strongest (r = .91) when participants reported improvement or decline in their subjective performance in their role, compared to lower correlations (r = .31) in those who's perception of role remained constant. A similar concept is described in the broaden and build theory of positive emotions, which suggest that positive emotions widen the array of thoughts and actions that come to mind, and that the inverse is true too (Fredrickson, 2001). This may be the phenomenon explaining the result in van Erp Taalman Kip and Hutschemaekers (2018), which was the only paper identified in the systematic review that was not in support of the dual-continua model. This study was conducted in the context of severe depression, and showed that participants were not able to record any level of mental wellbeing. Recall from Cacioppo and Berntson (1994) that the fact that participants in a certain context express extreme distress without any wellbeing does not invalidate the dual-continua model. It may still be important to understand the unique antecedents that may mitigate distress and build wellbeing, and these things could be the same or unique.

It is not difficult to imagine situations in life in which people can experience two strong, but differently valanced, emotions. Examples include the sadness of attending a funeral of a close friend, whilst being grateful for the time spent together and the meaning attributed to the loss, or the simultaneous experience of joy, relief, terror, and anxiety of childbirth. The question is whether the complexity experienced would be captured in a paper-based or online survey. The difficulty of attributing this experience to survey tools is likely influenced by the factors expressed in the discussion of Chapter 6, the DMA and the broaden and build theory. Joseph and Wood (2010) suggested the possibility of standardised interview schedules, as a way of overcoming the limitations of self-report assessment tools and to seek behaviourally-based methods of positive functioning and mental wellbeing.

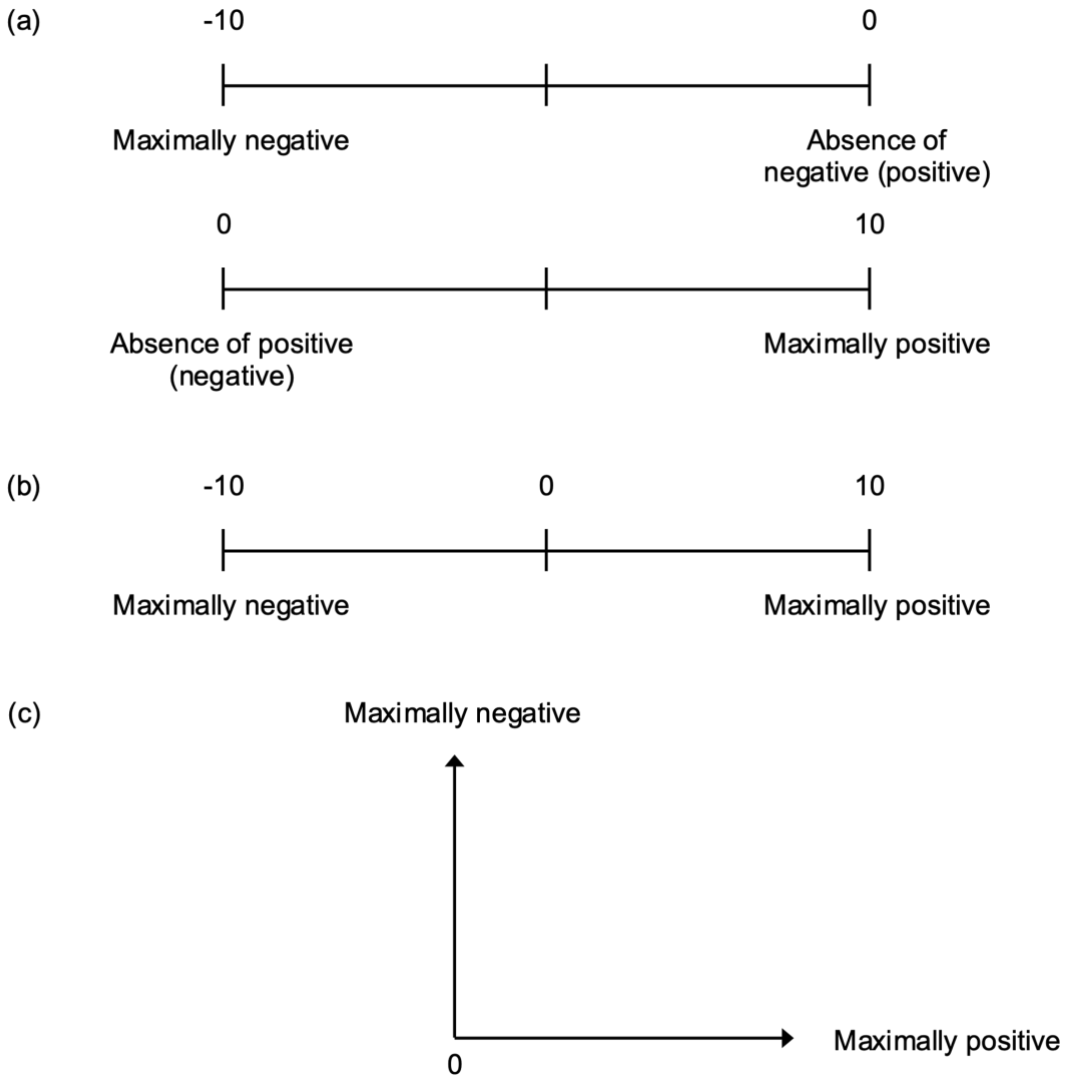
Despite invariance issues, both Chapters 5 and 6 demonstrated the MHC-SF does tap into three aspects of mental wellbeing, regardless of psychological distress or clinical diagnosis. This is a relevant finding in the conceptualisation of wellbeing as a hierarchical, multi-dimensional concept (an approach that is now mirrored in psychological distress and mental illness) and has been supported in the literature (Gallagher et al., 2009). While there is dispute in the literature about the nature of the 'general factor' in wellbeing, i.e., is it a bifactor model the most appropriate or is it hierarchical (discussed in detail in Chapter 5), there is consensus that measures of wellbeing tap into a general factor of wellbeing, with dimensions below them, as theorised (Disabato et al., 2019). The question remains how to best reconcile the dual-continua model with the hierarchical dimensional models of psychopathology and mental wellbeing.

Findings in the Context of Previous Research

Conceptual Rationale and Empirical Evidence Supporting the Dual-Continua Model

This thesis has presented a conceptual rationale for the utility of the dual-continua model of mental health as the most appropriate way to conceptualise and assess the relationship between mental wellbeing and mental illness. Many studies identified in the Chapter 2 systematic review supported the dual-continua model of mental health and mapped their results to implications that the model could have on mental health research and practice that are not possible under other potential relationships between mental wellbeing and mental illness (Figure 1 [Chapter 1]; Pawelski, 2016)

Figure 1. Three conceptual relationships between positive and negative (repeated from Chapter 1).



Note: (a) Unipolar positive as the absence of negative, or unipolar negative as the absence of positive; (b) Bipolar relationship with positive and negative as a single dimension; and (c) Bivariate relationship with positive and negative as distinct dimensions.

These implications relate primarily to assessment of mental health, prevention of mental illness/promotion of mental wellbeing, treatment of mental illness, and recovery from mental illness. Table 15 summarises these implications and describes the benefits that the dual-continua model adds over and above other possible relationships been mental wellbeing and mental illness. Please note that while a 'wellbeing only' option is also a possibility, there is no claim in the literature that distress does not exist therefore it has not been included here (Pawelski, 2016).

Table 15. Summary of the academic and practical benefits of using dual-continua conceptualisations of the relationship of mental wellbeing and mental illness.

Model	Illness only	Post-positive psychology	Dual-continua model of mental health
Brief definition	Mental wellbeing is merely the absence of mental illness	Mental wellbeing exists and reflects the opposite pole of a single continuum with mental illness.	Mental wellbeing and mental illness reflect two distinct, but related, continua.
Assessment	Only distress required	Only need to assess distress when it's present, otherwise measure wellbeing	Must measure both at the same time
Prevention/promotion	Early detection of symptoms, mitigate risk factors, and address causes of distress.	Promote mental wellbeing to protect against future mental illness, mitigate risk factors that decrease mental wellbeing.	Enables understanding of unique or shared risk factors for mental wellbeing and mental illness, which can inform tailored approaches and setting priorities.
Treatment	Treat and mitigate symptoms of disorder and dysfunction.	Wellbeing interventions can be used to complement treatments to reduce distress and	As above, enables understanding of unique or shared intervention components that improve wellbeing and/or alleviate

		dysfunction	distress
Recovery	Reduce symptoms or dysfunction to below clinical levels and prevent future recurrence	Promote optimal function following mitigation or dysfunction	Promote wellbeing to improve chance of recovery or to facilitate personal recovery for those with chronic or recurrent mental disorder.

The 'illness-only' model describes wellbeing as the absence of mental illness. In this model, only the assessment of mental illness is required, as wellbeing can be inferred by the absence of distress or dysfunction. This approach has been the overwhelming approach undertaken in clinical settings around the world (Joseph & Wood, 2010). The post-positive psychology model describes a bipolar continuum ranging from illness to mental wellbeing, something like the extension of a number line from the previous model. While the post-positive psychology model requires the assessment of mental wellbeing and mental distress, it does not necessarily require that both are assessed concurrently. The assessment of distress would be primarily required in clinical settings while the assessment of wellbeing is required in the general population. Finally, the dual-continua model builds on the previous two models, by requiring that the inclusion of both mental wellbeing and mental illness are included in mental health assessments. This assessment approach is supported theoretically in psychometric literature (Cacioppo & Berntson, 1994) (discussed in Chapter 4). The superiority of the dual continua model of mental health in assessment over the previous models has also been demonstrated empirically, with many studies identified in Chapter 2 (e.g. Eklund et al., 2010).

The next theme of implications of the dual-continua model relates to the prevention of mental illness and the promotion of mental wellbeing. In the illness-only model, prevention and promotion is solely focused on early detection of symptoms (Morgan et al., 2018), modifying risk exposure and strengthening coping mechanisms of individuals (WHO, 2004). The introduction of wellbeing into the model adds additional methods to the system for prevention (Kobau et al., 2011), including mental health promotion interventions that promote mental wellbeing, build adaptive skills, and assisting the achievement of optimal function and developmental milestones (Arango et al., 2018). This is a significant improvement to the system, as a range of studies have demonstrated that wellbeing is a protective factor for future mental illness (Fredrickson, 1998; Garland et al., 2010; Trompetter, de Kleine, et al., 2017; Watson & Naragon-Gainey, 2010). Further, efficacious (Bolier et al., 2013; Sin & Lyubomirsky, 2009) and cost-effective (Schotanus-Dijkstra et al., 2018; Weiss et al., 2020) wellbeing interventions are available in the literature to be utilised in this effort for mental health promotion or universal primary preventive interventions. The dual-continua model adds

nuance to the implications on prevention and promotion of mental health of the post-positive psychology model, in that it can be used to identify shared and unique antecedents of mental wellbeing and mental illness. At the level of social determinants of health, this approach has been demonstrated by Kinderman et al. (2015), where it was found that there are unique and shared antecedents leading to distress and/or mental wellbeing, and that this added insight allows for targeting interventions and enables best use of finite resources to address mental health priorities for a population.

In the theme of treatment of mental illness, in the first two scenarios, the reduction of distress symptoms and improvement of function is synonymous with improved wellbeing, following the principle of opposing evaluative activations (Cacioppo & Berntson, 1994, and discussed in Chapter 4). The dual-continua model, as a special case of the post-positive psychology model, does not necessarily add more interventions to the system, however, it does broaden the application and scope of interventions. For example, the dual-continua model would suggest that it is possible to build aspects of mental wellbeing in clinical populations, and that such interventions may even facilitate recovery. Further, it enables more sophisticated and targeted intervention design as it allows for an understanding of the shared and unique antecedents of wellbeing and distress. Multiple meta-analyses have demonstrated that that the promotion of mental wellbeing is possible in clinical samples (Chakhssi et al., 2018; van Agteren, Iasiello, et al., 2021), and interventions differentially promote wellbeing and/or reduce symptoms (Trompetter, Lamers, et al., 2017; van Agteren, Ali, et al., 2021), i.e. uncoupled activation in the language of (Cacioppo & Berntson, 1994). Like the example from Kinderman et al. (2015), a greater understanding of the unique and shared antecedents of program components would be highly relevant for the process-based intervention movement, whereby greater understanding of the processes leading to or alleviating distress and/or mental wellbeing could be used to improve intervention specificity and effectiveness (Hofmann & Hayes, 2019).

Finally, the dual-continua model has implications on the notion of recovery from mental illness. Recovery in the illness-only model is focused on clinical recovery, where by symptoms are eliminated and function is returned (Slade, 2010). In the post-positive psychology model, it could be argued that there is still a primary focus on clinical recovery, but that the model adds the concept of optimal function following recovery (Rottenberg et al., 2018). Again, the dual-continua model allows greater nuance to the post-positive psychology model, as it demonstrates that aspects of wellbeing can be improved in an individual, despite the diagnosis of a mental illness. A growing literature, including the study in Chapter 3 of the current thesis, indicate that improved mental wellbeing can improve the likelihood of recovering from a mental illness (Schotanus-Dijkstra et al., 2019). Others have argued for the relevance for wellbeing interventions in those with severe psychiatric disabilities and psychosis (Resnick & Rosenheck, 2006; Slade et al., 2016). The relevance of wellbeing promotion in the context of chronic or recurrent mental illness is also

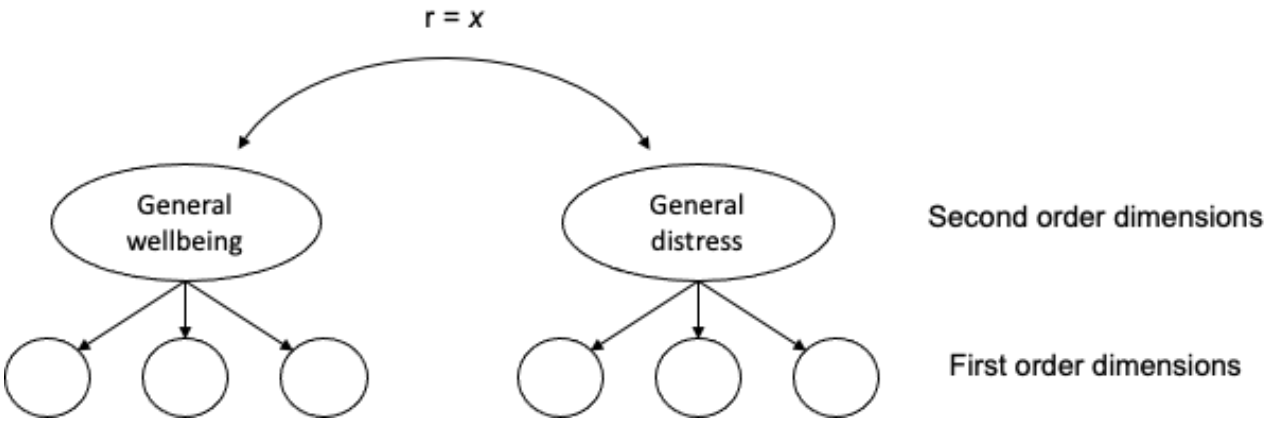
enabled by the more nuanced dual-continua model as a framework to integrate clinical and personal recovery (Slade, 2010). Personal recovery is defined as a "deeply personal, unique process of changing one's attitudes, values, feelings, goals, skills, and/or roles. It is a way of living a satisfying, hopeful, and contributing life, even within the limitations caused by illness. Personal recovery involves the development of meaning and purpose in one's life as one grows beyond the catastrophic effects of mental illness" (Anthony, 1993).

The lived experience is central to personal recovery, and consumer-based experiences of personal recovery have been compiled from around the world, including Australia (Andresen et al., 2003), New Zealand (Barnett & Lapsley, 2006; Goldsack et al., 2005; Mental Health Commission, 2000, 2002), Scotland (Scottish Recovery Network, 2006, 2007), USA (Ralph & Corrigan, 2005) and England (McIntosh, 2005). Mental health care consumers report notions such as hope, spirituality, empowerment, connection, purpose, self-identity, symptom management and stigma (Schrank & Slade, 2007). A framework of personal recovery was developed, following a systematic review of the literature, narrative synthesis, and expert consultation (Leamy et al., 2011). This research identified connectedness, hope and optimism about the future, identity, meaning in life, and empowerment as central to personal recovery, resulting in the CHIME model (Leamy et al., 2011). The CHIME model and personal recovery align closely to the dual-continua model of mental health, as it supports individuals to adopt an active role in their own recovery journey, primarily through a focus on building mental wellbeing resources in their lives which are uncoupled from the alleviation of symptoms or distress (Villagonzalo et al., 2018).

Consolidating the Hierarchical Dimensional Models of Wellbeing and Psychological Distress with the Dual-Continua Model of Mental Health

Both fields of mental wellbeing and psychopathology research are moving towards hierarchical and dimensional models (Caspi et al., 2014; Disabato et al., 2019; Kotov et al., 2017). In these parallel models, the second order 'general factor' sits above multiple 'first order' dimensions. To date, much of the research and investigation of the dual-continua model has been conducted at the level of the second order general factors, i.e., how is overall mental wellbeing related to overall psychological distress (Joseph & Wood, 2010)? This is represented in Figure 13, with general wellbeing and distress factors, where the correlation between the factors (indicated as r = *x*) is dependent on several variables.

Figure 13. Hierarchical dimensional model of mental health

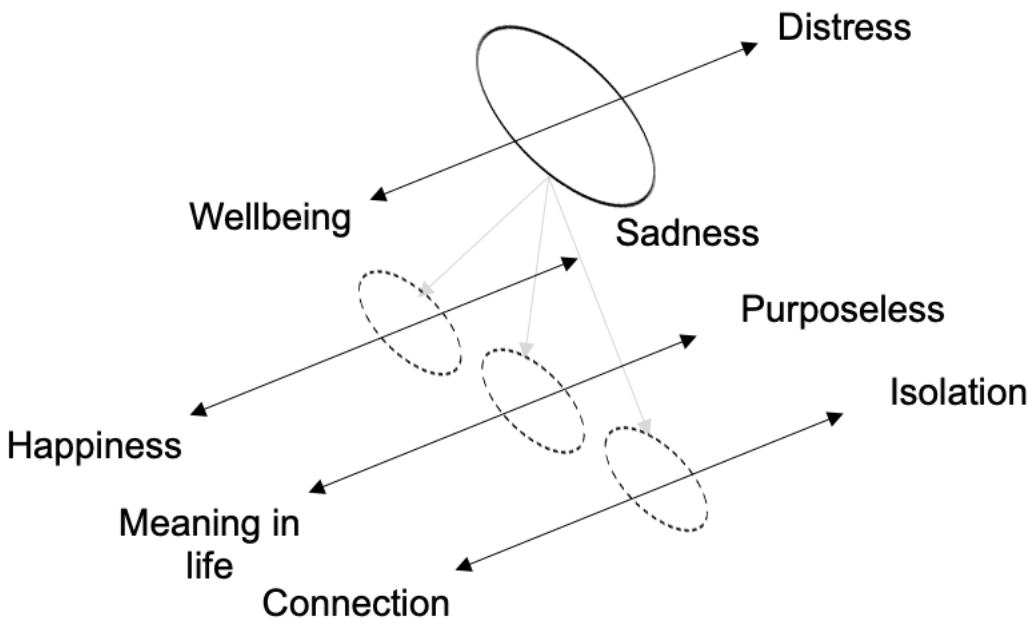


It has been demonstrated that the correlation (r = x, Figure 13) between the two general factors is highly variable, ranging from r = -0.7 (van Erp Taalman Kip & Hutschemaekers, 2018) to r = 0.0 (de Vos et al., 2018). Despite the sometimes-high correlations, the general factors are empirically separable. The factors that contribute to the correlation, as summarised in Chapter 4, include extremity response styles (Bentler, 1969), asymmetrical bipolar rating scales (Meddis, 1972), duration of the response window (Diener & Emmons, 1984; Russell, 1979), non-random error covariation stemming (Green et al., 1993; Russell, 1979), and the use of positively and negatively worded items for each construct respectively (Marsh, 1996; Schmitt & Stuits, 1985). The largest influence on the correlation between the two general factors is the first-order factors that are used to assess or define the factors themselves. As observed in the case of eating disorders, where the indicators of eating disorders are the least 'semantically opposite' (Feldman Barrett & Russell, 1998), in other words the first order factors that sit under psychopathology of eating disorder are distinct from those that constitute wellbeing. As the first order factors become more semantically opposite, such as the case of depression and wellbeing, the correlation between the two general factors increases.

A hypothetical case whereby wellbeing and psychological distress are defined by semantic opposites (e.g., happiness/sadness, meaning in life/purposelessness, and connection/loneliness) is presented in Figure 14. A model like this was proposed by Joseph and Wood (2010), whereby mental health is a general factor which is composed of a range of bipolar continua ranging from optimal function to dysfunction (i.e., happiness to sadness, connection with others to loneliness). In this hypothetical scenario, the general constructs of wellbeing and mental illness would appear so similar that they could be considered essentially a single bipolar continuum (r approaching 1, Figure 13). According to the principles outlined by Cacioppo and Berntson (1994), even in the scenario of a bipolar continuum, each first-order dimensions should still be assessed separately to enable the understanding of unique and shared antecedents. In other words, the factors that promote happiness are not necessarily the same as that which reduces sadness, and this nuanced

understanding cannot be identified unless both ends of the continuum are measured. The relevance of assessing both ends of a seemingly 'bipolar' continuum is exemplified in studies of optimism and pessimism. Scheier et al. (2021) demonstrated that absence of pessimism is a stronger predictor of physical health when compared with the presence of optimism. This the reduction of pessimism may be more relevant than the promotion of optimism for health promotion, an insight that would not be possible by measuring optimism or pessimism alone.

Figure 14. A bipolar model of mental health with bipolar second-order factors



In the absence of an agreed definition of the constitutive first-order characteristics of wellbeing, and the range of mental illnesses that have a variable relationship to these characteristics, the 'lower-order' approach to the dual-continua model has a range of academic benefits. Firstly, the approach enables for more nuance, avoiding 'construct plurality' issue whereby multiple factors can be called wellbeing or mental illness (Alexandrova, 2017). It also allows a better understanding of the particular characteristics of mental wellbeing that may be possible under certain mental illnesses, and which are unlikely. Further, the use of the lower dimensions is more likely to lead to more accurate assessment (because the terms of more concretely defined), and more practical intervention targets, i.e., building hope is more tangible and concrete than 'building wellbeing'.

Strengths and Limitations

The aim of the current thesis was to develop a greater understanding of the dual-continua model of mental health, the implications the model could have for health care system, and investigate the assessment of mental wellbeing in the context of clinical or psychologically distressed participants.

The studies contained in this thesis generated novel and important findings that have not been explored or reported previously in the literature. This knowledge facilitates and improves understanding of the relationship between mental wellbeing and mental illness, which can improve approaches and interventions to prevent, treat, and recover from mental illness. To this end, this thesis contains a comprehensive and detailed body of work that uses a range of analysis techniques to investigate the validity and implications of the model and identify technical issues that are pertinent to assessment of mental wellbeing and in clinical or distressed populations.

The dual-continua model remains a little known or applied framework for the assessment or intervention of mental health, however the systematic review reported in Chapter 2 identified a significant body of literature that indicates its validity and utility. The review identified a gap in the literature related to the role of mental wellbeing in the recovery from mental illness, which lead to the study reported in Chapter 3. The studies in Chapters 5 and 6 identified an issue that has not previously reported in the literature, that individuals experiencing high levels of psychological distress or with a diagnosed mental illness may respond differently on measures of mental wellbeing compared with the general population. The accurate assessment of mental wellbeing in clinical or distressed populations is necessary for the validity of the dual-continua model of mental health.

One strength of this thesis was that in addition to identifying an important psychometric issue related to the dual-continua model of mental health, it replicated the issue in a second study, using a separate analysis technique and population. The first study utilised the novel MASEM method, which extracted data from more than 100,000 participants who completed the MHC-SF in a range of languages from clinical and non-clinical settings. The second study utilised a large sample of the general population in Australia, using a more targeted statistical approach in measurement invariance analysis. This study replicated the initial finding using psychological distress rather than categorical mental illness in the first study.

It should be acknowledged that the work in the current thesis has a range of limitations. The limitations of the studies are described in the relevant chapters (1-2, 5-6), while broader limitations are discussed below. The main limitation is that the studies reported in Chapters 2, 5, and 6 all used the same measure of mental wellbeing, the MHC-SF. While this is amongst the most commonly used measures of mental wellbeing (van Agteren, Iasiello, et al., 2021), it remains unknown whether the psychometric issue identified in Chapters 5 and 6 are unique to the MHC-SF or will be shared with other measures of mental wellbeing. Further the studies included in the current thesis were not designed to identify the source of the metric non-invariance identified in Chapters 5 and 6. While the hypothesised causes of this issue are generic and would apply to other measures of mental wellbeing, future studies should investigate whether the similar issue is identified in other measures of mental wellbeing.

Chapter 4 identified a range of statistical issues that can influence the appearance of bipolarity between measure of mental wellbeing and mental illness. Because this thesis utilised well-validated measures for these constructs, it was not possible to avoid many of these issues, as it would have required the development of novel assessment tools or significant modifications to existing ones. As the studies included in this thesis were not necessarily focused on the separation of the two concepts, the influence of these issues on the bipolarity of the constructs was not relevant and would not have impacted the results.

Broader Implications and Future Research

In summary, findings from this thesis indicate the proper conceptualisation of the relationship between mental wellbeing and mental illness is important for the progress of the mental health system and research. It was found that the assessment of mental wellbeing in the context of psychological distress and mental illness is a complex issue. The reconciled combination of the dual-continua model and the hierarchical dimensional models again strongly allude to the importance of the psychometric issues identified in studies 3 and 4. Whether future measures address this issue by improving or modifying existing measures of wellbeing, as has been conducted in other psychological fields, or new measures are used specifically for the assessment of wellbeing in the context of distress or for specific mental illnesses (e.g. CHIME), remains to be seen.

The findings of the current thesis have broad implications for research, mental health systems and clinical practice, and introduce a range of future research questions. Firstly, the thesis has demonstrated that there is a role for wellbeing in assessment and intervention in clinical practice. Much more is required to understand which aspects of mental wellbeing are most important for clinical or personal recovery, how these aspects can be built in clinical practice, and whether different aspects are more suited to particular mental illnesses. Assessing levels of mental wellbeing is important to track clinical progress of participants or evaluate intervention effectiveness, therefore addressing the issues identified in measurement of wellbeing in the context of distress is required. As discussed above, some fundamental work is required to understand how individuals with a mental illness or psychological disorder perceive and value wellbeing items and surveys, with a range of techniques such as cognitive interviews and phenomenological interviewing are available.

Further, it should be understood whether general models of wellbeing are appropriate for clinical populations, or whether different combinations of characteristics are more appropriate. For example, while the aspects of the CHIME model are very similar to generic models of wellbeing, there may be a particular recovery lens that is more appropriate or beneficial for assessment in clinical space. Maybe a clinical interview format would be most appropriate to help participants

investigate functioning in their own lives which would be difficult to express or extract from other formats like pen and paper.

In terms of the dual-continua model itself, the field would benefit greatly from improving the separability of the constructs (or characteristics) of mental wellbeing and psychological distress. There are a range of potential sources of error that cloud separability, and future measures could be created with this in mind. As argued by Cacioppo and Berntson (1994), the separability allows for a range of nuanced implications, such as learning the conditions of coupled or uncoupled activation or wellbeing and/or distress, leading to more insight and understanding the unique and shared antecedents and predictors of mental wellbeing and psychological distress.

Conclusion

This thesis contributes to essential knowledge about the evidence of the dual-continua model, the implications it could have for the mental health research and practice, and considerations required when assessing mental wellbeing in the context of mental illness or psychological distress. This Chapter discussed the original results reported in the thesis and discussed them in the context of the literature. It was demonstrated empirically and theoretically that the dual-continua model offers greater potential for the investigation of mental health than the bipolar model, and that assessment tools that can maximise the separation of the concepts will provide the most fruitful academic outcomes. The chapter considered strengths and limitations of the thesis, and concluded with discussion of next steps for research into the dual-continua model of mental health. Of primary importance is clarity around models of mental wellbeing (i.e., which second-order factors should be included, and their resultant measurement tools), which enable second-order investigation of the relationship between the dimensions of mental wellbeing and psychological distress.

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APPENDICES

Appendix 1. Supplementary material from Chapter 2

Table 16 Summary of reviewed literature extraction.

Author	Aims/Purpose	Method	Location	Participants	Wellbeing tool	Mental illness tool	Key Result relevant to current review	Key implications of CMH
Alterman 2010	To examine the latent structure of a number of measures of mental health and mental ill-ness in substance use disorder outpatients	Cross-sectional study n = 484	United States of America	Adult (mental illness) Age: 38.4 (9.4) 70% male	- Positive and Negative Affect Schedule (PANAS)	- Profile of Mood States (POMS)	- The study found two distinct factors for mental illness and mental health - Some measures associated with positive mental health (social support and optimism) showed inverse high correlations and high factor loadings for	- CFA support for the existence of two obliquely related, negatively correlated dimensions - Some tools related to positive mental health also showed high correlations with negative mental health, which

							mental illness	may be influenced by the constructs and assessments used to measure them
Antaramian 2010	To investigate the utility of using a dual-factor approach in youth mental health and assess group differences in student engagement, academic achievement, environmental support	Cross-sectional study n = 764	United States of America	Youth (students) Specific age not reported 54% female	-Students' Life Satisfaction Scale (SLSS) - Positive and Negative Affect Scale for Children (PANAS-C)	-Self-report coping scale (SRCS)	- The results support the dual-factor model of mental health in young adolescents - those with low positive mental health and no mental illness are similarly at risk of developing academic and behavioural problems than those with mental	- Monitoring of wellbeing is recommended to help guide systematic interventions for those at risk of problematic school performance, as only students with complete mental health show advantageous academic and

							illness	behavioural outcomes.
Antaramian 2015	Examine the utility of the dual-factor model in understanding the psychological adjustment and educational functioning of college students	Cross-sectional study n = 561	United States of America	Adult (students) Age: 19.5 63% female	Subjective welbeing: - Positive and Negative Affect Schedule (PANAS) - Satisfaction With Life Scale (SWLS)	Center for Epidemiologic Studies Depression Scale (CES-D)	- The study found four clear groups with differing mental illness and positive mental health, supporting the dual-factor model of mental health - The groups differed in their educational functioning, with participants with complete mental health outperforming the other groups on student engagement and	- Both the presence of positive wellbeing and the absence of psychopathological symptoms are important for facilitating academic success, as positive mental health is a contributor to optimal college experience and academic success, thereby indicating that positive mental

							GPA	health should be considered in monitoring and intervention delivery
Baiden et al. 2016	Identify factors associated with complete mental health in individuals who had ever seriously considered suicide	Cross-sectional study Sample 1 n = 21270 Sample 2 n = 2842	Canada	Youth and Adult (General population) Age not reported Gender ratio not reported	- Mental Health Continuum - Short Form (MHC-SF)	World Health Organisation - Composite International Diagnostic Interview	- A dual-factor model is useful in describing mental health in lifetime suicide ideations; the study found lower complete mental health than people who did not show suicide ideation - Social support, financial stability, older age, good physical health and sleep are protective modifiable factors	- There are a number of modifiable protective factors (social support, physical health and sleep) that are associated with complete mental health in suicide ideations, and can present a target for policy and interventions

							for complete mental health - Many individuals with these positive attributes who had previously considered suicide made a full recovery into complete mental health, free of suicidal thoughts	
Bariola 2017	To determine the applicability of the dual continuum model in a sample of lesbians and gay men	Cross-sectional study n = 847	Australia	Adult (general population) Age: 18-85 48% female	- Mental Health Continuum - Short Form (MHC-SF)	- Patient Health Questionnaire (PHQ-9) - Generalized Anxiety Disorder Scale (GAD-7)	- There were higher rates of generalised anxiety in females, while no gender differences in depression or positive mental health were found	- The use of a dual-factor model is appropriate for LGBT people, and can provide extra insight into ways to achieve optimal health

							- Irrespective of displaying criteria for mental illness, varying levels of positive mental health were found, providing support for the dual-factor model - General perceived health status was higher among those with complete mental health, suggesting higher adaptability than the other groups	
Bartels 2013	The present study examined the association between subjective well-being (SWB)	Cross-sectional study	Netherlands	Youth (general population) Age:	- Satisfaction with life Scale (SWLS) - Subjective Happiness Scale	- Youth Self Report (YSR)	- Substantial shared genetic influences on wellbeing and psychopathology, where genetic	- As there is a genetic overlap between subjective wellbeing and psychopathology,

	and psychopathology, and genetics, and investigated the aetiology of this association in a large cohort of twins	n = 10610		16.4(1.6) 56% female			liability of low subjective wellbeing can be indicative of a genetic liability for higher psychopathology - The commonality of heritable influences on SWB and psychopathology may lead to the identification of the vulnerable at risk groups prior to any manifestation of psychopathology	screening for wellbeing can prove to be an innovative way to address mental illness, and reach larger proportions of the population, than waiting for psychopathology to occur. - Due to the influence of non-shared influences , which is complex and construct specific, there is evidence to suggest that mental illness and mental health are not polar opposites.

								-The genetic overlap between wellbeing and psychopathology justifies the integration of prevention and promotion in the field of Mental Health, and indicates that wellbeing screening can play an important role in this process
Bohlmeijer 2015	To evaluate the effect of Acceptance and Commitment Therapy on Flourishing within the Complete	Randomised Controlled Trial n = 376	Netherlands	Adult (mental illness) Age: 18-73 70%	- Mental Health Continuum - Short Form (MHC-SF)	Center for Epidemiologic Studies Depression Scale (CES-D)	- The use of an ACT intervention improved positive mental health significantly more than the control condition	-ACT is a treatment modality that can be used to promote positive mental health in individuals with mild to moderate

	Mental Health framework			female				depressive symptoms
Diaz et al. 2017	To apply the complete state model of mental health to posttraumatic stress disorder (PTSD)	Cross-sectional study n = 69	Spain	Adult (mental illness) Age: 42.3 (12.0) 56% female	- Satisfaction With Life Scale (SWLS) - Positive Affect Scale - Psychological Wellbeing Scales (PWS) - Social Wellbeing Scales (SWS)	- Davidson Trauma Scale - Structured clinical interview for DSM-IV-TR Axis I (SCID-I)	- The absence of PTSD following traumatic event is not equivalent to the presence of health (although many victims recovered from PTSD, very few achieved complete mental health) - Positive affect, self-acceptance and positive relationships were negatively correlated to PTSD	- It is important that public aid and health care for victims of terrorist attacks are aimed at improving victim positive mental health, even if they no longer meet diagnostic criteria for PTSD, with positive affect, self-acceptance and positive relationships being potential avenues for interventions

Dowdy 2018	To test the validity of a youth social emotional distress survey, and test its appropriateness for complete mental health screening	Cross-sectional study n = 3780	United States of America	Youth (students) Age not reported, high school grades 9-12 52% female	- Brief Multidimensional Student Life Satisfaction Scale (BMSLSS) - Social Emotional Health Survey Secondary	- Social Emotional Distress Survey-Secondary (SEDS-S) - Patient Health Questionnaire Depression Scale - Generalised Anxiety Disorder Scale	- The SED-S scale appears to be a valid measure of self-reported internalising distress - Analysis indicated that SED-S is related to, but distinct from life satisfaction and positive psychological traits	- Constructs of psychopathology are related to, yet distinct from constructs of positive mental health
du Plooy 2018	To examine a broad range of factors related to migration and their links to flourishing and/or distress	Cross-sectional study n = 1446	Australia	Adult (general population) Age: 46.5 (17.9)	- Mental Health Continuum - Short Form (MHC-SF)	- Kessler psychological distress scale (K10)	- A range of factors uniquely associated with either distress or flourishing, for instance younger age and being a student was	- Factors influencing psychological distress and flourishing are sometimes similar, and sometimes

				52% female			associated with distress, but not flourishing. Identifying with the host nation (Australia), and being self-employed, was associated with flourishing but not distress. -Other factors were associated with both, including amount of time spent in the host nation and experiences of discrimination and racism	different. - Informing or guiding the implementation of policies and interventions that support flourishing may help governments to reduce overall health and social costs. This needs to be based on a thorough understanding of factors associated with flourishing, distress or both.

Eklund 2011	To explore the utility of a dual-factor model of mental health in college students	Cross-sectional study n = 246	United States of America	Adult (students) Age: 18-25 79% female	- Brief Multidimensional students' life satisfaction scale (MBSLSS) - Mental Health Continuum - Short Form (MHC-SF)	Behaviour assessment scale for children-second edition (BASC-2)	- Positive traits hope, grit, and gratitude where higher in high wellbeing group, regardless of level of psychopathology - Attention problems were most profound for the students showing symptoms of mental illness, regardless of level of wellbeing - locus of control was highest for the students without symptoms of mental illness, regardless of levels of	- Important to evaluate the presence or absence of psychological symptoms and psychological wellness to obtain a more accurate and rounded assessment of individual functioning and to guide intervention design as different groups may require different interventions

							wellbeing	
Fontana 1980	To determine the applicability of the dual-continua model in a hospitalised physically ill population and to test whether positive and negative affect are independent with unique correlates	Longitudinal observational study n = 80	United States of America	Adult (physically ill) Age: 55.7 100% male	- Bradburn's ten items for positive and negative affect	- Personal Adjustment and Role Skills scale (PARS)	-The study supports the notion that psychological impairment and psychological health are independent of one another. - When asking others, this relationship is weakened, indicating that mental health and impairment are opposites when conceived	- Both psychological impairment and psychological health should be measured, particularly when they are assessed from people's self-reports - Measurement method (e.g. self- versus other) influences the presence of a dual-factor model.

							through the eyes of others	
Franken 2018	To validate the mental health continuum short form and the dual continua model of wellbeing in a mental health care setting	Cross-sectional study n = 472	Netherlands	Adult (mentally ill) Age: 40.0 (11.6) 59% female	- Mental Health Continuum Short Form (MHC-SF)	- Outcome Questionnaire (OQ-45)	- Correlations between positive mental health and psychopathology were generally high, particularly highest in mood disorders - The study demonstrated evidence to support the validity of the dual continua model in clinical populations, specifically mood	- The dual continua model is appropriate and applicable in mental health care, despite relatively high correlations between general psychopathology and wellbeing

							disorder, anxiety disorder, personality disorder, and developmental disorder	
Fuller-Thomson 2016	To investigate factors associated with complete mental health among a nationally representative sample of Canadians with a history of depression	Cross-sectional study n = 20955	Canada	Adult (mentally ill) Age: 20-89 51% female	- Mental Health Continuum - Short Form (MHC-SF)	- Composite International Diagnostic Interview (WHO-CIDI)	- Those who had never experienced a depressive episode, after controlling for other variables, had three times higher odds of being in complete mental health. - Two in five people with a history of depression demonstrated complete mental health	- Having had depression is associated with a lower odds of showing complete mental health - It is within the grasp of many individuals who have previously had depression (2 in 5) to fully flourish and achieve complete mental health, with several modifiable

							- Several modifiable factors such as social support, smoking, substance abuse, pain, spirituality and physical activity can be improved to achieve complete mental health. - Those whose longest depression were equally likely to achieve complete mental health as those with shorted depressive episode	factors (smoking, social support, pain, spirituality and physical activity) being identified as potential areas for interventions

Furlong 2017	To examine the possible effects of mischievous response patterns on school-based screening results, in the context of the dual-factor model of mental health	Cross-sectional study n = 1857	United States of America	Youth (students) 51% female	- Brief multidimensional student's life satisfaction scale (BMSLSS)	- Strengths and Difficulties Questionnaire (SDQ)	- 2% of the sample responds mischievous - most mischievous respondents were in the symptomatic but content groups and the troubled groups, not the vulnerable groups - The greatest number of students in all groups, particularly the vulnerable and troubled groups, respond meaningful	- Universal screening will lead to meaningful data for the large majority of respondents (98%), with particularly high meaningful responses noted for the vulnerable and complete mental health group

Gilmour 2014	To examine the distribution of mental health across the complete mental health subgroups in a Canadian community sample	Cross-sectional study n = 25113	Canada	Youth and Adult (general population) Age: 15-75 51% female	- Mental Health Continuum - Short Form (MHC-SF)	- Composite International Diagnostic Interview (WHO-CIDI)	- The study found high rates of flourishing (72,5%) - Complete mental health was only moderately correlated with mental disorders, mood disorders, generalized anxiety disorder and substance disorder -Older age, being married, low socio-economic status, high spirituality, good physical health were related to complete mental health	-While the large majority displayed complete mental health, the correlations between mental illness and mental health was only moderate, supporting the dual-factor models within Canada

Grant 2013	To assess whether low well-being is a risk factor for depressive symptoms	Longitudinal observational Study n = 1621	United States of America	Adult (general population) 48% female	Mental Health Continuum - Short Form (MHC-SF)	- Patient Health Questionnaire (PHQ-9)	- Individuals with low baseline wellbeing showed significantly more increase in depression over time when dealing with a stressful period in life	- The result indicate that assessing wellbeing status can be a practical way to address future risk for developing depression.
Greenspoon 2001	To explore the validity and utility of a dual-factor approach to mental health and mental illness	Cross-sectional study n = 407	Canada	Youth (students) Age: 10.5 (0.7) 50% female	Multidimensional Students' Life Satisfaction Scale (MSLSS)	- Behaviour Assessment System for Children (BASC)	- Many group differences were observed using the dual-continua model rather than the single illness-health continuum	The dual continua model has strong application in intervention and prevention, especially in youth

Hallion 2018	To assess complete mental health in adult siblings of those with a chronic illness or disability	Cross-sectional study n = 144	Australia	Adult (students) Control group: Age: 19.0 (1.7) 51% female Siblings group: Age: 22.7 (8.0) 68% female	- Satisfaction with life scale (SWLS) - Psychological Wellbeing Scale (PWB) - Social wellbeing scale (15-item)	- Depression Anxiety Stress Scales (DASS-21)	-The study found four distinct groups in siblings with and without illness - The study did not find worse outcomes for siblings of people with a chronic condition compared to their peers - The sample showed worse findings for this student population compared to the general public	- The use of CMH model in these two populations was supported as can be witness by four distinct groups in people with and without siblings with illness

Headley 1993	To determine the dimensions of mental health (life satisfaction, positive affect, anxiety, depression) and assess the validity of widely used measures	Cross-sectional study n = 942	Australia	Adult (general population) Age: 18-65 54% female	- Life as a whole (LAW) index - Satisfaction With Life Scale (SWLS) - Fordyce 0-10 Happy Scale (1-item) - Positive Affect Scale (PAS)	- Negative Affect Scale (NAS) - State Anxiety Scale - Beck Depression Inventory (BDI) - General Health Questionnaire (GHQ-12)	- Life satisfaction, positive affect, anxiety, and depression represent four separate dimensions that should all be measured in general population surveys - There are differences in relationships between positive and negative constructs, depression and life satisfaction are strongly related (pointing more towards a single continuum) whereas life	Four dimensions of mental health and mental illness (life satisfaction, positive affect, anxiety, depression) can be included in population surveys, but need to be assessed as separate constructs, as they influence one another differently.

							satisfaction and anxiety are less strongly correlated (pointing to two dimensions) - The results might be influenced by situational factors (e.g. mood at the time) as opposed to the underlying dimensions	
Heubeck 2000	To examine the factor structure underlying adolescents' responses to the Mental Health Inventory in a sample of Australian school students	Cross-sectional study n = 878	Australia	Youth (students) Age: 14.7 (0.9) 49% female	The mental health inventory	The mental health inventory	- The study finds adequate support for the existence of a correlated two-factor model - A single factor model showed poor fit - All positively worded items	- The study found evidence of the two-factor structure of psychological wellbeing and psychological distress, as this showed better fit than a single

							formed one factor, and so did all the negative ones, which may point to the two factor structure being a result of item wording	factor model
Hu 2007	To test whether the GHQ-12 assesses both positive and negative mental health, and that these domains are independent of each other	Cross-sectional study Sample 1 n = 8978 Sample 2 n = 6451	United Kingdom	Adult (general population) Sample 1: Age: 41.7 (16.0) 53% female Sample 2: Age: 43.0 (16.4)	6 positive items of General Health Questionnaire (GHQ-12)	6 negative items of General Health Questionnaire (GHQ-12)	- Positive mental health and symptoms of mental disorder were differently associated with age (older age = lower wellbeing), unemployment, being single, not having financial strain and having good physical health. - Fewer symptoms of	-Measuring wellbeing in addition to symptoms of mental illness provides more detail to the mental health profile of individuals, and can be used in population-based research

				53% female			mental disorder were also related to being male, and neither being a single parent nor living alone	
Huppert 2003	To compare the characteristics and determinants of positive mental health and mental illness in a general population sample.	Longitudinal observational Study n = 6317	United Kingdom	Adult (general population) Age: 18-65+ Gender ratio not reported	- Positive General Health Questionnaire (POS-GHQ)	-General Health Questionnaire	- Evidence of independence of positive and negative mental health, as they show differential response patterns over time, respond different for men (but not for women). - GHQ was more related to physical health (illness and	Positive mental health and mental illness are differently influenced by demographic, health, and social factors, and need to be measured separately to form a complete picture of mental health status

							disability), lack of social support; factors which don't appear to affect wellbeing as much. Employment on the other hand, affected wellbeing more, and mental illness less	
Iasiello 2019	To investigate whether positive mental health predicts recovery from a mental illness over time	Longitudinal study n = 1723	United States of America	Adult (general population) Age not reported Gender ratio not reported	- Bradburn's scales of positive affect - Ryff's measures of psychological wellbeing - Keyes' social wellbeing	Composite International Diagnostic Interview Short Form (CIDI-SF)	Increased or maintained high levels of positive mental health predict recovery from affective disorders over a 10 year period.	- Mental health care systems should explore offering of services designed to improve positive mental health in addition to reducing mental distress. - Positive mental

								health and mental illness are separate constructs, and both should be included in the assessment of patients interacting with mental health care systems.
Jans-Beken 2017	Investigate prospective associations between gratitude and both dimensions of psychopathology and subjective wellbeing	Longitudinal observational study n = 706	Netherlands	Adult (general population) Age: 44 (14) 69% female	- Satisfaction With Life Scale (SWLS) - Positive Affect and Negative Affect Schedule (PANAS)	- Symptom Check List-90 (SCL-90)	- Gratitude is only weakly associated with lower levels of psychopathology, while staying moderately associated with higher levels of wellbeing	- Cultivating a sense of gratitude may positively influence wellbeing, regardless of current levels of psychopathology, but is less likely to reduce symptoms of psychopathology

								when they are present, which holds implications for gratitude interventions
Jiang 2018	Examine the prevalence and correlates of three mental health categories as described in dual-factor models among older Adults in China	Cross-sectional study n = 15050	China	Adult (general population) Age: 63.0 (9.3) 53% female	- WHO Quality of Life questionnaire (WHO QoL)	- International Classification of Diseases, 10th version (ICD-10) - Anxiety (single item)	- Three distinct groups were found, which were line with other studies - Correlates differed per group, with complete mental health outperforming the other groups in education, income, employment, residence and cognitive function	The study finds validation of dual-factor models within a Chinese older adult population, which holds implications for interventions (e.g. more self-realisation activities should be promoted) as complete mental health is associated with a range of protective factors

								for mental illness.
Joseph 1993	To determine whether one should view depression and happiness as opposite ends of a single continuum	Cross-sectional study n = 56	United Kingdom	Adult (students) Age: 19.0 86% female	- Oxford Happiness Inventory	- Beck Depression Inventory (BDI)	A Bi-polar measure offered better capability to capture the range of responses than a unipolar measure	Using bi-polar measures of mental health and mental illness can better explain mental health within individuals and populations
Jovanovic 2012	To explore the relations between trait curiosity and the wellbeing and psychological distress of adolescents	Cross-sectional study n = 408	Serbia	Youth (students) Age: 16.6 (0.9) 61% female	Multidimensional student's life satisfaction scale (MSLSS) - Inventory of Affect based on the Positive and Negative Affect Schedule-X (SIAB-PANAS-	- Depression Anxiety and Stress Scale (DASS-21)	- Curiosity was differentially related to positive wellbeing (high curiosity was positively related to wellbeing), and showed no relation to depression,	The results indicate that curiosity is a specific predictor of positive wellbeing, but not of psychological distress, giving support to the two-continuum model of mental

					X)		anxiety, or stress.	health and illness.
Karademas 2007	To investigate whether predictor variables differently associate with positive wellbeing and mental illness symptoms	Cross-sectional study n = 201	Greece	Adult (general population) Age: 41.6 (10.2) 57% female	-Oxford happiness inventory	- Mood and Anxiety Symptom Questionnaire – (MASQ)	- The moderate correlations between the latent variables of wellbeing and mental illness support a dual-factor model -Optimism predicted both wellbeing and mental illness - problem-solving self-efficacy and the positive approach coping strategy were positively associated with wellbeing, while life stress was	- Mental illness and wellbeing are predicted by different factors, indicating the need to select specific strategies and techniques when trying to improve either one, and to further investigate the different predictors of mental health and mental illness

							only related to mental illness	
Karas 2014	Validation of the Polish Mental Health Continuum - Short Form and verification of the two-continua model in a Polish population	Cross-sectional study n = 2115	Poland	Adult (general population) Age: 29.0 (10.6) 56% female	Mental Health Continuum-Short Form (MHC-SF) - Positive and Negative Affect Schedule – Expanded Form (PANAS-X)	- General Health Questionnaire (GHQ-28)	- The study found that a two-related-factor model showed the best fit, compared to a to a single and two-factor-unrelated model	The use of the MHC-SF in a Polish population confirms the two-continua model of mental health, where mental health and mental illness are two related but distinguishable factors

Kelly 2012	Investigate the utility of the dual factor model in youth by determining the longitudinal stability of group membership and whether social support variables predicted changes in group membership	Longitudinal observational study n = 730	United States of America	Youth (Students) Age: 11-15 51% female	- Student's life satisfaction scale - Positive and Negative Affect Scale for Children (PANAS-C)	- Self-report coping scale (34-item)	- The study found that the vulnerable group was the most transient - Those with high subjective wellbeing were more likely to show less psychopathology at the follow-up - Of students with high psychopathology, those with high SWB were more likely to improve compared to those with low SWB - Social support positively influenced improvement in	- Using a dual-factor approach allows for better insight in who improved in mental health than measures of psychopathology alone

							mental health	
Keyes 2004	Employ the complete mental health diagnosis to investigate its association with coronary artery and cardiovascular diseases in community-dwelling adults	Cross-sectional study n = 3032	United States of America	Adult (general population) Age: 25-74 51% female	- Bradburn's scales of positive affect - Ryff's measures of psychological wellbeing - Keyes' social wellbeing	Composite International Diagnostic Interview Short Form (CIDI-SF)	- Complete mental health participants has the lowest prevalence of CVD - Those with mental illness and languishing had the highest risk of cardiovascular disease - Older females who were mentally healthy had lower risks of cardiovascular	- Complete mental health can be useful for identifying risk of cardiovascular disease more accurately than either dimension alone

							disease compared to any of the other groups	
Keyes 2005	To test the relationship between measures of mental health and mental illness	Cross-sectional study n = 3032	United States of America	Adult (general population) Age: 25-74 51% female	- Bradburn's scales of positive affect - Ryff's measures of psychological wellbeing - Keyes' social wellbeing	Composite International Diagnostic Interview Short Form (CIDI-SF)	- The structure of mental health is distinct from the structure of mental illness, with a two-factor model showing a better fit than a single factor model - Complete Mental Health was associated with low helplessness and high goal setting, resilience, and intimacy	- Classifying and monitoring a population with the added dimension of WB useful as anything other than complete mental health is associated with less healthy functioning - Extant talk therapies may be useful for promoting flourishing as well as treating mental illness (due to

								association of complete mental health with low helplessness and high goals, resilience, and intimacy)
Keyes 2008	To evaluate the Mental Health Continuum-Short Form in Setswana-speaking South Africans	Cross-sectional study n = 1050	South Africa	Adult (general population) Age: 30-80+ 62% female	- Mental Health Continuum–Short Form (MHC–SF) - Affectometer 2 (10-item) - Satisfaction With Life Scale (SWLS)	- General Health Questionnaire (GHQ)	- The study found a better fit for a two-factor model than for a one factor-model - The study found adequate internal consistency for the MHC-SF (0.74)	-Study validates the use of the MHC-SF in a South-African population

Keyes 2010	To determine the prevalence of mental health and mental illness, determine its stability over time and test whether changes in mental health predict changes in mental illness	Longitudinal observational Study n = 1723	United States of America	Adult (mental illness) Age: 25-74 Gender ratio not reported	- Bradburn's scales of positive affect - Ryff's measures of psychological wellbeing - Keyes' social wellbeing	Composite International Diagnostic Interview Short Form (CIDI-SF)	- Change in positive mental health impacted rate of mental illness, with reductions from flourishing to languishing being associated with an 8.2x risk of remaining diagnosed with mental illness and going from moderate mental health to languishing being associated with a 4.4x risk over a 10 year period - Staying languishing was associated with a 6,6x odds of remaining	- Positive mental health can predict the chance of 'recovery' from depression over a 10 year period, and can therefore be targeted in prevention initiatives

							diagnosed with mental illness - The likelihood of remaining diagnosed with mental illness declined by 26% per unit of change in wellbeing	
Kim 2017	To investigate group differences in suicide resilience using the complete state model of mental health.	Cross-sectional study n = 297	South Korea	Adults (Students) Age not reported Gender ratio not reported	- Mental Health Continuum - Short Form (MHC-SF)	- Mental Disorder Inventory (MDI)	- Levels of suicide resilience corresponded to complete state model group. In those without a mental illness, the 'complete mental health' group had the highest level of suicide resilience, which declined with wellbeing.	- The results of this study suggest that both mental illness and wellbeing should be actively considered in mental health promotion.

							Similarly, in those with a mental illness, suicide resilience declined with wellbeing.	
Kim et al. 2014	To investigate the relative associations of a strength-focused measure and a symptom-focused measure on wellbeing, and determine gender differences on these associations	Cross-sectional study n = 118	United States of America	Youth (students) Age: 15.1 (1.5) 56% female	- Social emotional health survey (SEHS) - Positive and Negative Affect Scale for Children (PANAS-C) - Students' Life Satisfaction Scale (SLSS)	- Behavioural Assessment System for Children-2 (BASC-2) - Behavioural and Emotional Screening System (BESS)	- Prediction of subjective wellbeing was stronger when using both strength- and symptom-focussed measurements, compared to either separately	- Using both strength-focused and symptom-focused screening measures could help school practitioners better understand the complete mental health needs and status of all students.

Kinderman 2015	Examine whether anxiety, depression and wellbeing have different causal determinants and mediators	Cross-sectional study n = 32827	United Kingdom	Adult (general population) Age: 40.5 (14.3) 61% female	- BBC subjective wellbeing scale (BBC-SWB)	- Cambridge Neuropsychological Test Automated Battery (CANTAB) - Goldberg Anxiety and Depression scales	- Low levels of subjective well-being were related to social isolation and low levels of adaptive coping. - Mental health problems were related to negative life events and rumination - Both are influenced via a complex interplay of variables, with individual influence of the factors differing for wellbeing and mental health problems when they influenced	- The study found support for the hypothesis that wellbeing and mental illness have distinct causal pathways, with different causal factors and psychological mediators - despite the existence of a high correlation between the two - Interventions looking to improve well-being and interventions aimed at preventing or treating mental illness should be

							both	complementary but different, and should target different causal factors and pathways
Lamers 2011	To evaluate the validity of the Mental Health Continuum-Short form across the life course	Cross-sectional study n = 1662	Netherlands	Adult (general population) Age: 47.6 (17.7) 50% female	Mental Health Continuum-Short Form (MHC-SF) - Satisfaction With Life Scale (SWLS) - Positive and Negative Affect Schedule (PANAS) - Happiness (1-item)	- Brief Symptom Inventory (BSI)	- The study found the best fit for the three factors within the MHC-SF - An overarching two-continua model with correlated factors showed the best statistical fit in confirmatory factor analysis	- Mental health and mental illness are distinct indicators of mental wellbeing, instead of a single continuum - The MHC-SF is a valid tool for measuring mental health in a Dutch population

Lamers 2012	Examine whether psychopathology and positive mental health show differential associations with the Big Five personality traits	Cross-sectional study n = 1161	Netherlands	Adult (general population) Age: 18-88 50% female	- Mental Health Continuum–Short Form (MHC–SF)	Brief symptom inventory (BSI)	- The big five personality traits are differentially associated with psychopathology and positive mental health. Emotional stability is related to psychopathology while extraversion and agreeableness is associated with wellbeing - The explained variance is greater for psychopathology (19%) than for wellbeing (9%)	- The study supports a dual-factor approach and indicates that Interventions that look at alleviating psychopathology may have to focus on different underlying factors than interventions that aim at enhancing positive mental health

Lamers 2015	Investigate the relation between positive mental health and mental illness symptoms over time	Longitudinal study n = 1932	Netherlands	Adult (general population) Age: 18-65+ 52% female	- Mental Health Continuum–Short Form (MHC–SF)	Brief symptom inventory (BSI)	- The study found a strong bidirectional relationship, with both low wellbeing and mental illness being a risk factor for the development of one another over time - The association remains after controlling for baseline levels of wellbeing and mental illness; a finding that highlights the existence of two factors. -Changes over time in welbeing and mental	This study underlines the importance and usefulness of monitoring positive mental health and psychopathology over time, for instance as part of assessment and outcome monitoring practices

							illness were an even stronger predictor than absolute levels	
Lim 2014	Examine the psychometric properties of the Mental Health Continuum-SF in a Korean population, and establish the prevalence of mental health in the sample	Cross-sectional study n = 547	South Korea	Youth (Students) Age: 16.1 (0.3) 57% female	- Mental Health Continuum–Short Form (MHC–SF) - Satisfaction With Life Scale (SWLS)	- General Health Questionnaire (GHQ)	- The MHC-SF showed a best fit when a three-factor solution was used - A two correlated factor showed the best fit between positive mental health and mental disorder	The current study validates the use of the MHC-SF in a Korean population, and supports the dual-factor model of mental health

Lupano Perugini 2017	Examine the psychometrics of the Mental Health Continuum-SF in the Argentinean context, and to obtain evidence of the two-continua model	Cross-sectional study n = 1300	Argentina	Adult (general population) Age: 40.3 (13.6) 50% female	- Mental Health Continuum–Short Form (MHC–SF) - Satisfaction with Life Scale (SWLS) - Positive and Negative Affect Scale (PANAS) - Well-Being Index (WBI)	- Center for Epidemiologic Studies - Depression Scale (CES-D) - Symptom Checklist-90-Revised (SCL-90-R)	- A three dimensional model for subjective, psychological and social wellbeing showed the best fit, regardless of gender or age - Scores on the MHC-SF were positively correlated to wellbeing indices and negatively to mental illness indices, supporting the dual-factor models	The current study validates the use of the MHC-SF in an Argentinian population, and supports the dual-factor model of mental health

Lyons 2012	Examine the contributions of personality, environmental, and perceived social support variables in classifying adolescents using a dual-factor model of mental health	Cross-sectional study n = 990	United States of America	Youth (students) Age: 14.6 (2.1) 64% female	- Students' Life Satisfaction Scale (SLSS)	- Youth self-report of the child behaviour checklist (YSR)	The four distinct groups as proposed by dual-factor models emerged, with personality and social support factors influencing each group differently - Extraversion and neuroticism were linked to the two psychopathology groups, but not with the vulnerable group - Parental social support contributed to vulnerable and troubled groups, while other social support did not	- interventions aimed at targeting student's mental health need to take antecedents into account depending on the four groups, the susceptibility to change of these antecedents (social support is for instance more likely to change than personality), and the magnitude of the effect of these antecedents

							differ between groups - Acute stressful life events predict being in the troubled group	
Lyons 2013	Determine the usefulness of the dual-factor model in adolescents, and its relationship to academic performance and student engagement	Longitudinal study n = 1809	United States of America	Youth (students) Age: 12.7 (0.7) 52% female	- Students' Life Satisfaction Scale (SLSS) - Positive and Negative Affect Scale for Children (PANAS-C)	Self-Report Coping Scale (SRCS)	- The four distinct groups performed differently on GPA and student engagement - The participants with low wellbeing but without mental illness showed less emotional engagement and a bigger decline in GPA than those with complete mental health	Professionals should consider a student's level of positive mental health, as it can aid in monitoring a potential area of risk that can affect GPA and student engagement

Macaskill 2012	To measure the relationship between strengths, wellbeing and coping mechanisms in individuals living with recurrent depression, and assess the usefulness of strengths assessment within psychological assessment	Mixed methods n = 112	United Kingdom	Adult (mental illness) Age: 41.3 (11.2) 24% female	- Satisfaction With life Scale (SWLS) - Positive and Negative Affect Schedule (PANAS)	- Short Depression-Happiness Scale	- Strength assessment was considered useful and helpful as a complement to traditional psychological assessment	- Integrating strengths within psychological assessment may transform how patients suffering from recurrent depression see themselves and the satisfaction with assessment, as well as how they view life after depression

Macaskill 2014	To examine the relationship of character strengths with mental illness and wellbeing	Cross-sectional study n = 214	United Kingdom	Adult (students) Age: 19.1 (3.3) 79% female	- Satisfaction With life Scale (SWLS) - Positive and Negative Affect Schedule (PANAS)	- General Health Questionnaire (GHQ-28)	- There were no differences between GHQ case and non-case students found on life satisfaction and positive affect scores, supporting a dual-factor model - There were differences in positive and negative affect between case and non-case students, indicating to the importance of addressing them separately in clinical practice -Character strengths were	- Character strengths are resources that therapists can use to build positive mental health in individuals with and without mental illness

							generally equally important for case and non-case students	
Magalhaes 2017	Explore the use of a dual-factor model in youth mental care and study group differences as determined by the dual-factor model in relation to a set of social support components and resources	Cross-sectional study n = 369	Portugal	Youth (general population) Age: 14.7 (1.8) 46% female	- Satisfaction With life Scale (SWLS) - Scales of Psychological wellbeing	- Reynolds adolescent adjustment screening inventory (RAASI)	- confirmatory factor analysis supports a better fit of a two-dimensional model compared to a one-dimensional model - There were group differences in social support, with the complete mental health group showing better results on	- This study supports the need to implement, monitor and evaluate interventions tailored to the youth's needs, taking into account their positive mental health as well as their psychological difficulties needs,

							social support dimensions, and the troubled group showing worst results - The promotion of protective factors (e.g. significant and supportive relationships) can contribute to higher levels of positive mental health	and not one or the other
Masse 1998	To investigate whether psychological distress and subjective wellbeing are the opposite poles of the same axis of	Cross-sectional study n = 398	Canada	Youth and Adult (general population) Age: 15-65+	- Well-Being Manifestations Measure Scale (WBMMS)	- Distress Manifestations Measure Scale (DMMS)	- The best model features a structure of psychological distress and wellbeing as two correlated dimensions reflecting a	- Assessments of mental health in the general population provide a better explanation of mental health when using measures on

	mental health, or independent constructs			52% female			higher order construct of mental health.	wellbeing and psychological distress
Olszewski 2012	To use the complete model of mental health to study group differences in applied ways of coping with stress	Cross-sectional study n = 74	Poland	Adult (students) Age: 22-44 Gender ratio not reported	- Satisfaction with Life Scale (SWLS)	- State-Trait Anxiety Inventory	- Two groups were identified, those with high anxiety and average life satisfaction, and those with above average life satisfaction and lower than average anxiety. - Participants in these groups responded differently to the COPE scale	NA

Payton 2009	To investigate the relationship between positive mental health, mental illness, and psychological distress	Cross-sectional study n = 4242	United States of America	Adult Age: 25-74 Gender ratio not reported	- Ryff's Scales of Psychological Wellbeing	Disorder - composite diagnosis of depression, anxiety, or panic attack Distress - composite of symptom items to measure mood and malaise	- Diagnosis of mental illness, positive mental health, and psychological distress are distinct, and should not be directly contrasted	- Conflating distress, disorder, and mental health likely obscures important underlying variation, therefore these variables should be measured separately
Peter 2018	To investigate the dual-factor model within a large-scale group of gays and lesbians, and their heterosexual counterparts	Cross-sectional study n = 25113	Canada	Adult (general population) Age: 45.7 51% female	- Mental Health Continuum - Short Form (MHC-SF)	- World Health Organisation World Mental Health-Composite International Diagnostic Interview (WMH-CIDI) criteria	- LGB individuals had less positive mental health and more mental illness than heterosexual counterparts - There were differing proportions in each of the four groups for LGB	- Using a dual-continua model aids in better identification of high-risk individuals, beyond what is found using a single continuum, as simply being free of mental illness does not

							compared to heterosexual counterparts - There were differences between the type of mental illness and the level of positive mental health experienced	guarantee optimal mental health, and levels of positive mental health differ depending on the mental illness diagnosis of the client
Petrillo 2015	Validation of the Italian MHC-SF and verification of the dual-factor model	Cross-sectional study n = 1438	Italy	Adult (general population) Age: 47.1 (19.6) 52% female	- Mental Health Continuum - Short Form (MHC-SF) - Satisfaction With life Scale (SWLS) - Positive and Negative Affect Schedule (PANAS)	- General Health Questionnaire (GHQ-12) - Center for Epidemiologic Studies Depression Scale (CED-D)	- The MHC-SF factor structure was replicated in this Italian sample and showed good psychometric properties	The MHC-SF is validated for use in Italian populations

Pruchno 1995	Examine the effects that caregiving has on the positive and negative mental health of multiple caregivers, their husbands and the co-resident children, and determine whether differential predictors for both exist in these groups	Cross-sectional study n = 140	United States of America	Adult (carers) Age: 49.4 (range 33-67) 100% female	- Positive Affect Scale of the Bradburn's Affect Balance Scale	- Center for Epidemiologic Studies Depression Scale (CES-D)	- Poorer physical health and greater negative appraisals were predictors of depression, while predictors of positive affect were less consistent in the population	- The study found differential predictors for positive mental health and negative mental health, with predictors differing for males and females, highlighting the importance of addressing different factors when targeting positive mental health and mental illness

Pruchno 1996	To investigate the relationship between positive and negative wellbeing and their differential predictors in a group of carers	Cross-sectional study n = 838	United States of America	Adult (carers) Age: 65.2 100% female	-Life Satisfaction Index A (LSIA) -Bradburn's Affect Balance Scale	- Center for Epidemiologic Studies Depression Scale (CES-D)	- A two factor model was confirmed with different predictors being associated with negative and positive mental health: positive appraisals were uniquely predictive of positive mental health, while child maladaptive behaviour was a unique predictor of negative mental health. - Some predictors, e.g. negative appraisal of the caregiving role and physical	- The study highlights the importance of discovering common and differential predictors of positive and negative mental health, and the study implications this has for potential treatment and prevention opportunities

							health, were predictive of both positive and negative mental health	

Renshaw 2014a	Investigate between-group differences of complete mental health across three key indicators of college student functioning (academic achievement, interpersonal connectedness, and physical health)	Cross-sectional study n = 1356	United States of America	Adult (students) Age: 19.2 (2.0) 65% female	- 10-item Life Satisfaction subscale of the Quality of Life Interview, Brief Version (QOL-BV)	- Brief Symptom Inventory-18 (BSI-18)	- Four distinct groups, as postulated by the dual factor model, could be noted in the data set - Life satisfaction provides additive value in predicting life-functioning across interpersonal, physical health, and academic achievement domains (when considered in conjunction with psychological distress indicators)	- Mental health work undertaken with college students would benefit from consideration of life satisfaction as a complement to traditional indicators of psychological distress, as it can aid in prediction of student achievement

Renshaw 2016	Investigate the concurrent validity of a duel-factor model using two analytic approaches, categorical and continuous	Cross-sectional study n = 951	United States of America	Adult (students) Age: 20.0 (1.6) 72-75% female	- Satisfaction With life Scale (SWLS) - Positive and Negative Affect Schedule (PANAS)	- Depression Anxiety Stress Scale (DASS-21) - UCLA Loneliness Scale	- Using a categorical approach to classifying mental health and illness, a dual-factor model shows the best fit - Using a continuous approach to classifying mental health and illness, a unidimensional wellbeing model showed a better fit, than a bi-dimensional model or a Uni-dimensional distress model	- Categorical or continuous approaches to operationalising mental health and mental illness can lead to different results, and more research into assessment methods is required - Categorical assessment is currently mostly used in practice, thereby validating the dual-factor approach for current mental health practice

Renshaw 2018	To validate the Psychological Wellbeing and Distress Screener in a Turkish population, and confirm the measure's dual-continua structure.	Cross-sectional study n = 399	Turkey	Youth (students) Age: 13.9 (1.6) 49% female	Psychological Wellbeing and Distress Screener (PWDS)	Psychological Wellbeing and Distress Screener (PWDS)	- The wellbeing and distress scales of the PWDS best fit the dual-continua model - Both scales significantly predicted positive affect, negative affect, and school support, yet only the wellbeing scale was a significant predictor of family support and peer support	- Measures of mental illness and wellbeing differentially predict variables related to desirable educational outcomes.
Rose 2017b	Identify mental health groups of African American youth and explore the association	Cross-sectional study	United States of America	Youth (students) Age: 15.0 (1.4)	Life satisfaction (Single item)	- Center for Epidemiologic Studies Depression Scale (CES-D) - WMH-CIDI	- The study found four distinct groups as demonstrated by using a dual-factor approach	- Dual factor is useful to more comprehensively assess mental health of school-going youth, as

	between the resulting classes and demographic and educational experiences	n = 1170		52% female			to mental health - Those demonstrating complete mental health had higher correlations with particularly school bonding, but also less suspensions and grade retention	can provide a more detailed insight into the associations of important factors such as school bonding (belonging) with mental health
Schönfeld 2016	Investigate the potential mediation effects of general self-efficacy on positive and negative mental health	Cross-sectional study n = 10698	Germany, China, Russia	Adult (students) Age: 21-26 47-69% female	Positive mental health scale (PMH)	- Depression Anxiety Stress Scale (DASS-21)	- Perceived self-efficacy mediated the effect of stress on positive mental health and mental illness, but significant differences were found such that larger effects were seen for positive mental	- Protective factors such as self-efficacy exert different influences on positive mental health and negative mental health in the context of stress-negating processes of daily life

							health. - These results were replicated in all three student samples	- Due to the changeable nature of self-efficacy and its significant (but different) role in both positive and negative mental health, it constitutes an important target for treatment and prevention to reduce the effect of stress on health
Schonfeld 2017	To compare indicators of complete mental health across the lifespan in different countries	Cross-sectional study n = 6303	Germany, Russia, United States of America	Adult (general population) 51-55% female	Positive mental health scale (PMH)	- Depression Anxiety Stress Scale (DASS-21)	- Older Russians experience more negative mental health, while German and American older adults experience more positive	- Complete mental health, resilience, and social support across the lifespan varies substantially, and may be

							mental health - Similarly, differences in levels of depression, anxiety and resilience were found in the three cohorts indicating a potential effect of economic and social circumstances between nations on both indicators	influenced by the particular economic and social circumstances a nation is exposed to.
Seow 2016	Determine levels of positive mental health in an Asian outpatient population, establish its correlates and investigate	Cross-sectional study n = 218	Singapore	Adults (mental illness) Age: 38.4 (11.7) 49% female	- Positive mental health instrument - Satisfaction With life Scale (SWLS)	- Generalized Anxiety Disorder 7 (GAD-7) - Patient Health Questionnaire (PHQ-9)	- Levels of positive mental health in this affective disorder outpatient group in a non-Western population varied - Sociodemographi	- It is important to explore the level and determinants of PMH among individuals with mental illness so that clinicians and health professionals can

	whether higher levels of positive mental health would be associated with better life satisfaction and general functioning in this population						c variables influence positive mental health: young age and early onset of illness was associated with lower positive mental health	formulate targeted wellbeing interventions in the treatment and rehabilitation of those individuals within clinical settings. This is particularly relevant for younger patients and those with early onset of illness as these display lower levels of positive mental health
Shaffer-Hudkins 2010	To test whether positive mental health and mental illness associate	Cross-sectional study	United States of America	Youth (students) Age: 12.96	- Students' Life Satisfaction Scale (SLSS) - Positive and Negative Affect	- Youth Self Report form of the Child Behaviour Checklist (YSR)		

	differently with various physical health indicators	n = 401		(1.0) 60% female	Scale for Children (PANAS-C)			
Smith 1996	To examine the usefulness of a two-factor model in predicting caregiving outcomes for older mothers providing care to offspring with mental retardation	Cross-sectional study n = 235	United States of America	Adult (carers) Age: 70.3 100% female	Ego-integrity subscale from the ego adjustment scale (10-item)	Negative affect scale of the affect balance scale (5-item)	- Wellbeing reduced negative mental health via decreasing perceived caregiver burden	- Positive caregiving appraisals are an essential aspect of any comprehensive theory of caregiver wellbeing, which can be influenced by improving positive mental health

Spinhoven 2015	Examine whether participants with higher symptom levels of a current or past emotional disorder report to be less happy than controls and to assess whether measurements of extraversion and neuroticism predict future happiness independent of measurements of emotional disorder or symptom severity	Longitudinal observational study n = 2142	Netherlands	Adult (mental illness) Age: 48.2 (13.1) 66% female	- Self-rating of Happiness scale (1-item) - Mood and Anxiety Symptom Questionnaire-Shortened Dutch Version (MASQ-D30; 30-item)	- Composite Interview Diagnostic Instrument (CIDI) - Inventory of Depressive symptomatology self-report (IDS-SR)	- happiness and emotional wellbeing were most strongly related to depressive disorders and to social anxiety disorder - relationships to generalised anxiety disorder, panic disorder and agoraphobia were much smaller - Personality factors, specifically extraversion, contribute to wellbeing, even after controlling for emotional disorder and	- Wellbeing levels differ per affective disorder type and personality type influences happiness and emotional wellbeing independently of psychological disorder or symptom severity, pointing to the utility of accounting for personality factors when trying to address wellbeing and happiness in people with and without mental illness

							symptom severity	
Suldo 2008, 2011	Examine whether student's initial levels of subjective wellbeing and psychopatholog y predict school performance one year later	Longitudinal observation al study n = 341	United States of America	Youth (students) Age: 13.0 (1.0) 59% female	- Students life satisfaction scale - Positive and Negative Affect Schedule for Children (PANAS-C)	Youth self-report form of the child behaviour checklist (YSR)	- Students with low psychopathology and moderate to high wellbeing had least deterioration of academic scores, including reading skills, attendance rates, academic self-perceptions and goals, and social support from classmates and parents	- the absence of mental illness is not sufficient to guarantee optimal academic achievement - This supports the collection of information regarding student's SWB in order to provide a more complete understanding of student's mental health as well as

							- Mean academic performance of vulnerable students was similar to that of troubled students, highlighting that psychopathology increases risk of underachieveme nt - Those with mental illness but high wellbeing had better physical health and social functioning	academic functioning
Suldo 2015	Examine the influence of peer behaviour on indicators of mental health	Cross-sectional study	United States of America	Youth (students) Age: 15.3 (1.0)	- Students life satisfaction scale - Positive and Negative Affect	Self-report of personality form of the Behaviour Assessment System for	-Positive peer relations resulted mainly in greater positive mental health, being life	Positive and negative peer relations and its associated behaviours

	and psychopathology	n = 500		59% female	Schedule for Children (PANAS-C)	Children, Second Edition (BASC-2)	satisfaction and positive affect, as opposed to psychopathology - Negative peer behaviours mainly influenced psychopathology and negative affect	influence positive mental health and mental illness differently
Suldo 2016	Determine the proportion of students in each quadrant of the dual-factor model and examine how mental health, defined in a dual-factor model, relates to adjustment, social adjustment,	Cross-sectional study n = 500	United States of America	Youth (students) Age: 15.3 (1.0) 59% female	- Students life satisfaction scale - Positive and Negative Affect Schedule for Children (PANAS-C)	Self-report of personality form of the Behaviour Assessment System for Children, Second Edition (BASC-2)	- The study found four distinct groups as indicated in the dual-factor model in this student population - The groups differ in academic attitudes, social adjustment, identity development, and physical	- Complete mental health, validated in this study, aligns with community approach to prevention, treatment, and promotion of wellbeing in youth, and can help schools determine allocation of

	identify development, and physical health.						health, with high positive mental health being associated with a lower likelihood of problems in developmental outcomes	efforts and resources: the most intense services should be reserved for troubled students, who require both reduction in psychopathology and increases in SWB.
Teismann 2017	Determine the proportion of participants who demonstrate suicide ideation and positive mental health, and examine whether the presence of positive mental health	Cross-sectional study n = 282	Germany	Adult (Mental illness) Sample 1: Age: 43.0 (12.1) 54% female Sample 2:	Positive Mental Health Scale (9-item)	- Depressive Symptom Inventory - Suicidality subscale (DCI-SS) - Suicidal behaviours questionnaire - revised (SBQ-R)	- The study could clearly find four distinct groups based on the dual-factor theories - Suicide behaviour was different between groups, with less suicide attempts in suicide	- the Complete state model is useful for identifying risk profiles for suicide ideations

	influences suicide behaviour			Age: 37.9 (12.8) 71% female			ideations that have moderate to high positive mental health	
Tomba 2014	To assess psychological well-being in out-patients with eating disorders and in controls.	Cross-sectional study n = 245	Italy	Youth and Adult (mental illness) Age: 28.3 (9.7) 96% female	- Psychological Wellbeing Scales	- General Health Questionnaire (GHQ)	Impaired levels of psychological wellbeing were independent from the presence of psychopathology, and differed per specific eating disorder diagnosis	- Results support the need to assess psychological wellbeing in outpatients with eating disorders, as it can share a more detailed view on mental health of eating disorder patients

Trompetter 2017	Investigate the impact of Acceptance and Commitment Therapy on depression or anxiety symptoms and positive mental health	Randomised Controlled Trial n = 250	Netherlands	Adult (mental illness) Age: 45.5 (11.0) 70% female	Mental Health Continuum - Short Form	- Center for Epidemiologic Studies Depression Scale (CES-D) - Hospital Anxiety and Depression Scale (HADS)	- Baseline level of and change in positive mental health moderately predicted effectiveness on depression/anxiety - Baseline level of and change in depression/anxiety moderately predicted effectiveness on positive mental health - Two thirds of participants improved on either positive mental health or depression/anxiety, not both	- the differential effect of ACT on positive mental health and mental illness, and the fact that response differs for patients, indicates that practitioners benefit from monitoring and working on and monitoring both when treating their patients. - using one treatment method may not necessarily mean that patients can achieve complete mental health as interventions, for a substantial

								group of participants, are only effective on one dimension - Systematically implementing measurements of both psychopathology and positive mental health will facilitate better informed decisions about the continuation and focus of patients' in mental health treatment.

van Erp Taalman Kip 2018	Examine whether emotional, psychological and social wellbeing are apparent in a tripartite structure, and test whether wellbeing is moderately correlated with mental illness symptoms in a mental health care sample	Cross-sectional study n = 1069	Netherlands	Adult (mental illness) Age: 47.6 (17.7) 63% female	Mental Health Continuum - Short Form	Outcome Questionnaire (OQ-45)	- Mental health patients do not display a tripartite structure for wellbeing - A two-factor model explained a good fit, but the wellbeing components only explained little variance - If factor independency is a pre-requisite, a single factor structure would be the best fit	- Mental illness and mental health are highly correlated in patients with high levels of mental illness - Therefore CMH may be a useful metaphor for recovery only, or for participants who are not mentally ill

Veit 1983	To describe the development of the Mental Health Inventory (MHI) and investigate the factor structure between psychological distress and wellbeing	Cross-sectional study n = 5089	United States of America	Youth and Adult (general population) Age: 13-69 54% female	- Mental health Inventory	- Mental health Inventory	- A large mental health factor underlies the mental health index , with two underlying factors for wellbeing and psychological distress - Reliance on a single score (psychological wellbeing or illness) is associated with a significant loss of information - Positive items clustered together to define psychological wellbeing and items describing negative states clustered	- The developed tool measures two distinct factors of mental health, being wellbeing and psychological distress

							together to define psychological distress - A total of 5 underlying factors influence wellbeing (positive affect, emotional ties) and psychological distress (anxiety, depression, loss of control)	
Vela 2016	Examine whether meaning in life, hope, mindfulness, and grit influence student life satisfaction and depression	Cross-sectional study n = 130	United States of America	Adult (students) Age: 20.2 (3.3) 62% female	Satisfaction With Life Scale (SWLS)	- Center for Epidemiologic Studies Depression Scale (CES-D)	- Presence of meaning in life, mindfulness and hope were related to life satisfaction - mindfulness and search for meaning in life were associated	Different traits associated with positive psychology differentially predict life satisfaction and mental illness, which holds implications for

							with depression - Different individual strengths influence life satisfaction and depression	intervention developers and practitioners
Venning 2013b	Determine the prevalence and distribution of complete mental health states in young Australians, and investigate the association of these states to health-risk behaviours	Cross-sectional study n = 3913	Australia	Youth (students) Age: 13-17 52% female	Satisfaction With Life Scale (SWLS) Psychological Wellbeing Scale Social Wellbeing Scale	Depression Anxiety Stress Scale (DASS-21)	Participants who had high wellbeing and no mental illness (42%) engaged less in health-risk behaviours such as smoking or consuming alcohol, compared to other groups	Measuring both mental illness and mental health can discover groups that previously may have gone unnoticed; groups who show differences in health-risk behaviour taking

Weich 2011	To describe mental wellbeing in a general population sample and to test whether indicators of wellbeing, health status, income and employment status are independent from mental illness	Cross-sectional study n = 7461	United Kingdom	Adult (general population) Age: 50.5 (18.4) 58% female	- 9 single item questions related to wellbeing	Clinical Interview Schedule (CIS-R)	- Wellbeing and mental illness are correlated but independent factors - Eudemonic and hedonic wellbeing are distinct but related components of wellbeing	The paper demonstrates evidence of the interrelation but independence of mental illness and mental health in an English population
Westerhof 2010	To study age differences in mental health and mental illness, and determine age differences in being completely mental healthy	Cross-sectional analysis of one time-point in longitudinal study	Netherlands	Adult (general population) Age: 48.32 (17.7) 50%	Mental Health Continuum - Short Form (MHC-SF)	Brief Symptom Inventory (BSI)	- older adults experience similar amounts of mental health as younger adults, as slight differences could be explained by age-related differences in life	This study did not find a clear relationship between age and level of mental health (flourishing), but did find differences in mental illness,

	(flourishing and no mental illness) and mentally ill (languishing and mental illness)	n = 1340		female			circumstances - Younger adults do show more mental illness, but have no less mental health than older adults	highlighting the usefulness of the dual-factor model in assessment of mental health status in adults
Westerhof 2013	To analyse the components of complete mental health with sociodemographic variables over time	Longitudinal study n = 1340	Netherlands	Adult (general population) Age: 48.3 (17.7) 50% female	Mental Health Continuum - Short Form (MHC-SF)	Brief Symptom Inventory (BSI)	- Sociodemographic variables hold different relations with different indicators of mental illness and mental health; relations that are remarkably stable across time, - The exceptions to this stability were age and educational level, showing distinct	-Public mental health care is best served by a differentiated approach in the treatment and prevention of mental illness, as well as by the promotion and protection of mental health. Such a differentiated approach should be tailored to groups with

							time trajectories for the different indicators of mental health and illness.	different socio-demographic backgrounds.
Wilkinson 1998	To verify that, in adolescents, psychological health can be viewed as being comprised of two dimensions: wellbeing and distress	Cross-sectional study n = 345	Australia	Youth (students) Age: 17.1 (0.7) 79% female	- Satisfaction With Life Scale (SWLS) - Happiness Thermometer (1-item) - Positive and Negative Affect Schedule (PANAS)	- State-Trait Anxiety Inventory - Center for Epidemiologic Studies Depression Scale (CES-D)	The study found support for the two-factor model over a single factor model in this adolescent population, although the results were less profound when comparing results to adults - Anxiety and negative mood were indicators of psychological distress, while happiness, life satisfaction and	While a two-factor model worked in this adolescent population, the fit was less than what is witnessed in adult populations, thereby indicating that assessment may need to take each into account

							positive affect were indicators of wellbeing	
Winzer 2014	To investigate the existence of the dual-continua model in a Swedish sample, and explore its associations with demographic, social and health factors.	Longitudinal observational Study n = 23394	Sweden	Adult (general population) Age: 16-29 56% female	Positive Items of the General Health Questionnaire (GHQ-12)	Negative Items of the General Health Questionnaire (GHQ-12)	An exploratory and conformational factor analysis found support for a two-factor model. Predictors for positive and negative mental health were "mirrored", which points to a one-factor model.	- Measurement of two dimensions of mental health need to use instruments specifically adapted for this purpose, instead of using measurement tools that are designed to measure just one construct (e.g. mental illness) - Work needs to be done to identify specific

								theoretical predictors that are linked to positive mental health rather than ill-health
Wood 2010	To test whether people low in wellbeing are at risk for having clinically elevated levels of depression ten years later	Longitudinal observational Study n = 5566	United States of America	Adult (general population) Age: 51-56 55% female	- Scales of Psychological Wellbeing	-Centre for Epidemiologic Studies Depression (CES-D)	- People with low levels of positive wellbeing have a 7.2x higher risk of being depressed 10 years later, which remained 2.2x higher when controlling for other baseline predictors	- As low wellbeing predicts future depression, it becomes important to understanding its relationship with mental disorder, and supports the notion that addressing wellbeing as a means of preventing and treating depression is warranted

Xiong 2017	To verify the dual-factor model in a Chinese population, investigate differences in self-efficacy beliefs and academic emotions in the four different dual factor model groups, and determine the stability and dynamics of mental health status for each group	Longitudinal observational study n = 1293	China	Youth (students) Age: 14.7 (1.9) 47% female	- Satisfaction With Life Scale (SWLS) - Positive and Negative Affect Schedule (PANAS)	- Youth Self Report form of the child behaviour checklist	The different dual-factor model groups demonstrated different scores for self-efficacy and academic emotions, and different groups showed different stability in mental health over time. Most notably the vulnerable group showed high transition rates into other quadrants, pointing to the importance of targeting interventions at this group	- This measurement approach can assist school psychologists and others engaged in psychological service to children in schools target those most at risk to proactively prevent problems - Those with low subjective wellbeing and psychology are most transient and therefore may require particular attention from health providers to ensure the

								likelihood of positive change
Yoo 2018	To test the existence of the dual-continuum model and to examine the relationship between positive and negative mental health and a range of different predictors of	Cross-sectional study n = 471	South Korea	Youth (students) Age: 17.9 (0.4) 50% female	- Korean Child Wellbeing Index	- Reynold's Suicidal Ideation Questionnaire (SIQ)	- The dual-continuum model was supported as the data fit a two-factor correlated model rather than a single-factor model - Positive mental health and negative mental health	- The dual continuum model can be used to better inform theory-based interventions. The model provides greater insights into which interventions are likely to improve

	positive youth outcomes						differentially predicted variables related to mental health, most notably peer and parent relationships, self-work, and emotion-focused coping.	well-being or reduce mental illness.

Appendix 2: Supplementary material from Chapter 5

Table 17 Summary of factor analysis protocols and data source of included studies

		Factor Analysis		
Study	Data Source	Estimation method	Models tested	Model supported
Carvalho 2016 - sample 1	-	Robust maximum likelihood	CFA: Tripartite model	CFA: Tripartite model
Carvalho 2016 - sample 2	-	Robust maximum likelihood	CFA: Tripartite model	CFA: Tripartite model
de Bruin 2015	-	-	CFA: Single factor model, Tripartite model, and Bifactor model	CFA: Bifactor model
Donnelly 2019*	Provided by author	-	CFA: Single factor model, Two factor model, and Tripartite model	CFA: Tripartite model
Doré 2017*	Provided by author	Robust maximum likelihood method with the Satorra–Bentler chi-square	CFA: Single factor model, Two factor model, Tripartite model, and Hierarchical model	CFA: Tripartite model and Hierarchical model fit equally well
Echeverria 2017	-	Weighted least squares estimator	CFA: Single factor model, Two factor model, Tripartite model, and Bifactor model	CFA: Bifactor model

Ferentinos 2019* - sample 1	Provided by author	Robust maximum likelihood	CFA: Single factor model, Two factor model, Tripartite model, Bifactor model, and Four orthogonal factors ESEM: Tripartite model, and Bifactor model	ESEM: Bifactor model
Ferentinos 2019* - sample 2	Provided by author	Robust maximum likelihood	CFA: Single factor model, Two factor model, Tripartite model, Bifactor model, and Four orthogonal factors ESEM: Tripartite model, and Bifactor model	ESEM: Bifactor model
Franken 2018*	Provided by author	Robust maximum likelihood	CFA: Single factor model, Two factor model, and Tripartite model	CFA: Tripartite model
Fonte 2020		Maximum likelihood	CFA: Tripartite model	CFA: Tripartite model
Guo 2015	-	Maximum likelihood	CFA: Single factor model, Two factor model, and Tripartite model	CFA: Tripartite model
Hides 2016	-	nr	CFA: Single factor model, Tripartite model,	CFA: Bifactor model

			and Bifactor model	
Joshanloo 2013 - sample 1	-	Maximum likelihood	CFA: Tripartite model	NA
Joshanloo 2013 - sample 2	-	Maximum likelihood	CFA: Tripartite model	NA
Joshanloo 2013 - sample 3	-	Maximum likelihood	CFA: Tripartite model	NA
Joshanloo 2016a* - sample 1	Imputed	CFA: Maximum likelihood ESEM: Maximum likelihood with oblique geomin rotation	CFA: Tripartite model ESEM: Tripartite model	ESEM: Tripartite model
Joshanloo 2016a* - sample 2	Imputed	CFA: Maximum likelihood ESEM: Maximum likelihood with oblique geomin rotation	CFA: Tripartite model ESEM: Tripartite model	ESEM: Tripartite model
Joshanloo 2017a*	Imputed	CFA: Robust max-imum likelihood ESEM: Oblique geomin rotation	CFA: Single factor model, and Tripartite model ESEM: Tripartite model	ESEM: Tripartite model
Joshanloo 2017b*	Imputed	CFA: Robust max-imum likelihood ESEM: Oblique geomin rotation	CFA: Tripartite model ESEM: Tripartite model	ESEM: Tripartite model

Joshanloo 2017c*	Imputed	CFA: Robust max-imum likelihood ESEM: Oblique geomin rotation	CFA: Single factor model, Two factor model, and Tripartite model ESEM: Single factor model, Two factor model, and Tripartite model	ESEM: Tripartite model
Joshanloo 2017d* - sample 1	Imputed	CFA: Robust max-imum likelihood ESEM: Oblique geomin rotation	CFA: Tripartite model ESEM: Tripartite model	ESEM: Tripartite model
Joshanloo 2017d* - sample 2	Imputed	CFA: Robust max-imum likelihood ESEM: Oblique geomin rotation	CFA: Tripartite model ESEM: Tripartite model	ESEM: Tripartite model
Joshanloo 2017e*	Imputed	CFA: Robust max-imum likelihood ESEM: Oblique geomin rotation	CFA: Single factor model, Two factor model, and Tripartite model ESEM: Single factor model, Two factor model, and Tripartite model	ESEM: Tripartite model
Jovanovic 2015* - sample 1	Provided by author	Robust maximum likelihood method with the Satorra–Bentler chi-square	CFA: Single factor model, Two factor model, Tripartite model, Hierarchical model, and Bifactor model	CFA: Bifactor

Jovanovic 2015* - sample 2	Provided by author	Robust maximum likelihood method with the Satorra–Bentler chi-square	CFA: Single factor model, Two factor model, Tripartite model, Hierarchical model, and Bifactor model	CFA: Bifactor
Karaś 2014*	Provided by author	nr	CFA: Tripartite model	NA
Kennes 2020*	Provided by author	Maximum likelihood	CFA: Single factor model, Two factor model, and Tripartite model	CFA: Tripartite model
Keyes 2008	-	Maximum likelihood	CFA: Single factor model, Two factor model, and Tripartite model	CFA: Tripartite model
Khumalo 2011	-	nr	ESEM: Single factor model, Two factor model, and Tripartite model	ESEM: Tripartite model
Lamborn 2018*	Reported in study		CFA: Single factor model, Two factor model, Tripartite model, and Bifactor model ESEM: Tripartite model, and Bifactor model	ESEM: Bifactor model
Lamers 2011* Joshanloo 2016c	Provided by author	Robust maximum likelihood	CFA: Single factor model, Two factor model, and	CFA: Tripartite model

			Tripartite model	
Lim 2014	-	Robust maximum likelihood	CFA: Single factor model, Two factor model, and Tripartite model	CFA: Tripartite model
Longo 2017	-	CFA: Maximum likelihood ESEM: Target rotation	CFA: Tripartite model, and Bifactor model ESEM: Tripartite model, and Bifactor model	ESEM: Tripartite model
Luijten 2019	Provided by author	Robust maximum likelihood	CFA: Single factor model, Two factor model, and Tripartite model	CFA: Tripartite model
Lupano Perugini 2017*	Provided by author	Robust maximum likelihood	CFA: Single factor model, Two factor model, Tripartite model, and Hierarchical model	CFA: Tripartite model
Machado 2015	-	Weighted Least Squares Mean- and Variance-adjusted (WLSMV) method	ESEM: Single factor model, Two factor model, Tripartite model, and Bifactor model	ESEM: Bifactor model
Monteiro 2020*	Provided by author	Maximum likelihood	CFA: Single factor model, Tripartite model, and Bifactor model	CFA: Bifactor model

Orpana 2017	-	robust maximum likelihood	CFA: Single factor model, and Tripartite model	CFA: Tripartite model
Petrillo 2015	-	Maximum likelihood estimation	CFA: Single factor model, Two factor model, Tripartite model, and Hierarchical model	CFA: Tripartite model
Rafiey 2017	-	Maximum likelihood estimation	CFA: Tripartite model	NA
Reinhardt 2020*	Provided by author		CFA: Single factor model, Two factor model, Tripartite model, and Bifactor model ESEM: Single factor model, Two factor model, Tripartite model, and Bifactor model	ESEM: Bifactor model
Rogoza 2018*	Provided by author	Robust maximum likelihood estimation	CFA: One factor model, Tripartite model, and Bifactor model ESEM: One factor model, Tripartite model, and Bifactor model	ESEM: Bifactor model
Salama-Younes	-	NR	CFA: Single factor model, Two	CFA: Tripartite

2011			factor model, and Tripartite model	model
Salama-Younes 2011a	-	NR	CFA: Single factor model, Two factor model, and Tripartite model	CFA: Tripartite model
Santini 2020*	Provided by author	Unweighted least squares estimator with means and variance adjusted	CFA: One factor model, Two factor model, and Bifactor model	CFA: Bifactor model
Schutte 2017	-	CFA: Robust maximum likelihood. ESEM: Oblique target rotation was applied, and orthogonal bifactor target rotation was applied for bifactor ESEM	CFA: Tripartite model, and Bifactor model ESEM: Tripartite model, and Bifactor model	ESEM: Bifactor model
Singh 2016	-	Robust maximum likelihood estimation	CFA: Tripartite model	NA
Singh 2017	-	Robust maximum likelihood estimation	CFA: Tripartite model	NA
Skrzypiec 2018*	Provided by	Robust maximum	CFA: Tripartite	NA

	author	likelihood estimation	model	
van Erp Taalman Kip 2018*	Provided by author	NR	CFA: Tripartite model	NA
van Zyl 2019*	Provided by author	Maximum likelihood	CFA: One factor model, Two factor model, Tripartite model, Hierarchical model, and Bifactor model ESEM: One factor model, Two factor model, Tripartite model, Hierarchical model, and Bifactor model	ESEM: Bifactor model
Yin 2013*	Provided by author	Maximum likelihood estimation	CFA: Single factor model, Two factor model, and Tripartite model	CFA: Tripartite model
Żemojtel-Piotrowska 2018*	Provided by author	Maximum likelihood estimation	CFA: Single factor model, Two factor model, Tripartite model, and Bifactor model ESEM: Tripartite model, and Bifactor model	ESEM: Bifactor model

Note: * Indicates studies included in the meta-analysis

Table S2 – COSMIN assessment of methodological quality

Table 18 COSMIN assessment of methodological quality

	Structural validity	Internal consistency	Reliability	Measurement error	Hypotheses testing for construct validity	Cross-cultural validity\measurement invariance	Criterion validity	Responsiveness
Carvalho 2016 - sample 1	+	+	?	?	?	+	?	?
Carvalho 2016 - sample 2	+	+	?	?	?	+	?	?
de Bruin 2015	+	+	?	?	+	?	?	?
Donnelly 2019*	+	+	?	?	+	?	?	?
Doré 2017*	+	+	?	?	+	+	?	?
Echeverria 2017	+	+	?	?	+	?	?	?
Ferentinos 2019* - sample 1	+	+	?	?	+	+	?	?
Ferentinos 2019* - sample 2	+	+	?	?	+	+	?	?
Franken 2018*	+	+	?	?	+	?	?	+
Fonte 2020	-	+	?	?	+	+	?	?
Guo 2015	+	+	?	?	+	+	?	?
Hides 2016	+	+	?	?	+	?	+	?
Joshanloo 2013 - sample 1	+	+	?	?	+	+	?	?
Joshanloo 2013 -	+	+	?	?	+	+	?	?

sample 2								
Joshanloo 2013 - sample 3	+	+	?	?	+	+	?	?
Joshanloo 2016a* - sample 1	+	+	?	?	+	+	?	?
Joshanloo 2016a* - sample 2	+	+	?	?	+	+	?	?
Joshanloo 2017a*	+	+	?	?	+	+	?	?
Joshanloo 2017b*	+	+	?	?	+	+	?	?
Joshanloo 2017c*	+	+	?	?	+	+	?	?
Joshanloo 2017d* - sample 1	+	+	?	?	+	?	?	?
Joshanloo 2017d* - sample 2	+	+	?	?	+	?	?	?
Joshanloo 2017e*	+	+	?	?	+	+	?	?
Jovanovic 2015* - sample 1	+	?	?	?	+	?	?	?
Jovanovic 2015* - sample 2	+	?	?	?	+	?	?	?
Karaś 2014*	+	+	?	?	+	+	?	?
Kennes 2020*	+	+	?	?	+	?	?	?
Keyes 2008	+	-	?	?	+	?	?	?
Khumalo 2011	-	-	?	?	+	?	?	?
Lamborn 2018*	+	?	?	?	+	?	?	?
Lamers 2011* Joshanloo 2016c	+	+	?	?	+	?	?	?

Lim 2014	-	+	?	?	+	?	?	?
Longo 2017	+	?	?	?	+	?	?	?
Luijten 2019	+	+	?	?	+	+	?	?
Lupano Perugini 2017*	+	+	?	?	+	+	?	?
Machado 2015	+	+	?	?	+	?	?	?
Monteiro 2020*	+	?	?	?	+	?	?	?
Orpana 2017	+	+	?	?	+	?	?	?
Petrillo 2015	+	+	?	?	+	+	?	?
Rafiey 2017	+	+	?	?	+	?	?	?
Reinhardt 2020*	+	?	?	?	+	+	+	?
Rogoza 2018*	+	?	?	?	+	?	?	?
Salama-Younes 2011	+	-	?	?	+	?	?	?
Salama-Younes 2011a	+	-	?	?	+	?	?	?
Santini 2020*	+	?	?	?	+	+	+	?
Schutte 2017	+	?	?	?	+	+	?	?
Singh 2016	+	+	?	?	+	?	?	?
Singh 2017	+	+	?	?	+	+	?	?
Skrzypiec 2018*	+	?	?	?	+	?	?	?
van Erp Taalman Kip 2018*	+	+	?	?	+	?	?	?
van Zyl 2019*	+	+	?	?	+	?	?	?

Yin 2013*	-	+	?	?	+	?	?	?
Żemojtel-Piotrowska 2018*	+	+	?	?	+	+	?	?

Table 19 Factor loadings of the hierarchical model

General population				R^2
	Subjective	Social	Psychological	
Item 1: happy	0.78			0.61
Item 2: interested in life	0.81			0.65
Item 3: satisfied with life	0.83			0.69
Item 4: social contribution		0.66		0.44
Item 5: social integration		0.67		0.44
Item 6: social actualisation		0.75		0.56
Item 7: social acceptance		0.66		0.44
Item 8: social coherence		0.67		0.45
Item 9: self-acceptance			0.72	0.52
Item 10: environmental mastery			0.68	0.46
Item 11: positive relations with others			0.7	0.49
Item 12: personal growth			0.66	0.44
Item 13: autonomy			0.68	0.46
Item 14: purpose in life			0.78	0.60
Second order factor	0.85	0.83	0.94	
Common variance explained	27%	32%	41%	
Total variance explained	14%	17%	21%	

Clinical samples				R^2
	Subjective	Social	Psychological	

Item 1: happy	0.86			0.74
Item 2: interested in life	0.91			0.82
Item 3: satisfied with life	0.87			0.75
Item 4: social contribution		0.66		0.44
Item 5: social integration		0.75		0.57
Item 6: social actualisation		0.81		0.66
Item 7: social acceptance		0.78		0.61
Item 8: social coherence		0.75		0.57
Item 9: self-acceptance			0.75	0.57
Item 10: environmental mastery			0.78	0.61
Item 11: positive relations with others			0.79	0.62
Item 12: personal growth			0.8	0.65
Item 13: autonomy			0.81	0.65
Item 14: purpose in life			0.84	0.71
Second order factor loading	0.89	0.94	0.97	
Common variance explained	26%	32%	42%	
Total variance explained	17%	20%	27%	

Table 20 : Factor loadings of the bifactor structure

General population	General factor	Subjective	Social	Psychological	R^2
Item 1: happy	0.65	0.44			0.62
Item 2: interested in life	0.7	0.41			0.65
Item 3: satisfied with life	0.72	0.41			0.69
Item 4: social contribution	0.61		0.19		0.41
Item 5: social integration	0.58		0.29		0.42
Item 6: social actualisation	0.56		0.54		0.61
Item 7: social acceptance	0.54		0.38		0.44
Item 8: social coherence	0.49		0.5		0.49
Item 9: self-acceptance	0.68			0.22	0.51
Item 10: environmental mastery	0.63			0.27	0.46
Item 11: positive relations with others	0.65			0.25	0.49
Item 12: personal growth	0.61			0.28	0.45
Item 13: autonomy	0.6			0.39	0.51
Item 14: purpose in life	0.73			0.24	0.60
Common variance explained	75.4%	7.2%	11.0%	6.4%	
Total variance explained	39.5%	3.8%	5.8%	3.4%	

Clinical samples	General factor	Subjective	Social	Psychological	R^2
Item 1: happy	0.75	0.42			0.74

Item 2: interested in life	0.79	0.45			0.83
Item 3: satisfied with life	0.78	0.35			0.72
Item 4: social contribution	0.63		0.11		0.41
Item 5: social integration	0.72		0.12		0.53
Item 6: social actualisation	0.71		0.46		0.72
Item 7: social acceptance	0.7		0.36		0.61
Item 8: social coherence	0.69		0.27		0.54
Item 9: self-acceptance	0.74			0.09	0.55
Item 10: environmental mastery	0.76			0.15	0.60
Item 11: positive relations with others	0.77			0.07	0.60
Item 12: personal growth	0.74			0.32	0.65
Item 13: autonomy	0.74			0.4	0.70
Item 14: purpose in life	0.81			0.2	0.69
Common variance explained	85.7%	5.6%	4.9%	3.8%	
Total variance explained	54.6%	3.6%	3.1%	2.4%	

Appendix 3: Supplementary material from Chapter 6

Table 21 Results of measurement invariance testing in the original MHC-SF factor structure

Model	χ^2	RMSEA	CFI	TLI	$\Delta\chi^2$
Configural	4596.5 (148)	0.064	0.913	0.89	43.66
Metric	4640.2 (159)	0.062	0.913	0.90	$p < 0.0001$

Table 22 Identification of the source of metric invariance in the original MHC-SF factor structure.

Relaxed item:	χ^2	df	$\Delta\chi^2$	Δdf	P
1	4638.7	158	1.5	1	0.221
2	4622.2	158	18	1	< .001*
3	4631.9	158	8.3	1	0.004*
4	4636.1	158	4.1	1	0.043*
5	4640	158	0.2	1	0.655
6	4635.9	158	4.3	1	0.038*
7	4639.7	158	0.5	1	0.480
8	4640.2	158	0	1	1.00
9	4640.2	158	0	1	1.000
10	4639.7	158	0.5	1	0.480
11	4639.1	158	1.1	1	0.294
12	4627.1	158	13.1	1	< .001*
13	4640.2	158	0	1	1.00
14	4634.3	158	5.9	1	0.015*