Conceptualisation, Assessment and Treatment of Anhedonia in Adolescent Depression

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Declaration

I confirm that this is my own work and the use of material from other sources has been acknowledged. This PhD was funded by an Economic and Social Research Council (ESRC) PhD studentship.

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Abstract

Anhedonia, the loss of interest and/or pleasure in previously enjoyable experiences is a core symptom of Major Depressive Disorder. It is associated with depression severity, relapse and poor treatment outcome. Despite this, little is known about how this symptom is experienced by adolescents. Most current psychological treatments for depression do not target anhedonia and for young people there are no adequate measures of this symptom for use in research or treatment. This thesis aims to explore adolescents' experiences of anhedonia, to critically evaluate the available anhedonia self-report measures and to develop a self-report measure that can be used by therapists and researchers to develop effective ways to reduce anhedonia in young people. Paper 1 explores adolescents' experiences of anhedonia. Semi-structured interviews about the experience of anhedonia were conducted with 34 adolescents with a primary diagnosis of depression (n = 12) or elevated depressive symptoms (n = 22). Next self-reported measurements of anhedonia were examined. Paper 2 presents a systematic review and critical evaluation of the psychometric properties of 14 self-report anhedonia scales, which highlights limitations in their psychometric properties and relevance for adolescents. Following on from this, Paper 3 describes the development and validation (n = 2098) of an adolescent specific self-report measure of anhedonia developed based on adolescents' experiences of anhedonia defined in Paper 1. Lastly, the treatment of adolescent anhedonia was explored in Paper 4. In this qualitative study, adolescents' (n = 8) experiences of Brief Behavioural Activation (BA) for depression, a treatment development to enhance positive reinforcement and increase engagement in valued activities, were explored with a focus on understanding its impact on anhedonia. Taken together, these findings have implications for understanding, assessing and treating the symptom of anhedonia during adolescence in both clinical and research settings.

Chapter 1. Thesis Introduction

1.1. Thesis rationale and overview

Anhedonia (loss of interest or pleasure) is a core symptom of Major Depressive Disorder (APA, 2013). It is associated with depression severity, relapse and poor treatment outcomes. Despite this little is known about how this symptom is experienced by adolescents. Current psychological treatments for depression do not target anhedonia and for young people there are no adequate measures of this symptom for use in research or treatment. The aim of this thesis therefore is to explore adolescents' experiences of anhedonia, to develop a measure of adolescent anhedonia that can be used by therapists and researchers to improve understanding of anhedonia, and to develop effective ways to reduce anhedonia in young people. This introduction will describe and critically evaluate the construct of anhedonia in the context of adolescent depression and explain how the research described in this thesis will advance the understanding, assessment and treatment of adolescent anhedonia.

Approximately 50-80% of young people with a diagnosis of Major Depressive Disorder (MDD) experience clinically significant levels of anhedonia (e.g. Goodyer et al., 2017; Lewinsohn et al., 2003; Orchard et al., 2017; Sørensen et al., 2005). The symptom of anhedonia may be particularly problematic during adolescence as the ability to experience pleasure is important for forming close interpersonal relationships and developing hobbies and interests which guide significant life-course decisions (Hankin, 2006). Thus, anhedonia in adolescence can have major long-term repercussions for development and life-span trajectory.

Anhedonia in adolescents has been identified as a predictor of adult-onset depression. Wilcox and Anthony (2004) examined clinical features that emerged in childhood and adolescence prior to the development of adult-onset depression. Persistent anhedonia and

worthlessness were identified as having particular prognostic value, with individuals with adult-onset MDD reporting persistent anhedonia in childhood/adolescence 17 times more than individuals who did not develop depression. However, the unique role of adolescent anhedonia in predicting future depression is not consistently reported, for example, van Lang et al., (2007) found that adolescent sleep problems, but not anhedonia, significantly predicted the onset of MDD.

Although the developmental trajectories of emotional disorder symptoms in adolescence remain largely unknown due to a shortage of longitudinal data, one longitudinal investigation found that adolescents do not appear to 'mature out' of anhedonic symptoms as they transition into adulthood, and this symptom appears to worsen across this developmental period (Conway et al., 2017). Furthermore, Bennik et al., (2014) suggested that anhedonia at the end of adolescence (compared to earlier in adolescence) increases the risk for MDD given its stronger stability and association with depressed mood by this age. The prevalence of anhedonia may also differ by gender, but this requires further exploration. In a clinical sample of adolescents, males and females reported similar depression severity and symptom prevalence, but differed in endorsement of specific symptoms, with more males reporting the symptom of anhedonia than females (Bennett et al., 2005). Wilcox and Anthony, (2004) reported that the relationship between anhedonia and adult onset depression was even stronger in females, with adolescent anhedonia reported 31-32 times more often by females who subsequently developed depression compared to those that did not. In a longitudinal study Kouros et al., (2016) found that within person changes in anhedonia predicted increased likelihood of subsequent Major Depressive Episodes (MDEs) in boys; one-unit increase from boys' average level of anhedonia increased the odds of having a MDE the next year by 2.30.

Anhedonia in adolescents has also been associated with a number of adverse clinical outcomes. In a cross-sectional study, Gabbay et al., (2015) found that anhedonia severity, but not irritability, was associated with greater overall illness severity, suicidality, episode duration and number of MDD episodes in 90 adolescents with MDD. Anhedonia has also been associated with suicide attempts in adolescents (Auerbach et al., 2015). Depressed adolescents with a history of one or more suicide attempts reported more severe anhedonia than depressed adolescents with previous suicidal thoughts, but not actions, after controlling for symptoms of suicidal ideation, depression and anxiety. This is in line with evidence from the adult literature which has shown that loss of interest and pleasure were independently associated with higher levels of suicidal ideation in a depressed inpatient sample at baseline, over time and at discharge, even after controlling for loss of energy (Winer et al., 2014). Furthermore, a meta-analysis of studies in adults found a robust association between anhedonia and suicidality, independently of depression (Ducasse et al., 2018). Therefore, the available evidence suggests that anhedonia is an important feature of adolescent depression that warrants further attention.

Worse outcomes after treatment for depression are associated with the symptom of anhedonia in adults. Data from two large drug treatment trials conducted in Europe and the USA (GENDEP, N = 811, Uher et al., 2009; and STAR*D, N = 3637, Rush et al., 2006) were analysed to explore predictors of outcome following anti-depressant medication in adults with at least moderate depression. Nine symptom dimensions were explored and scores on the interest-activity symptom dimension (reflecting low interest, reduced activity, indecisiveness and lack of enjoyment) predicted poor treatment outcome irrespective of overall depression severity, antidepressant type and other clinical correlates (Uher et al., 2012). Furthermore, secondary analysis of a randomised controlled trial of 433 adults with MDD following antidepressant medication with or without cognitive therapy identified

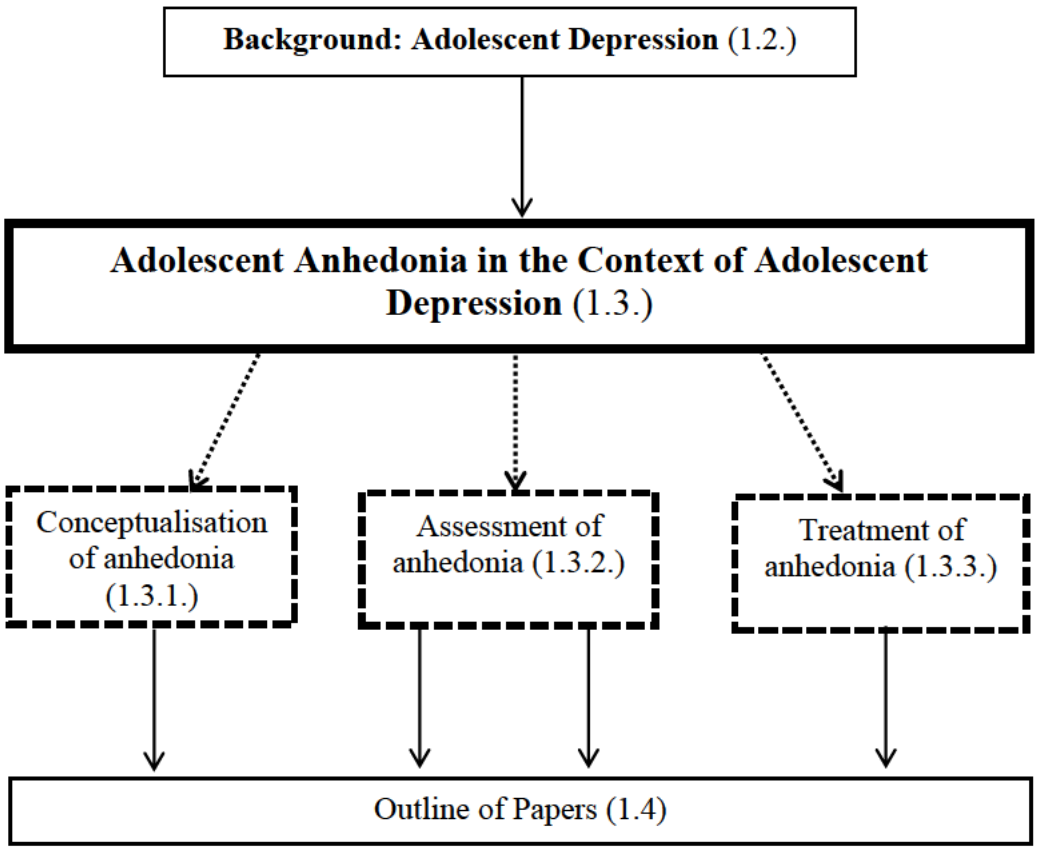
distress and anhedonia at baseline as predictors of time to remission within one year and recovery within three years (Khazanov et al., 2020).

Although less research has been conducted with adolescents, anhedonia has also been identified as a predictor of poor clinical outcomes in young people with Major Depressive Disorder. The Treatment of Resistant Depression in Adolescents (TORDIA) trial (Brent et al., 2008), included 334 SSRI-treatment resistant young people who were randomised to a medication switch with or without CBT. McMakin et al., (2012) investigated if 5 baseline symptom dimensions (reported depressed mood, anhedonia, somatic symptoms, morbid thoughts, observed depression) predicted recovery. All symptom clusters independently predicted depression free days. However, in a multivariate model, anhedonia was the only symptom dimension to predict longer time to remission and fewer depression free days. This suggests that anhedonia may be an important prognostic indicator in adolescents with treatment resistant depression. However, potential methodological limitations of this study include using a cluster of items on the Child Depression Rating Scale (CDRS-R) rather than an anhedonia specific rating scale.

The aim of this thesis is to examine the symptom of anhedonia (loss of interest and/or pleasure) in the context of adolescent depression. This thesis consists of four papers which specifically focus on the conceptualisation, assessment and treatment of anhedonia. Given that anhedonia is a core symptom of depression and that little is known about the subjective experience of anhedonia in adolescents, the first aim of this PhD was to gain a greater understanding of the experience of anhedonia in adolescents using qualitative methods [chapter 2]. Self-report scales are an important clinical and research tool. Although a range of scales exist to assess the presence of anhedonia, there is disparity in what components of anhedonia are measured, and few have been adapted or validated for adolescents. Therefore, the second aim of this PhD was to evaluate existing self-report measures of anhedonia

[chapter 3] and the third aim was to develop a new scale to improve the identification of this symptom [chapter 4]. As anhedonia is a predictor of treatment severity and poor treatment outcome and is neglected in most treatments for depression further work is needed to understand the experience of anhedonia in the context of available treatments for depression. Therefore, the fourth aim of this PhD was to explore changes in young people's experiences of anhedonia after completing Brief Behavioural Activation for adolescent depression, which aims to increase valued activities and thereby increase positive reinforcement [chapter 5]. This chapter first describes a brief summary on adolescent depression [chapter 1.2.] and then describes and critically appraises the literature on anhedonia in the context of adolescent depression [chapter 1.3.], focusing on its conceptualisation [chapter 1.3.1], measurement [chapter 1.3.2.] and treatment [chapter 1.3.3.]. The overall thesis aims and an outline of the four papers is then discussed [chapter 1.4]. [see Figure 1].

Figure 1. *Outline of Chapter 1.*



1.2. Background: adolescent depression

1.2.1. The adolescent period

Adolescence is a time of biological, social and cognitive change, starting with the onset of puberty and continuing through the teenage years into the 20s (Hall, 1904) to the point of reaching a stable, independent role in society (Blakemore, 2018). Changes that occur during adolescence make it a period of increased risk for mental health disorders, including depression (Blakemore, 2019; Hankin, 2006). Social and cognitive changes that occur during adolescence distinguishes this as a unique period of development which sees the formation of personal identity, intimate relationships, independence and autonomy (Christie & Viner, 2005). The adolescent brain undergoes extensive and rapid neurological development (Fuhrmann et al., 2015). Three neurodevelopmental mechanisms underlie these changes. The first two, myelination and axonal growth result in faster transmission of neural signals and the third, synaptic pruning results in the elimination of unnecessary synapses. All three processes lead to heightened neural plasticity during adolescence, which means the brain is increasingly able to adapt to its environment and change in accordance with environmental stimuli (Blakemore, 2018).

Of particular relevance to this thesis is the fact that adolescence is a period characterised by increased affective, motivational and reward seeking behaviour (Forbes et al., 2010; Galvan, 2010). Adolescents are more likely than adults to seek out rewards (Shulman et al., 2016), to engage in risky behaviours (Steinberg, 2004), and to experience heightened responses to emotional cues (Casey et al., 2011). The dual systems perspective provides a biological model explaining why adolescence is a particular time of heightened vulnerability to heightened emotional reactivity and risky behaviour (Shulman et al., 2016; Steinberg, 2008, 2010). According to this perspective, the brain's socio-emotional system

(i.e. the amygdala, regions of the striatum, orbitofrontal cortex, medial frontal cortex), which drives increased reward seeking and emotional reactivity, develops more rapidly than the cognitive-control system (i.e. the prefrontal cortex), which plays an important part in planning and regulating behaviour and regulating emotions (Casey et al., 2011; Somerville & Casey, 2010; Steinberg, 2004). This imbalance in the rate of development of systems within the brain means that in emotional situations, adolescents' subcortical system which seeks out novelty, risk and reward will sometimes "win out" over the control system which inhibits sensation seeking and risk-taking behaviours (Casey et al., 2011; Steinberg, 2008). As a result, adolescents may react differently to adults in response to rewarding or emotional stimuli.

Despite adolescence being a time of heightened reactivity to rewarding stimuli, it is also the time when most mental health problems begin to emerge (Kessler et al., 2007). Forbes and Dahl, (2012) argued that this results in adolescence being the period with the greatest disparity in reward related processing than at any other point across the lifespan. For example, adolescents exhibit increased physiological responses to emotional stimuli compared to children and adults (Forbes et al., 2010; Gilbert, 2012), but they are at increased risk of developing depression, which is underpinned (in part) by low reward reactivity (Gotlib et al., 2010). Therefore, it is important to take into account developmental differences in reward processing during this period, and to ensure conceptual models map onto the experience of depression in adolescence.

The social brain network continues to develop across adolescence (Mills et al., 2014), and adolescence is seen as a period of heightened reactivity to social stimuli, including social rewards (Foulkes & Blakemore, 2016). During adolescence, individuals are more likely to place a higher value on the judgements and opinions of others than during childhood or adulthood (Blakemore, 2018). For example, abilities such as mentalising (the ability to infer

intentions, beliefs and desires in other people and to predict their behaviour) continue to develop throughout this period, and are important for the formation and maintenance of social relationships and for navigating the social world (Choudhury et al., 2008). In the company of peers, adolescents have a greater preference for immediate rewards than they do when alone (O'Brien et al., 2011). Healthy adolescents also exhibit elevated reward seeking in the presence of peers (Gardner & Steinberg, 2005). There is also some evidence that adolescents experience more positive affect (Foulkes & Blakemore, 2016) and less anxiety (e.g. Henker et al., 2002; Schneiders et al., 2007) when with their peers. This suggests that adult models may not fully conceptualise the factors that exacerbate high approach-motivated positive emotions in adolescents (Gilbert, 2012).

The social context also changes throughout adolescence, and young people increasingly assert more control over their decisions, emotions and actions (Choudhury et al., 2006). Adolescents are also faced with important social and academic decisions that will affect them throughout life. As highlighted above, the cognitive control system, which develops in late adolescence and early adulthood, includes a number of processes that are key to decision making, such as impulse control, working memory and complex reasoning (Hartley & Somerville, 2015). Introspective abilities which involve reflecting on how confident one is about one's decisions and actions, continue to develop throughout adolescence (Blakemore, 2018). Individuals in late adolescence and adulthood are better at knowing and judging their own performance than young adolescents (Weil et al., 2013). These introspective skills (e.g. self-awareness and self-reflection) are important for describing and self-reporting one's emotions and behaviours, which is key to understanding, articulating and treating difficulties with mental health.

1.2.2. Prevalence and long-term implications of adolescent depression

A major depressive episode may emerge at any age, but the likelihood of onset increases markedly with puberty (APA, 2013). Depressive disorders (from now on described as depression unless otherwise specified) are common and debilitating, and a major contributor to the overall global burden of disease (WHO, 2018). Prevalence studies have shown that the rate of depression in childhood is low and substantially rises across the adolescent period (NHS_Digital, 2018; Thapar et al., 2012). The twelve-month prevalence of Major Depressive Disorder in adolescents is estimated at 8% (Avenevoli et al., 2015; Mojtabai et al., 2016) and an estimated 20% of adolescents experience an episode of depression by the time they reach 18 years old (Thapar et al., 2012). In the UK (NHS_Digital, 2018) and worldwide (Polanczyk et al., 2015) 2 - 3% of children and young people experience depression at any one time. In a recent UK sample, rates of depression amongst adolescents were higher in 17-19-year olds (4.5%) than in 11 to 16-year olds (2.7%) (NHS_Digital, 2018). Depression is more prevalent among females across the lifespan and in adolescence two to three times more girls than boys meet diagnostic criteria for depression (Mojtabai et al., 2016; Nolen-Hoeksema & Girgus, 1994). These statistics highlight the need for depression prevention and early intervention during the adolescent period.

Depression that develops during adolescence often has negative implications for present and future health and development. In particular young people with depression often experience comorbid anxiety (Thapar et al., 2012) and substance misuse disorders (Hernandez et al., 2016; Kaminer et al., 2007). Suicidal thoughts are a symptom of depression and there is an increased risk of suicidal behaviours (Hawton et al., 2012; Strandheim et al., 2014), with suicide being the leading cause of death in young people aged 15 to 24 (ONS, 2019). A recent meta-analysis identified that depression in adolescence is associated with long term adverse outcomes, such as failure to complete secondary school and high rates of unemployment (Clayborne et al., 2019). Clinical studies have also

confirmed that adolescent depression is a chronic and recurrent condition, with 50-70% of young people going on to develop a further episode within five years, and around 20% of young people developing persistent depression into adulthood (Dunn & Goodyer, 2006). Therefore, targeting adolescent depression promptly may help to prevent further negative outcomes later in life.

1.2.3. Identification and diagnosis of adolescent depression

A formal diagnosis of depression is based on one of two classification systems, the Diagnostic and Statistical Manual of Mental Health Disorders (DSM-5) or the International Classification of Diseases (ICD-11) (APA, 2013; WHO, 2020). Severity of a disorder is determined by the number and severity of symptoms, as well as the degree of functional impairment. According to the DSM-5 (APA, 2013), a diagnosis of Major Depressive Disorder (MDD) in adolescents requires that five or more of the following symptoms are present in the past two-week period: depressed mood or irritability, anhedonia, significant weight/appetite change, sleep disturbance, psychomotor changes, fatigue, negative self-perceptions, cognitive disturbances, and suicidal ideation. In adolescents at least one of the core symptoms, depressed mood/irritability or anhedonia, must be present for a diagnosis of MDD, alongside other somatic and/or cognitive changes (APA, 2013). MDD is characterised by discrete episodes of at least two weeks duration, with clear changes in "affect, cognition, and neuro-vegetative functions" (APA, 2013, p. 155). Other depressive disorders are more rarely diagnosed in adolescence, but are still debilitating, for example Persistent Depressive Disorder (PDD) is characterised by a chronic and prolonged period of low mood accompanied by other depressive symptoms (APA, 2013) and is experienced by approximately 1% of adolescents at any one time (Sund et al., 2001).

For adolescents the diagnostic criteria for depression are almost the same as for adults, apart from the inclusion of irritability as a core symptom of MDD alongside

depressed/low mood (APA, 2013), and the time requirement for a diagnosis of PDD is one year, rather than two in adults. Adolescent-onset MDD can be viewed as an early-onset form of the adult disorder (Maughan et al., 2013; Thapar et al., 2012); however, some studies highlight the difference in symptom presentation between adults and adolescents. For example, Rice et al., (2019) found that appetite and weight changes, loss of energy and insomnia were more common in adolescents with MDD than adults. Although more common in adults (Rice et al., 2019), the symptom of anhedonia has been identified as having particular prognostic value, with individuals with adult-onset MDD reporting persistent anhedonia in childhood/adolescence 17 times more than individuals who did not develop depression (Wilcox & Anthony, 2004). As highlighted earlier, this symptom has also been identified as a significant predictor of worse clinical outcomes in adults (Ducasse et al., 2018; Winer et al., 2014) and adolescents (Auerbach et al., 2015; McMakin et al., 2012; Rubin, 2012).

Few research studies have explored the subjective or qualitative experience of living with specific depressive symptoms. In a qualitative interview study, young adults with depression (aged 18-25) highlighted difficulties with depressed mood, concerns about being identified as depressed, a feeling of alienation from friends and family, and a sense of failure from not achieving expected developmental outcomes (Kuwabara et al., 2007). Furthermore, in a study with 77 clinically-referred adolescents with a diagnosis of depression, Midgley et al., (2015) captured five key features of their experiences: 1) 'misery, despair and tears'; 2) 'anger and violence towards themselves and others'; 3) 'a bleak view of everything'; 4) 'isolation and cutting off from the world'; and 5) 'the impact on education'. These themes resonated with some core diagnostic features of depression e.g. misery, as well as factors which may be central to a number of mental health conditions such as the feeling of isolation, and contextual factors, such as the impact on education. A systematic review of qualitative

studies of depression from around the world identified descriptions of key symptoms such as depressed mood and fatigue in individuals' narratives (Haroz et al., 2017), but despite its impact on clinical outcomes, no qualitative studies to date have explored the lived experience of losing interest and pleasure in depression. Haroz et al.'s (2017) review also identified a number of other clinical features not in the diagnostic framework, namely social isolation/loneliness, crying, anger and general pain; thus indicating that the diagnostic criteria may not fully capture the subjective experience of a complex phenomenon such as depression, or more specific symptom profiles.

Diagnostic categorical approaches to mental health disorders (e.g. DSM and ICD) have been criticised for their inability to predict treatment response, and for not capturing the underlying mechanisms of dysfunction in mental health (Insel et al., 2010). In response to these concerns, a dimensional framework approach was developed to understand the specific underpinnings of mental health disorders in research, namely the NIMH Research Domain Criteria (RDoC) Initiative (Insel et al., 2010; NIMH, 2018). RDoC identifies a set of dimensional constructs looking across the whole spectrum of pathophysiology (normal to abnormal) rather than within diagnostic categories. This biopsychosocial model, driven by advances in neuroscience, identified five potential mechanisms underlying psychopathology, namely: the negative valence system, the positive valence system, the cognitive system, the social process system, and the arousal or regulatory system. This approach has been proposed as helpful for understanding the biological, mechanistic and symptom specific underpinnings of clinical characteristics, such as disturbances in the positive valence system i.e. reward processing (NIMH, 2011b) and the negative valence system i.e. loss (NIMH, 2011a), which are of particular relevance to this thesis.

1.3. Adolescent anhedonia in the context of adolescent depression

1.3.1. Conceptualisation of anhedonia

The term ‘anhedonia’ was introduced in the late 1800s by the French psychiatrist Ribot (1896). Ribot drew on observations of his own patients, and described individuals experiencing a “complete absence of emotional reaction” and “no pleasure” from thoughts of leisure activities, as well as family and home (Ribot, 1896, cited in Snaith, 1993, pg. 958). There was relatively little attention given to this psychological concept until Meehl (1962) who considered anhedonia to be a personality trait that predisposed individuals to mental disorders and Klein, (1974) who explored anhedonia as a symptom of depressive disorders and a clinical marker predicting response to anti-depressant drugs. Klein, (1974) proposed that there were two major domains of pleasure, appetitive (‘the pleasure of the chase’) and consummatory (‘the pleasure of the feast’). In the context of depressive disorders, Klein, (1974) described anhedonia as,

“a sharp, unreactive, pervasive impairment of the capacity to experience pleasure or to respond affectively to the anticipation of pleasure [which] results in a profound lack of interest and investment in the environment often associated with inability to enjoy food, sex and hobbies” (in Snaith, 1993, p.958).

In 1980, the revised Diagnostic and Statistical Manual of Mental Health Disorders (DSM-3) included “loss of interest and pleasure” as one of two core depression symptoms. Snaith (1993) considered this DSM definition to elicit “confusion”, as it combined both loss of interest and loss of pleasure; he argued that it was possible to retain interest in, but to lack pleasure from a stimulus. Despite this the current DSM-5 definition characterises anhedonia as “markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day (as indicated by either subjective account or observation)” (APA, 2013). It states that individuals may describe “feeling less interested in hobbies, not caring anymore, or not feeling any enjoyment in activities that were previously considered pleasurable” (APA,

2013, p.163). As well as emotional changes, behavioural changes may be observed, with individuals socially withdrawing or neglecting pleasurable avocations (hobby or minor occupation) (APA, 2013).

As well as being a core symptom of depression, anhedonia also features as a negative symptom of schizophrenia, alongside lack of motivation, flat affect, poverty of speech, and social withdrawal (APA, 2013). Anticipatory deficits have been particularly explored in the context of schizophrenia (Gard et al., 2007), but evidence supporting a loss of consummatory pleasure is mixed (Visser et al., 2020). Negative symptoms of schizophrenia often predate positive symptoms, such as psychosis, with the mean onset negative symptoms in the teenage years, but psychosis does not typically begin to emerge until the early 20s (Millan et al., 2014). Anhedonia has also been identified as a feature of substance dependence (e.g. Hatzigiakoumis et al., 2011) and PTSD (e.g. Nawijn et al., 2015), and has been recognised as a feature of neurological conditions such as Parkinson's disease (e.g. Loas et al., 2012). Anhedonia may also be experienced in the context of anxiety disorders, particularly social phobia (Brown et al., 1998; Kashdan, 2007), although this is not reflected in the diagnostic criteria.

1.3.1.1. Models relevant to understanding the concept of anhedonia

Positive affect. Anhedonia is often conceptualised as a state of low positive affect. Russell's (1980) circumplex model proposed that the basic dimensions of affect arose from behaviour of two independent neurophysiological symptoms, the arousal and valence system. Depression was considered an unpleasant and moderately deactivated affective state (Posner et al., 2005), and emotive states related to anhedonia sit at different points along these two continua, for example, excitement is considered as a pleasant and highly aroused state; feeling happy or pleased, a pleasant and moderately aroused/activated state; and feelings of fatigue or boredom an unpleasant and deactivated state. Watson and Tellegen, (1985) built

upon Russell's (1980) circumplex model and presented a circular structure which also incorporated the dimensions of high and low positive and negative affect (as well as pleasantness/arousal dimensions). High positive affect was conceptualised as an active, enthusiastic, excited state, and low positive affect a drowsy, dull or sluggish state. The concepts of positive and negative affectivity were used as a basis for understanding the structure of affective disorders (Watson et al., 1988). Clark & Watson's (1991) tripartite model proposed that low positive affect, described as reduced zest for life, enthusiasm, alertness, activation, and pleasurable engagement with the environment, was a core and unique feature of depression. In contrast, elevated distress or negative affect (e.g. upset, angry, guilty, afraid, sad, disgusted, worried) was considered a general or non-specific feature to anxiety and depression, and physiological arousal a unique feature of anxiety (later reconceptualised as specific to panic disorder, Watson et al., 1995).

Early evidence from studies with psychiatric samples of children and adolescents found support for the tripartite model (Joiner et al., 1996), with depressive disorders diagnoses associated with a combination of low positive affect and high negative affect (Joiner & Lonigan, 2000). In adult studies the relationship between positive and negative affect (as measured by the Positive and Negative Affect Scale, Watson et al., 1988) was typically reported as orthogonal or only weakly related, however in children and adolescence evidence to support this distinction is mixed (Anderson & Hope, 2008). Although low positive affect may not be as unique to depression as originally conceptualised (Brown et al., 1998; Kashdan, 2007) it still remains a key feature of depressive disorders across the lifespan (Chorpita & Daleiden, 2002).

More recent emotional reactivity-based models of depression also provide a basis for understanding anhedonia as a state of low positive emotionality. The positive attenuation hypotheses views individuals with depression to have reduced emotional responsiveness to

positive stimuli, with evidence supporting this concept (Rottenberg, 2005; Rottenberg et al., 2005). A meta-analysis of emotional reactivity studies found support for a reduction in responsivity to both positive and negative stimuli in adults with depression (Bylsma et al., 2008). This finding supported a third model, the Emotion Context Insensitivity (ECI) theory which posits that depression leads to a dampening down of all emotions. Of particular relevance to this thesis, Bylsma et al., (2008) reported that a reduction or dampening of affect was larger in response to positive rather than negative stimuli, suggesting reductions in positive affect may require particular attention. De Fruyt et al., (2020) also suggested that anhedonia may be a loss of positive affect, but may also sit within a broader loss of affect.

Approach motivation. Anhedonia is often conceptualised as a state of low motivation, specifically low levels of behavioural approach. Motivation-based models of depression (e.g. Fowles, 1980; Gray, 1990) proposed that there is a link between decreased activity in the Behavioural Activation System (BAS) and depression. Theorists have long argued that two general motivational systems underlie behaviour, the Behavioural Approach System (BAS), associated with approach/ appetitive behaviour towards signals of reward or non-punishment, and the Behavioural Inhibition System (BIS), related to sensitivity to signals of punishment (e.g. Bijttebier et al., 2009; Gray, 1981). Depression is considered to be underpinned by the downregulation of the BAS which guides approach to rewarding stimuli; whilst anxiety is hypothesised to be most notably underlined by the upregulation of the BIS which promotes withdrawal from punishing stimuli.

Evidence supports the link between depression and *hypo*activity of the reward systems – a generally lowered motivation toward appetitive stimuli and *hyper*activity of the punishment systems – increased sensitivity toward aversive stimuli (e.g. Depue & Iacono, 1989; Henriques et al., 1994; Henriques & Davidson, 2000). A study of depressed and recovered individuals identified that depressed individuals showed hypoactive BAS and

hyperactive BIS (Pinto-Meza et al., 2006). Individuals who had recovered from depression still had hypoactive BAS but not hyperactive BIS, suggesting that the behavioural approach system may continue to be disrupted long term even though general depression levels have reduced. Hyposensitivity of the behavioural activation system (Alloy et al., 2016; Treadway & Zald, 2013) is hypothesised to lead to decreased motivation, withdrawal, reduced goal related cognitions, and symptoms such as anhedonia.

The pleasure cycle. Anhedonia is often understood to be underpinned by a neurobiological disruption in the reward system (i.e. the positive valence system). This system is responsible for responses to positive motivational situations or contexts (NIMH, 2018). The neural and biological basis of reward is a complex process requiring multiple brain systems, including a variety of brain regions, neural circuits and neurotransmitters (e.g. (Treadway & Zald, 2011). The limbic system is involved in emotion processing and memory formation, and parts of this system (and connected regions) are involved in reward processing (i.e. amygdala, the ventral tegmental area (VTA), the ventral striatum (Nucleus Accumbens: NAcc), ventral palladium (VP)). Regions of the prefrontal cortex (PFC), a part of the brain heavily involved in cognitive processing/decision making, have also been implicated in reward processes, such as constructing action plans to obtain valued outcomes (e.g. ventral medial prefrontal cortex, (vmPFC)). Other regions such as the insula and the orbitofrontal cortex (OFC) have also been implicated in reward anticipation and predictive appetitive reward value.

Early hypotheses considered that the neurotransmitter dopamine was central to all aspects of reward processing and was known as the "pleasure chemical" (Smillie & Wacker, 2014; Wise, 1982). However, animal research has since shown that dopamine is involved in reward motivation, reinforcement and associative learning, but is less involved in the pleasurable experience of receiving a reward (e.g. Berridge & Robinson, 1998). In contrast,

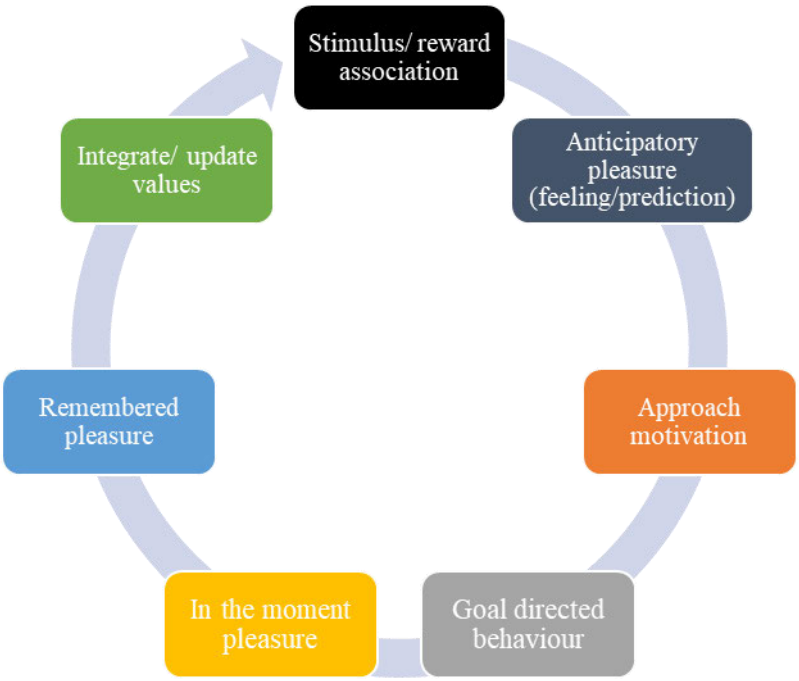
opioid, endocannabinoid and GABA-benzodiazepine neurotransmitters are important for generating feelings of pleasure and euphoria when a reward is received ((Berridge et al., 2009). Some regions of the limbic system have been identified as "hedonic hotspots" including sites in the shell of the NAcc and the VP which exhibit heightened liking or pleasurable responses when stimulated with opioid receptor agonists (Peciña & Berridge, 2005) or endocannabinoids (Mahler et al., 2007). Outside of these hotspots, stimulation increases "wanting" for food, but not "liking", suggesting that there is also an anatomical distinction between these components of reward (Berridge et al., 2009). Other neurotransmitters such as serotonin may also help modulate dopamine and opioid release and help regulate a number of reward processes (Gorwood, 2008). Evidence from neuroscience therefore suggests that different reward processes correspond to dissociable neurobiological mechanisms and partially distinct, but overlapping, brain circuitry.

Berridge and Robinson (1998, 2003) suggested that these different neurobiological mechanisms correspond to separate psychological components known as wanting (i.e. motivation for reward, including implicit incentive salience 'wanting' and cognitive "incentive goals"), liking (i.e. the pleasure component or hedonic impact of a reward, including implicit 'liking' and "conscious pleasure"), and learning (i.e. associations, representations and predictions about future rewards based on past experiences, including explicit and implicit knowledge produced by associative conditioning and cognitive processes). Each component of reward contains explicit processes that are available to 'conscious awareness' and implicit processes that are not accessible to conscious awareness; both elements are important to the reward process (Berridge & Kringelbach, 2008; Berridge & Robinson, 2003).

Further distinctions have been made between reward related processes, particularly in separating out the sub-processes involved in motivation and learning. Der-Avakian and

Markou, (2012) identified a number of discrete reward-related processes involved in engaging in goal-directed actions for rewards. These distinctions are in line with the RDoC initiative Positive Valence System (NIMH, 2011b, 2018), which considers the following elements of reward responsiveness: desire for rewards (reward valuation), expectations regarding the probability of attaining rewards (reward expectancy), willingness to expend effort to attain a reward (effort valuation), anticipation of future rewards (reward anticipation), immediate (initial responsiveness) and sustained (reward satiation) responses to rewards, as constructs related to reward learning (NIMH, 2011, 2018). The term decisional anhedonia has also been used to describe impaired decision making in the context of reward (e.g. Der-Avakian & Markou, 2012; Treadway & Zald, 2011). A key distinction for this thesis is between a) the expected or experienced enjoyment when imagining or looking forward to something pleasant (*anticipation*) and b) the willingness to exert effort to obtain something pleasant (*effort/motivation*) (e.g. Frey et al., 2015; Rzepa et al., 2017).

Figure 3. *Model of reward processing – the pleasure cycle*



Note. Adapted from Kring and Barch (2014)

The relationship between components of reward is complex, but put simply, it starts with making an association between a stimulus and a reward, which leads to anticipatory pleasure, which then activates motivational processing and encourages an individual to seek out stimuli and experience reward. This information is remembered, integrated, and consequently updates our reward values (Kring & Barch, 2014; Rizvi et al., 2016b). However, the psychological components are interconnected and operate together as part of a coordinated network which integrates the motivational, emotional and learning processes (Kring & Barch, 2014). See Figure 3.

1.3.1.2. Conceptual challenges in understanding anhedonia. In recent years, progress in understanding the neurobiological mechanisms of reward has challenged the conceptualisation of anhedonia (Rømer Thomsen et al., 2015). Building on the description of reward by Berridge and Kringelbach (2008), distinctions have been made between consummatory (lack of satiation and resolution of desire) and anticipatory anhedonia (decreased expected enjoyment, planning, desire and/or effort expenditure to reach something pleasant) (Kring & Barch, 2014). Although "wanting" and "liking" components of reward are dissociable at the neurobiological level (e.g. Berridge et al., 2009), it is less clear if these components map onto the subjective experience of anhedonia (i.e. when assessed via clinical or self-report). It is also unclear to what extent the understanding of anhedonia from a neuroscience perspective is applicable and meaningful at the experiential or clinical level. As well as being conceptualised by components of the reward process, anhedonia is also understood to be a construct of 'loss' within the negative valence system domain (NIMH, 2011a). This is an important distinction, as the removal of something pleasant is inevitably linked to a feeling of absence and withdrawal, and ultimately negative emotions (Watson et al., 2017).

Inconsistent use of terminology makes it difficult to translate findings from neuroscience to clinical settings. In animal or human neuroimaging studies of reward processing, anticipation is triggered by a reward "cue" which signals to the animal or human that they are about to be presented with a rewarding stimulus e.g. a light flash which has been paired to signal the appearance of a reward (e.g. Berridge, 2003). The 'anticipation' in this context is assessed by observing neural activity after the cue is presented. In contrast, when assessing anticipation clinically, an individual is typically asked to imagine "looking forward" to an experience they would enjoy. This requires them to make a mental representation of a past event and evaluate it (Nielson et al., 2020). The subjective account involves both recall of an "anticipated experience" i.e. what people *think* they will feel when something happens in the future; and the "anticipatory experience" itself, i.e. what people actually *feel* in the present moment when they are thinking about something positive happening in the future (Gard et al., 2007). The clinical account and the neural activity of both are assumed to assess 'anticipation' but further research is needed to understand whether the current understanding of reward related neural processes can be translated to provide insight into the mechanisms driving the clinical experience of anhedonia. In order to do so there is a need for consistent empirical definitions of anhedonia that are informed by clinical experience (e.g. Forbes & Dahl, 2012).

A further important conceptual consideration is whether all facets of altered reward processing should be captured under the symptom of anhedonia. Researchers have suggested that definitions of anhedonia are too specific and that they often do not encompass motivational components, with most focusing on low consummatory pleasure. In neuroscience *anhedonia* is now often used as a blanket term to refer to a range of reward related deficits (Treadway & Zald, 2011), and in line with the RDoC initiative, its underpinnings are often linked to changes in the positive valence system (Insel et al., 2010).

However, it is also possible that the components of reward map onto other symptoms of depression. For example, reduced approach motivation may be linked to hopelessness, loss of energy and appetite, and psychomotor retardation, in addition to anhedonia (Fowles, 1988). Alloy et al., (2016) considered that reward hyposensitivity is likely to be the most strongly associated with the symptom of anhedonia, but also highlighted the importance of examining specific symptom clusters and their relationship with reward sensitivity.

A number of other constructs relate, and often overlap with the concept of anhedonia. Boredom is a relevant emotional experience, which has been identified as related to, but distinct from apathy, anhedonia and depression (Danckert et al., 2011). Apathy is another construct with a clear overlap with anhedonia, conceptualised as a lack of motivation (Marin et al., 1991). Anhedonia is also closely linked to broader constructs of wellbeing, which encapsulates positive affect or pleasure (hedonia) and a sense of meaningfulness or engagement in life (eudaimonia) (Berridge & Kringelbach, 2011). The relationship between anhedonia and other related constructs, i.e. its nomological network, has not been widely explored. However, self-report measures of anhedonia typically correlate with measures of positive affect, positive emotions, behavioural activation and relevant clinical disorders to a greater or lesser degree (see Chapter 3). The relationship between the clinical experience of anhedonia and other depressive symptoms and related constructs warrants further exploration.

1.3.2. Assessment of anhedonia.

Some progress is being made in understanding the fundamental concept of anhedonia in depression, however, there is still significant disparity between fields of research. Difficulties with formulating a consistent picture of this symptom is exacerbated by the use of different types of measurement to assess the presence and severity of anhedonia. For instance, changes in reward functioning, particularly the anticipation or motivation for reward

are typically measured functional MRI or laboratory tasks, and self or clinician report tend to assess loss of positive affect or consummatory pleasure. More studies are needed to look dimensionally across multiple components of reward in parallel, and the evidence base for adolescence is small and often inconsistent across studies or types of reward.

Consummatory pleasure. In brief, adolescents and adults with depressive symptoms or a clinical diagnosis typically report lower levels of consummatory pleasure and positive affect (Trøstheim et al., 2020), depressed adolescents have also shown less frequent and shorter durations of positive emotion and more difficulty sustaining positive emotion (Forbes et al., 2004). Conversely, evidence from self-report assessment in the moment (Experience Sampling Methodology) suggests depressed individuals experience lower positive affect and fewer positive events, but when taking part in pleasurable activities, found them *as* pleasurable as non-depressed individuals and reported *greater variability* in affect (Heininga et al., 2017; van Roekel et al., 2016), demonstrating the complex picture of self-reported reward-related functioning.

Although low consummatory pleasure and positive affect are a cornerstone feature of depression (APA, 2013), findings from behavioural studies are mixed (Dunn, 2012). Robust evidence supports low ratings of pleasure in behavioural studies of pleasant faces and images (Bylsma et al., 2008), but evidence in response to primary rewards such as food suggest that no differences exist (Dichter et al., 2010; McCabe et al., 2009). Neural studies typically find decreased activation in regions of the brain linked to consummation of rewards, including in response to food (McCabe et al., 2017) and pleasant words/faces, with some evidence to supports its link with lowered self-reported pleasure (Epstein et al., 2006). However, discrepancies exist with heightened and lowered neural activity reported in adults (Keedwell et al., 2005; Smoski et al., 2011) and adolescents (Rzepa et al., 2017; Stringaris et al., 2015) across studies.

Anticipatory pleasure. When assessed via self-report in the moment or retrospectively, depressed adults typically report lower levels of anticipatory pleasure (e.g. Liang et al., 2020; Wu et al., 2017), however this is often measured alongside consummatory pleasure and is not readily dissociated (e.g. Winer et al., 2014). Adults and adolescents with depression also have difficulty imagining a positive future, which is likely linked to anticipatory deficits. For example, Morina et al., (2011) found that adults with MDD provided poorer vividness ratings for deliberately generated prospective positive scenarios than controls. A deficit in reward anticipation at the neural and behavioural level is also consistently observed in depressed adults and adolescents. For example, McFarland & Klein, (2009) measured anticipatory positive affect before adults received a monetary reward and found that depressed individuals reported less anticipatory pleasure than healthy controls. Similarly, fMRI studies indicate that adults and adolescents with depression or 'at risk' of depression display lower levels of anticipatory pleasure at the neural level in response to a range of rewards, including food, money and social stimuli (Forbes et al., 2009; Gotlib et al., 2010; Rzepa & McCabe, 2019; Stringaris et al., 2015). A range of research in adults (Halahakoon et al., 2020; Rizvi et al., 2016) supports this finding, as well as the more limited evidence in adolescent samples.

Effort and motivation for reward. Willingness to exert effort to reach a reward is typically measured using behavioural tasks, but a few self-report scales have demonstrated that adults with depression (Rizvi et al., 2015) or elevated symptoms of depression (Khazanov et al., 2020) report differences in an array of reward difficulties including effort for reward. However, these scales do not enable a specific examination of effort for reward in isolation of other reward related functions. In a sample of college students, higher levels of consummatory pleasure were related to levels of physical activity (Leventhal, 2012), suggesting a link to motivational anhedonia. Treadway et al., (2009) developed the Effort

Expenditure for Rewards Task (EEfRT) as a behavioural measure of effort-based decision making, and found patients with Major Depressive Disorder were less willing to expend effort for rewards than controls (Treadway et al., 2013). In an alternative effort-based paradigm, Sherdell et al., (2012) found that among depressed participants, but not healthy controls, anticipatory self-rated pleasure predicted likelihood to exert effort to reach a reward, suggesting that self-rated anticipation may be linked to physical effort/motivation. When measuring physical effort to reach a chocolate reward, adolescents with depressive symptoms displayed reduced behavioural effort (Rzepa & McCabe, 2019) and decreased neural activation (Rzepa et al., 2017; Rzepa & McCabe, 2019).

Taken together, this suggests that adolescents with depression experience a range of differences in reward processing compared to healthy controls, however, the evidence across types of measurement (e.g. self-report vs. neural), types of rewarding stimuli (e.g. social vs. physical), and components of the reward process (e.g. consummatory vs. anticipatory) differ greatly, with some differences between adults and adolescents. It is unclear if different types of measurement are tapping into the same constructs, or whether all types of reward processing are available to conscious awareness, i.e. can only be inferred via neuroimaging techniques or behavioural tasks. How these measures relate to and map onto the experience of anhedonia in depression needs to be elucidated.

1.3.2.1. Clinical assessment of anhedonia in adolescents. Of particular relevance to this thesis is the clinical assessment of anhedonia. Clinical assessment and treatment of problems with anhedonia rely on an individual's self-report and verbal description of their experiences. In clinical settings, anhedonia is typically measured as part of a broader assessment. Clinical interviews provide a detailed and thorough assessment of anhedonia but require extensive time and training to be valid (Gledhill et al., 2003). Therefore, despite

recommendations (e.g. NICE, 2018, 2019) these tools are not used routinely in clinical settings.

Two diagnostic interview schedules are recommended for the assessment of depression and its symptoms in adolescents (NICE, 2019), the Kiddie-Schedule for Affective Disorders and Schizophrenia (K-SADS; Kaufman et al., 1997) and the Child and Adolescent Psychiatric Assessment (CAPA; Angold & Costello, 2000). Both diagnostic interviews ask young people open questions about losing enjoyment in activities. Any lack of enjoyment needs to be a change from previous enjoyment levels, not just evidence of a general low level of positive affect. The CAPA states that loss of interest and boredom should not be considered evidence of anhedonia; despite the current DSM-V definition of this symptom as the 'loss of interest and pleasure' (APA, 2013, p.94).

In contrast, the K-SADS considers both interest and boredom as integral parts of the 'make-up' of anhedonia (Kaufman et al., 1997). Despite providing prompt questions relating to a range of deficits in pleasure; the KSADS does not require the interviewer to ask specifically about intensity, effort or anticipation of rewards. Instead, it instructs that enough information is gathered to ascertain whether the young person meets the DSM-V criteria of experiencing anhedonia 'more days than not, for most of the day' in the past two weeks (APA, 2013, p. 94). Therefore, a conflicting message is sent about what information clinicians and researchers should gather to accurately identify anhedonia as a symptom of depression. Conflict in the description of anhedonia in clinical interviews, may, in part, be due to the lack of knowledge surrounding the subjective experience of anhedonia, as reported and described by adolescents. To date there is no clinical evidence or qualitative research to ascertain the exact nature of 'loss of interest and pleasure.' Therefore, little is known about whether adolescents' experiences are consistent with diagnostic criteria or current understanding of specific reward processing deficits in depression.

Self-report scales of anhedonia have the advantage of being quick and easy to administer and therefore would be a useful tool in clinical settings. A number of validated measures are used to measure anhedonia in adults. Self-report scales are the most practicable tool; however, no systematic evaluation of the validity and reliability of each scale exists. A systematic review of these scales forms part of this thesis (Chapter 3). A key element in addressing problems in the measurement of anhedonia, and thus further improving our understanding is to meaningfully capture the subjective experience of anhedonia in adolescents. Currently there are no well validated self-report measures of anhedonia that are suitable for and address the developmental period of adolescence and the different aspects of anhedonia that adolescents experience.

1.3.3. Treatment of anhedonia in adolescent depression

Psychological treatments for depression typically focus on reducing low mood and often do not directly target the symptom of anhedonia. Cognitive Behaviour Therapy (CBT), an approach which focuses on challenging negative thoughts, beliefs and attitudes, and changing behaviours (Beck, 1979), has the largest evidence base for treating MDD in adults and adolescents (Hankin, 2006; Thapar et al., 2012). In children and adolescents, a systematic review and network meta-analysis exploring the efficacy and acceptability of nine psychotherapies for depression compared CBT, Interpersonal Psychotherapy (IPT), supportive therapy, cognitive therapy, family therapy, play therapy, behavioural therapy, problem-solving therapy and psychodynamic therapy (Zhou et al., 2015). At short term follow up only IPT and CBT were more effective than control conditions, and only IPT retained superiority at long-term follow up. The effectiveness of several types of psychotherapy (e.g. behavioural therapy and supportive therapy) were rarely examined within this age group, meaning it was hard to establish their efficacy. However, evidence from a meta-analysis of outcomes following psychological therapy in young people found at best,

moderate support for evidence-based treatments, and effect sizes for the treatment of depression were smaller than for other common mental health disorders (Weisz et al., 2017). A recent meta-analysis of psychotherapy for adolescent depression also found, at best, moderate support for the efficacy of CBT and IPT in treating adolescent depression (Eckshtain et al., 2020).

One possible reason for the modest improvements in depression based on current recommended treatments is that anhedonia and low positive affect are relatively unchanged by existing therapies, despite being a core symptom of depression (Craske et al., 2016; Dunn, 2012). For example, a secondary analysis of data from two randomised controlled trials (DeRubeis et al., 2005; Hollon et al., 2014) that compared 16 weeks of antidepressant medication with cognitive therapy, or cognitive therapy showed that there were smaller improvements in positive affect than negative affect after treatment (Dunn et al., 2020).

Currently no psychological treatments for adolescents specifically target anhedonia. Two treatments that directly target anhedonia have recently been developed for adults. Positive Affect Treatment (PAT; Craske et al., 2016, 2019) uses cognitive and behavioural strategies to target anticipation, consumption and learning of reward. In a pilot trial 96 participants who had depression and/or anxiety were randomised to PAT or Negative Affect Treatment (NAT) – a cognitive behavioural treatment aimed at reducing threat sensitivity (Craske et al., 2019). Participants who were randomised to PAT reported significantly more positive affect, and less depression, anxiety, stress and suicidal ideation at 6 months follow up compared to NAT.

Augmented Depression Therapy (ADePT; Dunn et al., 2019a; 2019b) aims to simultaneously target core features of depression in the positive valence system (PVS) and the negative valence system (NVS). ADePT is a 15-session treatment for acute depression in adults which uses elements from existing treatments targeting negative affect, as well as

mechanisms targeting positive affect (Dunn, 2017). A randomised multiple baseline case series evaluation of ADePT with 11 adult participants resulted in 7 participants improving on measures of depression and wellbeing, and 9 participants showing reliable and clinically significant improvement on at least one of these outcomes (Dunn et al., 2019b). Group level analysis showed significant pre to post change on all outcomes, with the effect size of some positive valence system outcomes superior to existing treatments. Although this treatment is yet to be widely evaluated, preliminary findings suggest that ADePT may change positive and negative aspects of depression. These approaches are not currently a treatment option for depressed adolescents.

1.3.3.1. Behavioural Activation. Behavioural Activation (BA), initially a component of CBT, was developed as a stand-alone treatment for depression after Jacobson et al., (1996) identified that the behavioural component of CBT was as effective in treating depression in adults as full CBT. Forbes (2020) suggested that by increasing participants' contact with rewarding stimuli and thus targeting (low) reward functioning, BA may bring about improvements in depression symptoms. Therefore, due to its focus on increasing positive reinforcement and engagement with rewarding experiences (Forbes, 2020), this approach may be beneficial for treating the symptom of anhedonia, but this is yet to be explored.

BA is based on the learning theory of depression (e.g. Lewinsohn, 1974). Behavioural theories of depression are based on basic learning principles which state that depression occurs when positive reinforcement is reduced. This often occurs as the result of a life event e.g. relationship breakup, death, injury, unemployment, failure, which triggers the onset of depression and then reduces positive reinforcement. Following this trigger event, depression is then maintained if positive reinforcement continues to be reduced e.g. by fewer rewarding activities being available. Lewinsohn, (1974) coined the central feature of this theory as 'response-contingent positive reinforcement', stating that depression is the result of a

reduction in positively reinforced behaviours. As a result, individuals only engage in a small range of passive behaviours (avoiding aversive stimuli), which leads to less frequent and satisfying positive reinforcement and the chance to experience rewards in the social environment, therefore maintaining depression (Ferster, 1983; Veale, 2008).

BA is a recommended treatment for adult depression (NICE, 2018), with two main manuals used. Martell et al.'s (2001) approach is based on functional analysis, which focuses on the "function" of both approach and avoidance behaviours, rather than specifically targeting problematic behaviours. A randomised controlled trial of BA, cognitive therapy and antidepressant medication in adults found that for severely depressed patients' behavioural activation and antidepressant were equally as effective, and both were more effective than cognitive therapy (Dimidjian et al., 2006). More recently, a randomised controlled non-inferiority trial comparing the cost and outcome of BA versus CBT for adults with depression, found that BA was not inferior to CBT and that it was more cost effective as it could be delivered by staff who had less intensive and costly training than CBT therapists (Richards et al., 2017).

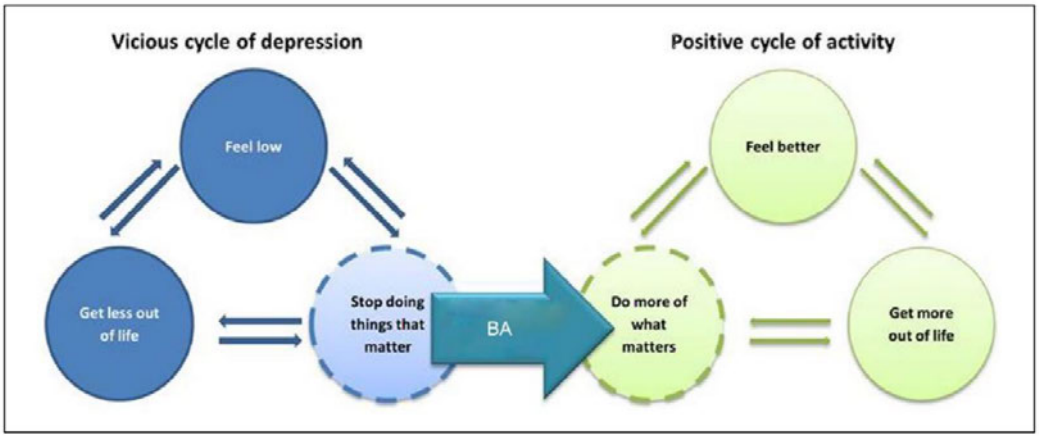
McCauley et al., (2011) highlighted that developmental characteristics of adolescents, such as avoidance of social, school and family involvement, and lack of mastery of cognitive and coping skills, may mean that BA is particularly suited to the treatment of depression in adolescents. McCauley et al., (2016) compared the Adolescent Behavioural Activation Program (A-BAP) with evidence-based practice for depression (EBP-D). They randomised 60 depressed young people recruited in a university hospital-based community mental health clinic to A-BAP and EBP-D. They reported preliminary support for BA as a treatment for adolescent depression, with significant improvements in depression, global functioning, activation and avoidance at the end of treatment. There was no significant difference between treatment conditions, suggesting that BA may be as efficacious as other evidence-based

treatments (i.e. CBT or IPT-A). However, this small trial requires replication in a larger study with participants recruited from routine mental health settings.

A briefer and simplified version of BA was developed by Lejuez et al., (2001). This focuses on targeting reinforcement for depressed and non-depressed behaviours and activity scheduling without functional analysis. The approach is "values-based" and focuses identifying the individuals' values, and then identifying activities that are in line with these values, and therefore personally rewarding (e.g. Lejuez et al., 2001, 2011). Non-cognitive treatments may be particularly engaging for adolescents with depression, who struggle with abstract cognitive reasoning, motivation and fatigue (e.g. Hetrick et al., 2015). Behavioural treatments have also been identified as no less effective in treating depression in adolescents (Weisz et al., 2006).

Pass et al., (2015) developed a brief 8 session form of BATD for adolescents, Brief BA. This focuses on keeping treatment focused and engagement, identifying the young person's values (What matters to you), helping the young person to 'Do more of what matters' (i.e. things that are consistent with their values) and using parent and others to support the young person and provide reinforcement. See Figure 3.

Figure 3. *Simplified old versus new behavioural maintenance cycle used in Brief Behavioural Activation*



Note. *Figure from Pass et al., (2016).*

Brief BA has been successfully explored in a number of clinical case studies (Pass et al., 2015, 2016; Pass et al., 2018) as well as a case series (Pass et al., 2018) with 20 young people from a clinical service. Participants reported a significant decrease in depression symptoms over the course of treatment, with most participants not requiring a further intervention at the end of treatment (Pass et al., 2018).

Although research has not explicitly considered the impact of BA on the symptom of anhedonia, a meta-analysis of RCTs found a significant effect of BA on subjective wellbeing (which incorporates positive affect), however the studies were of mixed quality (Mazzucchelli et al., 2010). Further research is needed to understand and explore whether this treatment is targeting the symptom of anhedonia and increasing positive affect.

1.4. Thesis Aims

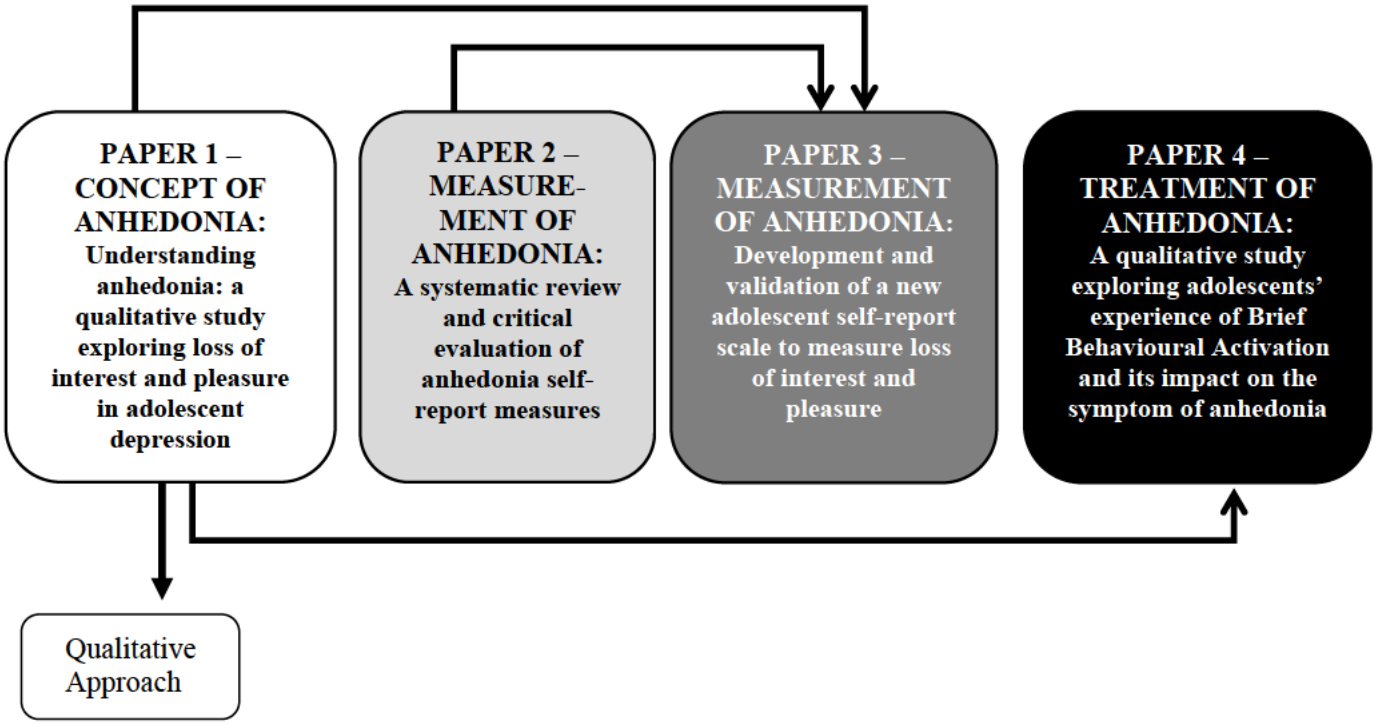
1.4.1. Overall Aims

The overall aim of this thesis is to improve understanding of the conceptualisation, assessment and treatment of anhedonia in the context of adolescent depression. Although anhedonia is a core symptom of depression and a predictor of poor treatment outcome it is neglected in most treatments for depression. For this reason, it is important to better understand the experience of anhedonia in adolescence, when the incidence of depression begins to peak. This aim will be met through a number of related activities which are presented in the format of research papers.

1.4.2. Outline of Papers

This thesis consists of 4 studies presented in paper form. Three of the four papers are published articles (papers 1, 3 and 4) and are accompanied by their published online supplementary material, as well as additional supplementary material for the thesis (i.e. details on the qualitative approach). One paper is an unpublished manuscript (paper 2), and is also accompanied by supplementary material. The following section provides an overview of the rationale for each paper and the choice of methods that were used. See Figure 4.

Figure 4. *Outline of papers*



Note. This figure highlights the four papers in this thesis, and the link between them. Paper 1 informed the development of the remaining papers, particularly paper 3 and 4. Paper 2 informed the development of paper 3.

Paper 1: Watson, R., Harvey, K., McCabe, C., & Reynolds, S. (2020). Understanding anhedonia: a qualitative study exploring loss of interest and pleasure in adolescent depression. *European Child and Adolescent Psychiatry*, *29*(4), 489–499. doi: 10.1007/s00787-019-01364-y

Little is known about the symptom of anhedonia in adolescents. Some qualitative studies have explored the broader experience of adolescent depression (e.g. Midgley et al., 2015) but no qualitative studies have focused on the lived experience of anhedonia in the context of adolescent depression, or indeed in adulthood. Therefore, the first paper in this thesis explores the experience of anhedonia in adolescents. Two groups were recruited;

young people in a clinical service who had a primary DSM-5 (APA, 2013) diagnosis of Major Depressive Disorder or Persistent Depressive Disorder, and adolescents with elevated symptoms of depression who were recruited from the community. Semi-structured one-to-one qualitative interviews were used to explore the concept of anhedonia with each participant. This research was exploratory, and therefore the researchers created a topic guide to guide the interviews, but ultimately with the direction of information being guided by the participants.

Paper 2: Watson et al. (in prep). A systematic review and critical evaluation of anhedonia self-report measures:

With an improved understanding of anhedonia from paper 1 the aim of this paper was to systematically identify and critically evaluate self-report measures of anhedonia. Narrative reviews (e.g. McCabe, 2018; Rizvi et al., 2016b) have summarised the properties of measures used to assess anhedonia, however, an in-depth search and critical analysis of the measurement properties of all available self-report scales has not been conducted. PROSPERO systematic review guidelines were followed and three databases were searched to identify studies that develop or further validated a self-report measure of anhedonia. The quality of eligible papers was evaluated using the Consensus-based Standards for the selection of health-based Measurement Instruments (COSMIN) (Mokkink et al., 2018). Thus, the quality of development and validation and the psychometric properties (e.g. internal consistency) of each scale were rated to ascertain the validity and reliability of each measure.

Paper 3. Watson, R., McCabe, C., Harvey, K., & Reynolds, S. (in press). Development and Validation of a New Adolescent Self-Report Scale to Measure Loss of Interest and Pleasure: The Anhedonia Scale for Adolescents (ASA). *Psychological Assessment*. doi: 10.1037/pas0000977:

The systematic review (i.e. paper 2) identified that few self-report scales are suitable to assess anhedonia in adolescent depression. Scales that have been validated with young people have only assessed specific components of pleasure (e.g. SHAPS; Snaith et al., 1995), or responses to specific types of reward (e.g. ACIPS; Gooding & Pflum, 2014). No self-report measure of anhedonia was developed using a 'bottom up' approach, which selected items on the basis of in-depth interviews with the target population. Therefore, items were developed based on qualitative data reported in (Watson et al., 2020) (paper 1). Feedback was provided by clinical experts and young people to ensure that items were in line with the broader understanding of this construct as well and with vocabulary terminology used by adolescents. The measure was developed with a community sample of young people as this enabled a large dataset, which is necessary to establish the psychometrics of a self-report scale. Measures of validity (content, convergent, structural, discriminant) and reliability (internal consistency and test re-test) were explored and reported.

Paper 4: Watson, R., Harvey, H., Pass, L., McCabe, C., & Reynolds, C. (2020). A Qualitative Study Exploring Adolescents' Experience of Brief Behavioural Activation for Depression and its Impact on the Symptom of Anhedonia. ***Psychology and Psychotherapy: Theory, Research and Practice.*** **doi: 10.1111/papt.12307**.

As highlighted above, anhedonia is rarely targeted in treatments for depression. Behavioural Activation is often used to treat depression in adults and a brief form of BA has been established for use with adolescents (Pass et al., 2015). BA is based on behavioural principles, and aims to increase engagement in positively reinforcing activities to reduce depression. However, despite its relevance to the symptom of anhedonia, little is known about whether this symptom is modified in Brief BA. To explore the experience of young people who received Brief BA and to identify changes in anhedonia after Brief BA, clinical participants from study 1 were invited to take part in a second interview after they completed

treatment. The same research method was used as in Paper 1 with the researcher conducting qualitative one to one interviews to gain an in-depth understanding of adolescents' experiences.

1.5. References

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Chapter 2.

Paper 1: Understanding anhedonia: a qualitative study exploring loss of interest and pleasure in adolescent depression

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Contributions: R.W, C.M., and S.R designed the present study. R.W collected and transcribed the data for analysis. R.W performed the analysis with methodological input from K.H. R.W wrote the manuscript with input from all authors (K.M., C.M and S.R).

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Abstract

Anhedonia (or loss of interest and pleasure) is a core symptom of depression and may predict poor treatment outcome. However, little is known about the subjective experience of anhedonia, and it is rarely targeted in psychological treatment for depression. The aim of this study is to examine how young people experience anhedonia in the context of depression. Semi-structured interviews were conducted with 34 adolescents with a primary diagnosis of depression (N=12) or elevated depressive symptoms (N=22). Thematic analysis was used to identify important aspects of adolescents' experiences. Four main themes were identified: 1) Losing the joy from life and experiencing flattened emotion; 2) Struggling with both motivation and being actively engaged; 3) Losing a sense of connection and belonging; 4) Questioning sense of self and purpose, and losing sight of the bigger picture. The results challenge the framing of anhedonia as simply the loss of interest and pleasure. Adolescents reported a range of experiences that mapped closely onto the cluster of negative symptoms associated with schizophrenia and were similar to the sense of 'apathy' characteristic in Parkinson's disease. This highlights the potential benefit of taking a trans-diagnostic approach to understanding and treating reward deficits associated with mental health problems.

Key Words: Anhedonia, Depression, Adolescence, Qualitative. Understanding

Introduction

Anhedonia is a core symptom of major depressive disorder (MDD). It is defined by the DSM-5 as *'markedly diminished interest or pleasure in all, or almost all activities most of the day, nearly every day'* (APA, 2013). The first onset of MDD frequently occurs in adolescence, with up to 20% of young people experiencing a depressive episode by the age of 18 (Thapar et al., 2012). In adolescents, depressed mood/irritability or anhedonia must be present for a depression diagnosis (APA, 2013). Over half of young people with a diagnosis of MDD report anhedonia in the UK (Goodyer et al., 2017; Orchard et al., 2017). Anhedonia has been identified as a potential predictor of poor treatment outcome in adolescents above and beyond all other depression symptoms (McMakin et al., 2012). It may also be key to understanding suicidality, with adolescent suicide attempters reporting greater anhedonia severity than suicide ideators, even after controlling for depression and anxiety (Auerbach et al., 2015). Despite the importance of anhedonia for diagnosis and prognosis, a variety of conceptual and methodological challenges exist meaning that the symptom of anhedonia is not well understood.

Research using functional MRI and behavioural tasks suggest that there are distinct components of anhedonia related to liking (consummatory/hedonic impact), wanting (anticipatory/motivation) and learning (reward prediction) (Berridge & Kringelbach, 2008; Berridge & Robinson, 2003). Although behavioural studies report no deficits in consummatory anhedonia in adults (Dichter et al., 2010; Sherdell et al., 2012) neural differences have been found during consummation in adults at risk of depression and adolescents with depression symptoms (McCabe et al., 2009, 2012; Rzepa et al., 2017). A deficit in reward anticipation is consistently reported in depressed adults and adolescents both at the neural (Zhang et al., 2013) and behavioural level (Rizvi et al., 2016), whilst studies

examining reward learning also find depressed adults have a reduced ability to behaviourally learn about reward (Pizzagalli et al., 2008; Vrieze et al., 2013). Taken together, this suggests that the concept of anhedonia may be better defined as a deficit in multiple aspects of reward processing.

The clinical assessment of anhedonia in young people is based on either administration of semi-structured diagnostic interviews, of which the Kiddie-Schedule for Affective Disorders and Schizophrenia (K-SADS) (Kaufman et al., 1997) is the gold standard, or on self-report questionnaires (e.g. Snaith Hamilton Pleasure Scale, SHAPS; Snaith et al., 1995). Both methods rely on young people giving an accurate description of the symptom and its components. Most questionnaire measures have been developed for and with adults and contain items that are of doubtful relevance to young people. For example, *"I would enjoy a cup of tea, coffee, or my favourite drink"* (SHAPS; Snaith et al., 1995) and *"The sound of crackling wood in the fireplace is relaxing"* (Temporal Experience of Pleasure Scale, TEPS; Gard et al., 2006). The most recent self-report questionnaires aim to assess components of anhedonia, e.g. consummatory (liking) and anticipatory (wanting) anhedonia. However, factor analysis shows that participants' responses load on to separate factors that reflect rewards from different types of activities, namely general versus intimate aspects of social pleasure (i.e. Anticipatory and Consummatory Interpersonal Pleasure Scale; ACIPS) (Gooding et al., 2016; Gooding & Pflum, 2014), or hobbies versus sensory pleasures (i.e. Dimensional Anhedonia Rating Scale; DARS) (Rizvi et al., 2015). The TEPS (Gard et al., 2006) is the only questionnaire in which separate factors for 'liking' and 'wanting' emerge, but these are highly correlated.

These limitations mean that it is unclear how best to assess adolescent anhedonia. Qualitative studies are needed as we do not know the best way to capture this experience in adolescents. Previous qualitative studies (Mccann et al., 2012; Midgley et al., 2015) have

explored aspects of adolescents' experiences of depression but none have specifically elicited adolescents' experiences of anhedonia in the context of depression. Therefore, the aim of this study was to explore how adolescents with a depressive disorder (or elevated symptoms of depression) experience anhedonia. One to one qualitative interviews allowed this topic to be explored sensitively. Thematic analysis ensured an in-depth exploration of the data, whilst enabling the research to capture a breadth and diversity of experiences.

Methods

Ethical approval for the study was obtained from the University of Reading Research Ethics Committee and NHS Research Ethics Committee. Guidelines for ensuring rigour and reflexivity in qualitative research were followed (Harper & Thompson, 2012), as well as the COREQ checklist for reporting qualitative data (Tong et al., 2007).

Participants and recruitment

Participants included adolescents aged 13-18 recruited from the community (age, M = 15.4, SD = 1.6; gender, 55% male) or a clinical service (age, M = 15.6, SD = 1.5; gender, 42% male).

Community participants were recruited through their school. Eighteen schools in the South of England were approached and three agreed to take part in the study (two co-educational and one single-sex school). Recruitment from a single sex school enabled male participants' to be well represented within the study, as male participants are typically under-represented in clinical samples (Orchard et al., 2017). Based on the index of free school meals the 3 schools differed on socio-economic status (proportion of children eligible for free school meals were 2%, 10% and 15%; 12% is the UK average) (GOV.UK, 2018). Adolescents were screened (n = 715, approximately 40% of those invited to take part) for

symptoms of depression using the Mood and Feelings Questionnaire (MFQ: long version) (Angold, Costello, & Pickles, 1987); or the Short Mood and Feelings Questionnaire (SMFQ, short version) (Messer et al., 1995). MFQ data from two of the three schools was collected in collaboration with other researchers for ongoing projects. The MFQ is the recommended screening tool for depression in the UK (NICE, 2019) and has good reliability and moderate diagnostic accuracy (Wood et al., 1995). From this sample we purposively sampled 30 young people seeking diversity of age, gender and a range of MFQ scores above the clinical cut-off to capture the range of depression severity (minimum scores for inclusion 27 on the MFQ (Wood et al., 1995) and 8 on the SFMQ (Angold et al., 1996). Adolescents identified were invited to take part in this study approximately 2 weeks after completing the questionnaire. Twenty-two (73%) of those invited participated in the study, and 8 (27%) did not respond to requests to participate.

Clinical participants were recruited from referrals to a Child and Adolescent Mental Health Service (UK) in the South of England. As part of the routine clinical assessment young people, completed two semi-structured diagnostic interviews; the Kiddie-Schedule for Affective Disorders and Schizophrenia depression section and psychosis screen (K-SADS-L) (Kaufman et al., 1997) and the Anxiety Disorders Interview Schedule for Children (ADIS-IV-C/P) (Brown et al., 1994). Twenty young people who met DSM-5 criteria for a primary diagnosis of depression (APA, 2013) were invited to take part in the research. Twelve (60%) participants gave consent or assent to take part; and 8 (40%) declined or did not respond to requests to participate. Of those who took part, eleven met criteria for Major Depressive Disorder and one for Persistent Depressive Disorder.

Procedure

A topic guide was developed using the authors' clinical experience and research expertise in the fields of depression, anhedonia and qualitative methodology. Questions were

evaluated by clinical experts, piloted on adolescents, and revised accordingly. The topic guide explored the following: a) Current and past interests and hobbies; b) Future enjoyment and plans; c) Changes and/or loss of enjoyment and interest. The topic guide was used flexibly and comprised open questions relating to pleasure and enjoyment, followed by prompts to gather richer data about each experience.

Informed written consent was obtained from all participants, and from the parents of young people under 16 years of age. The first author (RW), a female PhD student, conducted all the interviews face-to-face. They took place in a quiet room at the school or clinic with only the researcher and participant present. Interviews were audio recorded and lasted an average of 33 minutes (range 17 to 73 minutes). Participants received a £10 gift voucher for their participation. Theoretical saturation was reached, with the data collection process no longer offering any new or relevant insights. Interviews were transcribed verbatim by RW, and all identifying information removed and pseudonyms assigned. Field notes were made after the interview and Nvivo software used to aid in analysis.

Analysis

Thematic Analysis (TA) was used to identify and analyse patterns of meaning in the dataset, highlighting the most salient clusters of content. This method is best suited to exploring a group's conceptualisation of a specific phenomenon (Harper & Thompson, 2012). TA is not connected to a specific ontological or epistemological position; therefore, in this study the researchers adopted a broadly critical realist (post-positivist) perspective (Guba & Lincoln, 1994). This position makes the assumption that reality is measurable and observable, whilst acknowledging that participants are not fully aware of all the factors that influence their experiences (Harper & Thompson, 2012). The researchers considered their own sources of bias and prior assumptions, including knowledge and experience gained from

working in child and adolescent mental health services (RW, SR) and conducting research into young people's mental health (KH, CM, SR).

Constant comparative techniques were used to analyse the data, based on Braun & Clarke's (2006) six stage thematic analysis method. In stage 1), the first author became familiar with the data by conducting and transcribing the interviews, and then reading and re-reading the transcripts. In stage 2), RW conducted line by line coding. Coding was an inductive and recursive process, with constant comparisons made between and within transcripts. All data were initially coded for both explicit and implicit meaning. Only information regarding unique personal circumstances, or treatment was categorised as 'wider content.' The labelling of codes focused on capturing the experience of anhedonia. In stage 3), codes were combined into potential themes, which reflected major features and patterns in the data. In stages 4) and 5) themes were reviewed by examining all codes and themes collectively. As recommended by Saldaña (2015), tentative themes were reviewed by the research team (RW, KH, CM and SR). During these coding meetings, alternative interpretations were considered and discussed until a consensus on the interpretation of patterns in the data was reached. In the last stage, stage 6), agreed themes were finalised and quotations illustrative of each theme were identified.

Results

Overview of Themes

Adolescents' experiences were captured in four main themes: 1) Losing the joy from life and experiencing flattened emotion; 2) Struggling with both motivation and being actively engaged; 3) Losing a sense of connection and belonging; and 4) Questioning sense of self and purpose, and losing sight of the bigger picture (see Figure 1). Each theme highlighted a unique aspect of adolescents' experiences; however, there were areas of conceptual overlap.

All major themes and sub-themes were expressed by both the clinical and community sub-samples.

Table 1. *Participant Demographics and Clinical Characteristics*

Pseudonyms	**Age**[a]	**Gender**	**Ethnicity**	**MFQ**		**SHAPS Score (/56)**[c]	**Sub-Sample**
				Long Score (/66)[b]	**Short Score (/26)**[b]		
Adam	17	Male	White British	**40**	-	39	Clinical
Alice	13	Female	White British	**37**	-	32	Clinical
Amy	15	Female	White British	-	**24**	40	Community
Anna	13	Female	White British	-	**10**	46	Community
Ben	14	Male	Other	**31**	-	37	Community
Carl	16	Male	White British	**59**	-	37	Community
Chris	15	Male	White British	-	**11**	46	Community
Claire	17	Female	White British	-	-	30	Clinical
Elliot	16	Male	Other Asian Background	**30**	-	29	Clinical
Gary	16	Male	White British	**46**	-	33	Clinical
Helen	17	Female	White British	-	**13**	50	Community
Ivy	13	Female	Other White Background	**39**	-	35	Clinical
Isla	15	Female	Other Asian Background	-	**15**	36	Community
India	16	Female	Other White Background	**46**	-	35	Clinical
Jacob	16	Male	White British	**45**	-	26	Clinical
Jasmine	14	Female	White British	**26**	-	23	Clinical
Jayden	15	Male	White British	**41**	-	36	Clinical
Jennifer	17	Female	White British	**42**	-	37	Clinical
Joanne	15	Female	White British	-	**16**	38	Community

Karly	14	Female	White British	-	**22**	16	Community
Lucy	16	Female	White British	**44**	-	34	Clinical
Maya	15	Female	White British	-	**21**	41	Community
Mel	13	Female	Pakistani or Pakistani British	-	**10**	47	Community
Matthew	18	Male	White British	**32**	-	53	Community
Maddie	15	Female	White British	-	**18**	46	Community
Neil	15	Male	Chinese	**33**	-	44	Community
Quentin	15	Male	Other Mixed Background	-	**11**	43	Community
Richard	18	Male	Other White Background	**27**	-	40	Community
Ross	18	Male	White British	**37**	-	32	Community
Stuart	16	Male	Other White Background	**31**	-	44	Community
Tessa	17	Female	White British	-	**20**	-	Community
Tylor	15	Male	Other White Background	**31**	-	39	Community
Theo	13	Male	White British	**27**	-	43	Community
Timothy	17	Male	White British	**34**	-	40	Community

Note. [a] Age at interview, [b] MFQ score at screening or diagnosis. MFQ = Mood and Feelings Questionnaire (higher scores indicate more depression). Participants completed either the long or short MFQ. [c] SHAPS = Snaith Hamilton Pleasure Scale (higher scores indicate more pleasure).

[Insert Figure 1]

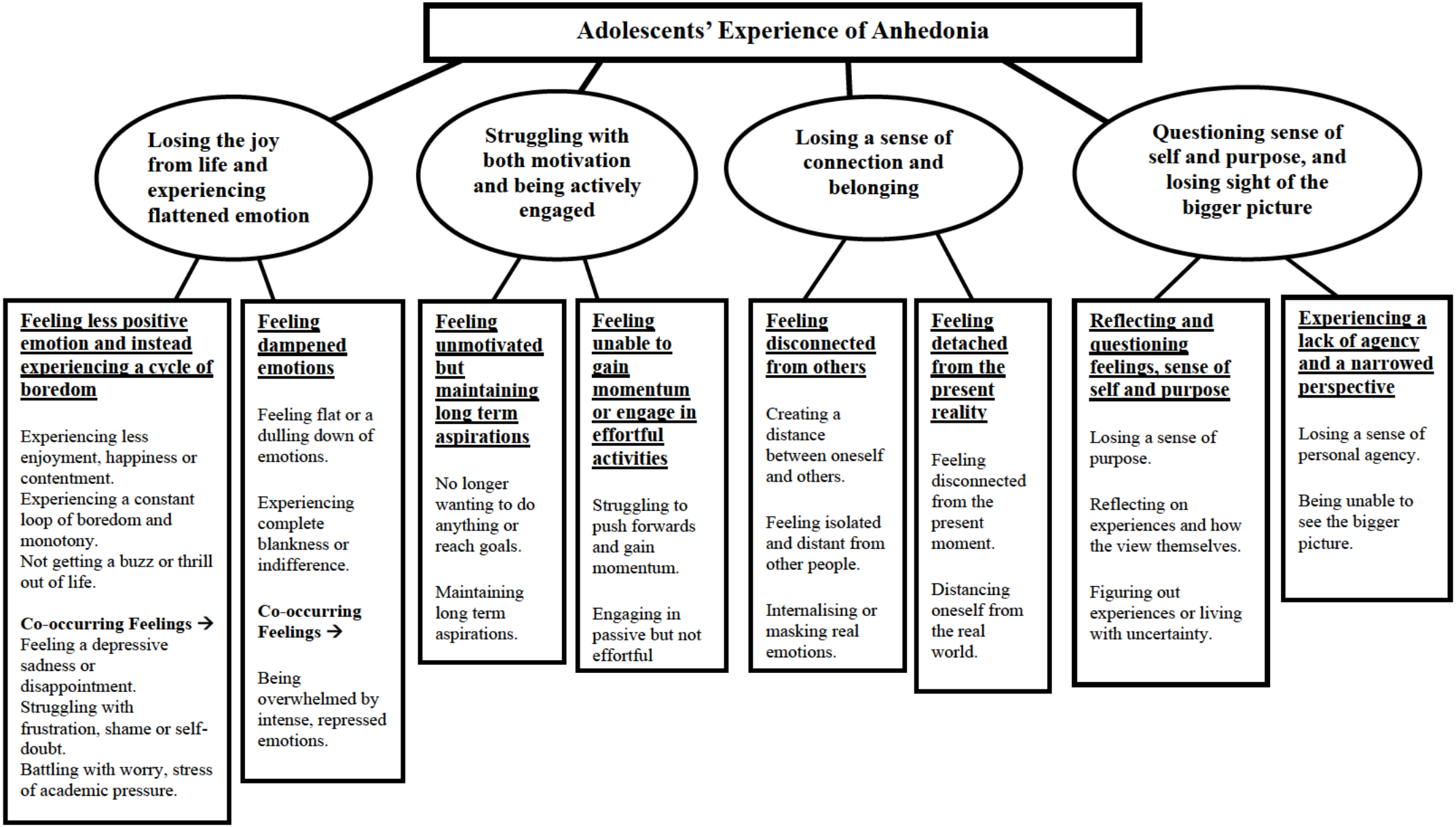

Figure 1. Diagram showing the interview topic (level 1), themes (level 2), sub-themes (level 3), and higher-level codes (level 4).

Theme 1 – Losing the joy from life and experiencing flattened emotion: *"I lost what I enjoyed doing"* (Tessa, community)

This theme concerns the disruption of adolescents' positive emotions and co-occurring negative emotions.

Sub-theme: Feeling less positive emotion and instead experiencing a cycle of boredom

Young people used a range of words to describe the presence or absence of positive emotions, including *"enjoyment," "interest," "satisfaction," "pride," "curiosity," "fun," "endorphin rush," "excitement," "enthusiasm," "relaxing," "good"* and *"happy."* They described positive emotions as arising from being creative, active, achieving something difficult and spending time with others. A number of adolescents recruited from the clinic and the community described feeling a global loss of interest and enjoyment in anything. They described everything (or almost everything) as *"boring".* This often seemed to contradict initial descriptions of hobbies and interests they took part in, or for which they expressed a liking or preference. These feelings of boredom and disinterest were closely linked with not wanting to do things. Adolescents also felt a sense of *"monotony,"* and described feeling like they were in a *"constant loop"* of mundane activities.

> *"I was just like completely bored with it. Like you get bored with a TV show, and you're like, okay leave it then, just move onto another one. It's quite like that with reading and sport because it was just a, I'm bored with this, let's try and find another thing and then I never really found another thing, I just try and do a lot of different things, think I was interested in them then get bored, and just get into a cycle of boredom, finding something else, bored with that, move on"* (India, clinic).

Concepts such as *"excitement"* and *"enthusiasm"* were used by some participants in reference to both current enjoyment and the anticipation of future events. For example, Jayden (clinic) said *"I get really excited watching TV, 'cos I get really into what I'm*

watching." For others excitement was absent, e.g. *"nothing feels exciting"* (Ivy, clinic), or things *"sap the enthusiasm out of me" (*Stuart, community). Many young people could not think of anything they were looking forward to or excited about, however, it was often unclear whether this was because they did not anticipate having fun, could not imagine future events, or had a *"bad memory"* for remembering what they had planned (i.e. prospective memory problems).

> *"If there's something new and shiny, new film or game I'll probably be like, yeah it will come out and I'll see it, but most stuff doesn't get me excited, just sort of, wait for it to turn up and see how to feel about it."* (Ross, community).

While adolescents typically described a change in positive emotions; some also described feelings of sadness, anxiety and shame. These negative emotions sometimes resulted in a loss of positive feelings.

Sub-theme: Feeling dampened emotions

When asked to describe their feelings, some adolescents reported a partial or complete blunting of any emotion. They described themselves as feeling *"dull," "grey," "flat," "vacant," "a blank sheet," "empty"* and *"emotionless."* Some young people described a general flatness, passivity, and feeling *"indifferent"* or not *"caring"* about anything. Jacob (clinic) described special events like his birthday as feeling like *"just another day."* This flatness was also displayed vocally by them talking with little intonation. Most young people's experiences reflected a loss of both positive and negative emotion.

> *"I didn't really feel anything, like, there was no like happiness or excitement, but there was also like no sadness. It was just like everything was grey."* (Carl, community).

The sense of blunted emotions was not reported all the time or by all young people. Sometimes adolescents felt strong fluctuations in mood, with their feelings shifting abruptly from happiness to sadness.

***Theme 2* – Struggling with both motivation and being actively engaged*: "I'm never motivated to do anything"* (Jasmine, clinic)**

This theme captures changes in wanting to do things, effort exerted and types of activities young people engaged in.

Sub-theme: Feeling unmotivated but maintaining long term aspirations

Adolescents described changes in how much they "*wanted"* or felt *"motivated"* to act or engage in experiences. This lack of drive often contrasted with young people's stated long-term ambitions and goals, for example going to university, or playing in a band. Some participants' lack of drive was related to specific experiences such as going to school or seeing friends. Others described a more global lack of drive, with them "*not wanting to do anything at all*" or even "*not wanting to live"* (Amy, community).

> *"Yeah like although they were the things I enjoyed, although I knew I should be enjoying them, for some reason like, I just like wouldn't have the motivation to do it."* (Ivy, clinic).

A loss of drive often occurred alongside a lack of positive emotion. Some participants, however, reported that although they had no drive at all, when they engaged in activities they did enjoy them. This was reported by young people in both the clinical and community samples.

Sub-theme: Feeling unable to gain momentum or engage in effortful activities

Many adolescents were less willing to make efforts needed to reach their goals or felt that everything required more effort. Young people often said *"I just can't be bothered"* or that they had to *"force"* themselves to do anything. Many participants noted that making an effort to get things done was the key barrier to engaging with life and to improving their mood. Jennifer (clinic) said *"it's like if you have a wheel, starting to push the wheel is a lot of effort but the momentum will carry it forwards."* Young people sometimes linked their lack

of mental and physical effort to low levels of energy and fatigue as well as to a lack of drive. When feeling unmotivated and fatigued, a number of adolescents said they did very little, often spending their free time just lying in bed.

> *"Most of the time it's my parents forcing me to get out of bed, other times if I actually have something planned, just sort of, force me to get out of bed…The last few days, I couldn't even bring myself to get out of bed."* (Gary, clinic)

Some adolescents were able to identify activities that they would and would not do. For example some could put in enough effort to engage in passive activities, for example,

> *"So it's kind of, putting in effort to go and do things that will decline. I would do more, kind of, passive things, so like TV and movies, where it's just in front of you."* (Richard, community)

Other young people continued to take part in more demanding activities because they felt compelled or obligated.

Theme 3 – Losing a sense of connection and belonging*: "I'll be there but I won't be present"* (Jennifer, clinic)

This theme focuses on adolescents' connections with others and the world around them.

Sub-theme: Feeling disconnected from others

Young people described a sense of relatedness, where they knew other people had similar feelings or shared experiences, and that helped them to feel connected. Receiving direct social support was important, with adolescents describing the significance of having a "*support network."* Receiving emotional support helped to improve their mood and motivation. In the absence of connection, adolescents often felt detached from others.

"Participant: "Yeah sometimes, like sometimes when I say no to my friends a lot they'll just go and have a fun time and then they'll be talking about it.

Researcher: How does that make you feel?

Participant: A bit, quite more lonely." (Alice, clinic).

Many participants found it difficult to communicate or express their feelings to others and instead kept things internalised. Some felt an internal struggle; they wanted to talk about their feelings, but did not want to be a burden to others. Putting feelings into words was especially hard for those in the community who did not routinely discuss their emotions with others. Some masked their real feelings by pretending they were happy or enjoying experiences when they were not.

"I guess, most of the time things - I probably appear as though it excites me, but then inside I'm just like going along with everyone else. Like if they find it exciting, I will just be like 'yeah that's nice,' but I'll probably find it really boring." (Isla, community)

Sub-theme: Feeling detached from the present reality

As well as social connections, some young people experienced a disconnection from their surroundings, and/or a disconnection from themselves. This sub-theme featured more strongly in the community sample. When describing feeling disconnected from the moment, adolescents used phrases such as, *"going through the motions"* or being on *"autopilot."* Some adolescents described this as if they were watching things happen from afar, like in a film or without any depth. One young person described this feeling as an out-of-body experience, as if watching themselves from above.

"I just go through the normal stuff, but being more looking on than actually doing it, it's more like it's looking through a film, and just my body doing exactly

what it would have done anyway, with me in my head watching somehow, rather than me just being there." (Tylor, community)

For many young people disconnecting from the world around them was also a deliberate distraction from their feelings or situations.

Theme Four: Questioning sense of self and purpose, and losing sight of the bigger picture: *"What's the point in trying anymore?"* (Maddie, community)

This theme reflects adolescents' search for meaning and understanding, and their perception and beliefs about the world.

Sub-theme: Reflecting and questioning feelings, sense of self and purpose

Adolescents described a loss of purpose, questioning the meaning of life and of taking part in day to day activities. This description was closely linked to not wanting to do things. A loss of purpose was described by adolescents in both the clinical and community samples.

"When I think in the more wide sense I realise that there's really no point to any of this, GCSEs, exams all of that, eventually we're all gonna die, what use does it really have." (Stuart, community).

In contrast to lacking purpose, feeling the need to have a meaningful life, and thinking *"I won't have anything to look back on"* (Isla, community) was the driving force for some young people to change their actions.

Young people differed in their ability or interest in self-reflection. A lot of adolescents expressed uncertainty, as in feeling like *"I don't know my feelings."* Some young people were in the process of discovering their identity, saying *"I just kinda didn't realise my interest"* (Ivy, clinic) and *"[I'm] still trying to figure out what I like more"* (Mel, community). Others displayed explicit insight into their feelings, and expressed this at a

deeper level, often appearing self-critical and considering what their feelings said about them. Matthew (community) said *"I thought I was a bit better than that, but clearly wasn't."*

Sub-theme: Experiencing a lack of agency and a narrowed perspective

As well as searching for self-discovery, young people talked about their view of the wider world and often expressed a bleak outlook and a lack of personal agency. The majority of young people described feeling "*stuck," "trapped"* or *"enclosed."* This sometimes resulted in a *"mental battle"* between how they felt i.e. no emotion, and how they wanted to feel i.e. excited. At other times, this was experienced as *"acceptance"* and resignation.

> *"Like you don't feel yourself. People point it out to you, and you don't change 'cos that's how you feel."* (Amy)

When struggling with their emotions, a number of young people described a narrowing of their perspective. Some young people felt *"there's kind of no way of getting back to the way I was"* (Joanne, community) and could not see beyond their current circumstances or emotional state. This was closely linked with adolescents having a bleak outlook on the future, having *"a lack of overall optimism"* (Neil, community), and not wanting to think long term, or believing that nothing would change.

Connection between Themes

The salience of, and connection between, themes was considered. Themes 1 and 2 encapsulated the most prominent and central components of anhedonia, and Themes 3 and 4 incorporated secondary experiences related to, or part of anhedonia. In addition, Themes 1-3 captured the feelings and behaviours that comprised adolescents' experiences and theme 4 identified the cognitions and interpretation of feelings and behaviours (see Figure 2).

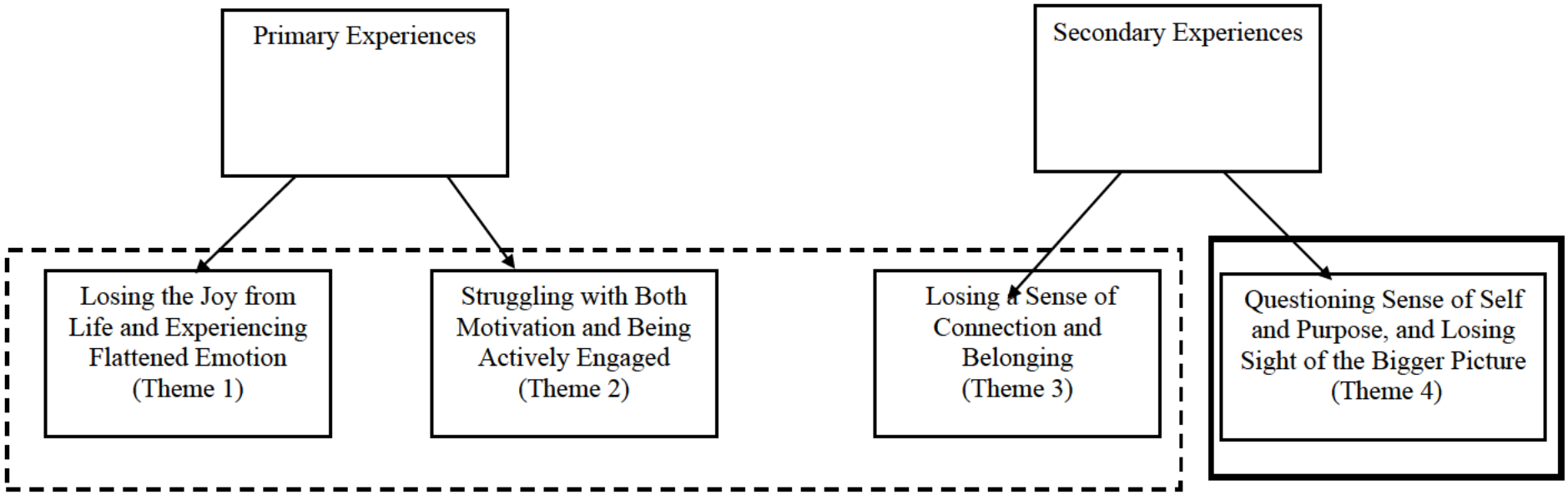

Figure 2. Diagram showing the relationship between themes. The primary experiencing problems were captured in themes one and two. The secondary experiencing problems were captured in themes three and four. A dotted line represents the themes which capture the emotional and behavioural components of adolescents' experiences. A bold solid line represents the theme which captures the cognitions and interpretation of experience.

Discussion

This study aimed to understand the experience of anhedonia in the context of adolescent depression. Although it is considered to be a core symptom of depression, the subjective experience of anhedonia in adolescents has only been investigated using self-report scales, and therefore little is known about its nature, and how it is experienced and described by adolescents. Our results indicate that young people have a variety of different experiences which form the symptom of anhedonia. This included a loss of positive affect, a blunting of all emotion, a loss of drive and willingness to exert effort, social withdrawal, dissociation, loss of purpose, and hopelessness. These experiences were reported by adolescents with a formal diagnosis of depression (clinical sample) and by those with elevated symptom of depression (community sample). The experiences of the clinical participants were more homogenous, most likely due to specific eligibility criteria being in place in the clinical service, in comparison to community participants who were identified based on a self-report scale. No clear gender differences emerged from the data, but this is likely an interesting area for future exploration. The descriptions of anhedonia in this study challenge the framing of anhedonia as simply the loss of interest and pleasure (APA, 2013).

The range of experiences captured as part of anhedonia share features with general accounts of depression, i.e. a bleak view of everything and isolation and cutting off from the world (Midgley et al., 2015). They also bear a close resemblance to the description of reward deficits that are characteristic of other disorders (Millan et al., 2014). For example, the negative symptoms of schizophrenia include loss of motivation, emotional blunting, and social withdrawal, as well as the loss of interest and pleasure (particularly anticipatory pleasure) (American Psychiatric Association, 2013). The results of this study highlight marked similarities between the accounts of anhedonia by young people with depression and depression symptoms and the narratives of young people who have schizophrenia (Gee et al.,

2019). Both groups report reduced motivation, enthusiasm, blunted affect, social withdrawal and lack of agency. There are also marked overlaps between the experiences of anhedonia described here and, the description of 'apathy' in Parkinson's disease which is described as a lack of interest, enthusiasm or motivation (McCabe, 2018). No participants in the clinical group reported any psychotic symptoms, therefore it is unlikely that these individuals were presenting with schizophrenia. These symptoms were not assessed in the community sample. It is possible that participants were experiencing prodromal depressive symptoms and would go on to experience schizophrenia. However, prodromal symptoms often lack specificity i.e. marked social isolation or withdrawal (Manju et al., 2018) and clinically these features could be indicative of a range of psychopathology, not just schizophrenia (McGorry et al., 1995). Due to the similarity of experiences across disorders, these findings suggest that anhedonia may be best understood by taking a trans-diagnostic approach, looking across disorders. The NIH Research Domain Criteria approach aims to classify mental disorders based on dimensions of observable behaviour, rather than clustering symptoms into disorders (Cuthbert, 2015). The similarity in the experience of reward-related deficits across disorders suggests that taking a more transdiagnostic approach may be useful for treating anhedonia (Husain & Roiser, 2018).

The data from this study provide some insights into the extent to which consummatory, anticipatory and motivational anhedonia can be distinguished by adolescents. Aspects of anhedonia were typically mentioned as co-occurring, but could often be distinguished from each other, for example, adolescents frequently described not *wanting* to do something, but if they did do it, they *enjoyed* it. In contrast adolescents did not make a clear distinction between lack of anticipation (i.e. looking forward to experiences, feeling excited) and lack of enjoyment (i.e. feeling that something was fun or satisfying) and these experiences tended to be described as one. This may explain why most questionnaire

measures of anhedonia have not been able to identify independent factors reflecting the subjective experience of anticipatory and consummatory pleasure, despite the fact that these components can be disambiguated at a neural level (DARS (Rizvi et al., 2015); ACIPS (Gooding & Pflum, 2014). Our data suggest that simply asking about wanting vs. enjoyment in self-report measures and not anticipation vs. enjoyment may be more easily understood and reported by adolescents. The clinical assessment of anhedonia in adolescents may also benefit from developing new non-verbal methods of assessing this construct in order to disambiguate anticipation vs. enjoyment.

We found that adolescents often struggled to imagine pleasurable events in the near future. This may reflect difficulties or deficits in anticipatory pleasure but may also reflect prospective memory problems. Typically, participants' long-term goals and ambitions e.g. going to university, were intact even though the young person reported feeling hopeless and said they did not look forward to experiences. This distinction between the negative near future and the more positive distant future indicates that when depressed young people maintain some positive aspirations. These may form a basis for psychological treatments that target and enhance positive mental imagery (Pile et al., 2018).

A number of questions about adolescents' subjective experience of anhedonia remain unanswered. It was often hard for young people to distinguish between loss of positive affect and the presence of negative affect e.g. feeling bored and feeling sad. Therefore, it is unclear if some experiences (i.e. feeling disconnected) are best represented as part of anhedonia, or if they reflect broader negative emotions associated with depression. A number of adolescents described a blunting of all emotion (positive and negative), which is consistent with evidence that young people with depression symptoms have blunted neural responses to both positive and negative stimuli (Rzepa et al., 2017).

Strengths and limitations

It is a strength of this study that both adolescents with a diagnosis of depression and those who reported symptoms of depression but did not have a diagnosis were recruited. This provided some clinical diversity. However, no adolescents were recruited from in-patient units or complex services; and therefore, it is possible that the most severe instances of anhedonia were not captured in this study. Likewise, there was some diversity among participants regarding socio-economic status (using free school meals as a proxy). However, the sample was not diverse in other aspects, for example geography and ethnicity. An aim of qualitative research is to understand the experiences of a specific sub-group, but it is of value to build on the findings of one study by conducting further studies with different samples.

This qualitative study provides rich data but the study is not designed to provide results that can be generalised to the broader populations of adolescents with depression. Future quantitative research would be needed to establish the extent to which the experiences described by the participants in this study reflect those of the broader population of adolescents with symptoms of depression.

Conclusions

This study highlights the subjective experience of anhedonia in adolescent depression. Young people's accounts revealed a wide range of challenges beyond loss of interest and pleasure, i.e. loss of motivation, sense of connection and trying to make sense of these experiences. Our data suggest that the current concept of anhedonia in depression captures a limited aspect of the experiences of young people and overlaps with the negative symptoms of schizophrenia. Young people found it difficult to identify different components of anhedonia, such as anticipatory and consummatory aspects. Thus, the clinical assessment of anhedonia in adolescents may benefit from developing new non-verbal methods of assessing this construct. Of particular interest and importance to assessment and treatment, was that although young people reported elevated depression symptoms and many had a formal

diagnosis, most reported that their long-term goals and aspirations were intact, even in the context of current feelings of hopelessness and low motivation.

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2.1. Electronic Supplementary Material

Description of Qualitative Themes, Sub-themes, Codes, and Concepts within each Code

Sub-theme	Overall Codes	Concepts within each code
THEME 1. EXPERIENCING A LOSS OF JOY AND A FLATTENING OF EMOTION		
SUB-THEME: Feeling less positive emotion and experiencing a cycle of boredom	Experiencing less enjoyment, happiness or contentment	Presence or absence of feelings relating to: enjoyment, fun, contentment, joy, happiness, satisfaction, sense of achievement, feeling good, or liking.
	Experiencing a constant loop of boredom or monotony	Presence or absence of feelings relating to: interest, fascination, curiosity, variation, or intrigue. Or conversely boredom.
	Not getting a buzz or thrill out of life	Presence or absence of feelings relating to: excitement, eagerness, can't wait, anticipation, enthusiasm, exhilaration, thrill, or liveliness. This relates to current emotional states, as well as the expectation, and imagination of future events.
	Feeling a depressing sadness or disappointment	Presence of absence of sadness (i.e. unhappiness, misery, sadness, crying, or feeling down) or disappointment (i.e. feeling let down, or despair).
	Struggling with frustration, shame or self-doubt	Presence or absence of irritability, anger, dislike, hatred, jealousy or envy, or shame (i.e. embarrassment, shame, or self-conscious emotion).
	Battling with worry, stress or academic pressure	Presence or absence of anxiety (i.e. worry, scared, anxiety, stress, pressure)
SUB-THEME: Feeling	Experiencing a dulling down of emotions	Partial or complete loss or lack of emotion (either lack of positive, or neither positive or negative).

dampened emotions	Experiencing complete blankness or indifference	A general flatness (i.e. dull, grey), blankness (i.e. feeling nothing) or indifference (i.e. not caring about anything).
	Being overwhelmed by intense, repressed emotions	Feeling strong or an overwhelming amount and/or intensity of emotion. A sense of catharsis and feeling of relief from releasing strong or repressed emotions.
	Fluctuating between strong highs and lows	Feeling or experiencing extreme highs and lows or sudden changes in emotions from one to another.
THEME 2. STRUGGLING WITH MOTIVATION AND ACTIVE ENGAGEMENT		
SUB-THEME: Feeling unmotivated but maintaining long term aspirations	No longer wanting to do anything or reach goals	Presence or absence of drive, wanting to do things, feeling motivated, and being goal orientated.
	Maintaining long term aspirations	Presence or absence of ambition and long-term goals and aspirations.
SUB-THEME: Feeling unable to gain momentum or engage in effortful activities	Struggling to push forwards and gain momentum	Changes in effort exerted. Making more of an effort, feeling like things are more effort to do, pushing through or being pushed to do things, and trying/being invested in reaching a goal – doing things in order to get the end result. Or conversely making less effort, or not trying.
	Engaging in passive but not effortful activities	Presence or absence of physical action or taking part in activities/experiences. Or making a distinction between passive and active activities i.e. only engaging in passive activities (i.e. watching TV) rather than active activities.
THEME 3. LOSING A SENSE OF CONNECTION AND BELONGING		
	Creating a distance	Presence or absence of connection with other people, a

SUB-THEME: Feeling disconnected from others	between oneself and others	sense of relatability, being similar to others or sharing experiences. Or conversely shutting off (physically and emotionally) and creating a barrier between themselves and others (i.e. social withdrawal).
	Feeling isolated and distant from other people	Presence or absence of social support from others, feeling understood, listened to, and helped. Or conversely feeling or being left to handle things without help or being called an attention seeker.
	Internalising or masking real emotions	Presence or absence of communication with others, talking about/expressing emotions to others. Or conversely keeping feelings inside (i.e. internalising), or masking real feelings and/or pretending to other people.
SUB-THEME: Feeling detached from the present reality	Feeling disconnected from the present moment	Feeling disconnected from the moment/reality, watching things happen from afar, like through a film/ without depth. Or feeling a sense of disconnection and unreality in one's personal self, like watching self/ outer body experience.
	Distancing oneself from the real world	Escaping into another world/ reality (i.e. computer game) or distracting self from current situation by doing something else. Could be used as a coping strategy.
THEME 4. QUESTIONING SENSE OF SELF, PURPOSE, AND THE BIGGER PICTURE		
SUB-THEME:	Losing a sense of purpose	Importance or loss of purpose, motive/reason, meaning, not seeing the point, including questioning existence.

Reflecting on feelings, identity and purpose	Reflecting on experiences and how they view themselves	Presence or absence of self-awareness, insight about themselves, reflection on how they feel about or view themselves. Considering self-image, identity and view of the self, as well as self-criticism, self-confidence and self-esteem. Or conversely, not considering the impact of their experiences on how they view themselves.
	Figuring out experiences or living with uncertainty	Figuring out and making sense of experiences, situations or emotions i.e. what they like, don't like. Or conversely experiencing uncertainty, unsure of what they are feeling or experiencing. Or simply accepting their experiences without trying to understand or make sense of their feelings or experiences.
SUB-THEME: Experiencing a lack of agency and a narrowing of perspective	Losing a sense of personal agency	The presence or absence of personal agency. Feeling/ believing they do or do not have the power or ability to control how they feel. Resigning themselves to the fact there is nothing they can do to change their emotions. Feeling restricted or guided by social institutions (i.e. school) and societal norms (i.e. parenting).
	Being unable to see the bigger picture	A shift or change in perspective, viewing things differently i.e. not seeing the bigger picture, or beyond the current problem or situation. Also feelings of hopelessness, and having a bleak outlook on things to come. Or conversely feeling hopeful and optimistic.
Wider Context		
	Broader Personal Circumstances	The description of unique personal circumstances (i.e. domestic abuse).
	Past or current mental health support	The description of mental health support, which includes support from NHS services and school counselling or services (i.e. teacher involvement). This also includes expectations or changes in depression or anhedonia as a result of treatment.

2.2. Additional Supplementary Material

2.2.1. Topic Guide

Could you tell me what you do in your spare time? What makes you feel happy? What do you find really interesting? What usually motivates you? What do you look forward to?

CURRENT ACTIVITIES & HOBBIES

Can you tell me more about this? What were you thinking? How do you feel/ does that feel? How do you find this? How did you behave/ act? What did you do? How often/ when/ where? In what sense/ what do you mean? How has this changed?

Physical (Focus on one activity/hobby in detail)

Social (Focus on one experience/ activity in detail)

School/Work

Can you tell me about an activity or hobby that you do?

- What do you enjoy/ not enjoy about this activity?
- How much do you enjoy this?
- What makes you want to do this?
- What motivates you?
- Has there been a change in how much enjoy this activity?

Can you tell me about a particularly memorable time/ the last time that you did this?

- Did you have a good time? What did you enjoy about this?
- What would have made this experience (even) more enjoyable?
- What about it feels particularly special or good?
- How do you feel beforehand/ in the moment/ afterwards?
- What would have made this experience (even) more enjoyable?
- How much did you enjoy it compared to other people there? How come?

FUTURE

What activities/ events do you have planned in the future (i.e. in the summer holidays)?

- Why do you want to do this?
- How do you feel about this?
- What are you looking forward to about this?
- What makes you feel excited?
- How easily do you get excited by things?

How do you feel about the future? Do you think how much you enjoy things is likely to change?

What activities would you like to do more of in the future? Why?

CHANGES IN ENJOYMENT

Sounds like there has been a change in how much you enjoy things, can you tell me more about that?

Can you tell me about something you used to enjoy, but no longer like?

- How come you don't enjoy this anymore? *(What changed?)*
- How would you feel if you had to do this activity now?

LOSS OF ENJOYMENT

Now or in the past, have there ever been a time when nothing seemed fun/ or things seemed less fun than you would expect? Was anything still enjoyable?

<u>Specific Instance in Detail</u>

Can you tell me about a particular time/ point in time when this happened? (Tell me about the last time…)

- How did this make you feel?
- How long does it last?
- How does this change/ develop during this time?
- Was there any cause/ trigger for this experience?
- How did you come out of this experience? What changed? *(Gradual/ sudden?)*
- What do other people say/ do when you feel like this?
- What do you do/did you do when you feel/felt like this?
- Does anything change how you feel?
- Do you still do these activities even when they don't feel enjoyable? If so, why?

<u>Other Experiences/ Episodes</u>

- How often does/ did this happen?
- How does this compare between episodes/ how you feel at other times (normally)?

DESCRIPTION OF ANHEDONIA

- When you don't enjoy things, what words best describe how you feel?
- When you don't enjoy things, do you also feel sad? Or do these feelings happen at different times?
- Is there a difference between feeling sad and not enjoying things? What is the difference?

[FOR CLINICAL PARTICIPANTS ONLY]

Expectations of Treatment

How do you feel about receiving treatment here in the AnDY clinic?

Do you think this will be helpful?

- If yes, what do you think will be helpful?
- If no, why not?

PAST/CURRENT SUPPORT FOR DEPRESSION/MENTAL HEALTH

Have you received any support for depression in the past?

- If yes, how did you find that experience?
- If yes, was anything helpful or unhelpful?
- If yes, did anything change how much you enjoyed doing things?
- If no, how come?

Are you receiving any other support for depression or mental health?

- If yes, then what?

Self-Help

Is there anything you do to make yourself feel better?

- If yes, does that help? Why?
- If no, why not?

CONCLUDING

- How do you feel in yourself at the moment?
- How did you find answering these questions?
- That's all the questions that I have for you, do you have anything else you would like to say?

2.2.2. COREQ Checklist

COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

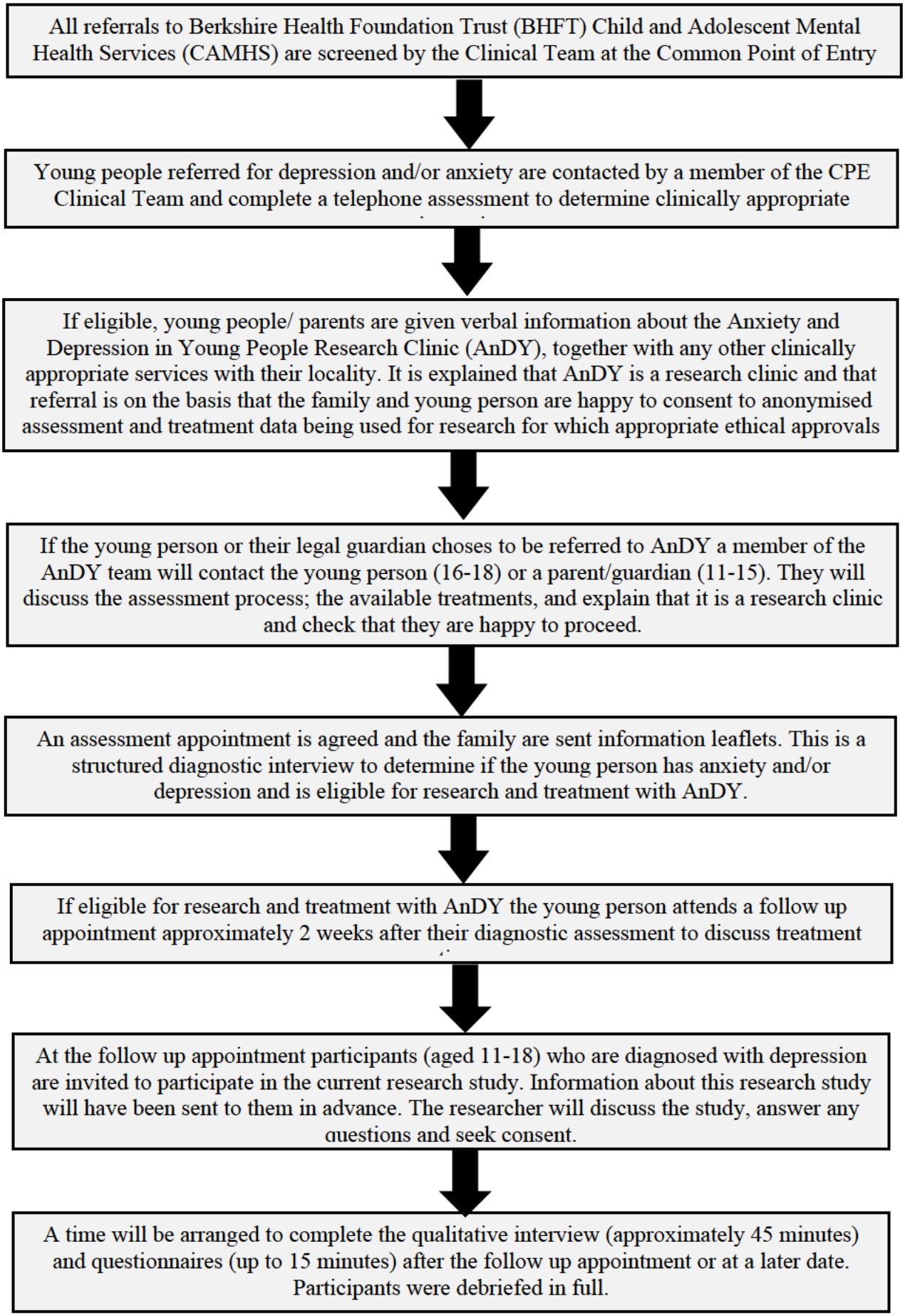
A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	
Occupation	3	What was their occupation at the time of the study?	
Gender	4	Was the researcher male or female?	
Experience and training	5	What experience or training did the researcher have?	
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	
Sample size	12	How many participants were in the study?	
Non-participation	13	How many people refused to participate or dropped out? Reasons?	
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	
Field notes	20	Were field notes made during and/or after the inter view or focus group?	
Duration	21	What was the duration of the inter views or focus group?	
Data saturation	22	Was data saturation discussed?	
Transcripts returned	23	Were transcripts returned to participants for comment and/or	

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	
Description of the coding tree	25	Did authors provide a description of the coding tree?	
Derivation of themes	26	Were themes identified in advance or derived from the data?	
Software	27	What software, if applicable, was used to manage the data?	
Participant checking	28	Did participants provide feedback on the findings?	
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	
Data and findings consistent	30	Was there consistency between the data presented and the findings?	
Clarity of major themes	31	Were major themes clearly presented in the findings?	
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

2.2.3. Clinical Recruitment Procedures



2.2.4. Qualitative Approach

Ontology

Ontology concerns itself with the nature of what is true. Most quantitative research is built on positivist, realist underpinnings, which considers there to be one absolute truth that can be 'discovered' using 'objective' measures and that mirrors 'reality'. In contrast, qualitative research is typically built on relativist, interpretivist, underpinnings, which considers there to be multiple versions of reality, and what is considered 'real' depends on the meaning attached to it. Therefore, if reality is created by what we see, it changes and evolves depending on an individuals' experiences. Reality is therefore considered context bound, and one interpretation of the truth may not apply to other contexts, thus the social world does not exist independent of our conceptualisation of it (Harper & Thompson, 2012).

As highlighted, in this research we adopted a generally 'critical realist' (post positivist) approach, which assumes that to *some* extent the social and physical world exist independent of our conceptions of it (Guba & Lincoln, 1994). For example, anhedonia is a construct that exists even beyond our conscious awareness, and is a 'real' documented clinical phenomenon. However, critical realism differs from 'realism' in that it acknowledges that we are not aware of everything that influences our thoughts, feelings and behaviours; and these may differ depending on context. Critical realism acknowledges that people are not fully aware of all the factors that influence or contribute to their experiences e.g. early life experiences, family beliefs, cultural expectations (Harper & Thompson, 2012). For example, adolescents being interviewed may have had previous involvement with clinical services and/or research staff which is likely to influence their engagement with the current research at a conscious or sub-conscious level.

Critical realism also recognises the limits of participants' ability to accurately reflect on past thoughts and feelings (Madill et al., 2000). When interviewing adolescents with depression they may not be able to directly and explicitly tell us what drives, shapes and maintains their experiences of anhedonia. Furthermore, an individual's experience of anhedonia may differ, or change over time/ depending on the scenario, and each of these experiences are just as 'true' or as much a reflection of reality as one another (i.e. there is not one 'absolute truth' of what that experience entails). We also acknowledged that an individual's clinical experience of anhedonia (and depression more broadly) includes an element of meaning making, and this is a part of the clinical experience. For example, if a young person feels that anhedonia has ruined their life, this 'truth' shapes their interpretation of this experience, what this is, and what it means to experience this symptom.

Epistemology and reflexivity

Epistemology is closely linked to ontology, and asks the researcher to consider the relationship between the knower and what can be known. It prompts the researcher to consider how their perceptions influence our understanding of knowledge, how we know what we know, and how we come to understand another person's unique word view. Ontological standpoints (i.e. what the researcher believes about the nature of reality) influence these epistemological underpinnings (i.e. what relationship the researcher should have with what is being studied). Positivist/ realist underpinning are in line with an objective view of knowledge, which assumes that knowledge is independent of the researcher/ the researcher should not influence the data that is gathered and should try to stay separate from it (i.e. an etic approach - taking an outsider's view of someone's situation). In contrast, relativist/interpretivist perspectives are in line with a subjective view of knowledge, and considers interaction with the participants as necessary to gain an in depth understanding of an individual's experience (i.e. an emic approach – interacting with people to find out what

truth means to the participants). The latter approach acknowledges and considers the potential influence of the researcher on what is being researched, in particular a reflection of how one's own beliefs and opinions influence the data collection and analysis (reflexivity). The concept of reflexivity is central to analysis and interpretation of the data (Braun & Clarke, 2020).

In this research study we adopted a subjective stand point, with the researcher's in-depth interaction with study participants forming and shaping the data. I, as the primary researcher, was also aware of my own sources of bias and prior assumptions, such as, personal experiences and knowledge/experience gained from working in child and adolescent mental health services in other research and clinical capacities. In particular, I considered how my own knowledge and expertise influenced the collection of the data/ the interaction with participants, and all researchers considered how their knowledge and expertise influenced the interpretation of the data and the data analysis. For example, my experience of interviewing adolescents using diagnostic semi structured interviews, shaped my approach to the data collection; I had to adopt my style from gathering information to fulfil a threshold criterion, to facilitating an open conversation, and open-ended questions to gather a more in-depth response, guided by participants' experiences. The research team came with a broader range of clinical and research expertise, for example, understanding of anhedonia from a neuroscience perspective, qualitative expertise, or experience of working with young people experiencing depression and anxiety.

Rigour

A number of steps were taken to ensure rigour (i.e. the transparency of the research process, the defensibility of the design decisions and thoroughness of conduct) of this study (Harper & Thompson, 2012). The interview topic guide was reviewed by two clinical psychologists with experience working with depressed adolescents, and by an expert qualitative researcher. The researcher made a conscious effort to maintain a consistent

approach to data collection and analysis, whilst ensuring the content of the interviews were guided by participants. Notes or memos were made throughout the analysis process describing the researcher's thoughts and interpretations. For example, I wrote personal field notes immediately after each interview, detailing biases that influenced the data collection and analysis, and considered how they may have shaped the data .i.e. *were they difficult or easy to engage? did something about their experience resonate with my own personal experiences? was I more attune to information that was in line with my current understanding of anhedonia from the literature?* Further to this, contextual factors were considered i.e. *was the young person/ family in a rush to get home? did they describe feeling supported generally by their family/ friends? was the interview perceived as a safe space to talk about their mental health difficulties more generally?* (particularly in the community). Furthermore, all interviews were given equal consideration in analysis and selection of quotes, and interviews were coded in a random order to prevent the researcher from giving priority to analysis of interviews based on personal preference.

Reliability checks or second coding of transcripts was not performed, as this is not in line with reflexive forms of qualitative analysis (Braun & Clarke, 2019a). Reflexive approaches advocate that interpretation forms an important component of the analysis; thus acknowledging that differences in analysis would occur if coded by another researcher with different knowledge and sources of bias. However, efforts were made to ensure the analysis provided a credible (i.e. the extent to which findings are believable and well founded) interpretation of the data (Harper & Thompson, 2012). This was achieved by conducting regular coding meetings with the researcher team which had a range of knowledge and expertise; this facilitated in-depth discussions of potential meaning with regards to interpretation of the data, and considered whether other credible interpretations should be considered. This process provided a form of triangulation, i.e. the use of different sources of

information (in this instance researchers), to establish how 'sound' my interpretation of the data. However, convergence was not the aim, as this implies there was one correct way to interpret the data, instead the purpose was to facilitate further, in-depth analysis and interpretation of the data. These processes ensured we presented a credible interpretation of the data, but also acknowledge it is one of several potential credible interpretations. Furthermore, we did not ask participants for feedback on their data once analysed; as the interpretation of the data forms a part of the process of meaning making. Adolescents' experiences may differ on any given day, and thus it is likely that if asked on a second occasion this account may differ. Instead we acknowledge that we are only capturing a snapshot of adolescents' experiences, within their current personal context.

Individual interviews

Individual interviews provide a means of collecting in-depth data of an individuals' experiences. We selected individual interviews over focus groups, predominantly due to the sensitive nature of the topic. As individuals were selected based on having elevated depression symptoms/diagnosis, often with comorbid anxieties, we also wanted to ensure that participants who were quieter or more reluctant had the chance to speak and describe their experiences.

Choice of thematic analysis

Thematic analysis is not tied to a particular epistemological position and lends itself to identifying relatively broad themes which summarise the content of the data. Analysis involves a constant moving back and forth between the entire data set, the coded extracts of data, and the emerging themes and broader concepts (Howitt, 2016). Similarities exist with approaches such as interpretative phenomenological analysis (IPA), which is a method of choice for exploring 'lived experience'. IPA is typically more suitable for very in-depth analyses of a small sample of participants. Furthermore, in this study we were interested

predominantly in what adolescents described and experienced, rather than what it might mean for participants to have these concerns in their particular context. Concepts that originated from grounded theory were also employed, particularly as a result of reviewers' comments to consider the struggles, processes and tensions underlying adolescents' experiences (Charmaz, 2014).

Sample size justification

The sample size for the clinical sample was restricted predominantly by pragmatic constraints, as adolescents were recruited through a small clinical service, with a number of ongoing research projects. A subsample of 12 clinical participants provided some demographic diversity i.e. age, gender and (some) ethnicity. The community sample was selected from a wider pool of potential participants; thus, we were more readily able to employ purposive sampling techniques to capture diversity in age (across the span), gender (both), ethnicity (some diversity), and depression severity (above the clinical cut off). A subsample of 22 community participants were selected to enable this diversity, and in line with previous qualitative studies which have typically recruited around 15 to 20 participants for thematic analysis (e.g. Crouch et al., 2019; O'Brien et al., 2016; Reardon et al., 2018).

In this first paper we acknowledged that we reached a level of theoretical saturation, with the data collection process no longer providing any new insights. However, in later conceptualisations of reflexive thematic analysis, Braun and Clarke (2019b) considered whether data saturation is a concept which fits with reflexive forms of data analysis. The process of interpretation, as well as the researcher's backgrounds, shape the analysis. Therefore, participants' experiences are not just there to be 'extracted' by the researcher: it depends on how the individual / and the person listening to them interprets that information on any given day. Data saturation suggests that is possible to 'capture' all possible experiences, which is not in line with this way of thinking. Having said that, there is a need

for purposive sampling to help facilitate in gathering a diverse range of views. In the clinical sample particularly, the practical constraints of this study i.e. time, location, meant the diversity captured was sub-optimal, but overall, we captured a range of views across the sample with some differences in demographic characteristics.

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Chapter 3.

Paper 2: Systematic Review and Critical Evaluation of Anhedonia Self-Report Scales

Manuscript in preparation.

Contributions: R.W and S.R designed the present study. R.W conducted the literature searches and wrote the draft manuscript. FO/AL/SR second rated the studies, and FO/SR revised and reviewed the final manuscript.

Abstract

Background: Anhedonia, the loss of interest or pleasure, is a symptom that is characteristic of several mental health problems, most notably depression and schizophrenia. There are multiple self- report measures of anhedonia making it hard for clinicians or researchers to choose the most psychometrically robust and clinically suitable. Therefore, the aim of this review was to systematically review and critically evaluate the psychometric qualities of self-report measures of anhedonia. **Method:** A systematic search was performed using PsycINFO, Web of Science and PubMed databases to identify all peer reviewed research that described the development and psychometric properties of anhedonia self-report measures. Eligible papers were then evaluated using the Consensus-based Standards for the selection of health-based Measurement Instruments (COSMIN) protocol (Mokkink et al., 2018). **Results:** Fourteen self-repot scales were identified and fifty-nine studies described their measurement properties. A range of scales capture state and trait anhedonia within clinical and non-clinical populations, however, most anhedonia self-report scales had multiple psychometric limitations. In particular, scales were rarely developed with involvement from both the target population and relevant professionals. Structural validity was widely assessed, but often inconsistent across samples. Tests of convergent and discriminant validity demonstrated the varying nomological network of available measures. Criterion validity, responsiveness, cross cultural validity and measurement invariance were rarely examined. **Limitations:** Subscales that have not been independently validated were not included in the review, despite their potential utility. **Conclusions:** The psychometric evidence base for anhedonia scales needs to be developed and new scales are needed to assess anhedonia in some populations, particularly children and adolescents.

Keywords: anhedonia; self-report; scale; questionnaire; psychometric; measures

Introduction

Anhedonia, the loss of interest or pleasure, is a feature of several mental health and neurological disorders. It is one of the two 'core' symptoms of depression (alongside low or depressed mood, or irritability in children and adolescents) one of which must be present for a diagnosis of major depressive disorder (DSM-5; APA, 2013). Anhedonia is also a negative symptom of schizophrenia (e.g. Garfield et al., 2014), and is recognised as a feature of substance misuse disorders, PTSD and Parkinson's disease (e.g.; (Assogna et al., 2011; Nawijn et al., 2015) and has been linked to anxiety (e.g. Winer et al., 2017). The experience of anhedonia predicts poor outcomes from treatment for depression (McMakin et al., 2012; Vrieze et al., 2013), and the negative symptoms of schizophrenia, including anhedonia, are significant predictors of functional disability and long-term adverse outcomes (Kirkpatrick & Buchanan, 1990; Milev et al., 2005). Until recently anhedonia has been neglected as a focus of treatment, but there is renewed interest in targeting anhedonia (or low positive affect) in psychological treatments (e.g. Craske et al., 2019; Dunn et al., 2019). It is therefore important to be able to assess and monitor the experience of anhedonia in clinical and community settings.

Traditional definitions of anhedonia have focused on the experience of pleasure *in the moment* (Ribot, 1896; Snaith, 1993), however, researchers have begun to consider anhedonia to be a multi-faceted construct linked to broader reward-related deficits, including the inability to "*pursue, experience or learn about reward"* (Berridge & Robinson, 2003; Rømer Thomsen et al., 2015). The sub-components of reward are typically categorised as wanting (appetitive/motivational), liking (consummatory/hedonic) and learning (predictions made about possible future rewards) (Berridge & Kringelbach, 2008). Researchers have also begun to distinguish between the *anticipation* of a future reward and motivational processes

involved in promoting goal direct behaviours, including the *effort* exerted in pursuit of a rewarding experience (e.g. McCabe, 2018; Treadway & Zald, 2011). In line with the RDoC Domains of Interest Initiative (Insel et al., 2010), anhedonia is linked to changes in the positive valence system, such as reward responsiveness which includes desire, expectation, willingness to expend effort, anticipation, immediate and sustained responses to rewards (NIMH, 2011b); and is represented as a concept of 'loss' within the negative valence system (NIMH, 2011a; Watson et al., 2017). Therefore, it may be more accurate to describe this complex and multifaceted construct of 'anhedonia' as an umbrella term for a spectrum of impairments in hedonic function.

A number of different approaches are taken to assess anhedonia, including clinical interviews, behavioural tasks, self-report questionnaires, and fMRI brain imaging (see Rizvi et al., 2016 review). Self-report questionnaires are cheap, relatively quick and easy to administer, and therefore useful for screening anhedonia in the community and measuring the severity of anhedonia in clinical and research settings. Several reviews have included a description of some of the self-report scales available to assess anhedonia (e.g. McCabe, 2018; Rizvi et al., 2016; Thomsen, 2015), however no review has systematically identified and evaluated the psychometric properties of existing scales. Researchers and clinicians therefore end up using different instruments, of varying psychometric quality and theoretical orientation. This diversity may limit the validity and utility of the information obtained and constrains the ability to pool data and make meaningful comparisons between individuals and groups across settings and studies. The consequence of this disparity is to slow down clinical and scientific advances in understanding, and quite probably, treating anhedonia.

The primary aim of this review is therefore to provide a comprehensive and critical review of measures of anhedonia that will help clinicians and researchers decide which measure is best suited to their setting. First, we wanted to identify all published self-report

scales that claim to assess anhedonia and have been validated in either clinical or non-clinical samples. Second, we aimed to assess the quality of the research methods used to develop the measure and the psychometric evidence available for each scale. Third, we wanted to ascertain the nomological network of existing scales. A nomological network is a theoretical framework for what concept is trying to be measured, an empirical framework for how it will be measured, and the link between these frameworks (Cronbach & Meehl, 1955). Put simply, this means we want to understand what specific components of anhedonia are being captured by each measure i.e. lack of consummatory or anticipatory pleasure, and how these relate to measures of overlapping constructs i.e. depression, neuroticism, positive affect. This helps to build an understanding of where each scale is likely to sit within the conceptual space (e.g. Leventhal et al., 2006), and to evaluate if each measure assesses the clinical construct of anhedonia in a more, or less direct way. Lastly, on the basis of the quality of evidence and psychometric properties reviewed, we wanted to identify the most appropriate self-report measures to use to assess anhedonia in a range of clinical and research contexts.

Method

This systematic review was registered on the PROSPERO international prospective register of systematic reviews (CRD42019127483) (Watson et al., 2019). The methods used in this review were informed by the Preferred Reporting Items for Systematic Reviews, and Meta-analyses (PRISMA) guidelines (e.g. Moher et al., 2016).

Inclusion and Exclusion Criteria

Articles were included in the review if: a) the full text was available in English; b) the article was published in a peer-reviewed journal; c) the article was an original paper (not reviews); d) the study described the initial development and/or further validation of a self-report scale; e) the self-report scale measured the construct of anhedonia, which included, as

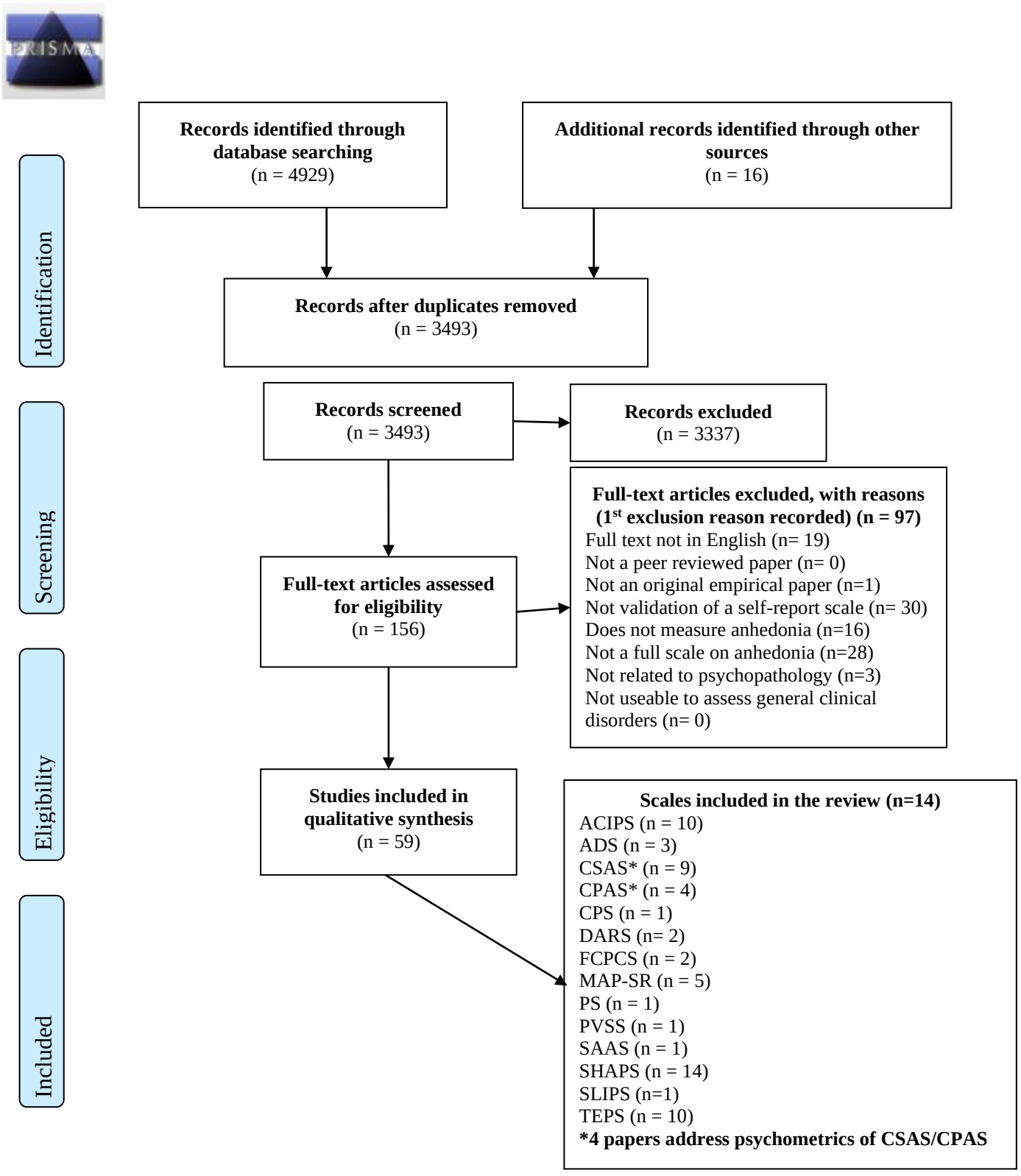
a minimum, the measurement of consummatory anhedonia/pleasure. Therefore, scales measuring related or similar clinical constructs such as positive affect, well-being, behavioural approach, apathy, behavioural activation; or personality constructs such as impulsivity or proneness to boredom were not included. And finally, f) the study evaluated full-scale measure of anhedonia or an independently validated subscale (i.e. not a single item instrument, or a scale derived of a list of pleasant events which includes an assessment of frequency).

For the purpose of this review we excluded articles if: a) the original self-report measure was not developed to understand, or be applied to mental health (e.g. was use to assess motivation in relation to sport, shopping or another activity); or b) the scale was designed to assess anhedonia in relation to very specific clinical issues (e.g. skin picking or sexual dysfunction) and could not be used to assess anhedonia in the general population or in relation to mental health disorders such as depression. Scales were also excluded if they had been developed for specific populations, such as individuals with learning/intellectual disabilities, as this was beyond the scope of the current study.

Search Strategy

A systematic search using PsycINFO, Web of Science and PubMed databases was performed on 28th February 2020. Synonyms of terms for the construct of interest (e.g. anhedonia), instrument type (e.g. questionnaire) and questionnaire properties (e.g. reliability, validity), were used to search the titles, abstracts, and keywords of publications from 1970 to the current date. Search terms (and variations) were as follows: concept 1: anhedonia, hedonia, reward, pleasure, disinterest, concept 2: questionnaire, scale, inventory, concept 3: psychometric, reliability or validity. See Appendix A for more details. Database and ancestry searching were used to find papers pertaining to both the original development and subsequent psychometric validation of the identified questionnaires. A citation search

(abstract search of all papers that had cited the development paper) was also performed for studies documenting the initial development of each measure. Figure 1 shows the PRISMA flow diagram of search results.



PRISMA Flow Diagram.

Abstract screening was completed by RW and 10% was second coded by FO. There was high inter-rater reliability (K = .846). Full text screening was completed by RW and second coded by FO/AL, with moderate inter-rater reliability (K = .692). All discrepancies were discussed between the authors and a decision reached based on the study criteria. The data extraction process was completed by RW and checked by AL. In total 59 studies which evaluated the psychometrics of 14 scales were included. See Appendix for PRISMA diagram.

Appraisal using the COnsensus-based Standards for the Selection of health Measurement Instruments (COSMIN)

We reviewed each paper using the Consensus-based Standards for the selection of health-based Measurement Instruments (COSMIN) protocol for systematic reviews of self-report questionnaires (Patient Reported Outcome Measure: PROM) (Mokkink et al., 2018; Terwee et al., 2012). The COSMIN protocol is a standardised tool developed specifically for assessing the methodological quality of studies and psychometric evidence for patient-reported outcome measures. COSMIN assesses the development of PROMs and 9 psychometric properties as follows:

1. **Content validity** is the degree to which the content of a scale is an adequate reflection of the construct to be measured. The COSMIN standard is that that potential questionnaire items are identified with help from the target population and relevant experts.
2. **Structural validity** is the degree to which scores of a scale are an adequate reflection of the dimensionality of the construct to be measured. The COSMIN procedure recommends that the structural validity of self-report measures of anhedonia is assessed using Classic Test Theory (CTT), with a preference for confirmatory over exploratory factor analysis; or an Item Response Theory (IRT) or Rasch Model.

Constructs of anhedonia are related concepts so should be used oblique rotations (as recommended e.g. Flora & Flake, 2017), so quality of evidence downgraded if orthogonal rotations used (unless both were assessed and difference was negligible, or when using a bifactor model when factors are constrained to be orthogonal).

3. **Internal consistency** is the extent to which an instrument's scales are correlated. Likert scale response formats result in ordinal data/items, so quality was downgraded if items were treated as continuous (Flora & Flake, 2017).
4. **Cross cultural validity/measurement invariance** is the degree to which items on a translated or culturally adapted scale are an adequate reflection of the performance of the items of the original version of the scale**.** In the COSMIN guidance an assessment of cross-cultural validity requires direct comparisons need to be made between two sets of data from different locations. Measurement invariance also related to other characteristics such as gender, and refers to whether respondents from different groups with the same latent trait level respond similarly to a particular item.
5. **Reliability** is the extent to which scores for patients who have not changed are the same for repeated measurement under different conditions (i.e. test–retest). In the COSMIN guidance, this should be a measure of agreement i.e. intra-class correlation coefficient or Cohen's kappa.
6. **Measurement error** is the systematic and random error of an individual's score that is not attributed to true changes in the construct to be measured.
7. **Criterion validity** is the degree to which the scores of a scale are an adequate reflection of a 'gold standard,' as described by the study authors or when an assessment of sensitivity/specificity etc. was established. In the COSMIN guidance, differences between individuals with and without a diagnosis are categorised under hypothesis testing 'discriminative validity'.

8. **Hypotheses testing** relates to whether the scores of an instrument are consistent with hypotheses based on the assumption that the instrument validly measures the construct to be measured. Convergent validity of self-report measures was assessed by examining correlations with questionnaires or other methods that assessed related and/or unrelated constructs. Discriminative validity was assessed between 'known groups' such as clinical groups and non-clinical populations. Convergent and discriminative validity was assessed in line with the authors prediction regarding the relationship between measures, with 'absolute' strengths and differences reported in Table 1 and Figure 2.
9. **Responsiveness** is the ability of an instrument to detect change over time, and therefore is the test of the validity of a change score.

The assessment of measures properties that were not included in the COSMIN description of psychometric properties (i.e. incremental validity) were not captured within the synthesis, but may be included as 'other' in Table 1. See supplementary material Appendix B for details.

COSMIN Procedure First the methodological quality of each paper that contributed psychometric data about any anhedonia measure was assessed using the COSMIN Risk of Bias Checklist (see Mokkink et al., 2018 for a detailed procedure). Minor adaptations were made to the descriptions of some criteria to improve the clarity and specificity of ratings (see Supplementary Material: Appendix B). Each quality criterion (i.e. structural validity) for each study was rated on a four-point scale: very good, adequate, doubtful, or inadequate and these results are provided in supplementary materials Appendix E. The first author (RW) conducted the quality appraisal procedure for all studies, and all papers were second rated by one of the other authors (AL/FO/SR). Inter-rater reliability for the ratings of bias was high (Intra-Class Correlation .802, CI .632, .898). Disagreements were resolved through discussion and consultation with COSMIN recommendations.

Next the psychometric results or ‘evidence’ were assessed against the COSMIN recommended standards (e.g. internal consistency should be assessed using Cronbach’s alpha and should exceed alpha = 0.7) (Prinsen et al., 2018; see supplementary material Appendix C). All psychometric data available from each journal article was assessed and rated independently by RW and AL as either sufficient (+), insufficient (-) or indeterminate (?) as prescribed by the COSMIN protocol (ICC .749, CI .660, .815). Consensus was reached through discussion and consultation of COSMIN guidelines. The psychometric ratings reported by each study for each measure of anhedonia were then combined to create an overall evaluation of each measurement property (e.g. if 3 papers provided data on the structural validity of one anhedonia measure these ratings were combined). As recommended by the COSMIN protocol, overall ratings of sufficient (+), insufficient (-), or indeterminate (?) were based on the majority of results reported across all studies.

A modified Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach was then used to establish the overall quality of evidence for each aspect of psychometric measurement property (see supplementary material: Appendix D) (Mokkink et al., 2018; Prinsen et al., 2018). The quality of evidence starts as high and is then down-graded based on 1) risk of bias, 2) inconsistency, 3) imprecision, and 4) indirectness (See Mokkink et al., 2018 for details). The strength of evidence for the structural validity measurement property was based on the majority of sufficient, insufficient ratings (see previous step). Where there were inconsistencies (i.e. not all ratings were sufficient), then the final GRADE rating for the overall quality of evidence for each scale was downgraded. The quality ratings for each scale were combined with the overall rating for the strength/quality of evidence for each aspect of measurement (e.g. structural validity) to produce a final rating of high, moderate, low or very low. The information was then summarised and described qualitatively.

Results

Fifty-nine papers assessing the psychometric qualities of 14 anhedonia self-report scales were identified and rated (see Supplementary Material: Appendices E, F, G and Tables 1 and 2). Table 1 shows key characteristics of each anhedonia scale and summarise the key methodological features which are assessed using the COSMIN procedure.

Table 1. Summary of included self-report measures of anhedonia ordered chronologically

Scale/ Study Authors (original development study denoted with *)	**Concept of Interest** *(based on description and inspection of items)*	**Purpose of the Scale/ What Makes it Unique?**	**Type of Reward/ and Trait/ State**	**Location / No. of Items** *(across all studies – development study denoted with *)*	**N of Studies Samples*** *(across all studies – development study denoted with *)*	**Summarised Measurement Properties Based on COSMIN Criteria** *(across all available studies)*
Chapman Social Anhedonia Scale (CSAS) (Chapman et al., 1976)* (Bailey et al., 1993; Chan et al., 2012; Cicero et al., 2016; Cihan et al., 2015; Fonseca-Pedrero et al., 2009; Leak, 1991; Reise et al., 2011)	*"Pleasure is characterised by a strong positive affect, by a keen anticipation of the experience that evokes it, by a satisfying recollection of the experience, and by a willingness to expend effort to achieve the experience."* Items Predominantly Consummatory	**Purpose –** Designed to measure anhedonia in *schizophrenia* using a true-false format. Attempts made to eliminate effects of depression. **Unique –** First measure of individual differences in social anhedonia	Social Trait	**Location:** USA* Turkey Spain China **No. Items:** 56*, 48, 40, 15	**Community** (Students* Adults* Young Adults) **Clinical** (Schizophrenia* Personality Disorder) N = 7233 across 9 papers	**DV/CV**: Target population reviewed relevance and comprehensibility of items; the expertise of item writers not specified. **SV**: 1, 2 or 7 factors **IC**: High internal reliability. **CCV/MI: culture –** Spanish and Turkish translation validated but no assessment of MI. **gender –** males reported higher levels of anhedonia than females in schizophrenic samples; females reported higher levels of anhedonia in general public, but no assessment of MI by gender. **R:** High re-test reliability. **ME:** N/R **CRV:** N/R **HT: a) strong:** social closeness; **moderate:** schizoid / schizotypal personality disorder, agreeableness; **weak:** avoidant and compulsive personality disorder, anticipatory and consummatory pleasure, anxiety, depression; **very weak:** clarity of emotions, magical ideation, perceptual aberration; **non-sig:** hopelessness, self-esteem, harm avoidance. **HT b)** significantly more anhedonic scores in participants with schizotypy traits/ schizotypal personality features than healthy controls. **RP:** N/R
Chapman Physical Anhedonia Scale (CPAS)	" "	**Purpose –** " " **Unique –** The first	Physical	USA* Spain China	**Community** (Students* Adults*	**DV/CV**: Target population reviewed relevance and comprehensibility of items; the expertise of item writers not specified.

(Chapman et al., 1976)* (Bailey et al., 1993; Chan et al., 2012; Fonseca-Pedrero et al., 2009)		measure of individual differences in physical anhedonia	Trait	51*, 40	Young Adults) **Clinical** (Schizophrenia* Personality Disorder) N= 2664 across 4 papers	**SV**: 1 factor solution. **IC**: Moderate/high internal reliability. **CCV: culture –** Spanish and Turkish translation validated but no assessment of MI. **gender –** males reported higher levels of anhedonia than females in schizophrenic samples; females reported higher levels of anhedonia in general public, but no assessment of MI by gender. **R:** N/R **ME:** N/R **CRV:** N/R **HT**: **a) moderate:** lack of anticipatory and consummatory pleasure in participants with schizoid or schizotypal features and avoidant personality disorder; **weak/moderate:** social anhedonia; **very weak:** schizotypal traits. **HT b)** significantly more anhedonic scores in participants with schizotypy traits/ schizotypal personality features than healthy controls. **RP:** N/R
Fawcett Clark Pleasure Capacity Scale (FCPCS) (Fawcett et al., 1983)***** (D'haenen, 1996)	*"Anhedonia (pleasure capacity) is an insensibility relating to pleasure alone"* Consummatory	**Purpose –** To determine the incidence of state anhedonia among psychiatric patients. **Unique –** To develop a state measure of anhedonia, and to establish whether anhedonia can be used to distinguish between subgroup of depressed patients.	Social, Sensory, Sense of Mastery State	USA*, The Netherlands 36*, 14	**Community** (Adults) **Clinical** (Major Depressive Disorder* Manic Disorder* Schizophrenia*) N = 690 across 2 studies	**DV/CV**: Professionals (clinicians specialised in mood disorders) developed scale items; items reviewed and discussed by professionals to ensure relevance, comprehensibility, and comprehensiveness. The target population was not indicated in scale development or revision. **SV**: 1 factor solution. **IC**: High internal reliability. **CCV/MI:** Dutch translated version, but no assessment of MI. **R:** N/R **ME:** N/R **CRV:** Some ability to discriminate between clinically depressed and healthy controls (using difference of 2 SDs below mean of controls). **HT**: **a) *moderate/weak:*** pleasure, social and physical anhedonia, depression; ***very weak:*** neuroticism; ***non-sig:*** length of hospital stay, neuroticism, number of suicide attempts. **b)** significant differences in scores between individuals with

						depression and healthy participants; but no difference between individuals with schizophrenia or 'manic disorder' and controls **RP:** N/R.
Pleasure Scale for Children (PS) (Kazdin, 1989)*****	*"Anhedonia refers to the reduced ability or capacity to experience pleasure and is reflected in diminished interest in a number of rewarding and potentially rewarding events and activities"* Consummatory	**Purpose –** The development of a scale for *children* designed to measure degree of pleasure experienced in relation to a range of activities. **Unique –** First child-specific anhedonia scale	Social, Physical and Other State	USA* 39*	**Clinical** (psychiatric inpatients aged 6-13*, depressed and non-depressed) N = 232 in one paper	**DV/CV**: Scale developed by clinical researchers working with child psychiatric inpatients, pilot responses were used to guide scale refinement. **SV**: 1 factor solution. **IC**: High internal reliability. **CCV/MI:** N/R **R:** N/R **ME:** N/R **CRV**: Discriminated between clinically depressed and healthy participants (scale correctly identified 72.7% of depressed patients and 69.6% of non-depressed patients). **HT**: **a)** ***weak/very weak:*** positive experience and affect; ***non-sig:*** depression, internalising and externalising problems. **b)** significant difference in scores for children with a depression disorder than other psychiatric disorder. **RP:** N/R
Anhedonic Depression Scale - the Mood and Anxiety Symptoms Questionnaire (Clark & Watson, 1991)***** (Bredemeier et al., 2010; Kendall et al., 2016)	*"Positive emotional experiences e.g. felt cheerful, optimistic, had a lot of energy, looked forward to things with enjoyment… and loss of interest e.g. anhedonia, disinterest, low energy"* Consummatory, Anticipatory, Effort, Motivation	**Purpose** – To create a specific depression factor defined on one pole by the positive emotionality items and on the other by anhedonia and other symptoms of depression (Watson et al., 1995). **Unique** – To measure low positive affect unique to	General State	24 (high positive affect), 9 (loss of interest) **22** (anhedonic depression) – 8 and 14 item subscales	**Community** (students, adults, young people) N = 275	[data below is only provided for studies which have evaluated the Anhedonic Depression Scale of the MASQ as an independent scale] **SV:** 2 factor solution. **IC:** High internal reliability. **CCV/MI:** N/R **R:** N/R **ME:** N/R **CRV:** RoC analysis to screen for depressive disorders. **HT:** N/R **RP:** N/R **Other:** time-invariance to assess 'state' positive emotionality, but <25% of the variance was attributed to fluctuating components of the model.

		depression, alongside other aspects thought to distinguish depression from anxiety, such as low motivation.				
Snaith Hamilton Pleasure Scale (SHAPS) (Snaith et al., 1995)* (Chong Guan et al., 2014; Franken et al., 2007; Fresán & Berlanga, 2013; Langvik & Borgen Austad, 2019; Leventhal et al., 2015; Liu et al., 2012; Martino et al., 2018; Nagayama et al., 2012; Nakonezny et al., 2015, 2010; Santangelo et al., 2009; Thomas et al., 2012; Yee et al., 2014)	*"Hedonic tone, the ability to experience pleasure, and anhedonia, its absence"* Consummatory	**Purpose –** The construction of a pleasure scale. **Unique –** Need for a 'simpler' scale unlikely to be affected by social class, sex, age, dietary habits or nationality, covering a wide range of domains of pleasure.	Sensory, Social, Hobbies, Food/ Drink State	UK* The Netherlands, USA Italy China UAE Malaysia Norway Mexico Japan 14	**Community** (adults* adolescents) **Clinical** (psychosis, substance abuse, Major Depressive Disorder* schizophrenia, Parkinson's disease) N = 5107 across 14 studies	**DV/CV**: General population asked about relevance, comprehensiveness and comprehensibility, professionals not involved. **SV**: 1, 2, 3, 4 factor solutions. **IC**: Moderate/ high internal reliability. **CCV/MI: culture -** Italian, Arabic, Chinese, Simplified Chinese, Malay and Japanese versions validated, but no assessment of MI. **gender -** disparity across studies with regards to gender differences, but no assessment of MI. **R:** Moderate/ high re-test reliability. **CRV**: some ability to discriminate between clinically depressed and healthy controls (English version - a cut-off score of 2 when items dichotomised). **HT**: **a)** ***moderate:*** consummatory pleasure, physical anhedonia, apathy, general health, depression; ***weak:*** anticipatory pleasure, pleasantness, happiness, pleasure sensitivity; ***very weak/non-sig:*** anxiety, depression, negative affect, behavioural inhibition**.** **b)** significant difference between clinical (individuals with depression, psychosis, substance abuse, schizophrenia, Parkinson's disease), and healthy participants; and between severe and mild/moderate depression. **RP:** some sensitivity to change of clinical status. **Other: (predictive)** significant proportion of SHAPS variance explained by extraversion.
Self-Assessment Anhedonia Scale (SAAS)	*"Insensibility relating to pleasure alone"* Consummatory	**Purpose –** To create a new anhedonia rating scale	Physical, Intellect--ual, Social	Spain 27	**Community** (adults*) **Clinical** (schizophrenia*,	**DV/CV**: Professionals (psychiatrists) asked about relevance of items to individuals with schizophrenia. **SV**: 1 factor solution. **IC**: High internal reliability. **CCV/MI:** N/R

(Olivares et al., 2005)*****		**Unique –** To distinguish anhedonia in depression and schizophrenia and measure change in perception of hedonic capacity.	State		depression*, on dialysis*) Total n = 120	**R:** N/R **ME:** N/R **CRV:** N/R **HT**: **a) *moderate:*** physical anhedonia. **HT: b)** significant difference in scores between individuals with depression, schizophrenia and healthy controls (individuals with depression more anhedonic than those with schizophrenia, both higher than healthy controls). **RP:** N/R
Temporal Experience of Pleasure Scale (TEPS) (Gard et al., 2006)* (Chan et al., 2010; Chan et al., 2012; Garfield et al., 2016; Geaney et al., 2015; Ho et al., 2015; Li et al., 2018; Simon et al., 2018; Strauss et al., 2011; Zhou et al., 2019)	*"Diminished capacity to experience pleasure… anticipatory pleasure closely linked to motivation and goal-directed behaviour… consummatory pleasure is more closely linked to satiation or a resolution of desire"* Consummatory, Anticipatory	**Purpose –** Designed to measure individual trait dispositions in both anticipatory and consummatory experiences of pleasure. **Unique** – The first trait pleasure scale to distinguish between temporal components of the experience of pleasure.	Sensory Trait (State version adapted)	USA*, Australia, UK, Germany, China 17*, 18, 20	**Community** (Students, Adults) **Clinical** (Opioid Dependence, Schizophrenia) Total n = 7259 across 10 papers	**DV/CV**: Target population involved in checking relevance of items. **SV**: 2 or 4 factor solutions. **IC**: Moderate/high internal reliability. **CCV: culture -** Direct comparison of the TEPS in a Chinese and American sample, with the 4-factor model fitting the data. German version validated, but no assessment of MI. **gender** – females reported higher pleasure scores, and MI across gender in Chinese version. **R:** High re-test reliability. **ME:** N/R **HT**: **a) Total scale: *strong/moderate:*** consummatory pleasure and positive affect; ***very weak/weak:*** negative affect, depression and anxiety. **Consummatory subscale: *moderate/weak:*** physical anhedonia, reward responsiveness, consummatory pleasure, apathy, positive and negative symptoms of schizophrenia; ***very weak/non-sig:*** behavioural activation, depression, behavioural inhibition, fun seeking, drive. **Anticipatory subscale: *moderate/ weak:*** physical anhedonia, behavioural activation, reward responsiveness, anhedonia, apathy, positive and negative symptoms of schizophrenia; ***very weak/non-sig:*** behavioural inhibition, depression, fun seeking; apathy. **b)** discrepant differences between individuals with schizophrenia and healthy controls. **RP:** In the state version TEPS scores between baseline and 1-month follow-up correlated well with changes in other state anhedonia and positive affect measures.

Motivation and Pleasure Scale- Self Report (MAPS-SR) (Llerena et al., 2013)* (Engel & Lincoln, 2016, 2017; Kim et al., 2016; Richter et al., 2019)	*"Anhedonia is assessed by tapping experienced… as well as expected pleasure; Avolition is assessed by how much an individual wanted or was motivated… and how much effort they made (as well as asociality)"* Consummatory, Anticipatory, Effort, Motivation	**Purpose –** To assess the motivation and pleasure domain of negative symptoms of *schizophrenia.* **Unique –** the focus on motivation and pleasure which directly relates to functional impairment.	General Trait	USA*, Germany, Korea 18*, 15	**Community** (adults) **Clinical** (schizophrenia*, schizoaffective disorder*) Total n = 309 across 4 papers	**DV/CV**: Target population and professionals not involved in scale development but developed to map onto an equivalent clinician-rated measure (CAINS). **SV**: 3 factor solution. **IC**: High internal reliability. **CCV: culture –** German and Korean translations validated, but no assessment of MI, **gender –** no gender or age differences, but no assessment of MI. **CRV**: Moderate correlation with gold standard schizophrenia interview motivation and pleasure subscale score (CAINS - MAP subscale). **HT**: **a)** ***moderate/weak:*** social closeness, social anhedonia, depression, negative symptoms of schizophrenia; ***very weak/non-sig:*** functioning and positive symptoms of schizophrenia. **b)** no significant differences between inpatient and outpatient groups.
Anticipatory and Consummatory Interpersonal Pleasure Scale (ACIPS) (Gooding & Pflum, 2014b)* (Chaix et al., 2017; Chan et al., 2016; Gooding et al., 2014, 2015; Gooding, Fonseca-Pedrero, et al., 2016; Gooding, Pflum, et al., 2016; Gooding et al., 2017; Gooding & Pflum, 2014a; Liang et al., 2020)	*"Pleasure is comprised of complex cognitive and emotional processes involved in wanting and liking, as well as learning… diminished ability to experience pleasure may be assessed directly through measures of anhedonia or indirectly through measures of pleasure"* Anticipatory & Consummatory	**Purpose -** A measure specifically designed to assess hedonic capacity for social and interpersonal interactions. **Unique** – Few previous measures adequately assessing pleasure for social interactions.	Social Trait	USA* Spain China France 17*, 20	**Community** (Students*, Adults Adolescents) **Clinical** (Schizophrenia, Bipolar, Major Depressive Disorder) Total n = 6349 across 10 studies	**DV/CV:** Target population checked comprehensibility of items. **SV**: 3 or 4 factor solution. **IC:** High internal reliability. **CCV/MI: gender –** scores higher (less anhedonia) in females than males, but no assessment of MI. **culture –** Spanish, Chinese and French versions translated, but no assessment of MI. **R:** High re-test reliability. **ME:** N/R **CRV:** N/R **HT: a)** ***strong/moderate:*** anticipatory and consummatory pleasure, social connectedness; **weak/very weak:** depression, punishment sensitivity, social anxiety; ***non-sig:*** positive symptoms of schizophrenia/ psychosis, social anxiety. **b)** significant difference between clinical (schizophrenia, bipolar, depression) and healthy participants; and between disorder differences. **RP:** N/R

Specific Loss of Interest and Pleasure Scale (SLIPS) (Winer et al., 2014)*	*"Anhedonia, or the loss of interest and pleasure, is a key component of many forms of psychological distress"* Consummatory, Anticipatory	**Purpose -** to assess recent changes in anhedonia. **Unique** - no validated measure examining recent changes in anhedonia.	General **State**	USA* 23*	**Community** (adults*) Total n = 590 in one paper	**DV/CV**: Target population and professionals not explicitly involved in scale development. **SV**: 1 factor solution. **IC**: High internal reliability. **CCV/MI:** N/R **R:** N/R **ME**: N/R **CRV:** N/R **HT**: **a) *moderate*:** anhedonia (incl. consummatory), depression; ***weak:*** positive and negative affect and anticipatory pleasure; ***very weak***: consummatory anhedonia. **RP:** N/R **Other (incremental validity):** Predicted anhedonia (items in BDI) over and above existing measures.
Dimensional Anhedonia Rating Scale (DARS) (Rizvi et al., 2015)* (Arrua-Duarte et al., 2019)	*"Anhedonia as an umbrella term for impairment of hedonic function over a spectrum of behaviours reflecting initial interest/desire, anticipation, motivation, effort and consummatory pleasure"* Desire, Motivation, Effort, Consummatory	**Purpose –** To capture a comprehensive representation of the anhedonic experience consistent with current neurobiological models. **Unique –** A dynamic scale to measure desire, motivation, effort, and pleasure.	Sensory, Social, Hobbies, Food/ Drink State	Canada* Spain 17*	**Community** (Adults*) **Clinical** (Bipolar, Major Depressive Disorder*, Psychotic disorders, Adjustment Disorders, Anxiety disorders, Personality disorders, Eating disorders) Total n = 615 across two papers	**DV/CV**: Professionals involved in item selection and revision. **SV**: 4 factor solution. **IC**: High internal reliability. **CRV/MI: culture:** Spanish version created and compared to the English version but no assessment of MI. **gender and ethnicity:** scores did not differ by gender or ethnicity, but no assessment of MI. **R:** N/R **CRV:** Moderate correlation with 'gold standard' SHAPS self-report. **HT**: **a) *moderate:*** consummatory pleasure; ***weak:*** drive, depression and physical activity; ***very weak/non-sig:*** behavioural inhibition and fun seeking. **b)** significant difference in scores between individuals with depression/psychiatric history. **RP:** N/R **Other (incremental validity):** Predicted depression severity and depressive status, over and above existing measures.
Chemosensory Pleasure Scale (CPS) (Zhao et al., 2019)*	*"Anhedonia, a diminished interest or feeling of pleasure toward*	**Purpose –** To develop a scale to assess olfactory anhedonia.	Sensory Not	China*	**Community** (Students*) Total n = 902 in one	**DV/CV**: Professional involved - items from existing scales (e.g. TEPS, CPAS and SHAPS) reviewed by a panel of psychologists, revised and reworded. **SV**: 3 factor solution.

	activities that should be enjoyable" Anticipatory & Consummatory	**Unique –** Measurement of smell and taste pleasure experiences.	Specified	12*	paper	**IC**: High internal reliability. **CCV/MI:** N/R **R**: High re-test reliability. **ME:** N/R **CRV:** N/R **HT: a)** ***strong:*** physical anticipatory pleasure; ***moderate/weak:*** physical consummatory pleasure; ***non-sig:*** social anhedonia. **HT: b)** N/R **RP:** N/R
Positive Valence System Scale (PVSS) (Khazanov et al., 2020)*****	*"Anhedonia is often referred to as abnormally low interest or pleasure in rewarding activities"* Consummatory (Initial Responsiveness & Reward Satiation), Anticipatory (Reward Anticipation & Expectancy), Motivational (Reward & Effort Valuation)	**Purpose -** To develop a measure of the NIMH RDoC Positive Valence System Domain – due to the recognised importance of altered responding to reward in psychopathology. **Unique –** First measure to assess the PVS domain. A *transdiagnostic* measure, not tied to the experience of pleasure within one disorder.	Food, Physical Touch, Outdoor, Positive Feedback, Social, Hobbies, Goals State	USA* 45*, 21* Total n = 1056 in one paper	**Community** (Adults* Students*) **Clinical** (Depression*)	**DV/CV**: Professionals involved in development of the scale and clarification with target population during piloting and testing. **SV**: 1 general factor and 7 sub-factors based on type of rewarding stimuli. **IC**: High internal reliability. **CCV/MI:** N/R **R**: High re-test reliability. **ME:** N/R **CRV:** N/R **HT**: **a) strong:** pleasure, motivation; ***moderate/weak:*** behavioural approach, pleasure, positive personality traits; ***weak:*** depression and negative emotionality; ***very weak/non-sig:*** punishment sensitivity and mania. **b)** significant difference in scores between adults with Major Depressive Disorder and healthy controls. **RP:** N/R **Other (incremental validity):** Predicted anhedonic depression, overall depression, and social/occupational impairment, over and above existing measures of behavioural approach and pleasure/anhedonia.

Note. **DV =** PROM Development (involvement of target population and/or professionals). **CV** = content validity. **SV =** structural validity (factor structure). **IC =** internal consistency reliability. **R=** Re-test reliability. **CRV =** criterion validity. **CCV** = cross cultural validity. **MI** = measurement invariance. **HT a)** = Hypothesis testing (convergent/divergent validity). **HT b)** = Hypothesis testing (known group differences/ discriminant). Absolute value of r strength of relationship indicated as follows: very weak $r < 0.3$, weak $0.3 < r < 0.5$, moderate $0.5 < r < 0.7$, strong $r > 0.7$. Reliability statistics: high reliability > .7; moderate >.6, low reliability <.6. RoC = Receiver operating Curve analysis.

Critique of Common Measurement Choices

Table 1 summarises the available psychometric data for each of the measures of anhedonia in relation to their development and content validity, structural validity, internal and test-retest reliability, criterion validity, convergent/ divergent validity and their discriminate validity. Most anhedonia scales were developed by identifying and selecting items using a deductive process based on theory or existing anhedonia measures. There was limited evidence that the relevance, comprehensiveness and comprehensibility of the items were assessed. None of the measures had used the target population and professionals to identify a pool of items as is recommended by the COSMIN guidance. Therefore, in line with COSMIN guidance, the content validity of all anhedonia self-report measures was rated as 'doubtful' or 'inadequate'.

The majority of studies used CTT to assess the structural validity of each scale. However, the methods chosen to assess structural validity were often sub-optimal. For example, the use of orthogonal rotations, which may not be appropriate because they work on the basis that factors are unrelated; or the use of principal components analysis (PCA) rather than an exploratory factor analytic technique (Flora & Flake, 2017). There was also difficulty in replicating the factor structure of some measures across studies, possibly due to different analytical choices or unstable constructs. When exploratory factor analysis was used, often less than 50% of the variance could be explained by the model fit, meaning more than half of the variance is unaccounted for by the proposed solution.

Further tests of validity included testing hypotheses about the relationship between scale scores and related constructs. However, there were inconsistent opinions about the desired strength of relationship between related constructs (within scales/across studies) and the expectation of whether anhedonia scales should converge with or diverge from measures of the broader clinical construct (i.e. depression). Further complicating matters is that the

conceptualisation of anhedonia was not defined in the same way by researchers who developed the measures of anhedonia. Some scales provided a more 'direct' assessment of the clinical symptom of anhedonia (e.g. the MAPSR, Llerena et al., 2013), whereas others assessed anhedonia in a more 'indirect' way, by inferring that low pleasure might indicate the presence of anhedonia (e.g. ACIPS, Gooding & Pflum, 2014). This may account for differences in strength of correlations with measures of depression or other constructs, or for the anticipated nomological network of each scale (i.e. interrelationships among concepts) (Clark & Watson, 2019). To help researchers to examine the underlying nature of the construct tapped by each anhedonia self-report measure Supplementary Material Section G highlights correlational data between each anhedonia measure and related constructs against standardised values.

The criterion validity of self-report measures of anhedonia was rarely assessed by predicting participants' membership of anhedonic and non-anhedonic groups. Few studies used a gold standard clinical interview to determine the criterion validity or responsiveness of anhedonia self-report scales or ran Receiver Operating Curve (RoC) analysis to establish the best clinical cut-off to distinguish between those with and without anhedonia. This analysis is impaired because there is no consistently recognised 'gold standard' tool to determine the presence of absence of 'anhedonia'. It also means that few self-report measures of anhedonia have usable cut-off scores.

Although some measures were translated and used in different cultures, cross cultural validity or measurement invariance were rarely reported. Similarly, gender differences in mean scores were frequently reported but without an assessment of measurement invariance, meaning these are rated as 'indeterminate'.

Most scales of anhedonia were internally consistent. However, although Likert scale data are best treated as ordinal, data were often treated as continuous in statistical analysis

(Flora & Flake, 2017). To assess test re-test reliability, Cronbach's alpha was typically reported rather than a measure of agreement, (i.e. intra-class correlation or Kappa), which is recommended by the COSMIN protocol. Table 2 summarises the pooled (across studies) quality of evidence and psychometric ratings for each self-report scale.

Table 2. COSMIN quality ratings and overall quality of evidence for each scale

	Structural Validity	Internal Consistency	CCV/MI	(Test-Retest) Reliability	Measurement Error	Criterion Validity	Hypothesis Testing (Convergent)	Hypothesis Testing (Known Groups)	Responsiveness
ACIPS									
Psychometric Properties	(-)	(+)	Gender (?) Culture (?)	(?)	N/R	N/R	(+)	(+)	N/R
Quality of Evidence	Moderate	High	Gender (Moderate) Culture (N/R) *	Low	N/R	N/R	Moderate	Moderate	N/R
ADS									
Psychometric Properties	(+)	(+)	N/R	N/R	N/R	(+)	N/R	N/R	N/R
Quality of Evidence	High	High	N/R	N/R	N/R	High	N/R	N/R	N/R
CSAS									
Psychometric Properties	(-)	(+)	N/R [no *direct* comparisons]	(?)	N/R	N/R	(+)	(+)	N/R
Quality of Evidence	Moderate	High	N/R	Low	N/R	N/R	Moderate	High	N/R
CPAS									
Psychometric Properties	(+)	(+)	N/R [no *direct* comparisons]	N/R	N/R	N/R	(+)	(+)	N/R
Quality of Evidence	Moderate	High	N/R	N/R	N/R	N/R	Moderate	High	N/R
CPS									
Psychometric Properties	(+)/(-)	(+)	N/R	(?)	N/R	N/R	(+)	N/R	N/R
Quality of Evidence	Moderate	Moderate	N/R	Low	N/R	N/R	High	N/R	N/R
DARS									
Psychometric Properties	(+)	(+)	Culture (?)	N/R	N/R	(-)	(+)	(+)	N/R
Quality of Evidence	High	High	Culture (Very Low)	N/R	N/R	Low	High	High	N/R
FCPCS									
Psychometric Properties	(?/-)	(+)	Culture (?)	N/R	N/R	(?)	(?/+)	(+)	N/R
Quality of Evidence	Low	Moderate	Culture (N/R) *	N/R	N/R	Very Low	Low	Moderate	N/R
MAP-SR									
Psychometric Properties	(+)	(+)	N/R [no *direct* comparisons]	(?)	N/R	(-)	(+)	(?)	N/R
Quality of Evidence	High	High	N/R	Low	N/R	High	Moderate	Moderate	N/R
PS									

Psychometric Properties	(+)	(+)	N/R	N/R	N/R	(?)	(+)	(+)	N/R
Quality of Evidence	Moderate	Moderate	N/R	N/R	N/R	Very Low	High	High	N/R
PVSS									
Psychometric Properties	(+)	(+)	N/R	(?)	N/R	N/R	(+)	(+)	N/R
Quality of Evidence	High	Moderate	N/R	Moderate	N/R	N/R	High	High	N/R
SHAPS									
Psychometric Properties	(+)	(+)	N/R	(-)	N/R	(?)	(+)	(+)	(?)
Quality of Evidence	Moderate	High	N/R [no *direct* comparisons]	Moderate	N/R	Moderate	Moderate	High	Very low
SAAS									
Psychometric Properties	(+)	(+)	N/R	N/R	N/R	N/R	(+)	(+)	N/R
Quality of Evidence	Low	Moderate	N/R	N/R	N/R	N/R	Moderate	High	N/R
SLIPS									
Psychometric Properties	(?)	(+)	N/R	N/R	N/R	N/R	(+)	N/R	N/R
Quality of Evidence	Moderate	High	N/R	N/R	N/R	N/R	High	N/R	N/R
TEPS									
Psychometric Properties	(-)	(+)	Culture (+) Gender (+)	(?)	N/R	N/R	(+)	(-)	(?)
Quality of Evidence	Moderate	High	Culture (Moderate) Gender (Moderate)	Moderate	N/R	N/R	Moderate	Moderate	High

N/R = Not Rated. Measurement error and cross-cultural validity were not assessed in any study and therefore are not included.
Following COSMIN procedures, the psychometric properties per scale were rated as: (+) = sufficient, (?) = indeterminate, or (-) = insufficient. The overall rating reflects the majority of (+), (?) or (-) ratings; if an equal number of ratings were given then both are reported. * No direct comparison between 2 different groups. Quality of evidence for each is based on modified Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach, and rated as: high, moderate, low, or very low; see Supplementary Material Appendix D.

Critical Evaluation of Included Scales

In this section we consider each of the anhedonia scales in chronological order. The strengths and weaknesses of each scale and the overall quality of evidence for each is discussed and further details about each measure can be found in Tables 1, 2 and supplementary material E and F.

The **Chapman Social Anhedonia Scale (CSAS) and Chapman Physical Anhedonia Scale (CPAS) (Chapman et al., 1976)** were developed to assess predominantly consummatory anhedonia in social and physical domains respectively. Chapman and colleagues also identified "other pleasures" such as intellectual or the pleasure of achievement, but this third category was omitted. The scales have been validated in community and clinical samples (e.g. Cicero et al., 2016; Bailey et al., 1993), with some checks with the population for relevance, and with professionals for comprehensibility and relevance. High quality evidence suggests that the CPAS is a unidimensional scale. The structure of the CSAS has been more widely validated but an optimal structure has not been confirmed, with some studies separating social apathy/aversion from social withdrawal and others separating this further i.e. preference for solitude. Both scales have good internal consistency. Evidence for the retest reliability of the CSAS is low, but no report of the test-retest reliability of the CPAS. Moderate quality evidence supported the nomological network of both scales, with the CSAS correlating strongly with social closeness, and both scales showing moderate correlations with measures of schizotypal personality disorder. The CPAS and the CSAS are also moderately correlated with one another. The CSAS demonstrated divergence from measures of hopelessness, harm avoidance and self-esteem. High quality evidence identified that both the CSAS and CPAS could discriminate between male adults with schizophrenia and male adult healthy controls (Chapman et al., 1976). Overall, further

evidence is needed to establish its psychometric properties in depressive samples, and to understand the structure of the CSAS.

The **Fawcett Clark Pleasure Scale (FCPCS) (Fawcett et al., 1983)** was developed to assess state consummatory anhedonia among psychiatric patients. In development, item comprehensibility, relevance, and comprehensiveness were checked with professionals (but not the target population). Despite its widespread use (e.g. Leventhal et al., 2006) there has been limited evaluation of its psychometric properties. Low quality evidence provides some support for a unidimensional model, but this was not supported in a Dutch translation. The FCPCS has good internal consistency with high quality evidence but there has been no assessment of test-retest reliability. The validity of the FCPCS has been examined with low quality evidence of weak to moderate correlations with pleasure, depression and anhedonia, and non-significant correlations with neuroticism and number of suicide attempts. Studies with moderate evidence supporting the ability of FCPCS scores to discriminate between clinical groups and healthy controls, as well as between in-patients and out-patients. Overall, therefore the FCPCS requires further evaluation of its structural validity, and retest reliability.

The **Pleasure Scale (PS) (Kazdin, 1989)** was developed to assess pleasure in children in relation to a range of activities, with some population checks for item comprehensibility and relevance. Initial analysis supported a one factor solution, but this has not been confirmed. There was high quality evidence for the convergent validity of the PS, which was correlated highly with positive experiences and was not significantly correlated with depression or internalising/externalising problems. Evidence of discriminant validity was reported; children who had a diagnosis of depression reported less pleasure than children with other mental health problems. Further studies are needed to evaluate the validity and reliability of the scale across all elements.

The **Anhedonic Depression Scale from the Mood and Anxiety Symptom Questionnaire (ADS) (original development Clark & Watson, 1991)** was designed to measure low positive emotionality and anhedonia which were seen as specific to depression. The ADS subscale has been widely used (e.g. Watson et al., 1995), but has only recently been validated as an independent scale (Bredemeier et al., 2010; Kendall et al., 2016) with good internal reliability. There is limited psychometric evidence for the ADS as an independent scale, but two recent studies have shown promise. High quality evidence from Kendall et al., (2016) showed support for a 2-factor model; high positive emotionality and low positive emotionality. High quality evidence from Bredemeier et al., (2010) supported the predictive validity of the ADS (22 item and subscales) for current depressive episodes. The ADS was a predictor of lifetime Major Depressive Disorder, above measures of neuroticism. The ADS was developed to assess unstable emotional states, therefore Kendall et al., (2016) investigated its time-invariance longitudinally. They found that less than 25% variance was accounted for by fluctuations, suggesting a close link between ADS score and trait positive emotionality. The relationship between the ADS as an independent measure and other self-report scales has not been established, but due to its broader focus on positive emotionality such as feeling hopeful/ proud of self, it is likely that its nomological network is different to more 'specific' scales which focus on responses to particular rewarding stimuli. Overall, there is a need for further studies to establish the psychometric properties of the ADS as an independent scale.

The **Snaith Hamilton Pleasure Scale (SHAPS) (Snaith et al., 1995)** measures consummatory pleasure in response to a range of rewarding stimuli. In development the comprehensibility and relevance of items was checked with the general population, and professionals were consulted about the scale's comprehensibility and comprehensiveness. The SHAPS has been validated in a number of studies in multiple countries (e.g. Liu et al.,

2012; Nagayama et al., 2012) and with participants recruited from clinical populations and the community (e.g. Fresán & Berlanga, 2013; Thomas et al., 2012). The structure of the SHAPs has been examined by research of moderate quality although results suggest that the structure is unstable, with between 1 – 4 factor solutions across studies i.e. separating social and physical pleasures, or distinguishing sensory, social, past-times and food and drink. Research of moderate quality established that the SHAPS has good internal reliability but there is insufficient evidence of test-retest reliability. Direct comparison of the SHAPS across cultures has not been made, despite multiple translations. Gender differences have also been reported in both directions, however, no assessment of measurement invariance across genders has been made. Overall, the SHAPS was more highly correlated with measures of consummatory pleasure, apathy and anhedonia, than with negative affect, behavioural inhibition and anxiety. Despite extensive evaluation, the nomological network of the SHAPS is unclear, with differences in the predicted and actual correlation of the SHAPS with measures of depression. For example, depression severity has been used as to assess convergent and divergent validity, and correlations between the SHAPS and depression severity has varied from moderate to very weak or non-significant. Scores on the SHAPS did differ between clinical groups and healthy controls, and between those with severe and mild depression. Cut off scores to differentiate between clinical and healthy controls have been proposed for the English (Snaith et al., 1995) and Malay (Chong Guan et al., 2014) versions of the SHAPS, but have often not been used in later validation studies. The SHAPS is one of few scales for which assess sensitivity of change to clinical status has been assessed, however, this needs to be further established.

The **Self-Assessment of Anhedonia Scale (SAAS) (Olivares et al., 2005)** measures consummatory pleasure in response to physical, social and intellectual stimuli. It its development professionals, but not patients or service users, were asked about relevance. The

SAAS has not been widely validated. The development study provided low quality evidence to support its structural validity i.e. a one factor solution. The SAAS had high internal reliability but test-retest reliability has not been reported. Evidence of moderate quality supported the convergent validity of the SAAS with physical anhedonia, but relationships between the SAAS and other related constructs have not been reported. Importantly, the SAAS discriminated between anhedonia in participants with depression and schizophrenia, and healthy controls. Further studies are needed to support the SAAS' psychometric properties, particularly to examine its structural and convergent validity.

The **Temporal Experience of Pleasure Scale (TEPS) (Gard et al., 2006)** measures anticipatory and consummatory anhedonia in response to sensory rewards. Item comprehensibility and relevance was checked with the general population and professionals, and relevance and comprehensiveness were checked with professionals. The psychometrics of TEPS have been assessed in in Western (e.g. Garfield et al., 2016) and Eastern (e.g. Zhou et al., 2019) countries, as well as in clinical groups and community samples (e.g. Strauss et al., 2011; Geaney et al., 2015). Moderate quality evidence supports the structural validity of the TEPS. This suggest that the structure may be unstable with a two factor (Gard et al., 2006; Garfield et al., 2016; Ho et al., 2015) (anticipatory and consummatory) and a four factor (Chan et al., 2012; Li et al., 2018) (further separating anticipatory and consummatory into abstract and concrete items) solution identified. There is moderate quality evidence to support the convergent validity of the TEPS, which is more highly correlated with consummatory pleasure and physical anhedonia, than with severity of depression, and behavioural activation and inhibition. There is mixed evidence of moderate quality of discriminative validity between clinical and healthy participants on the anticipatory and consummatory subscales. However, TEPS scores did predict physical effort expenditure for rewards (i.e. behaviour), but not induced pleasant affect (Geaney et al., 2015). An attempt has

also been made to establish responsiveness in the state version of the scale, with TEPS scores changing in line with pleasure/positive affect, but not depression. Overall, evidence is needed to establish its psychometric properties in depressive samples.

The **Anticipatory and Consummatory Interpersonal Pleasure Scale (ACIPS) (Gooding & Pflum, 2014b)** was designed to measure anticipatory and consummatory pleasure in response to social rewards with 3 or 4 factor solutions separating close social interactions, general/group interactions, social bonding/shared interests, sometimes separating friend and family interactions. Item comprehensibility and relevance were assessed by professionals and comprehensibility was checked by individuals recruited from the target population. The ACIPS has been predominantly validated by the scale developers in students and community samples, but was recently validated in a clinical sample (Liang et al., 2020) and across cultures (e.g. Gooding et al., 2016). It has also been adapted for completion by adolescents (Gooding et al., 2016) with adaptations made to the response format (i.e. reduced to 4-point Likert scale) and wording of some items (i.e. work to school), resulting in a 4 factor solution, with the first 3 factors broadly mirroring the adult version, with a 4th factor (one item) labelled negative affiliation/emancipation. High quality evidence demonstrated that the ACIPS has high internal consistency, but only limited and low-quality evidence has explored the temporal stability of the ACIPS. Evidence of moderate quality has examined the structural validity of the ACIPS with both a 3 and 4 factor solution. Overall, there is mixed evidence for the acceptability of model fit to the data (e.g. Chaix et al., 2017; Liang et al., 2020). ACIPS scores were more highly correlated with physical and consummatory anticipatory and consummatory pleasure, positive affect, schizotypy and reward responsiveness, than with positive symptoms of schizophrenia, general health, social anxiety, and depression, behavioural inhibition and negative affect. There is moderate quality evidence to support the discriminative validity of the ACIPS, there were significant

differences between control participants and individuals with schizophrenia, bipolar or depression symptoms (e.g. Gooding et al., 2014). There is some evidence of gender differences on the ACIPS but there has been no assessment of measurement invariance across genders. Overall, the criterion validity of the ACIPS needs to be further established, as well as its sensitivity to change.

The **Motivation and Pleasure Scale – Self-Report (MAPS-SR) (Llerena et al., 2013)** was originally designed to measure all aspects of schizophrenia. Only items related to motivational and pleasurable aspects were retained making it a useful measure of several components of anhedonia symptoms. In development item comprehensibility and relevance were assessed by professionals. The MAPS-SR has been validated in samples of adults with schizophrenia and translated into German (Engel & Lincoln, 2016) and Korean (Kim et al., 2016). There has been no assessment of measurement invariance across gender or culture. The structural validity of the MAPSR was assessed in one high quality study (Richter et al., 2019) which found a 3-factor solution separating pleasure and hedonic activity from social motivation and motivation for work. The MAPS-SR correlated positively with the gold-standard clinical interview of motivation and pleasure in schizophrenia (CAINS, Forbes et al., 2010), but did not discriminate between inpatient and outpatient groups (Engel & Lincoln, 2016). There is moderate quality evidence of convergent and divergent validity with higher correlations between the MAPS-SR and measures of physical and consummatory anticipatory and consummatory pleasure, positive affect, schizotypy and reward responsiveness, than with positive symptoms of schizophrenia, general health, social anxiety, and depression, behavioural inhibition and negative affect. There is high quality evidence that the MAP-SR is internally stable, but only limited low quality evidence that it is temporally stable. Further studies are needed to establish its structure, and group differences across relevant disorders.

The **Specific Loss of Interest and Pleasure Scale (SLIPS) (Winer et al., 2014)** was developed to assess changes in anticipatory and consummatory anhedonia. Scale items were not reviewed by professionals or the target population. The development and initial validation paper (Winer et al., 2014) suggested that the SLIPS has one factor and high internal consistency, but this has not been confirmed. The temporal stability has not been assessed, because the SLIPS was been developed to detect change over time. The SLIPS had weak to moderate positive correlations with loss of anticipatory pleasure, low positive and high negative affect, but there was discrepancy in the strength of relationship between the SLIPS and with measures of consummatory pleasure. The SLIPS demonstrated evidence of incremental validity, by predicting BDI anhedonia scores over and above existing measures of anhedonia and affect. Further studies are needed to establish the validity and reliability of the SLIPS across different genders, community and clinical participants and cross-culturally.

The **Dimensional Anhedonia Rating Scale (DARS) (Rizvi et al., 2015)** was developed to assess a range of aspects of reward processing: interest, motivation, effort and pleasure, self-generating items. In development, professionals were involved in checking items for comprehensibility and relevance but the target population were not consulted. The original study reported a four-factor structure separating items based on type of reward i.e. social activities, hobbies, food/drinks, sensory experiences, which was replicated in a Spanish sample (Arrua-Duarte et al., 2019); however, the factor structure is yet to be investigated using confirmatory analyses. The scale was assessed against the SHAPS as a 'gold standard', with low quality evidence of criterion validity because the SHAPS only measures consummatory pleasure, a narrower construct of pleasure than is assessed by the DARS. There were high correlations between the DARS and the SHAPS in a clinical sample and moderate correlations between the DARS and the SHAPs in community samples. DARS scores were more strongly correlated with measures of reward responsiveness, physical

activity and depression than with fun seeking and behavioural inhibition. Good quality evidence for discriminative validity was established, participants with a major depressive episode reported higher scores on the DARS than healthy controls (Rizvi et al., 2015). Further evidence is needed to explore the test-retest reliability, cross cultural validity, and responsiveness of the DARS.

The **Chemosensory Pleasure Scale (CPS) (Zhao et al., 2019)** was also developed to assess loss of anticipatory and consummatory pleasure in response to sensory rewards. It is predominantly based on items from the TEPS (Gard et al., 2006), and the SHAPS (Snaith et al., 1995). Item relevance and comprehensibility were checked by professionals. In the development of the CPS moderate quality evidence for structural validity was reported, with 3 factors (food, imagination and nature); there was mixed evidence for its model fit. The CPS had good internal consistency (moderate quality evidence) and test-retest reliability (low-quality evidence). Zhou et al., (2019) also reported evidence of convergent validity; the CPS was correlated more highly self-reported physical pleasure than self -reported social pleasure, and there were moderate correlations between the SPS and responses to experimental physical stimuli. Further studies are needed to establish the validity and reliability of the CPS across samples, and to establish its discriminant validity, re-test reliability, cultural validity, and responsiveness.

The **Positive Valence System Scale (PVSS) (Khazanov et al., 2020)** was developed to assess a range of reward related difficulties in the positive valence system, namely initial responsiveness, reward satiation, reward anticipation, expectancy and motivational. The comprehensibility and relevance of items were checked with the general population and professionals, and comprehensiveness of the items was checked with professionals. There was high quality evidence for the structurer of the PVSS, with one general factor and further sub-factors based on type of rewarding stimuli (i.e. food, physical touch, outdoors, positive

feedback, hobbies, social interactions, goals). In the development study, the PVSS was more strongly correlated with physical anticipatory pleasure, consummatory pleasure, motivation and pleasure, than with measures of punishment sensitivity, impairment, and anxious arousal. Khazanov et al., (2020) also reported high quality evidence for the discriminative validity of the PVSS between individuals with high and low self-reported depressive symptoms (on the PHQ-9), and for incremental validity, predicting depression, anhedonic depression over and above other measures of anhedonia. Further evidence is needed to support the validity and reliability of the PVSS and to establish its cross-cultural validity, retest reliability, criterion validity and responsiveness.

Discussion

Although anhedonia is a characteristic of many enduring mental health difficulties and some physical health problems, and has adverse effects on quality of life and functioning, there is no consensus or gold standard self-report measure of anhedonia. This review aimed to critically evaluate the psychometric qualities of self-report measures of anhedonia and to identify those best suited for specific use in clinical and research settings. Following a systematic search of the literature 14 self-report measures of anhedonia were identified, for which 59 studies assessed their psychometric qualities. The 59 psychometric studies were reviewed using the comprehensive COSMIN checklist for the assessment of patient reported outcome measures (PROMS) (Mokkink et al., 2018). The COSMIN protocol is highly systematised and detailed and specifically focuses on the evaluation of measure development and key psychometric features. Our critical appraisal identified a range of methodological problems that were common to self-report measures of anhedonia and gaps in the assessment of each scale's psychometric properties. With these caveats in mind, below we highlight

existing self-report measures of anhedonia that may be particularly useful for researchers and clinicians.

Recommended self-report anhedonia measures

All users of self-report measures have shared technical requirements – for example all scale scores should have high quality evidence of validity and reliability in their different forms. However, the use of anhedonia measures in research or clinical practice may mean that different components of anhedonia are relevant and different aspects of validity more or less important. For example, neuroscience researchers may favour self-report measures of anhedonia that assess a range of reward related difficulties that they can elicit and observe at a neural level, e.g. namely consummatory, anticipatory and motivational component of anhedonia. They may also prefer self-report measures that are valid for use with participants recruited from a non-clinical population. These aspects may also be relevant to clinicians, but the sensitivity of a scale to change, its discriminant validity (e.g. can it distinguish between individuals with and without anhedonia), face validity, and speed and ease of completion and interpretation are likely to be more important.

Assessment of anhedonia in research settings: Although self-report measures of anhedonia have multiple psychometric limitations their individual strengths may be more suitable for different types of research and research questions. For example, for researchers who wish to examine anhedonia as a multidimensional construct, self-report measures that assess multiple dimensions may be most useful. The Dimensional Anhedonia Rating Scale (Rizvi et al., 2015) and the Positive Valence System Scale (Khazanov et al., 2020) were developed to assess responses to a range of reward related difficulties i.e. interest, motivation, effort and pleasure, and responses to rewarding stimuli in different contexts i.e. social, sensory, leisure. The PVSS was developed in response to the RDoC initiative, to assess underlying difficulties in the Positive Valence System (NIMH, 2020). Therefore, it may be

the most useful tool for transdiagnostic research because items were not derived specifically from the construct of anhedonia in depression. Neither the PVSS nor the DARS produced separate factors reflecting different components of reward related difficulties e.g. consummation versus motivation. Therefore, Khazanov et al., (2020) suggested that that it may not be possible to separate out these components of reward via self-report, but this debate is ongoing. Although there has been limited validation of the DARS and the PVSS, psychometric properties assessed in the initial development studies had moderate to high quality of evidence, suggesting that these are promising research tools.

Other self-report scales may be more useful for experimental studies that use sensory or social stimuli to capture anhedonia/hedonic deficits. The Temporal Experience of Pleasure Scale (TEPS) and the Chemosensory Pleasure Scale (CPS) assess anticipatory and consummatory pleasure in response to sensory rewards (Gard et al., 2006; Zhao et al., 2019). Both scales have been validated in community samples and may be useful for screening purposes. Alongside its relevance for schizophrenia, the TEPS has also been validated for use with individuals with substance misuse disorder which may make it a useful measure for transdiagnostic research (Garfield et al., 2016). The CPS is a new scale developed based on physical pleasure items from the TEPS (Gard et al., 2006), CPAS (Chapman et al., 1976) and SHAPS (Snaith et al., 1995). It requires further validation but has shown some relationship with sensory ratings after food consumption and during anticipation (Zhao et al., 2019).

Researchers who wish to assess social pleasures may prefer to use the CSAS (Chapman Social Anhedonia Scale, Chapman et al., 1976) or the ACIPS (the Anticipatory and Consummatory Interpersonal Pleasure Scale, Gooding & Pflum, 2014). Similar to the DARS (Rizvi et al., 2015) and PVSS (Khazanov et al., 2020), the original scale development study of the ACIPS produced separate factors based on type of social relationship (i.e. intimate versus group interactions) rather than types of pleasure (i.e. consummatory versus

anticipatory). On balance, the ACIPS is a more contemporary measure with a growing evidence base (see Gooding & Pflum, 2014).

Assessment of anhedonia in clinical settings: Four scales have been validated for use with depressed participants; these are the Snaith Hamilton Pleasure Scale (SHAPS, Snaith et al., 1995), the Dimensional Anhedonia Rating Scale (DARS, (Rizvi et al., 2015) and the Fawcett-Clark Pleasure Scale (FCPCS, Fawcett et al., 1983), and the Anhedonic Depression Scale (ADS, Clark & Watson, 1991; Kendall et al., 2016). Each measure has discriminant validity and can distinguish between depressed and non-depressed individuals. Both the SHAPS (Snaith et al., 1995) and the ADS (Bredemeier et al., 2010; Clark & Watson, 1991) have established potential clinical cut-offs, which make them particularly useful as a screening measure. In addition, scores on the SHAPS (Snaith et al., 1995) can distinguish between individuals with severe depression and those with mild to moderate depression (e.g. Nakonezny et al., 2010).

The FCPCS (Fawcett et al., 1983) and to a lesser extent, the SHAPS (Snaith et al., 1995) contain some items that are now irrelevant or obsolete. Items on the ADS are more general and therefore still relevant. The DARS (Rizvi et al., 2015), is a new scale and therefore not widely validated, but may be a useful clinical tool because it allows individuals to self-generate pleasurable experiences so it is unlikely to become dated. Of the available choices, the ADS (Clark & Watson, 1991; Kendall et al., 2016) may be the most appropriate measure to assess a more general mood or symptom-like construct of anhedonia/loss of positive emotionality in depression, whereas the DARS (Khazanov et al., 2020) may be more suited to assess emotion-based reactions to rewarding stimuli in the context of depression.

A number of scales have been developed to assess anhedonia in schizophrenia and to distinguish between individuals with and without schizophrenia. These are the Chapman Physical and Social Anhedonia Scales (CPAS and CSAS, (Chapman et al., 1976), the

Temporal Experience of Pleasure Scale (TEPS, Gard et al., 2006) trait version and the Motivation and Pleasure Scale (MAPS-SR, (Llerena et al., 2013). The CSAS and CPAS (Chapman et al., 1976) contain a minimum of 40 items and were developed in the 1970s; thus there have been concerns about their current validity and length. The MAPS-SR (Llerena et al., 2013) assesses motivational and hedonic elements of the negative symptoms of schizophrenia and has been well validated against the equivalent clinical interview for schizophrenia (e.g. Kim et al., 2016; Llerena et al., 2013). Neither the MAPS-SR (Llerena et al., 2013) or the TEPS (Gard et al., 2006) have strong evidence of discriminant validity but, they are brief and their content is more contemporary therefore further validation may mean that they are more appropriate measures of anhedonia in the context of schizophrenia. The MAP-SR (Llerena et al., 2013) provides a broader symptom measure with participants responding to general statements, whereas the TEPS (Gard et al., 2006) provides a more concrete set of statements regarding reactivity to specific sensory stimuli.

An important reason to measure the severity of current symptoms is to monitor their severity and any change over time, including during and following treatment. Only the SHAPS and the TEPS have any evidence of sensitivity to change. The SHAPs was responsive to change in clinical status, and the TEPS state version was related to changes in anhedonia and positive affect, but not depression. The Specific Loss of Interest and Pleasure Scale (SLIPS) (Winer et al., 2014), was developed to assess changes in anhedonia, in line the with the idea that anhedonia in clinical disorders such as depression is a 'state' rather than 'trait' like construct (APA, 2013). However, the SLIPs has only been evaluated in participants recruited from the community and therefore it has limited clinical utility.

Of relevance to both research and clinical practice is the application of scales for use in particular groups such as children and adolescents. Given the high prevalence of depression (and anhedonia) in adolescents, it is important to consider if any self-report

measures of anhedonia are valid or appropriate for use with young people. The Pleasure Scale (Kazdin, 1989) was developed to assess consummatory anhedonia in children. It has distinguished between children with and without depression, but has not undergone any further validation since its development and therefore may not be considered the most useful clinical tool. Of the 'adult' self-report measures of anhedonia the ACIPS was has adapted for young people (Gooding, Pflum, et al., 2016), although the adaptation was not developed with input from adolescents. Other scales have been validated for completion by adolescents (i.e. SHAPS), but concerns have been raised around the relevance of some items to young people (Leventhal et al., 2015).

Strengths and Limitations

This is the first systematic appraisal of self-report measures to assess the symptom of anhedonia. This review focused on self-report measures that assessed the core aspects of anhedonia; however, there is no consensus about how to define anhedonia and therefore the boundaries could be drawn more widely (or more tightly) (e.g. Watson et al., 2020). However, we hope that identifying each scales' nomological network will show how each self-report measure of anhedonia relates to other constructs of interest (see Table 3). We excluded self-report measures of related, and potentially overlapping constructs, such as positive affect, wellbeing, apathy, behavioural approach and behavioural activation (see Supplementary Material G for details of other measures of related constructs identified in this review). This means that some measures that assessed broader aspects of depression and negative affect e.g. the Hedonic Deficit Inventory (HDI), (Frewen et al., 2012), or related constructs such as the Environmental Reward Observation Scale (EROS) (Armento & Hopko, 2007) were not reviewed. We also focused on full scales or independently validated subscales, and so excluded sub-scales of anhedonia within general measures of depression and affect e.g. the Center for Epistemological Studies – Depression (CES-D); Beck

Depression Inventory (BDI), despite their potential utility (Shafer, 2006). This was because if a subscale is not independently validated information is often not available to evaluate it in isolation. In addition, some of the self-report measures we reviewed are part of a broader measure that has been extensively validated e.g. the Anhedonia Depression Scale as part of the MASQ (Clark & Watson, 1991) and the Chapman Social and Physical Anhedonia Scales as part of the Chapman Psychosis-Proneness Scales (e.g. see Chan et al., 2015; Kwapil et al., 2008). For this reason, some psychometric data may not have been included in this review. We were also not able to review a number of translated versions of scales (e.g. Assouly-Besse et al., 1995) where the full text is not available in English.

The COSMIN protocol for assessing Patient Reported Outcome Measures (PROMs) (Mokkink et al., 2018) is a rigorous, comprehensive, and detailed method of assessing quality; however in some areas it may be overly conservative. For example, using these criteria every self-report measure of anhedonia was judged to have doubtful or inadequate content validity because they were not developed on the basis of extensive interviews and consultations with service users and professionals. Some measures did include some important aspects of this consultation but these did not reach the criterion set by COSMIN. Likewise, the criteria for sufficient Confirmatory Factor Analysis model fit was high (CFI/TLI .95), meaning that scales of a lower standard (.9) were rated as insufficient, despite this often being treated as an acceptable standard (e.g. Kline, 2005). The COSMIN methodology also requires that the results of different studies relating to the psychometrics of about a single measure are combined and the evidence is downgraded if the results of different studies are inconsistent. This meant that where multiple studies reported discrepancies in the factor structures of a self-report measures, these were rated lower in quality than scales that had only one validation study.

Further Research

We identified fourteen self-report measures of anhedonia. Based on the COSMIN protocol (Mokkink et al., 2018) each has significant methodological shortcomings. Of particular concern is that every measure had poor content validity. Although this initial difficulty cannot be remediated, further validation studies could establish the relevance, comprehensibility and comprehensiveness of items, and if difficulties occur, scales could be adapted.

Other measurement properties were routinely assessed, such as structural validity. However, here important discrepancies were reported and these may have been exacerbated by differences in analytical choices (see Flora & Flake, 2017). Convergent validity was also routinely assessed, and future research would benefit from building an understanding of the nomological network of each measure to help clarify the relationship between anhedonia and other related constructs (e.g. Olino et al., 2018). Convergent validity was almost always assessed against other self-report measures, resulting in issues of shared method variance (Reio, 2010). Future research could evaluate the relationships between self-report scales and experimental stimuli (e.g. Geaney et al., 2015), and assess how these scales fare in the 'real world', otherwise there is a danger that scale development will continue to go round in circles, by assessing the acceptability of a scale against another arguably 'imperfect' measure.

Some measurement properties were rarely assessed, particularly cross-cultural validity, measurement invariance across genders, criterion validity and responsiveness. Although a number of scales have been translated and validated in different cultures, only one has assessed measurement invariance across cultures (Zhou et al., 2019). This means that it is not possible to know if there is equivalence across versions of the same measure in different languages or contexts. Similarly, a number of studies reported gender differences but did not assess measurement invariance. Thus, it is not possible to know if a 'true' gender difference is present. Future validation studies should build a stronger evidence base for

these psychometric properties. Until then researchers may need to prioritise whether to improve and refine existing measures or to abandon those and develop new, psychometrically valid alternatives. For new self-report measures of anhedonia methodological standards, such as those adopted by the COSMIN protocol (Mokkink et al., 2018) may provide a useful guide.

For clinical purposes, it is important to establish that self-report measures of anhedonia have criterion validity and ideally to use a clinical interview to establish if scales can differentiate between individuals who do and who do not meet criteria for the symptom. There are also major gaps in the availability of self-report measures of anhedonia that are suitable for use with key groups of participants, including children and adolescents, who differ in their experience of reward (Forbes & Dahl, 2012). We should also address the important requirement for 'state' measures of anhedonia to be sensitive to change because this is important if they are to be clinically useful. Further knowledge of these scales perform on these dimensions would greatly improve our understanding of how existing scales relate to the clinical construct of anhedonia.

Conclusions

Using a structured critical appraisal tool (the COSMIN protocol), this systematic review identified 14 self-report measures of anhedonia and 59 studies that reported on their psychometric qualities. We identified weaknesses in the development of self-report scales, mixed evidence to support the measurement properties of existing scales, and gaps in the assessment of their psychometric properties. We suggest that, in order to facilitate knowledge building, it is vital that researchers are transparent about the scale selection, and draw conclusions based on what is assessed, for example, the absence of consummatory pleasure. Therefore, rather than suggesting there is a 'one size fits all' for self-report scales, clinicians

and researchers should select the measure which captures the construct they wish to assess, and prioritise psychometric properties that are most important in their context.

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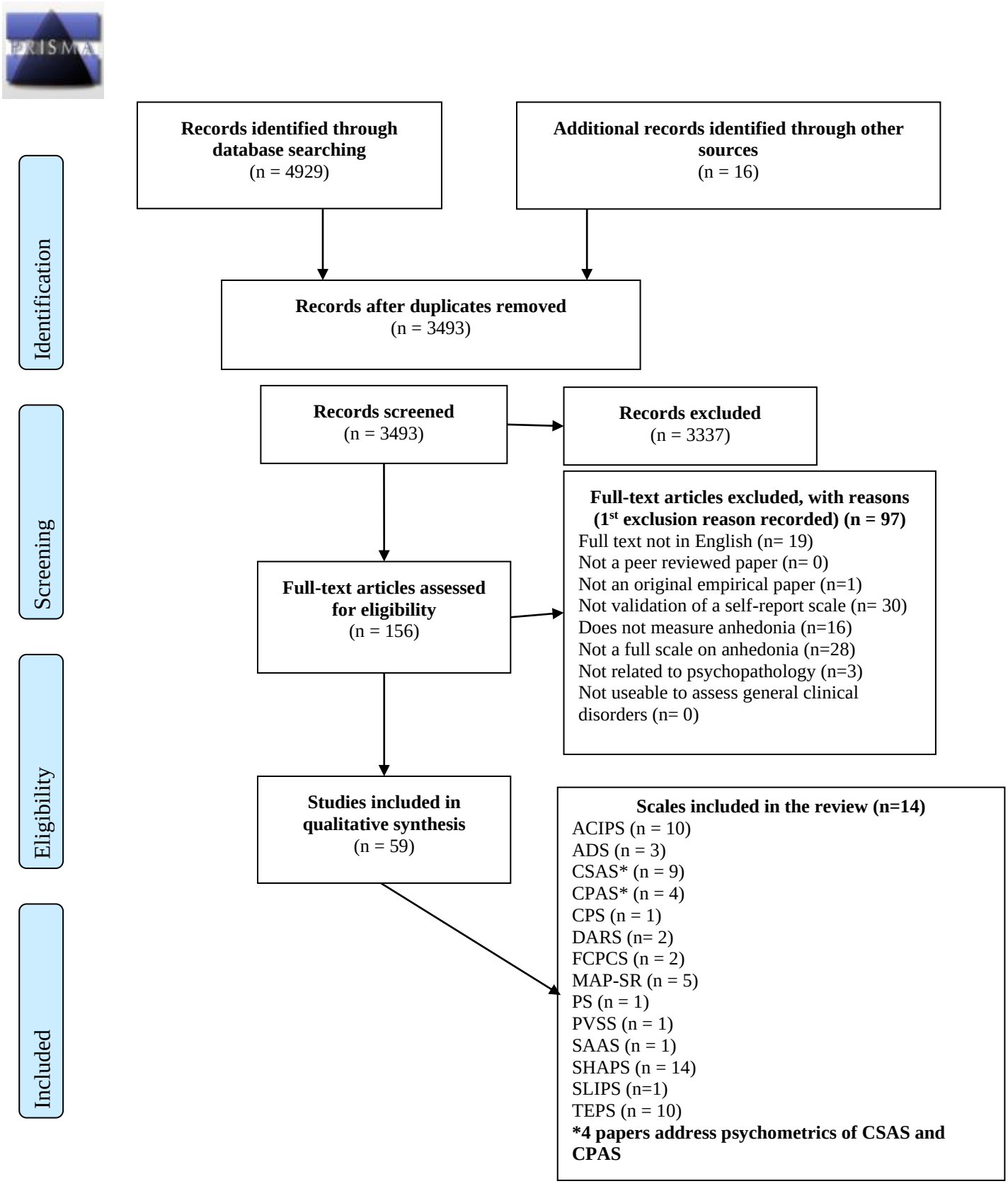
Appendix.



PRISMA Flow Diagram.

3.1. Supplementary Material

Section A – Search Terms

WEB OF SCIENCE
TS = (((anhedoni* OR hedoni* OR reward* OR pleasur* OR disinterest OR (lack ADJ2 interest) OR (loss ADJ2 interest) OR (diminished ADJ2 interest) OR (reduced ADJ2 interest)) AND (questionnaire* OR scale* OR inventor*) AND (psychometri* OR reliab* OR valid*)))

INCLUDING LIMITS:

- Psychiatry
- Psychology Clinical
- Psychology Multidisciplinary
- Psychology Social
- Neurosciences
- Clinical Neurology
- Social Science Interdisciplinary
- Psychology Developmental
- Psychology
- Behavioural Sciences
- Substance Abuse
- Psychology Applied
- Psychology Experimental
- Multidisciplinary Sciences
- Psychology Biological
- Rehabilitation
- Pediatrics
- Psychology Educational

Document Type: Article, English Language, 1970 – Current (2019)
Search: Topic (title, abstract, keywords)

PsycINFO
((anhedoni* OR hedoni* OR reward* OR pleasur* OR disinterest OR (lack NEAR/2 interest) OR (loss NEAR/2 interest) OR (diminished NEAR/2 interest) OR (reduced NEAR/2 interest)) AND (questionnaire* OR scale* OR inventor*) AND (psychometri* OR reliab* OR valid*))

Search: Abstract

INCLUDING LIMITS: English Language, Humans, Peer Reviewed Journal, 1970 – Current (2019)

PubMED

(((anhedoni*[Title/Abstract] OR hedoni*[Title/Abstract] OR reward*[Title/Abstract] OR pleasur*[Title/Abstract] OR disinterest[Title/Abstract] OR “lack of interest”[Title/Abstract] OR “loss of interest”[Title/Abstract] OR “diminished interest”[Title/Abstract] OR “reduced interest”[Title/Abstract])) AND (questionnaire*[Title/Abstract] OR scale*[Title/Abstract] OR inventor*[Title/Abstract])) AND (psychometri*[Title/Abstract] OR reliab*[Title/Abstract] OR valid*[Title/Abstract])

Search: Title/Abstract

INCLUDING LIMITS: Humans, English Language

Section B – Boxes of the COSMIN Risk of Bias Checklist and Additional Notes

COSMIN Measurement Properties

10. **Content validity** is the degree to which the content of a scale is an adequate reflection of the construct to be measured. The COSMIN standard is that that potential questionnaire items are identified with help from the target population and relevant experts.
11. **Structural validity** is the degree to which scores of a scale are an adequate reflection of the dimensionality of the construct to be measured. The COSMIN procedure recommends that the structural validity of self-report measures of anhedonia is assessed using Classic Test Theory (CTT), with a preference for confirmatory over exploratory factor analysis; or an Item Response Theory (IRT) or Rasch Model. Constructs of anhedonia are related concepts so should be used oblique rotations (as recommended e.g. Flora & Flake, 2017), so quality of evidence downgraded if orthogonal rotations used (unless both were assessed and difference was negligible, or when using a bifactor model when factors are constrained to be orthogonal).
12. **Internal consistency** is the extent to which an instrument's scales are correlated. Likert scale response formats result in ordinal data/items, so quality was downgraded if items were treated as continuous (Flora & Flake, 2017).
13. **Cross cultural validity/measurement invariance** is the degree to which items on a translated or culturally adapted scale are an adequate reflection of the performance of the items of the original version of the scale**.** In the COSMIN guidance an assessment of cross-cultural validity requires direct comparisons need to be made between two sets of data from different locations. Measurement invariance also related to other

characteristics such as gender, and refers to whether respondents from different groups with the same latent trait level respond similarly to a particular item.

14. **Reliability** is the extent to which scores for patients who have not changed are the same for repeated measurement under different conditions (i.e. test–retest). In the COSMIN guidance, this should be a measure of agreement i.e. intra-class correlation coefficient or Cohen's kappa.
15. **Measurement error** is the systematic and random error of an individual's score that is not attributed to true changes in the construct to be measured.
16. **Criterion validity** is the degree to which the scores of a scale are an adequate reflection of a 'gold standard,' as described by the study authors or when an assessment of sensitivity/specificity etc. was established. In the COSMIN guidance, differences between individuals with and without a diagnosis are categorised under hypothesis testing 'discriminative validity'.
17. **Hypotheses testing** relates to whether the scores of an instrument are consistent with hypotheses based on the assumption that the instrument validly measures the construct to be measured. Convergent validity of self-report measures was assessed by examining correlations with questionnaires or other methods that assessed related and/or unrelated constructs. Discriminative validity was assessed between 'known groups' such as clinical groups and non-clinical populations. Convergent and discriminative validity was assessed in line with the authors prediction regarding the relationship between measures, with 'absolute' strengths and differences reported in Table 1 and Figure 2.
18. **Responsiveness** is the ability of an instrument to detect change over time, and therefore is the test of the validity of a change score.

Section C – Criteria for Good Measurement Properties

Measurement Property	Rating[1]	Criteria
Structural Validity	+	**CTT** CFA: CFI or TLI or comparable measure >0.95 OR RMSEA <0.06 OR SRMR <0.08[2]. *EFA: Factors explain at least 50% of the variance. **IRT/Rasch** No violation of unidimensionality[3]: CFI or TLI or comparable measure >0.95 OR RMSEA < 0.20 OR Q3's < 0.37 AND no violation of monotonicity: adequate looking graphs OR item scalability >0.30 AND adequate model fit: IRT: $\chi 2$ >0.01 Rasch: infit and outfit mean squares ≥ 0.5 and ≤ 1.5 OR Z- standardized values > -2 and <2
	?	**CTT** CFA: Not all information for '+' reported *EFA: Explained variance not mentioned, or factor analysis not completed. **IRT/Rasch** Model fit not reported
	-	Criteria for '+' not met.
Internal Consistency	**+**	At least low evidence4 for sufficient structural validity[5] AND Cronbach's alpha(s) ≥ 0.70 for each unidimensional scale or subscale[6]
	?	Criteria for "At least low evidence4 for sufficient structural validity[5]" not met
	-	At least low evidence4 for sufficient structural validity[5] AND Cronbach's alpha(s) < 0.70 for each unidimensional scale or subscale[6]
Reliability	**+**	ICC or weighted Kappa ≥ 0.70.
	?	ICC or weighted Kappa not reported
	-	ICC or weighted Kappa < 0.70.
Measurement Error	**+**	SDC or LoA < MIC5
	?	MIC not defined
	-	SDC or LoA > MIC5
Hypothesis testing for	**+**	The result is in accordance with the hypothesis[7]

construct validity (see table below)		
	?	No hypothesis defined (by the review team)
	-	The result is not in accordance with the hypothesis[7]
Cross-cultural validity and Measurement Invariance	**+**	No important differences found between group factors (such as language) in multiple group factor analysis OR no important DIF for group factors (McFadden's R2 < 0.02).
	?	No multiple group factor analysis OR DIF analysis performed
	-	Important differences between group factors OR DIF was found
Criterion Validity	**+**	Correlation with gold standard ≥ 0.70 OR AUC ≥ 0.70
	?	Not all information for '+' reported
	-	Correlation with gold standard < 0.70 OR AUC < 0.70.
Responsiveness	**+**	The result is in accordance with the hypothesis7 OR AUC ≥ 0.70.
	?	No hypothesis defined (by the review team).
	-	The result is not in accordance with the hypothesis7 OR AUC < 0.70.

The criteria are based on, e.g., Terwee et al. (2012) and Prinsen et al. (2018).

AUC area under the curve, CFA confirmatory factor analysis, CFI comparative fit index, CTT classical test theory, DIF differential item functioning, ICC intraclass correlation coefficient, IRT item response theory, LoA limits of agreement, MIC minimal important change, RMSEA root mean square error of approximation, SEM standard error of measurement, SDC smallest detectable change, SRMR standardized root mean residuals, TLI Tucker–Lewis index

1 "+" = sufficient, " –" = insufficient, "?" = indeterminate
2 To rate the quality of the summary score, the factor structures should be equal across studies
3 unidimensionality refers to a factor analysis per subscale, while structural validity refers to a factor analysis of a (multidimensional) patient-reported outcome measure
4 As defined by grading the evidence according to the GRADE approach
5 This evidence may come from different studies
6 The criteria 'Cronbach alpha < 0.95' was deleted, as this is relevant in the development phase of a PROM and not when evaluating an existing PROM.
7 The results of all studies should be taken together and it should then be decided if 75% of the results are in accordance with the hypotheses

*Added in additional criteria from previous version of the COSMIN (Terwee et al., 2012) in order to rate EFA.

Section D: Modified GRADE Approach for Grading the Quality of Evidence

The GRADE approach is used to downgrade evidence when there are concerns about the quality of the evidence. The starting point is always the assumption that the pooled or overall result is of high quality. The quality of evidence is subsequently downgraded by one or two levels per factor to moderate, low, or very low evidence when there is risk of bias, (unexplained) inconsistency, imprecision (low sample size), or indirect results. The quality of evidence can even be downgraded by three levels when the evidence is based on only one inadequate study (i.e. extremely serious risk of bias).

Quality of Evidence	**Lower if**
High: We are very confident that the true measurement property lies close to that of the estimate* of the measurement property. **Moderate:** We are moderately confident in the measurement property estimate: the true measurement property is likely to be close to the estimate of the measurement property, but there is a possibility that it is substantially different. **Low:** Our confidence in the measurement property estimate is limited: the true measurement property may be substantially different from the estimate of the measurement property. **Very Low:** We have very little confidence in the measurement property estimate: the true measurement property is likely to be substantially different from the estimate of the measurement property.	**Risk of bias** -1 Serious -2 Very serious -3 Extremely serious **Inconsistency** -1 Serious -2 Very serious **Imprecision** -1 total n=50-100 -2 total n<50 **Indirectness** -1 Serious -2 Very serious

* Estimate of the measurement property refers to the pooled or summarized result of the measurement property of a PROM.

Below we explain in more detail how the four GRADE factors can be interpreted and applied in evaluating the measurement properties of PROMs:

(1) Risk of bias can occur if the quality of the study is doubtful or inadequate, as assessed with the COSMIN Risk of Bias checklist, or if only one study of adequate quality is available. See below instructions on downgrading for risk of bias:

Risk of bias	**Downgrading for risk of bias**
No	There are multiple studies of at least adequate quality, or there is one study of very good quality available.
Serious	There are multiple studies of doubtful quality available, or there is only one study of adequate quality.
Very Serious	There are multiple studies of inadequate quality, or there is only one study of doubtful quality available.

Extremely Serious	There is only one study of inadequate quality available.

(2)Inconsistency: if findings are inconsistent, rate the pooled or summarized result (e.g. based on the majority of results) as sufficient or insufficient and then downgrade the quality of the evidence for inconsistency with one or two levels.

(3)Imprecision refers to the total sample included in the studies. We recommend to downgrade with one level when the total sample size of the pooled or summarized studies is below 100, and with two levels when the total sample size is below 50.

(4)Indirectness can occur if studies are included in the review that were (partly) performed in another population or another context of use than the population or context of use of interest in the systematic review. For example, if only part of the study population consists of patients with the disease of interest, the review team can decide to downgrade with one or two levels for serious or very serious indirectness.

Section E. Quality ratings per study included in the review

	PROM DEVELOPMENT/ CONTENT VALIDITY	STRUCTURAL VALIDITY	INTERNAL CONSISTENCY	CROSS CULTURE VALIDITY/ MEASUREMENT INVARIANCE	RELIABILITY	MEASUREMENT ERROR	CRITERION VALIDITY	HYPOTHESIS TESTING (A)	HYPOTHESIS TESTING (B)	RESPONSIVENESS
ACIPS										
Gooding & Pflum (2014)	Inadequate	Adequate [due to EFA]	Doubtful [Likert scale – should use ordinal alpha - downgraded]	N/R	Doubtful [no ICC calculate and unclear if Ps stable]	N/R	N/R	Doubtful [some confusion re. difference in strength of correlation between TEPS and SAS]	N/R	N/R
Gooding & Pflum (2014) – further validation	N/A [same sample type as development]	Adequate [due to EFA]	Very good [ordinal alpha calculated]	Adequate Gender – [no group MI] [some lack of clarity re. samples similar on all other characteristics]	N/R	N/R	N/R	Very good	N/R	N/R
Gooding et al. (2014).	N/A [validated prev. in students]	Adequate [due to EFA]	Very good [ordinal alpha calculated]	N/R	N/R	N/R	N/R	Very good	Very good	N/R
Gooding et al. (2015)	Inadequate [not checked for validity in community samples of adults]	N/R	Very good	Doubtful Gender – [no group MI] [lack of clarity re. samples similar on all other characteristics]	N/R	N/R	N/R	Very good	N/R	N/R

Gooding et al. (2016)	Inadequate [subject matter expert – but not checked with target pop]	Adequate [due to EFA]	Very good	N/R Spanish [no group MI or direct comparison]	N/R	N/R	N/R	Very good	Adequate [more clarity on characteristics of subgroups]	N/R
Gooding, Pflum, Fonseca-Pedero, Paino (2016)	Adolescents [some adaptation in response format and wording – subject matter involved but not target pop].	Adequate [due to EFA]	Very good	Doubtful Gender – [no group MI] [lack of clarity re. samples similar on all other characteristics]	N/R	N/R	N/R	Very good	N/R	N/R
Chan et al. (2016)	Inadequate [clinical psychologists involved – but not target pop]	Adequate [due to EFA]	Very good	N/R Chinese [no group MI or direct comparison] Doubtful Gender [no MI and equivalence of samples]	N/R	N/R	N/R	Very good	Doubtful [need clarification for use of TEPS 10%]	N/R
Gooding et al. (2017)	Inadequate [subject matter expert involved – but not target pop]	Adequate [due to EFA]	Very good	N/R Chinese adolescent version [no group MI or direct comparison] Doubtful Gender [no MI and equivalence of samples]	N/R	N/R	N/R	Very good	N/R	N/R
Chaix et al. (2017)	Inadequate [independent translator involved- unclear of expertise – no target pop involvement]	Very good	Very good	N/R French version [no group MI or direct comparison]	N/R	N/R	N/R	N/R	N/R	N/R
Liang et al. (2020)	Inadequate [validity for use with clinical samples not established]	Adequate [little details included on decision	N/R	N/R	N/R	N/R	N/R	Adequate [little details included on decision	Adequate [some details included on subgroups]	N/R

		making process]						making process]		
ADS		Structural Validity	Internal Consistency	Cross Culture Validity	Reliability	Measurement Error	Criterion Validity	Hypothesis Testing (a)	Hypothesis Testing (b)	Responsiveness
Bredemeier et al (2010)	N/R	N/R	Very good	N/R	N/R	N/R	Very good	N/R	N/R	N/R
Kendall et al. (2015)	N/R	Very good	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
CSAS		Structural Validity	Internal Consistency	Cross Culture Validity	Reliability	Measurement Error	Criterion Validity	Hypothesis Testing (a)	Hypothesis Testing (b)	Responsiveness
Chapman et al. (1976)	Inadequate [not stated expertise of item writers, or target pop involvement]	N/R	Very good (KR20]	N/R Gender [no MI]	N/R	N/R	N/R	N/R	Adequate	N/R
Leak (1991)	Inadequate [unclear if prev validated in student sample/no evidence of checks for acceptability in this pop]	N/R	Adequate [ordinal alpha or KR20 not calculated]	N/R	N/R	N/R	N/R	Average [some lack of clarity for acceptability for student pop]	N/R	N/R
Bailey et al. (1993)	[no assessment for suitability with inpatients]	N/R	N/R	N/R	N/R	N/R	N/R	Very good	N/R	N/R
Fonseca-Pedrero et al. (2009)	Inadequate [Spanish translation – no evidence of expert or target pop involvement]	Very good	Adequate [ordinal alpha or KR20 not calculated]	N/R Spanish [no MGCFA]	N/R	N/R	N/R	Very good	N/R	N/R
Reise et al. (2011)	[general population – acceptability unclear]	Very good	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Chan et al. (2012)	N/R [previously validated in Chinese, non-clinical groups]	N/R	Adequate [ordinal alpha or KR20 not calculated]	N/R Gender [no MI]	N/R	N/R	N/R	Very good	Very good	N/R
Cihan et al. (2015)	Inadequate [no evidence of expert or target pop involvement in Turkish translation]	N/R	Adequate [ordinal alpha or KR20 not calculated]	N/R Turkish [no MGCFA]	Doubtful [no ICC]	N/R	N/R	Very good	N/R	N/R

Cicero et al. (2015)	N/R [prev validated in undergrad students]	Very good	N/R	N/R	N/R	N/R	N/R	Very good	N/R	N/R
Olino et al. (2016)	N/R [prev validated in undergrad students]	Very good	Adequate [ordinal alpha or KR20 not calculated]	N/R	N/R	N/R	N/R	Very good	N/R	N/R

CPAS		Structural Validity	Internal Consistency	Cross Culture Validity	Reliability	Measurement Error	Criterion Validity	Hypothesis Testing (a)	Hypothesis Testing (b)	Responsiveness
Chapman et al. (1976)	Inadequate [unsure expertise of item writers, or target pop involvement]	N/R	Very good [KR20]	N/R Gender [no MI]	N/R	N/R	N/R	N/R	Adequate	N/R
Bailey et al (1993)	[no assessment for suitability with inpatients]	N/R	N/R	N/R	N/R	N/R	N/R	Very good	N/R	N/R
Fonseca Pedrero et al. (2009)	Inadequate [Spanish translation – no evidence of expert or target pop involvement]	Adequate	Adequate [ordinal alpha or KR20 not calculated]	N/R Spanish [no MGCFA]	N/R	N/R	N/R	Very good	N/R	N/R
Chan et al. (2012)	N/R [previously validated in Chinese, non-clinical groups]	N/R	Adequate [ordinal alpha not calculated]	N/R Gender [no MI]	N/R	N/R	N/R	Very good	Very good	N/R

CPS		Structural Validity	Internal Consistency	Cross Culture Validity	Reliability	Measurement Error	Criterion Validity	Hypothesis Testing (a)	Hypothesis Testing (b)	Responsiveness
Zhou et al. (2019)	Inadequate	Very good/ Adequate	Adequate [ordinal alpha not calculated]	N/R	Doubtful	N/R	N/R	Very good	N/R	N/R

DARS		Structural Validity	Internal Consistency	Cross Culture Validity	Reliability	Measure--ment Error	Criterion Validity	Hypothesis Testing (a)	Hypothesis Testing (b)	Responsiveness
Rizvi et al. (2016)	Inadequate (1a. no qual method concept elicitation, 1b. no pilot study)	Adequate (due to EFA)	Adequate [ordinal alpha not calculated]	N/R	N/R	N/R	Doubtful (assessment against 'gold'	Very good	Very good	N/R

Arrua-Duarte et al. (2019)	Inadequate (translated version not checked with target pop)	Adequate (due to EFA)	Adequate [ordinal alpha not calculated]	Inadequate (no MGCFA or DIF)	N/R	N/R	SHAPS a self-report) Doubtful (assessment against 'gold' SHAPS a self-report)	N/R	N/R	N/R
	Inadequate	Adequate	Very good	Inadequate	N/R	N/R	Doubtful	Very good	Very good	N/R
FCPCS		STRUCTURAL VALIDITY	INTERNAL CONSISTENCY	CROSS CULTURE VALIDITY	RELIABILITY	MEASUREMENT ERROR	CRITERION VALIDITY	HYPOTHESIS TESTING (A)	HYPOTHESIS TESTING (B)	RESPONSIVENESS
Fawcett et al. (1983)	Inadequate [clinicians specialising in mood disorders, target population not involved]	Doubtful [due to sample size for 2PL IRT]	Adequate [ordinal alpha not calculated]	N/R	N/R	N/R	Inadequate [AUC or sensitivity/specificity not calculated]	Adequate [detailed description of comparator instruments not included]	Very good	N/R
D-heanen (1996)	Inadequate [psychiatrist involved in translation but not target population]	Adequate [assumable fits the research question]	Adequate [ordinal alpha not calculated]	N/R [Dutch version - (no MGCFA or DIF)]	N/R	N/R	N/R	Doubtful [limited psychometric properties available for comparator instrument]	Adequate [some lack of detail re. characteristics of subgroups]	N/R
MAP-SR		STRUCTURAL VALIDITY	INTERNAL CONSISTENCY	CROSS CULTURE VALIDITY	RELIABILITY	MEASUREMENT ERROR	CRITERION VALIDITY	HYPOTHESIS TESTING (A)	HYPOTHESIS TESTING (B)	RESPONSIVENESS
Park et a1. (2012)	Inadequate [target population not involved in development process and unclear expert involvement]	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Llerena et al. (2013)	N/R [previously evaluated in schizophrenic samples]	N/R	Adequate [ordinal alpha not calculated]	N/R	N/R	N/R	Very good	Very good	N/R	N/R

Engel & Lincoln (2016)	Inadequate [clinical experts and target pop not involved in translation]	N/R	Adequate [ordinal alpha not calculated]	N/R [German version - (no MGCFA or DIF)]	N/R	N/R	Very good	Very good	Average [more details on group characteristics – in and outpatients]	N/R
Kim et al. (2016)	Inadequate [clinically experienced individual involved in translation, but no validity checks with target pop]	N/R	Adequate [ordinal alpha not calculated]	N/R [Korean version - (no MGCFA or DIF)] Gender [no MI]	N/R	N/R	N/R	Very good	N/R	N/R
Engel & Lincoln (2017)	N/R [previously assessed in sample type]	N/R	N/R	N/R	N/R	N/R	Very good	N/R	N/R	N/R
Richter et al. (2019)	N/R [previously assessed in sample type]	Very good	Adequate [ordinal alpha not calculated]	N/R	Doubtful [ICC not calculate]	N/R	NR	Very good	N/R	N/R

Pleasure Scale (PS)		STRUCTURAL VALIDITY	INTERNAL CONSISTENCY	CROSS CULTURE VALIDITY	RELIABILITY	MEASUREMENT ERROR	CRITERION VALIDITY	HYPOTHESIS TESTING (A)	HYPOTHESIS TESTING (B)	RESPONSIVENESS
Kazdin (1988)	Doubtful [clinical research staff involved, and children interviews – few details included]	Adequate [due to EFA]	Adequate [ordinal alpha not calculated]	N/R	N/R	N/R	Inadequate [sensitivity or specificity not calculated]	Very good	Very good	N/R

PVSS		STRUCTURAL VALIDITY	INTERNAL CONSISTENCY	CROSS CULTURE VALIDITY	RELIABILITY	MEASUREMENT ERROR	CRITERION VALIDITY	HYPOTHESIS TESTING (A)	HYPOTHESIS TESTING (B)	RESPONSIVENESS
Khazanov et al. (2019)	Doubtful (some clarification with experts and target pop. But limited]	Very good	Adequate [ordinal alpha not calculated]	N/R	Adequate [Pearson' s r not ICC reported]	N/R	N/R	Very good	Very good	N/R

SHAPS		STRUCTURAL VALIDITY	INTERNAL CONSISTENCY	CROSS CULTURE VALIDITY	RELIABILITY	MEASUREMENT ERROR	CRITERION VALIDITY	HYPOTHESIS TESTING (A)	HYPOTHESIS TESTING (B)	RESPONSIVENESS
Snaith et al.	Inadequate [target	N/R	Adequate	N/R	Doubtful	N/R	Doubtful	Doubtful	N/R	Inadequate

(1995)	population check comprehensibility, relevance, comprehensiveness, but not experts]		[ordinal alpha not calculated]		[ICC not calculated]		[exact sensitivity/specificity not reported in text]	[details of comparator instruments not reported]		[sensitivity and specificity not described]
Franken et al. (2007)	Inadequate [not checked with experts or target population]	Adequate [due to EFA]	Adequate [ordinal alpha not calculated]	N/R	Very good	N/R	N/R	Very good	Very good	N/R
Nakonezny et al. (2010)	Inadequate [not checked with experts or target population]	Adequate [due to EFA]	Adequate [ordinal alpha not calculated]	N/R	N/R	N/R	N/R	Very good	Very good	N/R
Nakonezny et al. (2015)	Inadequate [not checked with experts or target population]	Doubtful [PCA with varimax rotation - downgraded]	Adequate [ordinal alpha not calculated]	N/R	N/R	N/R	Doubtful [sensitivity and specificity calculated – use of single item from self-report to establish CRV]	Very good	Adequate [justification for choice of 1 item to classify clinical groups]	N/R
Leventhal et al. (2015)	Inadequate [not checked with experts or target population]	Very good	Adequate [ordinal alpha not calculated]	N/R	N/R	N/R	N/R	Very good	N/R	N/R
Martino et al. (2018)	Inadequate [not checked with experts or target population]	Adequate [due to EFA]	Adequate [ordinal alpha not calculated]	N/R	N/R	N/R	N/R	Adequate [lack of clarity about expected correlations]	N/R	N/R
Liu et al. (2012)	Inadequate [not checked with target population, experts checked for comprehensibility and relevance]	Doubtful [PCA with varimax rotation - downgraded]	Adequate [ordinal alpha not calculated]	N/R [Chinese version translation but no group MI or group comparison] Gender [differences reported but no MI]	Very good	N/R	N/R	Very good	Very good	N/R

Thomas et a. (2012)	Inadequate [not checked with experts or target population]	N/R	Adequate [ordinal alpha not calculated]	N/R	N/R	N/R	N/R	Very good	N/R	N/R
Yee et al. (2014)	Inadequate [not checked with experts or target population]	N/R	Adequate [ordinal alpha not calculated]	N/R [Simplified Chinese version translation but no group MI or group comparison]	N/R	N/R	N/R	Very good	N/R	N/R
Langvik & Austad (2019)	Inadequate [not checked with experts or target population]	Very good	Adequate [ordinal alpha not calculated]	N/R	Doubtful [Cronbach's alpha not ICC reported]	N/R	N/R	N/R	N/R	N/R
Fresan & Berlanga (2013)	Inadequate [not checked with target population – comprehensibility checked with experts]	Doubtful [varimax rotation – downgraded]	Doubtful [dichotomous scoring used – should use Kuder Richardson or ordinal alpha]	N/R [Spanish version translation but no group MI or group comparison]	N/R	N/R	N/R	Doubtful [other minor flaws- only data presented for a comparator instrument described as measuring a different construct]	N/R	N/R
Nagayama et al. (2012)	Inadequate [not checked with target population – comprehensibility checked with experts]	N/R	Adequate [ordinal alpha not calculated]	N/R [Japanese version translation but no group MI or group comparison]	Very good	N/R	N/R	Adequate [question by authors about precision of comparator instrument]	N/R	N/R
Santangelo et al. (2009)	Doubtful [comprehensibility checked with experts and target population]	N/R	Very good	N/R	Very good	N/R	N/R	N/R	Very good	N/R
Chong Guan et al. (2014)	Doubtful [comprehensibility checked with experts and target population,	Doubtful [varimax rotation – downgraded]	Adequate [ordinal alpha not calculated]	N/R [Malay version translation but no group MI or	N/R	N/R	Very good	Very good	Very good	N/R

	relevance checked with target pop/]			group comparison]						
SAAS		**Structural Validity**	**Internal Consistency**	**Cross Culture Validity**	**Reliability**	**Measurement Error**	**Criterion Validity**	**Hypothesis Testing (a)**	**Hypothesis Testing (b)**	**Responsiveness**
Olivares et al. (2005)	Inadequate	Doubtful [varimax rotation – downgraded]	Adequate [ordinal alpha not calculated]	N/R	N/R	N/R	N/R	Adequate [lack of detail regarding convergent measures]	Very good	N/R
SLIPS		**Structural Validity**	**Internal Consistency**	**Cross Culture Validity**	**Reliability**	**Measurement Error**	**Criterion Validity**	**Hypothesis Testing (a)**	**Hypothesis Testing (b)**	**Responsiveness**
Winer et al. (2014)	Inadequate (1a. no qual method concept elicitation, 1b. no pilot study)	Adequate (due to EFA)	Very good	N/R	N/R	N/R	N/R	Very good	N/R	N/R
TEPS		**Structural Validity**	**Internal Consistency**	**Cross Culture Validity**	**Reliability**	**Measurement Error**	**Criterion Validity**	**Hypothesis Testing (a)**	**Hypothesis Testing (b)**	**Responsiveness**
Gard et al. (2006)	Doubtful [lack of clarity on identity of 'judges' on item development, but checks with pop about relevance of items]	Adequate [due to EFA]	Adequate [ordinal alpha not calculated]	N/R Gender [but no measurement invariance]	Doubtful [no ICC calculate]	N/R	N/R	Very good	N/R	N/R
Chan et al. (2010)	Inadequate [no assessment of acceptability in clinical pop]	N/R	N/R	N/R	N/R	N/R	Very good	N/R	Very good	N/R
Strauss et al. (2011)	Inadequate [no assessment of acceptability in schiz pop]	N/R	Very good	N/R	Very good	N/R	N/R	Very good	Very good	N/R
Chan et al. (2012).	Doubtful [clinical experts involved in translation and items adapted for culture – but target pop not involved – 2010	Very good	Adequate [ordinal alpha not calculated]	N/R Chinese version [no direct group comparison or MI]	Doubtful [ICC not calculate]	N/R	N/R	N/R	N/R	N/R

	described as pilot]									
Ho et al. (2015)	N/R [not a new sample type]	Very good	Adequate [ordinal alpha not calculated]	N/R	N/R	N/R	N/R	Very good	N/R	N/R
Geaney et al. (2015)	N/R [not a new sample type]	N/R	Adequate [ordinal alpha not calculated]	N/R	N/R	N/R	N/R	Very good	N/R	N/R
Garfield et al. (2016)	Inadequate [unclear of clinical experts or target pop involved in validation of state version]	Very good	Adequate [ordinal alpha not calculated]	N/R	Very good	N/R	N/R	Very good	N/R	HT (Very good)
Li et al. (2018)	N/R [already validated in samples]	Very good	N/R	Adequate [Chinese - not clear if groups similar on other characteristics]	N/R	N/R	N/R	N/R	N/R	N/R
Simon et al. (2018)	Inadequate [unclear of expertise involvement or target pop in translation]	Very good	Adequate [ordinal alpha not calculated]	N/R German version [no direct group comparison or MI]	N/R	N/R	N/R	Average [more detail needed on comparator instruments]	Very good	N/R
Zhou et al. (2019).	N/R [not a new sample]	Very good	Adequate [ordinal alpha not calculated]	Adequate [not clear if groups similar on other characteristics]	N/R	N/R	N/R	N/R	N/R	N/R

Section F. Measurement Property ratings per study included in the review

	STRUCTURAL VALIDITY	INTERNAL CONSISTENCY	CROSS CULTURE VALIDITY	RELIABILITY	MEASURE--MENT ERROR	CRITERION VALIDITY	HYPOTHESIS TESTING (A)	HYPOTHESIS TESTING (B)	RESPONS-IVENESS
ACIPS									
Gooding & Pflum (2014) - Development	(-) [EFA <50% variance explained]	(+)	N/R	(?) [ICC not calculate]	N/R	N/R	(+)	N/R	N/R
Gooding & Pflum (2014) – Further Validation	(+)	(+)	(?) Gender – [no group MI]	N/R	N/R	N/R	**(+)** [some lack of clarity on expected correlations – but implied inline with dev. paper]	N/R	N/R
Gooding et al. (2014).	(-) [EFA <50% of variance explained]	(+)	N/R	N/R	N/R	N/R	**(+)**	(+)	N/R
Gooding et al. (2015)	N/R	(+)	(?) Gender – [no group MI]	N/R	N/R	N/R	**(+)**	N/R	N/R
Gooding et al. (2016)	(+)	(+)	Spanish translation – [no MI]	N/R	N/R	N/R	**(+)**	(+)	N/R
Gooding et al. (2016) – ACIPS-A	(-) [EFA <50% of variance explained]	(+)	N/R	N/R	N/R	N/R	(+) [but unclear expected relationship with GHQ-12)	N/R	N/R
Chan et al. (2016)	(+)	(+)	(?) Chinese [no group MI or direct comparison] (?) Gender [no MI]	N/R	N/R	N/R	**(+)**	(+) [when compared to top and bottom 10% of TEPS]	N/R
Gooding et al. (2017)	(+)	(+)	(?) Chinese adolescent-version [no group MI or direct comparison]	N/R	N/R	N/R	**(+)**	N/R	N/R
Chaix et al. (2017)	(-) [CFA most fit indices criteria not met]	(+)	(?) French version [no group MI or direct comparison]	N/R	N/R	N/R	N/R	N/	N/R
Liang et al. (2020)	(-) [CFA most fit	N/R	N/R	N/R	N/R	N/R	**(?)** [hypothesis not	(?) [specific	N/R

	indices criteria not met]						clearly stated]	hypotheses between groups not stated]	
ADS	**Structural Validity**	**Internal Consistency**	**Cross Culture Validity**	**Reliability**	**Measurement Error**	**Criterion Validity**	**Hypothesis Testing (a)**	**Hypothesis Testing (b)**	**Responsiveness**
Bredemeier et al (2010)	N/R	(+)	N/R	N/R	N/R	(+)	N/R	N/R	N/R
Kendall et al. (2015)	(+) [fit on RMSEA & SRMR, but not CFI]	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
CSAS									
Chapman et al. (1976)	N/R	(+)	N/R	N/R	N/R	N/R	N/R	(+)	N/R
Leak (1991)	N/R [PCA included all scales – not just CSAS]	(+)	N/R	(?) [ICC not calculate]	N/R	N/R	(+) [the *majority* of hypotheses were supported]	N/R	N/R
Cihan et al. (2015)	(-) [not all criteria for model fit met CFI +/ RMSEA -]	(+)	N/R	(?) [ICC not calculate]	N/R	N/R	(+)	N/R	N/R
Cicero et al. (2015)	(-) [all models lower than model fit indices]	N/R	N/R	N/R	N/R	N/R	(+)	N/R	N/R
Olino et al. (2016)	(-) [CFA not all criteria for model fit met for 40 and 15 item versions]	(+)	N/R	N/R	N/R	N/R	**(+)**	N/R	N/R
Fonseca-Pedrero et al. (2009)	(-) [no fit for model indices]	(+)	N/R Spanish [no MGCFA]	N/R	N/R	N/R	(CPAS -)	N/R	N/R
Reise et al. (2011)	(-) [did not fit uni or bifactor models]	N/R	N/R	N/R	N/R	N/R	N/R	N/R	N/R
Bailey et al. (1993)	N/R	N/R	N/R	N/R	N/R	N/R	(-) [most hypotheses not supported]	N/R	N/R
Chan et al. (2012)	N/R	(+)	N/R	N/R	N/R	N/R	**(+)**	(+)	N/R
CPAS									
Chapman et al. (1976)	N/R	(+)	N/R	N/R	N/R	N/R	N/R	(+)	N/R
Fonseca Pedrero et al. (2009)	(CFA +)	(+)	N/R Spanish [no MGCFA]	N/R	N/R	N/R	(+)	N/R	N/R

Bailey et al (1993)	N/R	N/R	N/R	N/R	N/R	N/R	(-) [most hypotheses not supported]	N/R	N/R
Chan et al. (2012)	N/R	(+)	N/R Gender – [no MI]	N/R	N/R	N/R	(+)	(+)	N/R
CPS	**Structural Validity**	**Internal Consistency**	**Cross Culture Validity**	**Reliability**	**Measure-- ment Error**	**Criterion Validity**	**Hypothesis Testing (a)**	**Hypothesis Testing (b)**	**Respons-iveness**
Zhou et al. (2019)	EFA (+) / CFA (-) (CFI plus and TLI, but not for RMSEA, GFI)	(+)	N/R	(?) [Pearson' s r not ICC calculate d]	N/R	N/R	(+) [In line with predictions about self-report and experimental stimuli]	N/R	N/R
	Structural Validity	**Internal Consistency**	**Cross Culture Validity**	**Reliability**	**Measure-- ment Error**	**Criterion Validity**	**Hypothesis Testing (a)**	**Hypothesis Testing (b)**	**Respons-iveness**
DARS									
Rizvi et al. (2015)	**(+)** [final scale %variance reported in Arrua]	(+)	N/R	N/R	N/R	(-) (+) [used SHAPS as gold standard <.7 standard]	(+)	(+)	N/R
Arrua-Duarte et al. (2019)	(+)	(+)	(?) [Spanish and English comparison but no MGFA]	N/R	N/R	(-) [used SHAPS as gold standard <.7 standard]	N/R	N/R	N/R
FCPCS	**Structural Validity**	**Internal Consistency**	**Cross Culture Validity**	**Reliability**	**Measureme nt Error**	**Criterion Validity**	**Hypothesis Testing (a)**	**Hypothesis Testing (b)**	**Responsiveness**
Fawcett et al. (1983)	(?) [not all fit information provided]	(+)	N/R	N/R	N/R	(?) [AUC or sensitivity/sp ecificity not calculated]	(?) [unclear expected correlations]	(+)	N/R
D-heanen (1996)	(-) [failed to Rasch model]	(+)	N/R [Dutch version - (no MGCFA or DIF)]	(?) [ICC not calculate]	N/R	N/R	(+)	**(+)**	N/R
MAP-SR	**Structural Validity**	**Internal Consistency**	**Cross Culture Validity**	**Reliability**	**Measure-- ment Error**	**Criterion Validity**	**Hypothesis Testing (a)**	**Hypothesis Testing (b)**	**Responsiveness**
Llerena et al. (2013)	N/R	(+)	N/R	N/R	N/R	CAINS MAP (-)	**(+)**	N/R	N/R

						[correlation <.7]			
Engel & Lincoln (2016)	N/R	(+)	N/R [German version - (no MGCFA or DIF)]	N/R	N/R	CAINS MAP (-) [correlation <.7]	(+) [Most hypotheses supported]	(?) [unclear expected relationship between inpatients and outpatients]	N/R
Kim et al. (2016)	N/R	(+)	N/R [Korea version - (no MGCFA or DIF)] Gender [no MI]	N/R	N/R	(CAINS – MAP (-) [correlation <.7]	(?) [Expected correlations not specified]	N/R	N/R
Engel & Lincoln (2017)	N/R [previously assessed in sample type]	N/R	N/R	N/R	N/R	(CAINS MAP (-) [correlation <.7]	N/R	N/R	N/R
Richter et al. (2019)	**(+)**	(+)	N/R	(?) [ICC not calculate]	N/R	NR	**(-)** [Not in line with most expectations]	N/R	N/R
Pleasure Scale (PS)	**Structural Validity**	**Internal Consistency**	**Cross Culture Validity**	**Reliability**	**Measure-- ment Error**	**Criterion Validity**	**Hypothesis Testing (a)**	**Hypothesis Testing (b)**	**Responsiveness**
Kazdin (1988)	(+)	(+)	N/R	N/R	N/R	(?) [sensitivity/ specificity or AUC not calculated]	(+)	**(+)**	N/R
PVSS	**Structural Validity**	**Internal Consistency**	**Cross Culture Validity**	**Reliability**	**Measureme nt Error**	**Criterion Validity**	**Hypothesis Testing (a)**	**Hypothesis Testing (b)**	**Responsiveness**
Khazanov et al. (2019)	(+)	(+)	N/R	(?) [Pearson' s r not ICC reported]	N/R	N/R	(+) [in line with predictions]	(+)	N/R
SHAPS	**Structural Validity**	**Internal Consistency**	**Cross Culture Validity**	**Reliability**	**Measureme nt Error**	**Criterion Validity**	**Hypothesis Testing (a)**	**Hypothesis Testing (b)**	**Responsiveness**

Snaith et al. (1995)	N/R	(+)	N/R	(?) [ICC not calculate]	N/R	(?) [AUC not calculated]	(?) [expected correlations unclear]	N/R	(?) [sensitivity and specificity not calculated]
Franken et al. (2007)	(-) [due to <50% variance explained in study 1] (+) [>50% in study 2]	(+)	N/R	(+)	N/R	N/R	(?) [lack of clarity regarding expected relationship with a number of measures]	(+)	N/R
Nakonezny et al. (2010)	(-) [due to explaining <50% of the variance]	(+)	N/R	N/R	N/R	N/R	(+) [self-report and clinician rated scales]	(+)	N/R
Nakonezny et al. (2015)	(-) [due to explaining <50% of the variance]	(+)	N/R	N/R	N/R	(?) [AUC not calculated]	[+] "gold standard" measures of depression severity and quality of life clinician and self-report]	(+)	N/R
Leventhal et al. (2015)	(+)	(+)	N/R	N/R	N/R	N/R	(+) [in line with hypotheses apart from social phobia]	N/R	N/R
Martino et al. (2018)	(+)	(+)	N/R [Italian version translation but no group MI or group comparison]	N/R	N/R	N/R	(?) [lack of clarity about expected correlations]	N/R	N/R
Liu et al. (2012)	Non Clinical (-) [<50% variance] Clinical (+)	(+)	N/R [Chinese version translation but no group MI or group comparison] Gender – [no group MI]	(-) [ICC <0.7]	N/R	N/R	(+)	(+)	N/R
Thomas et a. (2012)	N/R	(+)	N/R [Arabic version translation but no group MI or group comparison]	N/R	N/R	N/R	(+)	N/R	N/R

			Gender – [no group MI]						
Yee et al. (2014) p.66	N/R	(+)	N/R [Simplified Chinese version translation but no group MI or group comparison]	N/R	N/R	N/R	(+)	N/R	N/R
Langvik & Austad (2019)	EFA (+) CFA (-) [did not meet criteria for fit indices]	(+)	N/R Gender [no MI calculated]	(?) [Cronbach's alpha not ICC reported]	N/R	N/R	N/R	N/R	N/R
Fresan & Berlanga (2013)	(+)	(+)	N/R	N/R	N/R	N/R	(+)	N/R	N/R
Nagayama et al. (2012)	N/R	(+)	N/R [Japanese version translation but no group MI or group comparison]	(-) [Cohen's Kappa for individual items – average <.7]	N/R	N/R	(+)	N/R	N/R
Santangelo et al. (2009)	N/R	(-) [Kuder Richardson <0.7]	N/R	(-) [ICC <0.7]	N/R	N/R	CPAS considered "gold standard" (+)	(+)	N/R
Chong Guan et al. (2014)	(+)	(+)	N/R [Malay version translation but no group MI or group comparison]	(-) [ICC <0.7]	N/R	(+)	(+) [measures of "concurrent" validity]	(+)	N/R

SAAS	STRUCTURAL VALIDITY	INTERNAL CONSISTENCY	CROSS CULTURE VALIDITY	RELIABILITY	MEASURE-- MENT ERROR	CRITERION VALIDITY	HYPOTHESIS TESTING (A)	HYPOTHESIS TESTING (B)	RESPONSIVENESS
Olivares et al. (2005)	(+)	(+)	N/R	N/R	N/R	N/R	(CPAS +)	(+)	N/R

SLIPS	STRUCTURAL VALIDITY	INTERNAL CONSISTENCY	CROSS CULTURE VALIDITY	RELIABILITY	MEASURE-- MENT ERROR	CRITERION VALIDITY	HYPOTHESIS TESTING (A)	HYPOTHESIS TESTING (B)	RESPONSIVENESS
Winer et al. (2014)	(?) (% variance explained not reported)	(+)	N/R	N/R	N/R	N/R	**(+)** (in line with predictions)	N/R	N/R

TEPS	Structural Validity	Internal Consistency	Cross Culture Validity	Reliability	Measure-- ment Error	Criterion Validity	Hypothesis Testing (a)	Hypothesis Testing (b)	Responsiveness
Gard et al. (2006)	(-) [EFA <50% variance explained]	(+)	N/R	(?) [no ICC calculate]	N/R	N/R	(+) [most hypotheses supported]	N/R	N/R
Chan et al. (2010)	N/R	N/R	N/R	N/R	N/R	N/R	(+) [correlation with PANSS – clinician rated, not specified as "gold standard" so included in HT not CRV]	(?) [unclear expected relationship with re. anticipatory and consummatory pleasure]	N/R
Strauss et al. (2011)	N/R	(+)	N/R	(+)	N/R	N/R	(-) [Failed to replicate previous findings in relation to external variables]	(-) [not in line with previous research]	N/R
Chan et al. (2012).	**(+)**	**(+)**	N/R	(?) [ICC not calculate]	N/R	N/R	N/R	N/R	N/R
Ho et al. (2015)	**(-)** [CFA did not fit model]	(+)	N/R	N/R	N/R	N/R	(?) [Mixed evidence for convergent and discriminant validity]	N/R	N/R
Geaney et al. (2015)	N/R	(ANT + CON -)	N/R	N/R	N/R	N/R	ANT (+) CONS (-)	N/R	N/R
Garfield et al. (2016)	**(-)** [did not meet fit indices criteria]	(+)	N/R	(+)	N/R	N/R	**(+)**	N/R	HT (?) [correlated with changes in SHAPS, PA but not depression]
Simon et al. (2018)	(-) [fit criteria not met]	(+)	N/R	N/R	N/R	N/R	(?) [some lack of clarity with regards to	(-) [no differences	N/R

							expected correlation with SANS and PANSS – not described as "gold standard")	between patient and controls]	
Li et al. (2018)	**(-)** [initial CFAs did not meet criteria]	N/R	**(+)** [Chinese and English - structural invariance for 4 factor solution] (+) [measurement invariance across time in Chinese sample]	N/R	N/R	N/R	N/R	N/R	N/R
Zhou et al. (2019).	(-) [fit indices criteria not met]	(+)	(+) Gender [measurement invariance – 4 factor holds in men and women]	N/R	N/R	N/R	N/R	N/R	N/R

Note. N/R = Not Rated. Three-point scale: (+) sufficient, (?) indeterminate, (-) insufficient. See COSMIN guidance (e.g. Prinsen et al., 2018) for details. ANT = Anticipatory; CONS = Consummatory.

Section G. Nomological network of anhedonia self-report scales displaying the relationship with other measures.

Legend:

STRONG (S) (>.7)

MODERATE (M) (>.5 <.7)

WEAK (W) (>.3 <.5)

VERY WEAK (<.3)

NON-SIG (NS)

	CSAS	CPAS	FCPCS	PS	ADS	SHAPS	SAAS	TEPS	MAP-SR	ACIPS	SLIPS	DARS	CPS	PVSS
PLEASURE														
anticipatory pleasure	W	M				W				S M W	W		S	S M
consummatory pleasure	W	M	M			M		S W		M W	M V W	VW	M W	S W
physical anhedonia	V W M		W			M W	M	M W#		M W			M	S M
social anhedonia		M W	W					W VW	W	M W			VW	
dimensional anhedonia						W		W# NS*			M			M
motivation and pleasure									W					S
pleasure sensitivity						W								
reward responsiveness						W		W* W#		M		M		M W
sensitivity to reward														W
APATHY														
apathy						M		M# W* NS						
lassitude						NS								
passivity										NS				
RESTRICTED AFFECT														
restricted emotion	W													
less emotional appraisal	VW													
less clarity of emotions	VW													
constricted affect										W V W				
flat affect									NS					
alexithymia								W						
emotional suppression	W													
POSITIVE EMOTIONALITY														
positive experience				W										
positive affect				V W		W V W		M W*		W	W			M
desire for pleasantness						W								
satisfaction in life						M W V W								
happiness						W								
emotional valence for positive images						W								
admiration										VW				
NEGATIVE EMOTIONALITY														
negative affect						V W NS		W		VW	W			W V W
suicidal preoccupation						W								
BEHAVIOURAL APPROACH														

behavioural activation								W#	VW*	NS*					M	W
fun seeking						NS		NS				W		VW		
drive	VW					VW		NS				VW		W	M	W
reward expectancy															M	W
engagement in pleasant experiences						W										
physical activity														W		
reward probability															M	
environmental suppressors															W	
PUNISHMENT SENSITIVITY																
harm avoidance	NS															
behavioural inhibition						NS		VW#	NS*			VW		NS	NS	VW
punishment expectancy															NS	VW
fear of negative evaluation															VW	
POSITIVE PERSONALITY TRAITS																
openness	NS															
extraversion,			VW												M	W
agreeableness,	M														M	W
self-esteem	NS															
affiliative tendency	M															
creative behaviour															VW	
NEGATIVE PERSONALITY TRAITS																
neuroticism			NS												VW	
rigidity	W															
pessimism						NS										
negative urgency						NS										
control	NS															
conscientiousness	VW														W	
SOCIABILITY																
sociability,												VW				
social impairment,			W												W	
sexual relationships,												NS				
social potency,												VW				
social desirability.	NS														NS	
prosocial interactions,												VW				
social closeness,	S										M					
social network relationships,											W					
loneliness,	M											W				
social connectedness												M				
no close friends,												W				
lack of social interest,	W															
faith in people,	W															
lack of empathy,	VW															
Social functioning															M	
DEPRESSION/ MOOD SYMPTOMS																
depression	W		W	NS		M	VW	NS		VW	NS#	W	NS	VW	M	W		W
anhedonic depression																M
hopelessness	NS		W			W										
SCHIZOTYPAL RELATED																
magical ideation	VW											VW	NS			
perceptual aberration	VW											NS				
ideas of reference												VW	NS			
schizoid, schizotypal personality disorder	M	M														
schizotypal traits																
odd speech												NS				

unusual perceptions										W	N S				
suspiciousness										VW					
positive symptoms of schizophrenia,								W#	NS						
unusual perceptions															
Schizotypy /schizotypal traits		VW								M					
schizoid and schizotypal personality disorder															
negative symptoms of schizophrenia,								W	W						
Schizotypal ambivalence										NS					
ANXIETY/ FEAR SYMPTOMS															
anxiety	W					NS		VW	NS						
social anxiety										W	N S				
anxious arousal														V W	NS
MANIA															
mania														VW	
hypomanic personality														VW	
agitation/mania									NS						
eccentric behaviour										W					
PERSONALITY DISORDERS (NON-SCHIZOID/TYPAL)															
avoidant personality disorder	W	M													
SOMATIC FEATURES															
appetite,						NS									
sleep,						NS									
somatic features,						NS									
GENERAL HEALTH															
general psychopathology									NS						
general health						M				NS					
internalising disorders				NS											
externalising disorders				NS											
behavioural problems				NS											
FUNCTIONING															
skills assessment									NS						
working productivity,									NS						
family network relationships,									NS						
independent living and self-care									NS						
work and school impairment														NS	
social impairments			W												
global assessment functioning									VW						
social functioning															
OUTCOMES															
length of hospital stay			NS												
number of suicide attempts.			NS												
OTHER															
anomia	W														
traditionalism	NS														

Note. *Consummatory Subscale; # Anticipatory Subscale.

Section H. Other measures of related constructs identified in this review

Related Constructs	Broader Clinical Disorder Measures
Pleasure	*Schizophrenia*
Lost Pleasure of Life (Hedonic damages)	Chapman Psychosis Proneness Scales (CPPS)
Pleasant Activities List (PAL)	Scale for the Assessment of Negative Symptoms (SANS)
Attitudes to Chocolate Questionnaire	Positive and Negative Syndrome Scale (PANSS)
Pleasant Events Schedule (PES) (MacPhillarmy & Lewinsohn, 1974)	Negative Symptom Assessment-16 (NASA-16)
California Older Person's Pleasant Events Schedule (COPPES)	Clinical Assessment Interview for Negative Symptoms (CAINS)
Delaying Gratification Inventory	Subjective Experience of Negative Symptoms
Sexual Pleasure Scale	Calgary Depression Scale for Schizophrenics
Anticipatory Pleasure Scale (Supernormal stimuli)	Specific Psychotic Experiences Questionnaire (in adolescents)
Pleasure Arousal Dominance	Schizoptypal Personality Questionnaire (SPQ)
Hedonic Deficit and Interference Scale	Brief Negative Symptoms Scale (BNSS)
Savoring Beliefs Questionnaire	Wisconsin Schizotypy Scale (WSS)
Tripartite Pleasure Inventory (TPI) (not validated)	Specific Psychotic Experiences Questionnaire (in adolescents)
Pleasantness Rating Task	ESQUIZO-Q
Pleasure and Health Behaviour Inventory	*Addictions*
Reward	General Addiction Scale
Rewarding Events Inventory (smoking)	Yale Food Addiction Scale
Skin Picking Reward Scale	Alcohol Expectancy Scale
Social Reward Questionnaire	Internet Addiction Scale
Barcelona Music Reward Questionnaire	Cannabis Experiences Questionnaire
Intrinsic Work Rewards Scale	*Depression*
Reinforcement Survey Schedule (Cautela & Kastenbaum, 1967)	Hospital Anxiety and Depression Scale (HADS)
Drive	Positive and Negative Affect Scale (PANAS)
Questionnaire of Smoking Urges	Patient Health Questionnaire (PHQ-9)
Reward-Based Eating Drive Scale	Depression Anxiety Stress Scale
Craving Typology Questionnaire	Children's Depression Inventory (CDI)
Boredom	Montgomery-Asberg Depression Scale
Boredom Proneness Scale	Beck Depression Inventory (BDI)
Boredom Susceptibility Scale	Edinburgh-Postnatal Depression Scale
Wellbeing	Reynolds Adolescent Depression Scale
The Wellbeing Scale (WeBs)	MMPI
Meaning in Life Questionnaire (in dissertation)	Multidimensional Child and Adolescent Depression Scale
WEMWEBS	Mood Disorder Questionnaire
Wellbeing Eudaimonic and Psychological Scales	Mood Questionnaire: Positive Affect Subscale
Questionnaires for Eudaimonic Wellbeing	Center for Epidemiological Studies Depression - Depression Anhedonia Subscale
	Zung Self-Rating Depression Scale (SDS) - Positive Emotion Subscale
Happiness	*Bipolar/Mania*
Enjoyment Scale (in dissertation)	The Hypomanic Attitudes and Positive Predictions Inventory (HAPPI)
Global Happiness Scale	

Pemberton Happiness Index	Multiple Visual Analogue Scale for Bipolarity (MVAS-BP - incl. consummatory reward, incentive reward)
Subjective Happiness Scale (SHS)	*General*
Orientations to Happiness Scale	Daily Goals Scale
Apathy	Symptom Checklist Revised
Starkstein's (1995) Apathy Scale (AS)	California Psychological Inventory
Apathy Motivation Index	General Psychological Wellbeing Scale (GPWS)
Apathy Evaluate Scale (AES) (Marin, 1991)	General Health Questionnaire
Apathy Inventory (AI)	
Lille Apathy Rating Scale	
Apathy Scale	
Motivation	
Adult Mastery Motivation Scale	
Hedonic and Eudaimonic Motives for Activities (HEMA)	
Effort-Reward Imbalance	
Social Motivation Questionnaire (SMQ)	
Appetitive Motivation Scale (AMS)	
Motivation and Energy Inventory	
Motivations to Eat (binging)	
Emotionlessness	
Affect Grid (single item)	
The Numbing Scale	
Toronto Alexithymia Scale	
Oxford-Liverpool Inventory of Feelings and Experiences (O-LIFE)	
Reinforcement Sensitivity	
BISBAS Scales	
Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ)	
Jackson 5	
Reward Sensitivity Questionnaire (RSQ)	
The Reinforcement Sensitivity Theory of Personality Questionnaire (RST-PQ)	
Personality Measures	
Tridimensional Personality Questionnaire (TPQ incl. novely seeking and reward dependence)	
Temperament and Character Inventory (Revised)	
Revised Reinforcement Sensitivity (RSQ17)	
Big-5 Inventory	
Reward Probability Index (RPI)	
The Early Adolescent Temperament Questionnaire–Revised: Pleasure Sensitivity Subscale	

Chapter 4.

Paper 3: Development and Validation of a New Self-Report Measure of Adolescent Anhedonia: The Anhedonia Scale for Adolescents (ASA)

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Abstract

Anhedonia, the loss of interest and pleasure in previously enjoyable experiences, is a core symptom of depression and a characteristic of other mental health and physical health problems. Most self-report measures of anhedonia have been developed for use with adults and their suitability for adolescents is questionable. In this paper we describe the development and psychometric qualities of a new measure, the Anhedonia Scale for Adolescents (ASA), designed specifically for use with adolescents aged 11-18 years. Items were generated from in-depth qualitative interviews with depressed young people, and then reviewed by an independent group of young people and clinically qualified experts in adolescent mental health. After piloting the new scale (n = 66), we established the structural validity of the measure with two groups of young people using exploratory (n = 1057) and confirmatory (n = 1041) factor analysis. The final scale consisted of 14 items, with 1 general factor and 3 specific factors producing the best fit to the data, 1) Enjoyment, Excitement and Emotional Flattening (negatively framed); 2) Enthusiasm, Connection and Purpose (positively framed); 3) Effort, Motivation and Drive (negatively framed). The ASA had high test-retest reliability and converged with standardized measures of depression, negative symptoms of schizophrenia, pleasure and positive affect. Findings from these analyses provided evidence of incremental validity, as the ASA was a stronger predictor of clinical group (high vs. low depressive symptoms) than existing measures used to assess anhedonia. The ASA has potential as a new clinical and research tool to assess adolescent anhedonia.

Keywords: anhedonia, depression, adolescents, psychometrics, measurement, scale

Public Significance Statement: In this study we developed and validated the Anhedonia Scale for Adolescents (ASA), a measure of anhedonia (loss of interest/pleasure) for adolescents. Results suggest that the ASA is a useful tool to assess anhedonia in adolescents.

Introduction

Anhedonia, the loss of interest and pleasure in previously enjoyable experiences, is a core symptom of major depressive disorder (MDD), and a feature of a range of mental health problems including schizophrenia, substance misuse, and post-traumatic stress disorder (APA, 2013). Amongst adolescents, MDD is one of the most common mental health problems (Polanczyk et al., 2015) and is associated with high rates of recurrence during adulthood (Dunn & Goodyer, 2006), increased risk of suicide (Hawton et al., 2012), and increased risk of long term adverse health, economic and social impacts (Clayborne et al., 2019). More than half of adolescents with depression meet diagnostic criteria for the symptom of anhedonia (Goodyer et al., 2017; Orchard et al., 2017) and anhedonia predicts poor treatment outcome in adolescents (McMakin et al., 2012).

Despite its adverse impact anhedonia is typically not targeted in psychological treatments of depression although there is increased interest in developing interventions that focus on reducing anhedonia and increasing positive affect (Craske et al., 2019; Dunn et al., 2019). The symptom of anhedonia is understood to be related to dysfunctional reward processing (RDoC Positive Valence System, (NIMH, 2011b, 2018; Rizvi et al., 2016), with increasing evidence suggesting that anhedonia consists of a number of different reward-related deficits, including the inability to pursue, experience or learn about pleasure/reward (Thomsen, 2015, Thomsen et al., 2015). Reward processing consists of several components or steps, known as wanting (appetitive/motivational), liking (consummatory/hedonic) and learning (predictions made about possible future rewards) (Berridge, 2003; Berridge & Kringelbach, 2008, 2015), with further distinctions made between the anticipation of future rewards and the effort expended to receive a reward (e.g. Kring & Barch, 2014). There is evidence to support differences in reward processing between depressed and non-depressed individuals (Halahakoon et al., 2020; Rizvi et al., 2016). Despite the accumulating body of

research on reward processing in depression, it is not clear precisely which aspects of the reward process are the most disabling, and which distinctions are accessible to conscious awareness. Research on the Positive Valence System Scale (PVSS), developed to assess the NIHM's positive valence system domain of interest within RDoC initiative (Insel et al., 2010), found differences between PVSS scores for individuals with high and low depression symptom scores (on the PHQ-9), supporting the link between self-reported reward processing difficulties and depression (Khazanov et al., 2020). Anhedonia also features as a concept of 'loss' within the Negative Valence System (NIMH, 2011a) domain of RDoC, highlighting the complex, and still largely unknown nature of anhedonia within mental health. Therefore, in this paper we operationalise the concept of anhedonia as a broad *loss* of interest and pleasure (APA, 2013), which encompasses the absence of, or inability to experience consummatory and/or anticipatory pleasure, to feel positive, happy, connected, fulfilled and motivated to engage with the world; or to experience the desire to seek out positive and rewarding experiences. This absence or loss may in turn be accompanied by a sense of frustration with the inability to feel pleasure, and may lead to feelings of detachment and behavioural withdrawal.

Adolescence is a critical time for *both* the development of depression and for changes in reward-related processing (Forbes & Dahl, 2012). In particular, adolescents are more likely than adults to seek out rewards (Shulman et al., 2016), to engage in risky behaviours (Steinberg, 2004), and to experience heightened responses to emotional cues (Casey et al., 2011; Somerville et al., 2010). Hyper-responsiveness in the brain reward system (i.e. striatum) during adolescence means that adolescents respond differently to rewarding stimuli than adults (Galvan, 2010). Despite generally increased reward seeking behaviour during this period, heightened depression rates (and therefore for many individuals reduced reward-related activity) leads to a greater disparity in reward-related functioning during adolescence

than at other points in the lifespan (Forbes & Dahl, 2012). The presentation of symptoms of depression in adults and adolescents may also be different. For example, Rice et al., (2019) found that vegetative and physical symptoms, such as fatigue, were more commonly reported by adolescents than adults. In addition, the way in which individual symptoms, such as anhedonia, are experienced may differ in adults and young people. Auerbach et al., (2017) suggested that the initial onset of anhedonia in young people is likely to be characterised by reduced energy and diminished motivation, and subsequently by behavioural withdrawal and broader features of anhedonia. In studies exploring real-life positive affect (Experience Sampling Methodology; ESM), adolescents with higher levels of depressive symptoms at baseline experienced fewer positive events and reported lower positive affect over the course of the study, but enjoyed pleasurable events 'in the moment'(consummatory) as often and as much as non-depressed adolescents (van Roekel et al., 2016). In an ESM study with adults, individuals meeting diagnostic criteria for major depressive disorder experienced blunted anticipatory and consummatory pleasure in comparison to healthy controls (Wu et al., 2017), suggesting possible differences in anhedonia based on age and/or clinical severity.

To better understand the experience and presentation of anhedonia in adolescents, assess the symptom, and develop new treatments that target anhedonia, sensitive and valid instruments are needed. The majority of scales to measure anhedonia have been developed for adults and therefore may not be optimal for the assessment of anhedonia during adolescence because of the key developmental changes that occur during this period (Forbes & Dahl, 2012) and potential differences in how anhedonia may be experienced by adults and young people. Most self-report measures used to measure anhedonia have been devised to assess only consummatory aspects of anhedonia/ loss of pleasure and do not assess anticipatory or motivational anhedonia (e.g. the Chapman Physical Anhedonia Scale (CPAS)/Chapman Social Anhedonia Scale (CSAS), Chapman et al., 1976; Fawcett - Clark

Pleasure Scale (FCPS), Fawcett et al., 1983; Snaith Hamilton Pleasure Scale (SHAPS); Snaith et al., 1995). In addition, of these consummatory measures, only the SHAPS (Snaith et al., 1995) has been validated for use with adolescents (Leventhal et al., 2015). Despite this some of the items are of arguable relevance to adolescents (i.e. pleasure from smelling flowers or bread). Although anhedonia is a core symptom of depression, when completed by adolescents, the SHAPS did not significantly correlate with the depression subscale of the Revised Child Anxiety and Depression Scale (RCADS) (Leventhal et al., 2015).

A number of more recently developed scales aimed to address both anticipatory/'wanting' and consummatory/'liking' aspects of pleasure or reward, e.g. the Anticipatory and Consummatory Interpersonal Pleasure Scale (ACIPS), (Gooding & Pflum, 2014) and the Temporal Experience of Pleasure Scales (TEPS), (Gard et al., 2006) within a specific domain, i.e. a social or sensory reward experience, respectively. However, items in both the TEPS and ACIPS that were developed to capture 'wanting' deficits (i.e. imagining how something will taste) likely map onto the ability to 'imagine' future events in a positive way, a concept that is important, but arguably different to 'wanting'. Instead 'wanting' *might* align more closely with questions about motivation to attain those positive experiences or the willingness to expend effort to reach a reward (McCabe, 2018). The fact that motivational difficulties are a prominent part of adolescents' experiences of anhedonia (Watson et al., 2020) also suggests it is important to ask about this component when making a full assessment of anhedonia in this age group.

Gooding et al., (2016) made efforts to adapt the ACIPS for adolescents but took a 'top-down' approach to validity, eliminating obvious irrelevancies and changing language (e.g. replacing *'work'* with *'school'*) rather than using an inductive approach by asking adolescents if the items captured their experience of social pleasure. Using a 'top down' approach may omit important aspects of adolescents' experiences. The Dimensional

Anhedonia Rating Scale (DARS) (Rizvi et al., 2015) is a recent measure that assesses a broad range of reward-related components in depression (pleasure, interest, motivation and effort) and types of reward (i.e. hobbies, social, and sensory). Although this scale does assess motivational difficulties, item selection was based entirely on internal consistency and structural analyses with no assessment of their validity (Rizvi et al., 2015). In addition, the DARS might not be the best choice of measure for adolescents, as it requires participants to generate specific activities to rate. This requires cognitive effort and may challenge depressed adolescents, who have depression specific working memory problems (Fisk et al., 2019).

Currently therefore, because there is no psychometrically valid measure of anhedonia developed based on adolescents' own experiences, we aimed to develop a new brief symptom measure for this age group. We used a predominantly inductive approach to scale creation. Inductive methods are considered useful when there is uncertainty about the exact definition or dimensionality of a concept (Tay & Jebb, 2017). This consideration applies to the measurement of anhedonia as there is considerable disparity in the literature regarding its conceptualisation (e.g. Forbes & Dahl, 2012; Gorwood, 2008; Rømer Thomsen et al., 2015). Many procedures that are typically attributed to a theoretical-rational or deductive method (see Clark & Watson, 2019) were also used to guide scale development, such as creating an item pool which is broader and more comprehensive than the theoretical view of the target construct. We followed a scale development process devised by Gehlbach and Brinkworth (2018) which focuses on establishing the construct validity of a scale by using an inherently collaborative approach, relying on the input of the target population in item construction; as well as specific questionnaire development guidance recommended by the Consensus-based Standards for the selection of health Measurement Instruments (COSMIN, Mokkink et al., 2018), which advocates using constructs and language generated through qualitative interviewing.

Watson et al., (2020) conducted a qualitative study with young people about their experiences of anhedonia, which formed the basis of the new scale development. In line with the growing body of literature which suggests that anhedonia is a multifaceted construct (e.g. Rømer Thomsen et al., 2015), adolescents described experiencing a flattening of emotion, and a loss of pleasure and joy from life; as well as a lack of motivation, passivity, and increased effort to engage in activities. Furthermore, adolescents described losing a sense of connection or belonging, feeling detached from people and the world around them, as well as struggling to find a purpose or to 'see the point' in what they were doing. The findings from this study suggested that most self-report measures used to assess anhedonia may be too narrow, and only capture a part of adolescents' subjective experiences. Therefore, quotes from the qualitative interviews were used as the basis of item generation, and items were piloted and refined with the help of young people and clinical and academic experts. The remaining items were then subjected to psychometric scrutiny; the structural validity of the scale was examined and confirmed in two large community sub-samples of young people; and the re-test reliability of scale scores was examined in a subsample of participants.

Given that anhedonia is a clinical construct that is considered to be state like in the context of depression (e.g. Loas, 1996), we anticipated that the new scale would correlate more strongly with measures of relevant clinical disorders than with personality traits or trait-like measures of related constructs. We predicted that the new Anhedonia Scale for Adolescents (ASA) would be positively correlated with self-report measures of affective disorders for which anhedonia is a distinct feature (i.e. depression, negative symptoms of schizophrenia) as well as with low levels of positive affect, and reduced reward processing (i.e. pleasure, motivation). We expected the ASA to be less strongly correlated with disorders in which anhedonia is not a symptom (i.e. anxiety) or with different constructs in which anhedonia is not a direct feature (i.e. behavioural inhibition, negative affect, impulsivity-

related behavioural approach). Furthermore, we expected that the ASA would be a stronger predictor of depressive status (high vs. low depressive symptoms) than existing validated measures used to assess anhedonia in adolescents.

Method

Scale Development

Item pool development. Item content for the adolescent anhedonia scale (ASA) was generated from qualitative interviews with adolescents about their experiences of anhedonia (Watson et al., 2020). In this qualitative study 34 adolescents recruited from a clinical service or the community, who had either a depressive diagnosis or elevated depression symptoms respectively, discussed their experiences of losing interest and pleasure. In line with current theoretical understanding of anhedonia as a multidimensional construct (e.g. Berridge & Kringelbach, 2008), adolescents responded to open ended questions about losing consummatory aspects of enjoyment and pleasure, changes in anticipation and future pleasure, as well as differences in motivation and effort. As is customary in qualitative research, interviews were guided by adolescents' own experiences, with further prompt questions used to elicit a greater depth of response. Adolescents experiences were analysed using thematic analysis (Braun & Clarke, 2006) and captured four main aspects of adolescents' experiences: 1) Experiencing a loss of joy and a flattening of emotion, 2) Struggling with motivation and active engagement, 3) Losing a sense of connection and belonging, 4) Questioning sense of self, purpose and the bigger picture. The first two themes were the primary aspects of adolescents' experiences, and the last two themes were the secondary aspects of these experiences.

An initial pool of 200 items was generated from statements made by young people who took part in the qualitative study. A thorough examination of existing self-report scales

was also conducted and used to inform the selection and wording of candidate items (Boateng et al., 2018; Clark & Watson, 1995). Duplicate items were eliminated, and the remaining items were categorised into the themes identified in Watson et al., (2020). Five adolescents commented on the relevance, acceptability and face validity of each questionnaire item. The 40 most preferred items that reflected all key features of each theme were then selected for further feedback.

Expert and adolescent feedback. Six clinical experts (i.e. clinical psychologists and child and adolescent psychiatrists working in UK publicly funded Child and Adolescent Mental Health services were asked about their experience of working with young people experiencing anhedonia. This included a discussion of the key themes from Watson et al., (2020). Some experts also gave specific feedback on the draft items. Their feedback confirmed that the items were relevant to their clients, but also highlighted conceptual overlap between anhedonia and other clinical constructs (e.g. low mood, hopelessness) and between concepts within the questionnaire (i.e. enjoyment, anticipation and motivation). All draft items were then reviewed by ten young people, to assess their face validity, readability and overall impression. When asked to rate different response options (i.e. agreement versus frequency) young people preferred the frequency scale and this was also considered to be the most clinically useful. Four points were selected to ensure that the available options were distinct. Based on the feedback from experts and young people several items were reworded and some items were removed. For example, some items that related to more abstract concepts e.g. *"being on autopilot"* were not readily understood, and some items *"I distracted myself from my feelings"* were considered too vague, and could relate to a number of experiences. Lastly, some items assessing a specific concept e.g. effort were preferred over the wording of other items [see Supplementary Material Section B for further details]. This resulted in a draft scale of 30 items for piloting.

Participants

Recruitment and Pilot Sample. Fifteen schools and colleges in the South of England were invited to take part in the study; seven responded and five agreed to take part. Students from three classes in one publicly funded comprehensive school (n = 66; M age = 12.0, SD = 1.7; 45.5% female, 81% White British) took part in the pilot study.

Main Sample. The main study (n = 2098 after 27 participants with more than 25% missing data on the ASA were removed) consisted of students from the remaining classes in the pilot comprehensive high school (n = 455), a second mixed-sex comprehensive high school (n = 211), two selective single sex schools (girls n = 651, boys n = 600) and students in psychology classes in a mixed-sex college for young people aged 16-18, (n = 181). Participants in the main study were aged 11–18 years (M = 14.39, SD = 2.07), with 55.5% females, and 50.0% white British, 5.5% white non-British; 34.1% Asian, 2.4% Black background, 6.5% mixed background, 1.5% other. Sixty five percent of invited participants took part. Based on the index of free school meals (percentage of pupils eligible for free school meals at any time in the past 6 years; average in England 27.7%), the two comprehensive schools had a percentage close to the national average (21.3 - 21.4%) and the two single sex schools had a percentage much lower than the national average (2.4 - 3.1%) (GOV.UK, 2020). These data were not available for the college students.

To explore and confirm the structure of the new scale, the sample was split into two groups defined by the questionnaire pack they completed (Pack A or Pack B; see procedure). The two samples did not differ on mean age, $t\ (2090) = .539$, $p > .05$ or gender $X^2\ (1) = 1.904$, $p > .05$ [see Supplementary Material Section D for ASA descriptive statistics by age and gender].

Procedure

Institutional ethical approval for the study was granted from the University Research Ethics Committee. Parental opt-out consent and participant opt-in assent was obtained for young people under 16, and participant opt-in consent was obtained for participants aged 16 and over. Participants were given questionnaire Pack A or Pack B which were assigned randomly to each participant (see below for details). Questionnaires were split into Pack A or B to reduce participant burden. Pack A and Pack B both contained the new anhedonia questionnaire and written feedback questions, demographic questions (age, gender, and ethnicity) and an adolescent specific measure of depression, the Mood and Feelings Questionnaire (MFQ; Angold et al., 1987). Participants also completed other questionnaires (depending on whether they received Pack A or B), which were randomly ordered (to reduce bias). Participants completed the questionnaires in their classroom/lecture hall during the school/college day. Participants in the pilot sample completed 30-items, and participants in the main sample completed the 32-item revised items plus 5 supplementary reversed items. When questionnaires had been completed participants were provided with information on sources of support for mental health. Consenting participants were entered into a prize draw to win an online voucher.

Measures

Completed by all participants:

The ***Anhedonia Scale for Adolescents (ASA)***. The ASA is a self-report scale of adolescents' experiences of anhedonia. See the results section for refinement of items, and Supplementary Material [Section B]. Participants rated each item on a four-point Likert scale from 0 – 3; never, sometimes, often, always, in respect to the past two weeks. Positively framed items are reverse scored, and a higher score indicates more anhedonia. Participants answered an open question, *'over the past two weeks, has anything stopped you from feeling positive?'* Subsequently, participants were asked to rate on a four -point Likert scale *'over the*

past two weeks, how often did you not feel positive? Response options included: none, several days, more than half the days, and almost every day.*'*

The ***Mood and Feelings Questionnaire (MFQ:*** (Angold et al., 1987) is a 33-item self-report scale of depression symptoms for adolescents. It has good psychometric properties (Burleson Daviss et al., 2006). A cut-off score of 27 and above has been identified as the difference between clinical and non-clinical levels of depressive symptoms (Wood et al., 1995). Each item is rated on a three-point Likert scale from 0, not true, to 2, true, (internal consistency ordinal α.97).

Questionnaire Pack A:

The ***Snaith Hamilton Pleasure Scale (SHAPS***; (Snaith et al., 1995) is a 14-item self-report scale of consummatory anhedonia that has been validated for use with adolescents (Leventhal et al., 2015). Each item is rated on a four-point Likert scale ranging from 0 = strongly agree, 3 = strongly disagree (Franken et al., 2007). A higher score indicates less pleasure (internal consistency ordinal α.91).

The ***Behavioural Inhibition and Behavioural Activation Scales (BISBAS;*** Carver & White, 1994) is a 24-item self-report dispositional/ personality measure of two motivational systems: the behavioural approach (BAS) and behavioural inhibition (BIS) systems. The Behavioural Approach system scales are divided into 3 subscales assessing different aspects of 'incentive sensitivity' (Carver & White, 1994), in particular the "fun-seeking" subscale is known to have elements of dysfunctional impulsiveness (e.g. Franken et al., 2005), whereas high "reward responsiveness" has been shown to uniquely predict internalising disorders, wellbeing and affect regulation (Taubitz et al., 2015). Each item is rated on a four-point Likert scale from 1, very true, to 4, very false. One item ("drive" subscale) elicited some confusion in the pilot study (item 21) therefore this item was therefore removed from analyses. A higher score indicates lower behavioural activation (internal consistency BAS

ordinal α.86; BAS drive ordinal α.78; BAS fun .61; BAS reward responsiveness ordinal α.79) and lower behavioural inhibition (internal consistency: BIS ordinal α.83).

The ***Positive and Negative Affect Scale – Child Version (PANAS-C:*** Ebesutani et al., 2012) is a 10-item measure of current positive (5-items e.g. cheerful) and negative affect states (5-items e.g. sad) adapted for children and adolescents (Watson & Clark, 1994). Each item is rated on a five-point Likert scale from 1, very slightly or not at all, to 5, extremely. A higher score indicates greater intensity of emotional experience (internal consistency, positive: ordinal α.91, negative ordinal α.85).

Questionnaire Pack B:

The ***Anticipatory and Consummatory Interpersonal Pleasure Scale – Adolescent version (ACIPS-A;*** Gooding et al., 2016; Gooding & Pflum, 2014) is a 17-item self-report scale of anticipatory and consummatory social pleasure, adapted for use with adolescents. Each item is rated on a four-point Likert scale from 1, very true, to 4, very false. A higher score indicates greater experience of pleasure (internal consistency ordinal α.93).

The ***Self-Evaluation of Negative Symptoms (SNS;*** Dollfus et al., 2016) is a 20-item self-report measure of negative symptoms of schizophrenia, namely social withdrawal, diminished emotional range, alogia, avolition and anhedonia. One anhedonia item was not administered to adolescents due to its sexual content. The scale consists of 2 factors reflecting 1) apathy (amotivation, anhedonia, alogia, asociality) and 2) emotional (diminished emotional range). Each item is rated on a three-point Likert scale from 0, strongly disagree, to 2, strongly agree. A higher score indicates the presence of more negative symptoms (internal consistency ordinal α. 94; apathy factor ordinal α.94; ordinal α.63 emotional factor).

The ***Generalised Anxiety Disorder Scale (GAD-7;*** Spitzer et al., 2006***)*** is a 7-item self-report scale of anxiety symptoms developed for adults but validated for use in adolescents. Each item is rated on a 4-point Likert scale from 0, not at all, to 3, nearly every

day. A greater score indicates the presence of more anxiety. This scale was only included in the pilot sample and was then replaced with a child and adolescent specific measure of child and adolescent anxiety (RCADS; Chorpita et al., 2000).

The ***Revised Child Anxiety and Depression Scale (RCADS***) is a 47-item child specific self-report measure of anxiety and depression (Chorpita et al., 2000; Spence, 1997). Each item is rated on a four-point scale 0 - 3 (never, sometimes, often, always). Unlike the GAD-7, this scale enables different types of anxiety to be assessed. The OCD subscale (6 items) was administered in Pack A, (internal consistency; OCD ordinal α.86). The GAD (6 items) and PANIC (9 items) subscales were administered in Pack B, (internal consistency; Panic ordinal α.93; GAD ordinal α.90). This scale was added after the initial pilot.

Statistical Analysis Plan

Data handling and scale refinement. All participants responded to closed and open-ended feedback questions, and items were reworded or removed at each stage in line with participants' feedback in several iterations. Participants with >25% missing data on the primary scale (ASA) were removed from all data analyses (Sample A, n = 10; Sample B, n = 17), and participants with >25% data missing on legacy instruments were removed from subsequent analyses where applicable (i.e. correlation between ASA and SHAPS) (Field, 2013). Item variance was examined for the ASA. Individual scale items were treated as endogenous ordinal data, and item-level correlations were calculated based on polychoric correlation matrices. Predictive mean matching was used to simulate values for item-level analyses with missing data <25% on the ASA. Total scale and subscale scores were treated as continuous data. When calculating total and subscale scores, if <25% data was missing on measures, a total score or subscale score was created using an average score multiplied by the number of items in the scale/subscale. [See Supplementary Material Section A for flow chart of the scale development and validation process].

Exploring the factor structure. Subsample A (n = 1057) was used for Exploratory Factor Analysis (EFA) using R studio (Psych package) based on polychoric correlations (see Revelle, 2020). Parallel analysis (Horn, 1965), the scree plot of actual and simulated eigenvalues, and Velicer's (1976) Minimum Analysis Partial (MAP) analysis were run to determine the number of factors to retain. EFA with Principal Axis Factoring (PAF) was conducted due to multivariate non-normality, with a factor loading of .3 considered acceptable for loading onto a factor, with a preference for loadings >.4 and cross loading <.32 (Tabachnick & Fidell, 2014). An initial PAF was run to eliminate items based on low communalities and/or lower factor loadings, whilst also retaining items within each subcategory of the original qualitative themes [see Supplementary B]. A further PAF was run with 14 items. All plausible factor solutions were explored using the following model fit indices: the Tucker-Lewis incremental fit index (TLI; Tucker & Lewis, 1973; (>.9 acceptable fit; >.95 good fit; >.97 very good fit) and the root means square error of approximation (RMSEA; Steiger, Shapiro & Brown, 1985; < .08, acceptable fit, <.05 good fit), and the percentage of variance explained (>50% acceptable) (Mokkink et al., 2018).

Confirming the factor structure. Subsample B (n = 1041) was used for Confirmatory Factor Analysis (CFA) using Weighted Least Square Mean and Variance Adjusted (WLSMV) estimators due to ordinal data with multivariate non-normality (Flora & Curran, 2004) in R studio (package Lavaan). Robust model fit indices for the CFA included: robust chi square/degree of freedom (<= 3, good fit); TLI (Tucker & Lewis, 1973) and confirmatory fit index (CFI; Bentler, 1990), with values approaching 1 implying a good model fit (>.9 acceptable fit; >.95 good fit; >.97 very good fit); and RMSEA (Steiger et al., 1985) and standardised root mean square residual (SRMR), with values approaching zero indicating a good model fit (< .08, acceptable fit, <.05 good fit) (e.g. Kline 2005; Hooper et al., 2008).

Hierarchical bifactor models were run to establish if the ASA was better explained by a general factor (representing the broad target construct) and specific factors (representing narrower sub constructs). In bifactor models it is assumed that general and specific subfactors are orthogonal, with the general factor accounting for associations between the group factors (Reise, 2012). Therefore, in the bifactor models covariances between the general and specific factors were constrained to be orthogonal.

Internal consistency and test re-test reliability. Internal consistency reliability for items in the full ASA scale and subscales was conducted using Cronbach's alpha based on polychoric correlations and omega statistics in R studio (psych package). Test-retest reliability (n = 200) was assessed and Intra-Class Correlations (ICC) were run in SPSS based on a two-way mixed effects model as recommended (Koo & Li, 2016).

Convergent and discriminant validity. Convergent and discriminant validity were established using Spearman's rank order correlations (due to multivariate non-normality) in SPSS between total scores on the ASA and related constructs. To compare the statistical difference in the strength of correlations between the ASA and convergent and discriminant measures we used an online calculator developed by Lenhard and Lenhard (2014). To facilitate this analysis, scales were reverse scored where necessary i.e. a *positive* correlation equates to low positive affect (PA), high negative affect (NA), low behavioural activation (BAS), high behavioural inhibition (BIS), low pleasure (ACIPS and SHAPS), high depression (MFQ), high schizophrenia symptoms (SNS) and high anxiety (RCADS). To further understand ASA' nomological network, multiple hierarchical step-wise linear regressions were run in SPSS to examine how much variance of the ASA was explained by related legacy constructs (convergent measures). Correlations were entered into the model in accordance with the strength of the correlation coefficient (highest to lowest).

Incremental and predictive validity. To test for incremental validity, hierarchical logistic regression was run in SPSS to determine whether ASA responses predicted membership of the 'depressed' group (based on a cut-off score of 27 on the MFQ; Wood et al., 1995) above and beyond alternative measures used to assess anhedonia), the SHAPS (Snaith et al., 1995) and the ACIPS-A (Gooding et al., 2016). Multicollinearity indices of tolerance and variance inflation factor cut offs were above 0.1 and less than 10, respectively (Field, 2013). To test for predictive validity, simple logistic regression was used to establish whether ASA scores at time point 1 were a significant predictor of 'depressed' group status at time point 2.

Results

Scale Feedback and Item Refinement

Feedback and scale revision (first iteration). In the pilot study (n= 66), participants provided written feedback on the draft Anhedonia Scale for Adolescents in respect of 1) the questionnaire instructions (100% of those who responded said they understood); 2) understanding of items (86% of those who responded understood all items); and 3) suggested changes to the measure (95% of those who responded did not suggest changes). We worked collaboratively with a clinical expert and a young person who was a member of our research Patient and Public Involvement group (PPI) to use the adolescents' responses and feedback to reword and revise the questionnaire items. Suggested changes included making the scale content / items more positive. Five items were selected for reversal where it was possible to reverse the item without changing the integral content of the construct being measured (e.g. feeling connected vs. disconnected) rather than concepts which could not be reversed (e.g. feeling flat). The draft anhedonia scale correlated highly with the MFQ (rs =.8), which indicated that some items may have been assessing general depression rather than anhedonia

specifically. Therefore a few items were refined and made more specific, for example, *"I could not be bothered to do anything [even if it would be fun],"* resulting in a 32-item scale for further testing [see Supplementary Material Section B].

Feedback and scale revision (second iteration). Participants from the sixth-form college (n = 181) completed the questionnaires and responded to written feedback on the questionnaire, finding the instructions (100%) and items (91%) easy to understand, and 94% making no suggestions for changes. A preliminary examination of the factor structure of the scale indicated that the reverse scored items clustered onto one factor. Therefore, to enable further exploration of the effect of valence in a larger sample of participants, reverse framed items were added to the end of the scale resulting in 37-items for further testing [see Supplementary Section B].

Feedback and item removal (third iteration). The remaining participants in Sample A (n = 906) and Sample B (n = 960) provided written feedback on the draft Anhedonia Scale for Adolescents; specifically, 1) the questionnaire instructions (99% said they understood); 2) understanding of items (90% understood all items); and 3) suggested changes to the questionnaire (80% did not suggest changes). Only 1 item was identified as 'not easy to understand' by >1% of participants and was therefore removed from subsequent analysis. A further item was removed from subsequent analysis, as upon reflection, the double-barrelled nature of the item meant participants' responses could have related to one of two different concepts within the statement (Clark & Watson, 2019). The remaining 30-items were retained to explore the factor structure.

Exploring the Factor Structure in Subsample A

The factor structure of the draft 30 item questionnaire was explored using data from 1057 participants who had completed Pack A. Participants used all response options for every item (i.e. never to always). Furthermore, all items had a standard deviation <.5, and no

items had significant skew or kurtosis (z-scores < 3.29; Tabachnick & Fidell, 2014). The Kaiser-Meyer-Olkin (KMO) measure verified the sampling adequacy for the analysis (.97) and Bartlett's Test of Sphericity was significant ($p<.001$), indicating the adequacy of this sample for factor analysis.

Initial exploration of the factor structure and item reduction. To determine the number of factors to retain, a parallel analysis (Horn, 1965) was run which suggested retaining 7 factors. The scree plot of actual and simulated eigenvalues was also examined, which displayed one large factor and a break after 3 or 4 factors for the actual data, with 3 factors clearly visible above the line for simulated data. Velicer's (1976) Minimum Average Partial (MAP) analysis was also run and suggested retaining a minimum of 3 factors. [See Supplementary Material Section C for further details].

Principal Axis Factoring with an Oblique Promax rotation (due to likely correlation between factors) (de Winter & Dodou, 2012) was run with a 7 and 3 factor solution explored. The 7-factor solution, in line with results of the parallel analysis, resulted in multiple items loading <.4 onto a factor, and a Heywood case suggesting possible over-extraction. Next, in line with the scree plot of actual and estimated eigenvalues and the MAP analysis, a 3-factor solution was explored. Almost all items loaded >.4 on to a factor and no items cross loaded >.4 onto a second factor. This produced a theoretically salient solution, with factors representing 1) affective elements of anhedonia, 2) motivational and effortful aspects, and 3) positively framed items which reflected a broader sense of purpose and meaning. Therefore the 3-factor solution was selected to facilitate item removal within dimensional categories [see Supplementary Material section B].

In order to produce a brief scale which reflected all elements of adolescents' experiences, items were reduced from 30 to 14 based on low communalities and factor loadings. The removal of items was completed in conjunction with information regarding

content validity to ensure items were retained that represent each important aspect of the conceptual content (Flora & Flake, 2017) i.e. we wanted to ensure some items were retained from every important concept identified in Watson et al., (2020) [see Supplementary Material Section B]. We also took into account any specific feedback from participants about particular items during item selection. After item removal, 14 items were retained for further exploration; 8 items reflected the subcategories of the 2 primary themes, 1) 'experiencing a loss of joy and a flattening of emotion', and 2) 'struggling with motivation and active engagement,' and 6 items reflected concepts in the secondary themes, 3) 'losing a sense of connection and belonging', and 4) 'questioning sense of self, purpose and the bigger picture' [see Supplementary Material sections B].

Further evaluation of the factor structure. Parallel analysis, the scree plot of actual and simulated eigenvalues, and Velicer's MAP analyses were re-run with the remaining 14-items, with a 4, 2 or 3 and 1 factor solution identified, respectively [see Supplementary Material Section C]. All four potential solutions were re-examined using PAF with the 4 factor solution resulting in a theoretically meaningful distinction between the 'anticipatory' items (looking forward/excitement) and both the a) 'motivational and effort' based items, b) the 'enjoyment in the moment, detachment and lack of affect' items, as well as the positively framed items about 'purpose, meaning and wellbeing' factors identified in the initial factor analysis. All items loaded >.4 onto a principal factor and cross loaded <.32 onto a subsequent factor (see Table 1). The 3-factor solution clustered items in the same way as the 4-factor solution, but with the anticipatory items loading on the 'enjoyment, detachment, lack of affect' factor, with all items loading >.4 onto a factor and cross loading <.32. The 2-factor solution produced factors separated based on valence (positive vs. negative) with all items loading >.4 and cross loading <.32; and the 1 factor solution also produced a solution with all items loading >.4 on the factor.

Fit indices for the 1 – 4 factor solutions were compared (see Table 3). The 3 and 4 factor solution produced an acceptable to good fit to the data, and the 1 and 2 factor solutions produced a low to acceptable fit to the data (see statistical analysis plan for recommended cut-offs). The 3-factor solution produced a good fit to the data, explaining 61% of the variance, 1) Enjoyment, Excitement and Emotional Flattening (34%), 2) Enthusiasm, Connection and Purpose (14%), and 3) Effort and Motivation (13%), with moderate correlations between factors (.62 – .75). The 4-factor solution had the best fit to the data explaining 62% of the variance, and produced the most theoretically meaningful solution with separate factors for: 1) Enjoyment, Flattening and Detachment (25% variance), 2) Purpose, Connection and Enthusiasm (13% variance) (positively framed), 3) Effort and Motivation (13% variance), 4) Excitement and Anticipation (11% variance). The correlation between factors was moderate to high (.62 - .79), therefore it was important to test whether a more parsimonious solution would produce an equal or favourable fit to the data in another sample (Sample B).

Examining the impact of positively and negatively framed items. As anticipated, the positively framed items clustered onto one factor in the multi-factorial solutions. Therefore, it was important to establish if these items would cluster when they had the same valence as the rest of the items in the scale using Confirmatory Factor Analysis (CFA). Data was analysed from 916 young people for whom the negatively framed counterparts of the positively framed items were collected. Using CFA (WLSMV), the 2 - 4 factor solutions produced an acceptable to good fit to the data when the positively framed items (i.e. *'enthusiastic'*) were reversed (i.e. *'no enthusiasm'*) [see Table 2]. Therefore, it is likely that items in the original analysis clustered based on content as well as valence (positive/ negative framing). In line with adolescents' and experts' feedback, and to make sure that completing the scale did not

induce a negative mood state in young people, we decided to retain the positively framed items rather than their negatively framed counterparts.

Table 1. Factor Loadings for the 14-item Anhedonia Scale for Adolescents (ASA) 3 Factor Solution

	EFA			CFA
	F1	F2	F3	
FACTOR 1 – Enjoyment, Excitement and Emotional Flattening				
I should have been enjoying things, but I couldn't	**0.82**	-0.01	0.02	**.778**
I pretended things excited me, but actually I found them boring[1]	**0.80**	-0.11	-0.01	**.644**
I felt detached from other people	**0.76**	0.10	-0.08	**.758**
Nothing felt fun or enjoyable	**0.73**	0.07	0.09	**.837**
I did not feel any emotion[1]	**0.69**	0.05	-0.01	**.737**
Nothing made me feel excited	**0.66**	0.12	0.09	**.851**
I couldn't see myself enjoying things in the future	**0.61**	0.18	0.05	**.644**
Internal Reliability [Sample A, α.92, ω.93; Sample B, α.91, ω.91]				
FACTOR 2 – Enthusiasm, Connection and Purpose				
I felt connected to the world around me (R)	0.11	**0.74**	-0.09	**.757**
I felt enthusiastic (R)	-0.07	**0.70**	0.21	**.760**
I felt like my life had meaning and purpose (R)	0.07	**0.65**	-0.01	**.729**
Internal Reliability [Sample A, α.79, ω.80; Sample B, α.79, ω.79]				
FACTOR 3 – Effort, Motivation and Drive				
I had no motivation to get started on things	-0.03	0.09	**0.78**	**.731**
I did not want to do anything[1]	0.05	0.02	**0.68**	**.659**
Everything felt like a lot of effort to do	0.36	-0.11	**0.51**	**.723**
I did not look forward to anything*	**0.57**	0.07	0.26	**.862**
Internal Reliability [Sample A, α.84, ω.80; Sample B, α.83, ω.83]				
Total Reliability – [Sample A, α.94, ω.95; Sample B, α.93, ω.95]				

Note. EFA = Exploratory Factor Analysis (Principal Axis Factoring); CFA = Confirmatory Factor Analysis (WLSMV; standardised loadings); F1 = Enjoyment, Excitement and Emotional Flattening; F2 = Enthusiasm, Connection and Purpose, F3 = Effort, Motivation and Drive. Loadings >.4 in bold. R = Reverse Scored. [1] Slight amendment to item wording to improve clarity and simplicity. *Item *"I did not look forward to anything"* initially included in Factor 1 in the EFA for Sample A and then in Factor 3 in the CFA for Sample B based on factor loadings and omega statistics. [See Supplementary Material Section C for further details and factor diagrams].

Table 2. Factor Loadings for the 14-item Anhedonia Scale for Adolescents (ASA) 4 Factor Solution

	EFA				CFA
	F1	F2	F3	F4	
FACTOR 1 – Enjoyment, Emotional Flattening and Detachment					
I should have been enjoying things, but I couldn't	**0.86**	0.02	0.08	-0.10	**.785**
I felt detached from other people	**0.80**	0.14	-0.03	-0.10	**.765**
I pretended things excited me, but actually I found them boring[1]	**0.76**	-0.09	0.03	0.01	**.651**
Nothing felt fun or enjoyable	**0.50**	0.06	0.07	0.30	**.847**
I couldn't see myself enjoying things in the future	**0.48**	0.19	0.06	0.14	**.804**
I did not feel any emotion[1]	**0.45**	0.04	-0.04	0.32	**.744**
Internal Reliability [Sample A, α.90, ω.89; Sample B, α.90, ω.89]					
FACTOR 2 – Connection, Purpose, and Enthusiasm					
I felt connected to the world around me (R)	0.14	**0.77**	-0.06	-0.07	**.757**
I felt enthusiastic (R)	-0.13	**0.69**	0.19	0.09	**.760**
I felt like my life had meaning and purpose (R)	0.05	**0.65**	0.00	0.01	**.729**
Internal Reliability [Sample A, α.79, ω.79; Sample B, α.79, ω.79]					
FACTOR 3 – Effort and Motivation					
I had no motivation to get started on things	-0.01	0.10	**0.81**	-0.05	**.760**
I did not want to do anything[1]	0.03	0.02	**0.67**	0.02	**.684**
Everything felt like a lot of effort to do	0.29	-0.10	**0.52**	0.07	**.752**
Internal Reliability [Sample A, α.80, ω.78; Sample B, α.77, ω.78]					
FACTOR 4 – Excitement and Anticipation					
I did not look forward to anything	0.13	0.01	0.15	**0.64**	**.825**
Nothing made me feel excited	0.24	0.07	-0.04	**0.64**	**.863**
Internal Reliability [Sample A, α.86, ω.76; Sample B, α.83, ω.76]					
Total Reliability – [Sample A, α.94, ω.95; Sample B, α..93, ω.95]					

Note. EFA = Exploratory Factor Analysis (Principal Axis Factoring); CFA = Confirmatory Factor Analysis (WLSMV; standardised loadings); F1 = Enjoyment, Emotional Flattening and Detachment; F2 = Connection, Purpose, and Enthusiasm, F3 = Effort and Motivation, F4 = Excitement and Anticipation. [1] Slight amendment to item wording to improve clarity and simplicity. Loadings >.4 in bold. R = Reverse Scored. [See Supplementary Material Section C for further details and factor diagrams].

Confirming the Factor Structure in Subsample B

The factor structure identified in Subsample A was confirmed with data from participants who completed pack B (n = 1041) using Confirmatory Factor Analysis (CFA) (WLSMV) with robust model fit indices reported. The KMO (.95) and Bartlett's Test of Sphericity ($p < .001$) indicated that the sample was adequate for factor analysis.

Fit indices for 1-4 factor solutions. The 1-4 factor solutions identified in the EFA were confirmed, with the 3 and 4-factor solutions providing a very good fit to the data (see Table 3). The 1 and 2-factor solutions produced an acceptable to good fit to the data, indicating that a more parsimonious solution was not an equal or superior fit to the data.

Higher order CFA. Next, we tested a bi-factor CFA model with the 3 and 4 factor solutions, in which items load onto both a general factor, and specific sub-factors. In the 4-factor solution, the model was not identified. The 3-factor solution converged and produced an excellent fit to the data. Lastly, a second-order CFA was run on the 3-factor solution in which items were indicators of anhedonia sub-factors, and these sub-factors were indicators of an overall factor. The second-order model produced a good fit to the data [see Table 3]. Both analyses indicate that when using the 3-factor solution, the ASA can be used as measure of one underlying construct, as well as, as a multidimensional measure.

Table 3. Fit indices for the 14-item Anhedonia Scale for Adolescents (ASA) Factor Solutions

Model	Description	Type of Factor Analysis	Sample	Robust X^2/Df	RMSEA with 90% [CI]	SRMR	CFI	TLI
1	1 Factor	EFA	A	-	.10 [.09, .11]	-	-	.90
2	2 Factors	EFA	A	-	.09 [.08, .09]	-	-	.92
3	3 Factors	EFA	A	-	.07 [06, .08]	-	-	.95
4	4 Factors	EFA	A	-	.05 [.05, .06]	-	-	.97
5	2 Factors [negatively framed]	CFA	A	491/76 = 6.5	.08 [.07, .08]	.04	.97	.97
6	3 Factors [negatively framed]	CFA	A	352/74 = 4.8	.06 [.06, .07]	.03	.98	.98
7	4 Factor [negatively framed]	CFA	A	309/71 = 4.4	.06 [.05, .07]	.03	.99	.98
8	1 Factor	CFA	B	702/77 = 9.1	.09 [.08, .09]	.05	.96	.95
9	2 Factors	CFA	B	411/76 = 5.4	.07 [.06, .07]	.04	.98	.97
10	3 Factors	CFA	B	300/74 = 4.1	.05 [.05, .06]	.04	.98	.98
11	4 Factors	CFA	B	258//71 = 3.6	.05 [.04, .06]	.03	.99	.98
12	Bifactor Model [1 general factor, 3 specific factors]	CFA	B	208/63 = 3.3	.05 [.04, .05]	.03	.99	.99
13	Second-Order Model [1st overall factor, 3 specific factors]	CFA	B	314/76 = 4.1	.06 [.05, .06]	.04	.98	.98

Note. EFA = exploratory factor analysis [principal axis factoring]; CFA = confirmatory factor analysis [WLSMV]; Df = degrees of freedom; RMSEA = root mean square error of approximation; CI = confidence intervals; SRMR = standardised root mean square residual; CFI = comparative fit index; TLI = tucker lewis index.

Internal Consistency and Test-Retest Reliability

Internal consistency reliability. The total 14-item scale and its individual factors were internally consistent based on ordinal Cronbach alpha (α) and omega (ω) reliability statistics (see Tables 1 and 2).

Test re-test reliability. A sub-sample of participants (n = 200) completed the ASA and MFQ at a convenience opportunity of 7-11 weeks after the first completion. This sub-sample significantly differed from the main pool of participants with more males (original sample, 56% female; retest sample, 33% female; X^2 (1) = 35.510, p <.05), younger participants (original sample age M = 14.38, SD = 2.08; retest sample age M = 13.93, SD = 1.68; t(268) = 3.524, p <.05) and more participants identifying as White British (original sample, 50% White British; retest sample, 58% White British, (X^2 (1) = 3.989, p =.046). Participants who completed fewer than 75% of the scale items were removed from the analysis (n = 10). The 14-item adolescent anhedonia scale demonstrated high temporal reliability for the total scale (ICC = .73 [.634, .794], p<.001) and each sub-scale (F1.78; F2.77; F3.74; p<.001). Furthermore, the total ASA at re-test had moderate to high temporal reliability with depression at re-test (MFQ) (ICC .640 [.521, .729], p<.001).

Descriptive Statistics by Age and Gender

For the 14-item ASA, mean total and sub-scale scores were significantly higher for female (M = 13.2, SD = 7.7) than male (M = 10.3, SD = 6.6) participants, *t*(2060) = 9.01, p <.001. Scores were also significantly higher in older (ages 15-18, M = 12.94, SD = 7.52) compared to younger (ages 11-14, M = 10.44, SD = 6.87) participants, t(1861) = -7.81, p<.001. See Supplementary Material D for further details.

Convergent and Discriminant Validity

Correlational analysis. In order to test convergent and discriminant validity we examined correlations between the ASA total scale and sub-scales and other measures of

anhedonia and related constructs (depression, negative symptoms, positive and negative affect, behavioural approach and inhibition, and anxiety). Participants who completed at least 75% of items were included in the analyses (see tables 3 and 4 for number of participants per analysis). The ASA correlated strongly (.6 - .7) with depression (MFQ); positive and negative affect (PANAS) and negative symptoms of schizophrenia (SNS), moderately (.4 - .6) with other measures of pleasure (SHAPS, ACIPS) and anxiety (RCADS), and had weak correlations with personality traits of behavioural approach and inhibition (.1-.4).

Table 4. Correlations between the Anhedonia Scale for Adolescents (ASA) with 3 subscales and other related measures (Sample A)

	ASA	ASA-F1	ASA-F2	ASA-F3	MFQ	SHAPS	BAS-REWARD	BAS-DRIVE	BAS-FUN	BIS	PANAS-PA	PANAS-NA	RCADS-OCD
ASA	-												
ASA- F1	.899**	-											
ASA- F2	.786**	.569**	-										
ASA- F3	.867**	.692**	.545**	-									
MFQ	.785**	.781**	.553**	.673**	-								
SHAPS	.499**	.420**	.508**	.390**	.350**	-							
BAS-REWARD	.319**	.247**	.380**	.231**	.170**	.493**	-						
BAS-DRIVE	.131**	.046	.201**	.116**	.050	.190**	.396**	-					
BAS-FUN	.188**	.140**	.220**	.148**	.113**	.308**	.452**	.261**	-				
BIS	-.403**	-.414**	-.249**	-.362**	-525**	-.023	.102**	.016	-.084**	-			
PANAS-PA	-.673**	-.592**	-.634**	-.533**	-.615**	-.491**	-.397**	-.185**	-.263**	.340**	-		
PANAS-NA	.637**	.633**	.480**	.511**	.756**	.301**	.113**	.032	.104**	-.507**	-.497**	-	
RCADS-OCD	.519**	.536**	.320**	.443**	.624**	.171**	.058	-.023	.045	-.472**	-.307**	.536**	-
N (Per Scale)	1055	1055	1032	1056	1002	1008	1001	800	1001	959	996	995	1010

Note. Spearman's Rho correlations are significant ** = p<.001, * = p<.05. ASA = Anhedonia Scale for Adolescents; ASA F1 = Adolescent Anhedonia Subscale 1; ASA F2 = Adolescent Anhedonia Subscale 2; ASA F3 = Adolescent Anhedonia Subscale 3; MFQ = Mood and Feelings Questionnaire; SHAPS = Snaith Hamilton Pleasure Scale; BAS = Behavioural Approach Subscales; BIS = Behavioural Inhibition Subscale; PANAS = Positive and Negative Affect Scale; RCADS-OCD = Revised Child Anxiety and Depression Scale – Obsessive Compulsive Disorder.

Table 5. Correlations between the Anhedonia Scale for Adolescents (ASA) with 3 subscales and other related measures (Sample B)

	ASA	ASA-F1	ASA-F2	ASA-F 3	MFQ	ACIPS-A	SNS-TOTAL	SNS-APATHY	SNS-EMOTIONAL	RCADS-P	RCADS-G
ASA	-										
ASA- F1	.891**	-									
ASA- F2	.803**	.588**	-								
ASA- F3	.843**	.656**	.529**	-							
MFQ	.777**	.757**	.577**	.657**	-						
ACIPS-A	-.484**	-.438**	-.474**	-.353**	-.361**	-					
SNS-TOTAL	706**	.678**	.525**	.603**	.741**	-.492**	-				
SNS- APATHY	.725**	.684**	.548**	.624**	.759**	-.490**	.972**	-			
SNS-EMOTIONAL	.393**	.418**	.269**	.313**	.414**	-.305**	.707**	.534**	-		
RCADS-P	.480**	.473**	.328**	.424**	.639**	-.146**	.518**	.524**	.311**	-	
RCADS-G	.494**	.492**	.347**	.411**	.627**	-.187**	.530**	.552**	.275**	.631**	-
N (Per Scale)	1040	1039	1006	1041	987	980	973	971	977	989	983

Note. Spearman's Rho correlations are significant ** = p<.001, * = p<.05. ASA = Anhedonia Scale for Adolescents; ASA F1 = Adolescent Anhedonia Subscale 1; ASA F2 = Adolescent Anhedonia Subscale 2; ASA F3 = Adolescent Anhedonia Subscale 3; MFQ = Mood and Feelings Questionnaire; ACIPS-A = Anticipatory and Consummatory Interpersonal Pleasure Scale – Adolescents; SNS = Self-Report Negative Symptoms of Schizophrenia; SNS- APATHY = Self-Report Negative Symptoms of Schizophrenia Apathy (social withdrawal, alogia, avolition and anhedonia), SNS-EMOTIONAL = Self-Report Negative Symptoms of Schizophrenia Emotional (diminished emotional range), RCADS-P = Panic Subscale, RCADS-GAD = Generalised Anxiety Subscale.

Comparison of correlations. To test if the association between ASA and self-report scales was significantly stronger for convergent versus discriminant measures, comparisons were made between pairs of correlation coefficients from dependent samples. First, it was predicted that the ASA would be more strongly correlated with self-report symptom measures of affective disorders in which anhedonia is a direct feature (depression, MFQ; and negative symptoms of schizophrenia, SNS) than other related disorders (anxiety, RCADS). Correlations below are reported in absolute strength. In Sample A, the strength of the correlation coefficient between the ASA and MFQ (r_s.785) was stronger than between the ASA and RCADS-OCD (r_s.519), z = 14.242, p<.001. In Sample B, the ASA was more strongly correlated with the MFQ (r_s.777) than with the RCADS-PANIC (r_s.480), z = 15.569, p <.001, or the RCADS-GAD (r_s.494), z = 14.649, p<.001. Furthermore, the association between the ASA and MFQ was stronger (r_s.777) than the relationship between the ASA and SNS (r_s.706), z = 4.956, p<.001, in line with the fact that the ASA was developed in the context of adolescent *depression*.

Second, it was predicted that the ASA would correlate more strongly with measures of trait or personality like measures of low positive affect (i.e. PA, Ebesutani et al., 2012) and reduced reward processing (i.e. pleasure, SHAPS, Snaith et al., 1995, ACIPS, Gooding et al., 2016; and reward responsiveness, BAS-reward; Carver & White, 1994; Franken et al., 2005), than with measures of trait/personality measures of high negative affect (NA; Ebesutani et al., 2012), high punishment sensitivity (i.e. BIS; Carver & White, 1994) and low impulsive-related approach (i.e. BAS-fun seeking, Franken et al., 2005). Correlations below are reported in absolute strength. In line with predictions, the ASA was more strongly related to low positive affect (PA) (r_s = .673) than high negative affect (NA) (r_s = .637), z = 1.661, p = .048, but not at the p<.001 significance level. The ASA was more strongly correlated with low reward-responsiveness, BAS-reward (r_s = .319), than with low BAS-fun seeking (r_s = .188), z

= 4.125, p<.001, but not with high behavioural inhibition (BIS), (r_s = .403), z = -2.152, p=.016. As anticipated, the ASA correlated more strongly with low levels of pleasure (SHAPS) (r_s = .499) than with high behavioural inhibition (BIS) (r_s = .403), z = 2.527, p =.006, or low levels of impulsive-related approach (BAS-fun seeking (r_s = .188), z = 9.159, p<.001). An independent samples comparison (ACIPS, Sample B; BISBAS Sample A) also found that the ASA correlated more strongly with low anticipatory and consummatory social pleasure (ACIPS-A) (r_s = .484) than with low impulsive-related approach (BAS-fun seeking (r_s =.188), z = 7.510, p<.001, or high behavioural inhibition (BIS (r_s = .403), z = 2.219, p =.013.

Hierarchical linear regression. In order to further understand ASA' nomological network, multiple hierarchical step-wise linear regressions were run to examine how much variance of the ASA was explained by related constructs (convergent measures). Correlations were entered into the model in accordance with the strength of the correlation coefficient (highest to lowest). For Sample A, ASA scores were significantly predicted by depression (MFQ), explaining 65% of the variance (R^2 = .65), positive affect (PANAS-PA), explaining a further 6% of the variance (ΔR^2 =.06), pleasure (SHAPS) explaining a further 3% (ΔR^2 =.03), and reward responsiveness (BAS-reward), explaining an additional <1% of the variance (ΔR^2 =.003). A total of 74% of the variance was accounted for by the convergent measures, F(4,945)=673.74, p <.001. For Sample B, ASA scores were significantly predicted by depression (MFQ) explaining 64% of the variance (R^2 = .64), negative symptoms of schizophrenia (SNS), explaining a further 4% (ΔR^2 =.04), and measures of pleasure (ACIPS), explaining a further 2% of the variance (ΔR^2 =.02). A total of 71% of the variance was accounted for by convergent measures, F(3, 932) = 741.80, p<.001. See Table 6.

Incremental and Predictive Validity

Hierarchical logistic regression. In Sample A, SHAPS responses significantly predicted membership of the depressed group (high vs. low MFQ scores), explaining 21% of

the variance, Nagelkerke R^2 = .21, $X^2(1)$ = 150.58, p <.001. When ASA responses were subsequently entered into the model there was a significant increase in the prediction of clinical group, Nagelkerke R^2 = .62, $X^2(2)$ = 541.59, p<.001, but the SHAPS was no longer a significant predictor (p = .480). In Sample B, ACIPS-A responses significantly predicted MFQ status, Nagelkerke R^2 = .16, X^2 (1) = 105.93, p <.001. When ASA responses were subsequently entered into the model, there was a significant increase in the prediction of MFQ clinical status, Nagelkerke R^2 = .60, $X^2(2)$ = 452.30, p <.001, but again the ACIPS was no longer a significant predictor (p = .745) of clinical group. See Table 6.

Simple logistic regression. To assess the predictive validity of the ASA simple linear regression was used to establish if ASA scores at time point 1 in the re-test subsample (n = 200) was a significant predictor of depressive status (high or low MFQ scores) at time point 2 (range = 7 – 11 weeks). The ASA scores significantly predicted depressive status, Nagelkerke R^2 = .31, $X^2(1)$ = 42.06, p <.001.

Table 6. Regression analyses to test for the convergent and incremental validity of ASA scores

Hierarchical multiple linear regression (predicting ASA total score from convergent measures)

	Step 1			**Step 2**			**Step 3**			**Step 4**		
Variable	***B (SE B)***	***β***	***t***	***B (SE B)***	***β***	***t***	***B (SE B)***	***β***	***t***	***B (SE B)***	***β***	***t***
MFQ	.42 (.01)	.81	42.14**	.32 (.01)	.61	27.44**	.31 (.01)	.58	27.07**	.31 (.01)	.59	27.41**
PA				-.53 (.04)	-.32	-14.11**	-.40 (.04)	-.24	-10.69**	-.37 (.04)	-.22	-9.61**
SHAPS							.21 (.02)	-.18	-9.47**	.18 (.02)	.15	7.31**
BAS-REWARD										.21 (.06)	.07	3.36**

	Step 1			**Step 2**			**Step 3**		
Variable	***B (SE B)***	***β***	***t***	***B (SE B)***	***β***	***t***	***B (SE B)***	***β***	***t***
MFQ	.42 (.01)	.80	40.80**	.29 (.02)	.56	19.78**	.30 (.01)	.56	20.58**
SNS				.29 (.03)	.32	11.33**	.21 (.03)	.23	7.66**
ACIPS-A							-.14 (.02)	-.17	-8.11**

Hierarchical multiple logistic regression (predicting depressive status from measures of anhedonia)

	Step 1			**Step 2**		
Variable	***B (SE B)***	**Wald $\chi 2$**	***OR [95% CI]***	***B (SE B)***	**Wald $\chi 2$**	***OR [95% CI]***

SHAPS	.15 (.01)	115.96**	1.16 [1.13, 1.20]	.014 (.02)	.50	1.01 [.98, 1.06]
ASA				.33 (.02)	195.14**	1.39 [1.33, 1.45]

	Step 1			**Step 2**		
Variable	***B (SE B)***	**Wald χ2**	***OR [95% CI]***	***B (SE B)***	**Wald χ2**	***OR [95% CI]***
ACIPS-A	-.09 (.01)	93.31**	.93 [.90, .93]	-.00 (.01)	.11	1.00 [.97, 1.02]
ASA				.31 (.02)	187.22**	1.36 [1.30, 1.42]

Simple logistic regression (predicting depressive status at time point 2 from ASA scores at time point 1)

	Step 1		
Variable	***B (SE B)***	**Wald χ2**	***OR [95% CI]***
ASA	.26 (.05)	30.45**	1.30 [1.18, 1.43]

Note. * p<.05, ** p<.001. *B* = Unstandardized beta, *SE B* = standard error for unstandardized beta, β = Standardized beta, *t* = t test statistic, Wald χ**2** = Wald chi squared statistic, OR = Odds ratio, 95% CI = 95% confidence intervals. ASA = Anhedonia Scale for Adolescents, MFQ = Mood and Feelings Questionnaire, PA = Positive Affect Subscale, SHAPS = Snaith Hamilton Pleasure Scale, ACIPS-A = Anticipatory and Consummatory Interpersonal Pleasure Scale Adolescent Version, BAS REWARD = Behavioural Activation Reward Responsiveness Subscale, SNS = Self-Evaluation of Negative Symptoms.

Discussion

The aim of this study was to develop an adolescent specific measure of anhedonia and to provide initial validation data. The initial pool of items was elicited from qualitative interviews with adolescents, piloted and then tested in two sub-samples to assess clarity, meaning, face validity, acceptability and coherence. The scale was explored and then confirmed using factor analysis, resulting in a 14-item scale. The best fit to the data was a bifactor solution, in which items loaded onto a general factor and 3 theoretically salient specific factors: 1) Enjoyment, Excitement and Emotional Flattening (negatively framed); 2) Enthusiasm, Meaning and Purpose (positively framed); 3) Effort, Motivation and Drive (negatively framed). Other psychometric properties of the ASA were acceptable, with high internal consistency, high test re-test reliability, and stronger convergence with measures of depression, anhedonia and negative symptoms of schizophrenia, than measures of anxiety, negative affect, behavioural inhibition and approach-related impulsivity.

In contrast to previous scales that have been developed for adults (DARS, Rizvi et al., 2015) and adapted for adolescents (ACIPS, Gooding et al., 2016), ASA items loaded onto separate factors that disambiguated some anticipatory/motivational elements from more consummatory aspects of anhedonia. The first factor relates to affective aspects of anhedonia, including the absence of the experience of enjoyment, excitement and a sense of emotional flattening and detachment. The second factor reflects the experience of connection, purpose and enthusiasm. The third factor captures a lack of drive, effort and motivation. These separate subscales reflect young people's complex and nuanced experiences of anhedonia and therefore may capture subtle distinctions that are heightened during adolescence. Unlike most anhedonia scales the ASA measures a broad range of deficits in the anticipation, motivation and enjoyment of rewards and the experience of feeling a sense of connection and purpose (Watson et al., 2020). Previous scales have predominantly focused on loss of

enjoyment/consummatory pleasure (e.g. the SHAPS; Snaith et al., 1995) and very few have considered self-reported effort as a measure of motivation for reward (McCabe, 2018). This is important because there is recent evidence that motivation, measured by the physical effort to attain reward, is a key component of anhedonia in adolescents (Rzepa et al., 2017; Rzepa & McCabe, 2019). Thus, self-reported motivation and the physical effort to attain rewards is an aspect of anhedonia in adolescents that is under examined and requires further investigation.

The teenage years are associated with heightened reward seeking (e.g. Shulman et al., 2016) but also high levels of boredom and apathy (e.g. Spaeth et al., 2015), which can make it difficult to distinguish normal teenage development from problematic levels of anhedonia or reward-related symptomology. When measured cross sectionally, the number of adolescents with anhedonia was higher in older adolescents. This trend was observed in both males and females, and similar to self-reported measures of depression symptoms, adolescents' anhedonia scores were higher in females than males. Overall, older adolescents reported higher levels of demotivation than emotional flattening on the ASA, particularly in males, and ASA scores correlated strongly with the apathy subscale of the Self-Report Negative Symptom Scale (SNS). However, future research is needed to conduct an assessment of measurement invariance of ASA scores across age and gender to understand potential group differences; and importantly, longitudinal studies are needed to establish within person changes in ASA scores across adolescence. It will also be of interest to assess if the subscales of the ASA are associated with behavioural measures of physical effort in young people with depression and with the neural response to anticipation, effort and consumption.

Similarly, concepts such as loss of purpose and connection are typically not captured by measures of anhedonia, despite being central to adolescents' subjective experience of

losing interest and pleasure (Watson et al., 2020), and these concepts are recognised as an important part of the assessment of hedonic well-being and functioning (Keyes, 2005). Losing a sense of connection and purpose may be particularly important during adolescence, as this is a critical time for relationship and identity formation (Christie & Viner, 2005; Mills et al., 2014). Furthermore, in line with adolescents' qualitative experiences, a sense of social detachment or masking (i.e. *I pretended things were fun, but actually I found them boring*) is captured in the ASA. Previous research has found a strong relationship between social anhedonia and social closeness in adults (Olino et al., 2016). This loss may be particularly felt during adolescence, as it is typically a time of enhanced sensitivity to social rewards and peer influence (e.g. O'Brien et al., 2011).

As hypothesised ASA had a large positive correlation with a well-established measure of adolescent depression and a medium to large positive correlation with aspects of the negative symptoms of schizophrenia measure, but importantly it retained some unique variance. Scores on ASA were also significantly positively correlated with self-report ratings of anxiety, but these correlations were significantly weaker than correlations between the ASA and measures of depression and negative symptoms of schizophrenia. Some overlap between these constructs is inevitable because of the well-established co-morbidity between depression and anxiety disorders (e.g. Brady & Kendall, 1992) as well as shared method variance (Reio, 2010). Furthermore, Clark & Watson, (2019) identified that the inclusion of negatively valenced mood items may result in capturing some aspect of negative affectivity or neuroticism. Therefore, an important next step for the validation of the ASA is to examine how it performs in a clinical sample chosen for diagnostic and symptom specificity, i.e. where the presence or absence of anxiety disorders and depression with and without anhedonia has been confirmed by clinical interview.

There were also moderate correlations between the ASA and existing measures of pleasure (the SHAPS and ACIPS) that are used to assess anhedonia. The strength of these relationships may have been attenuated because of the narrow focus of the SHAPS on consummatory pleasure SHAPS, Snaith et al., 1995 and the ACIPS on response to social rewards (ACIPS, Gard et al., 2006). Importantly, the ASA significantly predicted elevated depression symptoms (high vs. low MFQ scores) above and beyond other measures of anhedonia/pleasure (ACIPS, Gooding et al., 2014; SHAPS, Leventhal et al., 2015; TEPS, Gard et al., 2006). Furthermore, the ACIPS and SHAPS no longer predicted depressive status once the ASA was entered into the model, highlighting the clinical potential of the ASA.

As expected, the ASA was more strongly correlated with the Behavioural Approach System (BAS) reward responsiveness scale than BAS drive and fun seeking, as high BAS reward responsiveness has been identified as a unique predictor of wellbeing and affect regulation and low levels of internalising disorders, in comparison to other scales in the BIS/BAS (Taubitz et al, 2015). Furthermore, correlations with the BAS drive and fun seeking scales were small, demonstrating some discriminant validity, as these subscales have been linked to functional and dysfunctional impulsive-related approach behaviours, respectively (e.g. Franken et al, 2005), which arguably differs from the construct of anhedonia. Although the ASA was not more strongly related to low reward responsiveness (BAS-reward) than high behavioural inhibition (BIS), this may relate to the link between behavioural inhibition and neuroticism (e.g. Smits & Boeck, 2006), a personality feature that is closely related to internalising disorders such as depression (APA, 2013).

Importantly, although anhedonia is typically conceptualised as changes in the positive valence system which includes multiple components of reward processing (Research Domain Criteria, RDoC; Insel et al., 2010); it is also conceptualised within the RDoC negative valence system domain subsystem of ‘loss’ which involves a state of motivation

deprivation (NIMH, 2011b) that might be tapped into by questions negative affect or behavioural inhibition. This highlights the complex nature of anhedonia, and identifies the need for ongoing investigation into the mechanisms of change (e.g. Khazanov et al., 2020; Khazanov & Ruscio, 2016) and for consideration as to where this clinical construct should sit within the positive and negative valence system domains of interest.

This study had a number of strengths including robust construct validity. Items were generated from qualitative interviews with young people, which ensured that the constructs assessed align with adolescents' experiences and that the language and content are familiar and understood by this age group. The qualitative interviews also highlighted more diverse aspects of adolescents' experiences of anhedonia, including reduced motivation and effort, and reduced connection and purpose that are not typically assessed as part of anhedonia. Extensive feedback was collected from a large and ethnically diverse sample of adolescents spanning the developmental period (i.e. ages 11 to 18 years). This feedback also helped to ensure that the final scale was acceptable for the target population, but additional work is needed to validate the 14-items of the ASA as a stand-alone scale. Furthermore, some adolescents suggested they would have preferred a 5-point Likert scale, therefore further validation studies could consider including an option between never and sometimes i.e. rarely/occasionally. The descriptions of anhedonia captured in the original qualitative study which formed the basis for the ASA were often broad and all compassing, for example adolescents often found *everything* boring or *nothing* fun, rather than not enjoying some things or certain specific activities (Watson et al., 2020). Scale development and validation should be an iterative process and it will be important for future studies to continue to gather feedback from adolescents with depression to ensure their experiences are captured by the new scale and if/where necessary to make any further adaptations. Limitations to the study included moderate assessment of discriminant validity. Further studies are needed to confirm

if the ASA is able to discriminate between anhedonia and other unrelated disorders and to discriminate between young people who have depression with and without comorbid anxiety. The next step is to assess the performance of the ASA in well-defined clinical samples. This would also help to determine the optimal cut-off score for identifying problematic levels of anhedonia, which would be useful for community screening and clinical assessment. Likewise, including the ASA in treatment studies, i.e. as a baseline and outcome measure, would help establish if the measure is sensitive to changes in the severity of anhedonia.

In summary the ASA is the only measure of anhedonia that has been designed specifically with and for use by adolescents. It is based directly upon the experiences of anhedonia in adolescents with depression. It has good psychometric properties and will help clinicians and researchers to assess the multiple dimensions of anhedonia that adolescents experience. Subject to further clinical evaluation this new measure has the potential to fill a gap in the assessment tools available to researchers and clinicians who want to understand and treat adolescents experiencing the disabling symptom of anhedonia.

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Appendix. The Anhedonia Scale for Adolescents (ASA)

This questionnaire is about how interesting and enjoyable you have found your life over the past two weeks. Please answer all the questions as honestly as possible. Please circle how often you experienced the feeling, thought or behaviour described in each sentence. Your options are: NEVER (0) SOMETIMES (1) OFTEN (2) ALWAYS (3)

1. I had no motivation to get started on things
2. Nothing made me feel excited
3. I should have been enjoying things, but I couldn't
4. I felt detached from other people
5. I did not look forward to anything
6. Nothing felt fun or enjoyable
7. I couldn't see myself enjoying things in the future
8. I felt enthusiastic
9. I did not want to do anything
10. I pretended things excited me, but actually I found them boring
11. I felt connected to the world around me
12. I did not feel any emotion
13. Everything felt like a lot of effort to do
14. I felt like my life had meaning and purpose

Over the past two weeks, how often did you not feel positive? Please circle?

NONE SEVERAL DAYS MORE THAN HALF THE DAYS ALMOST EVERY DAY

Scoring: This is the suggested order for administering the scale. A higher score indicates greater levels of anhedonia (/42). Subscale 1: enjoyment, excitement and emotional flattening: 2, 3, 4, 6, 7, 10, 12; Subscale 2: enthusiasm, connection and purpose: 8, 11, 14; Subscale 3: effort, motivation and drive: 1, 5, 9, 13.

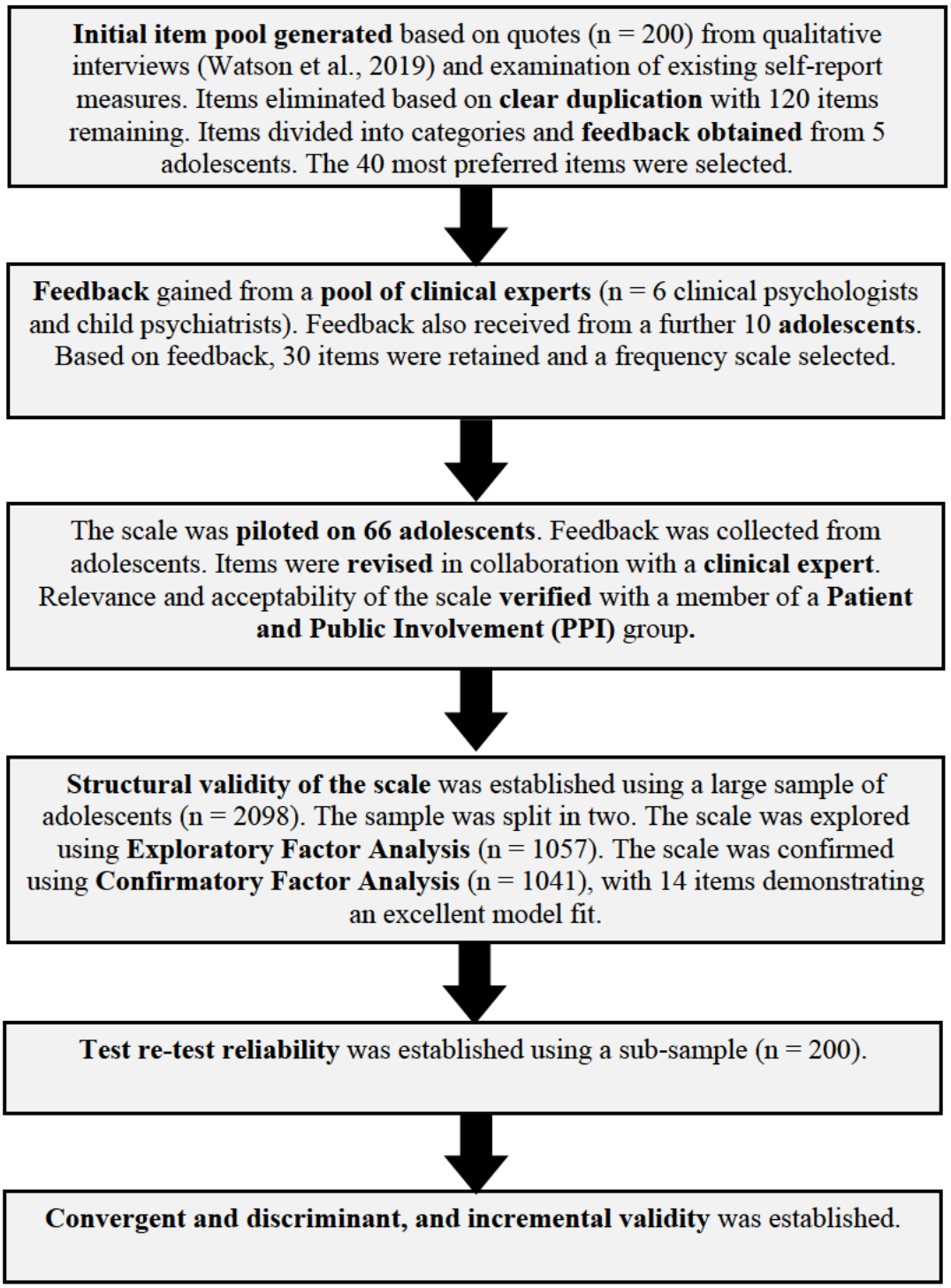
4.1. Electronic Supplementary Material

SUPPLEMENTARY MATERIAL:

Development and Validation of a New Adolescent Self-Report Scale to Measure Loss of Interest and Pleasure: The Anhedonia Scale for Adolescents (ASA)

Supplementary Material A: Flowchart of the scale development and validation process
Supplementary Material B: Item selection
Supplementary Material C: Factor analyses
Supplementary Material D: Descriptive statistics for 14-item Anhedonia Scale for Adolescents (ASA) by age and gender
Supplementary Material E: Correlational analyses for 4 factor ASA solution

Supplementary Material A. Flowchart of the scale development and validation process



Supplementary Material B: Item Selection

B1. Items refinement table

40-items (initial feedback)	30-items (pilot)	32-items *(plus 5 reversed items)*	14-items (final scale)
THEME 1 – *Experiencing a Loss of Joy and a Flattening of Emotion*			
Interest/Fun/Enthusiasm 1. Nothing felt fun or enjoyable 2. Life felt boring 3. I had no interest in anything 5. I had no enthusiasm **Excitement/Anticipation** 4. Nothing made me feel excited 6. I did not look forward to anything **Emotional Flattening** 7. I did not care about anything at all 8. Everything felt dull or grey 9. I felt flat or blank 10. I felt nothing	**Interest/Fun/Enthusiasm** 1. Everything felt boring 3. I had no interest in anything 9. I had no enthusiasm 15. Nothing felt fun or enjoyable **Excitement/Anticipation** 8. Nothing made me feel excited 10. I did not look forward to anything **Emotional Flattening** 11. I did not care about anything at all 22. Everything felt dull or grey 12. I felt flat 28. I felt no emotion	**Interest/Fun/Enthusiasm** 1/33. My life felt varied and interesting *(also reversed – My life did not feel varied or interesting)* 20/37. I felt enthusiastic (*also reversed – I had no enthusiasm)* 22. Everything felt boring 29. Nothing felt fun or enjoyable **Excitement/Anticipation** 11. I did not look forward to anything 16. Nothing made me feel excited **Emotional Flattening** 5. Everything felt dull or grey 9. I did not feel sad, just flat or bored 28. I felt no emotion 25. I did not care about anything at all	**Interest/Fun/Enthusiasm** 20) I felt enthusiastic 29) Nothing felt fun or enjoyable **Excitement/Anticipation** 11) I did not look forward to anything 16) Nothing made me feel excited **Emotional Flattening** 28) I did not feel any emotion[1]
THEME 2 – *Struggling with Motivation and Active Engagement*			
Drive/Wanting 11. I did not want to do anything 15. I just wanted to do nothing all day 13. I could not be bothered to do anything **Momentum/Ambition/Goals** 12. I had no motivation to get started on anything 14. I had nothing I was aiming for **Effort/Action** 16. I had to force myself to do anything 17. Everything seemed like a lot of effort to do 18. I could not bring myself to make any effort 19. I sat around not doing anything 20. I was not very active	**Drive/Wanting** 4. I did not want to do anything 17. I could not be bothered to do anything **Momentum/ Ambition/Goals** 14. I had no motivation to get started on anything 25. I had no goals for the future **Effort/Action** 6. I sat around not doing anything 19. Everything seemed like a lot of effort to do 23. I was not very active 26. I had to force myself to do anything	**Drive/Wanting** 10. All I wanted was to sit and do nothing 15. I did not want to do anything at all 21. I couldn't be bothered to do anything, even if it would be fun **Momentum/Ambition/Goals** 7. I had no motivation to get started on things 17/34. I had goals for the future I was working towards *(also reversed – I had no goals for the future)* **Effort/Action** 19) Everything felt like a lot of effort to do 2) I took part in activities but I did not enjoy them 4) I had to force myself to do anything	**Drive/Wanting** 15) I did not want to do anything[1] **Momentum/Ambition/Goals** 7) I had no motivation to get started on things **Effort/Action** 19) Everything felt like a lot of effort to do

THEME 3 – *Losing a Sense of Connection and Belonging*			
Social detachment 31.I felt disconnected from everybody else 32. I felt distant and alone 33. I shut myself off from other people **Communication** 34. I did not have much to say 35. I could not relate to other people 36. I kept my feelings inside **General detachment** 37. I was disconnected from the world 38. I felt like I was just watching my life happen 39. I was on autopilot, not noticing what happening around me 30. I distracted myself from my feelings	**Social detachment** 21. I felt detached from other people **Communication** 20. I did not have much to say 5. I kept my feelings inside **General detachment** 27. I was disconnected from the world 30. I felt like I was just watching my life happen 16. I did not notice what happening around me	**Social detachment** 6. I felt left out because other people were having fun and I wasn't 13. I felt detached from other people **Communication** 23. I pretended things excited me when actually I found them boring 31. I did not have much to say, even to those close to me **General detachment** 8. I felt like I was just watching my life happen 18. I felt like I was going through the motions 26/35. I felt connected to the world around me *(also reversed –I felt disconnected from the world around me*)	**Social detachment** 13) I felt detached from other people **Communication** 23) I pretended things excited me, but actually I found them boring[1] **General detachment** 26) I felt connected to the world around me
THEME 4 – *Questioning Sense of Self, Purpose and the Bigger Picture*			
Self-reflection/purpose 31. I felt like there was no point to anything 32. I felt like nothing had a purpose 33. I felt like it was not worth even trying 34. I could not work out what I liked doing 35. I could not understand what I was feeling **Lack of agency/perspective** 36. I felt like I could not change how I felt 37. I should have been enjoying things, but I couldn't 38. I stuck, like there was no way to be happy again 39. I felt like nothing was ever going to change 40. I felt hopeless about the future	**Self-reflection/purpose** 29. I felt like there was no point to anything 13. I felt like nothing had a purpose 7. I could not work out what I liked doing **Lack of agency/perspective** 24. I should have been enjoying things, but I couldn't 18. I stuck, like there was no way to be happy again 2. I felt like nothing was ever going to change	**Self-reflection/purpose** 3. I could not work out what I liked doing 24. I felt like there was no point to anything 30/36. I felt like my life had meaning and purpose *(also reversed – I felt like my life had no purpose or meaning)* **Perspective** 12. I couldn't imagine enjoying my life again 27. I couldn't see myself enjoying anything in the future **Lack of agency** 14. I should have been enjoying things, but I couldn't 32. I wished I could have found things enjoyable	**Self-reflection/purpose** 30) I felt like my life had meaning and purpose **Perspective** 27) I couldn't see myself enjoying anything in the future **Lack of agency** 14) I should have been enjoying things, but I couldn't [1] Slight amendments to improve clarity and simplicity.

B2. Reason for item removal:

1. **FROM 40-ITEMS [BASED ON FEEDBACK FROM ADOLESCENTS]**

ITEM DEEMED CONFUSING/ VAGUE

39. I WAS ON AUTOPILOT, NOT NOTICING WHAT HAPPENING AROUND ME
30. I DISTRACTED MYSELF FROM MY FEELINGS
36. I FELT LIKE I COULD NOT CHANGE HOW I FELT

REPETITION OF OTHER ITEMS [WORDING OF OTHER ITEM PREFERRED/ ITEMS COMBINED]

18. I COULD NOT BRING MYSELF TO MAKE ANY EFFORT
33. I FELT LIKE IT WAS NOT WORTH EVEN TRYING
31. I FELT DISCONNECTED FROM EVERYBODY ELSE
32. I FELT DISTANT AND ALONE
40. I FELT HOPELESS ABOUT THE FUTURE

2. **FROM 32-ITEMS TO 14 [BASED ON FEEDBACK AND FACTOR ANALYSIS]**

NOT EASILY UNDERSTOOD/COMPLEX

18. I FELT LIKE I WAS JUST GOING THROUGH THE MOTIONS
12. I FELT STUCK, LIKE I COULDN'T IMAGINE ENJOYING MY LIFE AGAIN

BASED ON COMMUNALITIES <=.4/ ITEM FEEDBACK

2. I TOOK PART IN ACTIVITIES BUT I DID NOT ENJOY THEM
3. I COULD NOT WORK OUT WHAT I LIKED DOING
9. I DID NOT FEEL SAD, JUST FLAT OR BORED
17. I HAD GOALS FOR THE FUTURE I WAS WORKING TOWARDS
31. I DID NOT HAVE MUCH TO SAY, EVEN TO THOSE CLOSE TO ME

BASED ON FACTOR LOADING/ CATEGORISATION – THEME 1

1. MY LIFE FELT VARIED AND INTERESTING
22. EVERYTHING FELT BORING
5. EVERYTHING FELT DULL OR GREY
25. I DID NOT CARE ABOUT ANYTHING AT ALL

BASED ON FACTOR LOADING/ CATEGORISATION – THEME 2

4. I HAD TO FORCE MYSELF TO DO ANYTHING
21. I COULDN'T BE BOTHERED TO DO ANYTHING, EVEN IF IT WOULD BE FUN
15. ALL I WANTED WAS TO SIT AND DO NOTHING ALL DAY

BASED ON FACTOR LOADING/ CATEGORISATION – THEME 3

8. I FELT LIKE I WAS JUST WATCHING MY LIFE HAPPEN
6. I LEFT OUT BECAUSE OTHER PEOPLE WERE HAVING FUN AND I WASN'T

BASED ON FACTOR LOADING/ CATEGORISATION – THEME 4

24. I FELT LIKE THERE WAS NO POINT TO ANYTHING
32. I WISHED I COULD HAVE FOUND THINGS ENJOYABLE

Supplementary Material C: Factor Analysis

C1. Initial Extraction of Factors [30-items after 2 items removed for comprehension]:

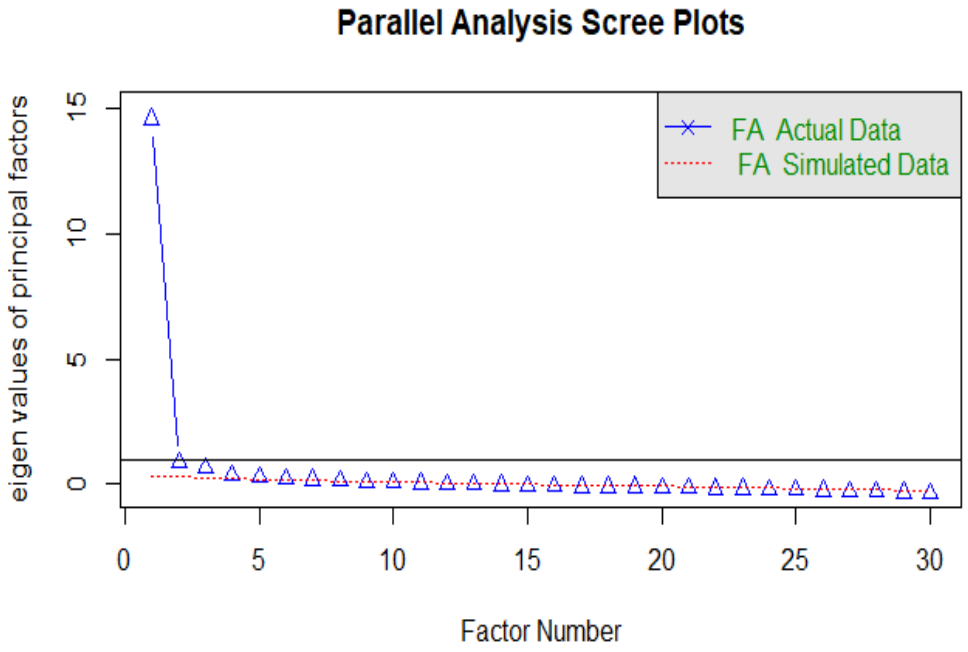
Parallel Analysis

Parallel analysis suggests that the number of factors = 7

eigen values of factors
[1] 14.58 0.89 0.67 0.36 0.29 0.23 0.19 0.13 0.09 0.08 0.04 0.01 -0.01 -0.04 -0.06 -0.07 -0.09 -0.11 -0.11 -0.12
[21] -0.16 -0.17 -0.18 -0.21 -0.22 -0.23 -0.27 -0.28 -0.31 -0.34

eigen values of simulated factors
[1] 0.35 0.29 0.25 0.23 0.20 0.18 0.16 0.14 0.12 0.10 0.08 0.07 0.05 0.03 0.01 -0.01 -0.02 -0.04 -0.06 -0.07
[21] -0.09 -0.10 -0.12 -0.13 -0.15 -0.17 -0.19 -0.22 -0.24 -0.27

Scree Plot of Actual and Simulated Factors



MAP Analysis

The Velicer MAP achieves a minimum of 0.01 with 3 factors

Statistics by number of factors:

1	0.011
2	0.011
3	0.010
4	0.012
5	0.014
6	0.015
7	0.018
8	0.020
9	0.023
10	0.027

C2. Initial EFA – 30-items:

Initial EFA (7 factors; loadings >.4 in bold):

Standardized loadings (pattern matrix) based upon correlation matrix

	item	PA1	PA4	PA2	PA5	PA6	PA3	PA7	h2	u2	com
ASA_25	23	**0.94**	-0.08	0.05	-0.01	-0.01	0.02	0.13	0.77	0.23	1.1
ASA_24	22	**0.83**	0.08	0.03	-0.10	0.01	0.11	0.10	0.81	0.19	1.1
ASA_28	26	**0.68**	0.13	-0.04	0.10	0.01	-0.11	0.14	0.55	0.45	1.3
ASA_27	25	**0.56**	0.21	0.09	-0.11	0.10	-0.01	0.01	0.65	0.35	1.5
ASA_29	27	**0.48**	0.12	0.05	0.14	0.13	-0.01	-0.09	0.75	0.25	1.6
ASA_16	15	**0.45**	0.03	0.16	0.38	-0.07	-0.03	-0.04	0.70	0.30	2.3
ASA_11	11	**0.44**	0.06	0.08	0.19	0.11	0.08	0.05	0.68	0.32	1.7
ASA_23	21	**0.43**	0.26	-0.13	0.13	-0.03	0.04	-0.13	0.55	0.45	2.4
ASA_21	19	**0.42**	-0.10	0.03	0.24	0.05	0.22	-0.09	0.63	0.37	2.5
ASA_19	17	0.30	-0.03	-0.07	0.26	0.24	0.17	0.14	0.55	0.45	4.2
ASA_13	12	0.01	**1.10**	0.03	-0.19	-0.09	0.05	0.19	0.84	0.16	1.1
ASA_6	6	-0.22	**0.83**	0.04	-0.03	0.18	0.02	0.01	0.63	0.37	1.2
ASA_14	13	0.11	**0.63**	0.00	-0.06	0.07	0.14	-0.08	0.71	0.29	1.3
ASA_32	30	0.20	**0.40**	-0.07	0.24	0.07	-0.03	0.01	0.57	0.43	2.3
ASA_31	29	0.26	0.35	0.11	0.30	-0.25	-0.06	0.10	0.46	0.54	4.3
ASA_5	5	0.22	0.26	0.17	0.14	0.16	0.04	0.19	0.65	0.35	5.1
ASA_20	18	-0.16	0.06	**0.82**	0.24	-0.07	0.03	0.00	0.71	0.29	1.3
ASA_26	24	0.05	0.31	**0.63**	0.02	-0.12	-0.08	0.08	0.56	0.44	1.6
ASA_1	1	-0.03	-0.14	**0.62**	0.32	-0.07	0.03	-0.02	0.46	0.54	1.7
ASA_17	16	0.08	-0.18	**0.56**	-0.23	0.08	0.08	-0.09	0.34	0.66	1.8
ASA_30	28	0.27	0.02	**0.55**	-0.16	0.11	-0.08	0.03	0.52	0.48	1.8
ASA_9	9	-0.11	-0.14	-0.04	**0.65**	0.19	0.01	0.13	0.32	0.68	1.4
ASA_22	20	0.41	-0.21	0.12	**0.50**	0.04	0.03	-0.13	0.72	0.28	2.7
ASA_3	3	-0.01	0.22	0.08	0.24	0.21	0.00	-0.07	0.43	0.57	3.4
ASA_4	4	-0.01	-0.03	-0.07	0.18	**0.81**	-0.09	0.12	0.58	0.42	1.2
ASA_7	7	0.00	0.01	0.12	0.08	**0.51**	0.25	0.24	0.64	0.36	2.2
ASA_2	2	0.12	0.11	0.04	0.00	**0.41**	-0.15	-0.06	0.32	0.68	1.7
ASA_10	10	0.31	0.10	-0.04	0.01	-0.24	**0.79**	-0.01	0.81	0.19	1.6
ASA_15	14	-0.13	0.08	0.06	0.07	0.11	**0.73**	0.06	0.70	0.30	1.2
ASA_8	8	0.24	0.17	0.01	0.22	0.26	0.07	0.36	0.65	0.35	4.1

```
                        PA1  PA4  PA2  PA5  PA6  PA3  PA7
SS loadings            5.54 3.63 2.71 2.49 1.97 1.84 0.10
Proportion Var         0.18 0.12 0.09 0.08 0.07 0.06 0.00
Cumulative Var         0.18 0.31 0.40 0.48 0.54 0.61 0.61
Proportion Explained   0.30 0.20 0.15 0.14 0.11 0.10 0.01
Cumulative Proportion  0.30 0.50 0.65 0.79 0.89 0.99 1.00

 With factor correlations of
      PA1   PA4   PA2   PA5   PA6   PA3   PA7
PA1  1.00  0.81  0.69  0.70  0.76  0.65 -0.30
PA4  0.81  1.00  0.54  0.74  0.70  0.53 -0.33
PA2  0.69  0.54  1.00  0.43  0.60  0.53 -0.18
PA5  0.70  0.74  0.43  1.00  0.63  0.61 -0.31
PA6  0.76  0.70  0.60  0.63  1.00  0.67 -0.33
PA3  0.65  0.53  0.53  0.61  0.67  1.00 -0.14
PA7 -0.30 -0.33 -0.18 -0.31 -0.33 -0.14  1.00
```

Initial EFA (3 factors, >.4 in bold):

```
Standardized loadings (pattern matrix) based upon correlation matrix
       item   PA1   PA3   PA2   h2   u2 com
ASA_13   12  0.99 -0.21  0.01 0.69 0.31 1.1
ASA_6     6  0.81 -0.06 -0.04 0.54 0.46 1.0
ASA_14   13  0.75  0.08  0.00 0.67 0.33 1.0
ASA_32   30  0.71  0.13 -0.12 0.57 0.43 1.1
ASA_23   21  0.64  0.15 -0.09 0.51 0.49 1.2
ASA_31   29  0.61 -0.02  0.05 0.40 0.60 1.0
ASA_28   26  0.58  0.10  0.07 0.51 0.49 1.1
ASA_29   27  0.56  0.24  0.12 0.72 0.28 1.5
ASA_27   25  0.55  0.09  0.23 0.63 0.37 1.4
ASA_16   15  0.47  0.26  0.16 0.66 0.34 1.8
ASA_24   22  0.44  0.29  0.22 0.73 0.27 2.2
ASA_5     5  0.43  0.28  0.17 0.63 0.37 2.1
ASA_3     3  0.42  0.22  0.02 0.40 0.60 1.5
ASA_25   23  0.39  0.28  0.24 0.67 0.33 2.6
ASA_2     2  0.38  0.09  0.08 0.25 0.75 1.2
ASA_15   14 -0.22  0.93  0.03 0.60 0.40 1.1
ASA_10   10 -0.02  0.80  0.03 0.65 0.35 1.0
ASA_7     7 -0.03  0.68  0.13 0.56 0.44 1.1
ASA_19   17  0.17  0.64 -0.07 0.55 0.45 1.2
ASA_21   19  0.19  0.57  0.07 0.61 0.39 1.2
ASA_9     9  0.06  0.52 -0.19 0.22 0.78 1.3
ASA_4     4  0.23  0.48 -0.05 0.42 0.58 1.5
ASA_22   20  0.27  0.48  0.10 0.62 0.38 1.7
ASA_8     8  0.32  0.46  0.01 0.57 0.43 1.8
ASA_11   11  0.38  0.40  0.13 0.68 0.32 2.2
ASA_20   18  0.05  0.11  0.69 0.63 0.37 1.1
ASA_17   16 -0.26  0.06  0.66 0.31 0.69 1.3
ASA_30   28  0.15 -0.06  0.66 0.51 0.49 1.1
ASA_26   24  0.35 -0.18  0.60 0.55 0.45 1.8
ASA_1     1 -0.08  0.23  0.52 0.41 0.59 1.4

                       PA1  PA3  PA2
SS loadings           7.65 5.79 3.02
Proportion Var        0.26 0.19 0.10
Cumulative Var        0.26 0.45 0.55
Proportion Explained  0.47 0.35 0.18
Cumulative Proportion 0.47 0.82 1.00

 With factor correlations of
     PA1  PA3  PA2
PA1 1.00 0.80 0.62
PA3 0.80 1.00 0.63
PA2 0.62 0.63 1.00
```

C3. Extraction of Factors [14-items after items removed based on first EFA]:

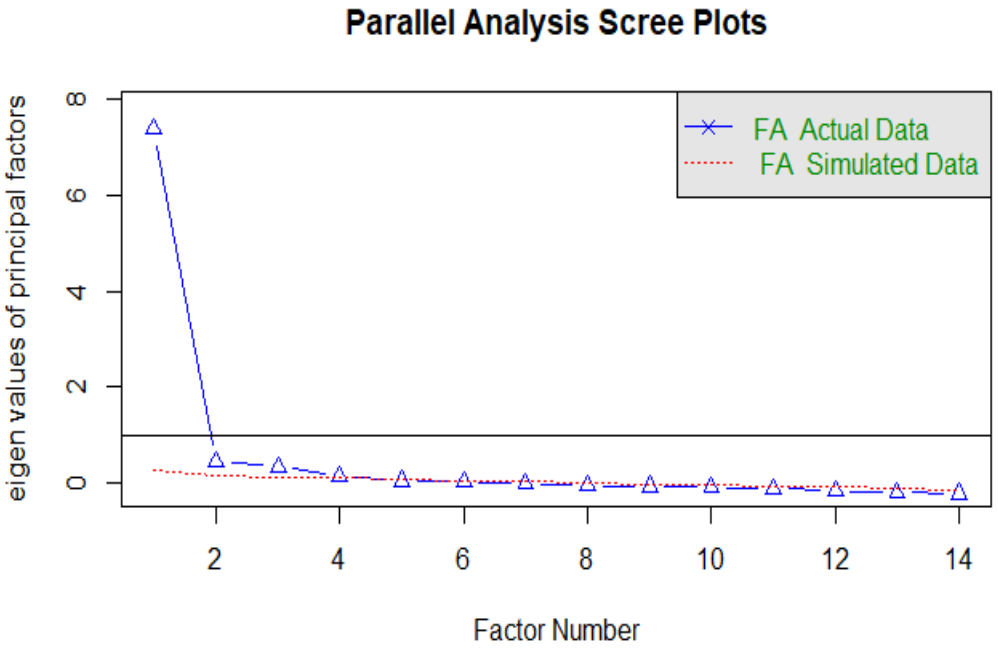
Parallel Analysis

Parallel analysis suggests that the number of factors = 4

eigen values of factors
[1] 7.38 0.44 0.33 0.14 0.03 0.02 -0.01 -0.06 -0.07 -0.11 -0.12 -0.18 -0.20 -0.22

eigen values of simulated factors
[1] 0.28 0.16 0.13 0.10 0.08 0.04 0.02 0.00 -0.03 -0.05 -0.07 -0.10 -0.13 -0.17

Scree Plot of Actual and Simulated Factors



MAP Analysis

The Velicer MAP achieves a minimum of 0.02 with 1 factors:

Statistics by number of factors:

1	0.018
2	0.022
3	0.027
4	0.038
5	0.054
6	0.071
7	0.098
8	0.124
9	0.177
10	0.276

Further EFA (4 factors, >.4 in bold):

Standardized loadings (pattern matrix) based upon correlation matrix

	item	PA1	PA2	PA3	PA4	h2	u2	com
ASA_14	12	**0.86**	0.02	0.08	-0.10	0.73	0.27	1.0
ASA_13	9	**0.80**	0.14	-0.03	-0.10	0.64	0.36	1.1
ASA_23	13	**0.76**	-0.09	0.03	0.01	0.53	0.47	1.0
ASA_29	10	**0.50**	0.06	0.07	0.30	0.73	0.27	1.7
ASA_27	14	**0.48**	0.19	0.06	0.14	0.62	0.38	1.5
ASA_28	11	**0.45**	0.04	-0.04	0.32	0.52	0.48	1.8
ASA_26	2	0.14	**0.77**	-0.06	-0.07	0.61	0.39	1.1
ASA_20	1	-0.13	**0.69**	0.19	0.09	0.62	0.38	1.3
ASA_30	3	0.05	**0.65**	0.00	0.01	0.48	0.52	1.0
ASA_7	4	-0.01	0.10	**0.81**	-0.05	0.68	0.32	1.0
ASA_15	6	0.03	0.02	**0.67**	0.02	0.53	0.47	1.0
ASA_19	5	0.29	-0.10	**0.52**	0.07	0.55	0.45	1.7
ASA_11	7	0.13	0.01	0.15	**0.64**	0.76	0.24	1.2
ASA_16	8	0.24	0.07	-0.04	**0.64**	0.74	0.26	1.3

	PA1	PA2	PA3	PA4
SS loadings	3.51	1.87	1.80	1.57
Proportion Var	0.25	0.13	0.13	0.11
Cumulative Var	0.25	0.38	0.51	0.63
Proportion Explained	0.40	0.21	0.21	0.18
Cumulative Proportion	0.40	0.62	0.82	1.00

With factor correlations of

	PA1	PA2	PA3	PA4
PA1	1.00	0.68	0.72	0.79
PA2	0.68	1.00	0.62	0.67
PA3	0.72	0.62	1.00	0.72
PA4	0.79	0.67	0.72	1.00

Further EFA (3 factors, >.4 in bold

Standardized loadings (pattern matrix) based upon correlation matrix

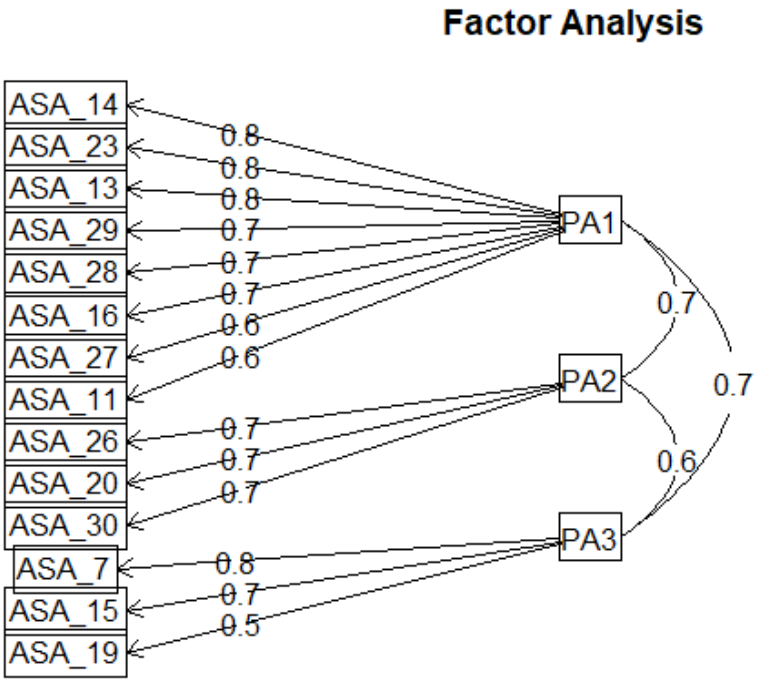
	item	PA1	PA2	PA3	h2	u2	com
ASA_14	12	**0.82**	-0.01	0.02	0.69	0.31	1.0
ASA_23	13	**0.80**	-0.11	-0.01	0.52	0.48	1.0
ASA_13	9	**0.76**	0.10	-0.08	0.60	0.40	1.1
ASA_29	10	**0.73**	0.07	0.09	0.74	0.26	1.1
ASA_28	11	**0.69**	0.05	-0.01	0.52	0.48	1.0
ASA_16	8	**0.66**	0.12	0.09	0.66	0.34	1.1
ASA_27	14	**0.61**	0.18	0.05	0.62	0.38	1.2
ASA_11	7	**0.57**	0.07	0.26	0.68	0.32	1.4
ASA_26	2	0.11	**0.74**	-0.09	0.60	0.40	1.1
ASA_20	1	-0.07	**0.70**	0.21	0.62	0.38	1.2
ASA_30	3	0.07	**0.65**	-0.01	0.49	0.51	1.0
ASA_7	4	-0.03	0.09	**0.78**	0.67	0.33	1.0
ASA_15	6	0.05	0.02	**0.68**	0.53	0.47	1.0
ASA_19	5	0.36	-0.11	**0.51**	0.55	0.45	1.9

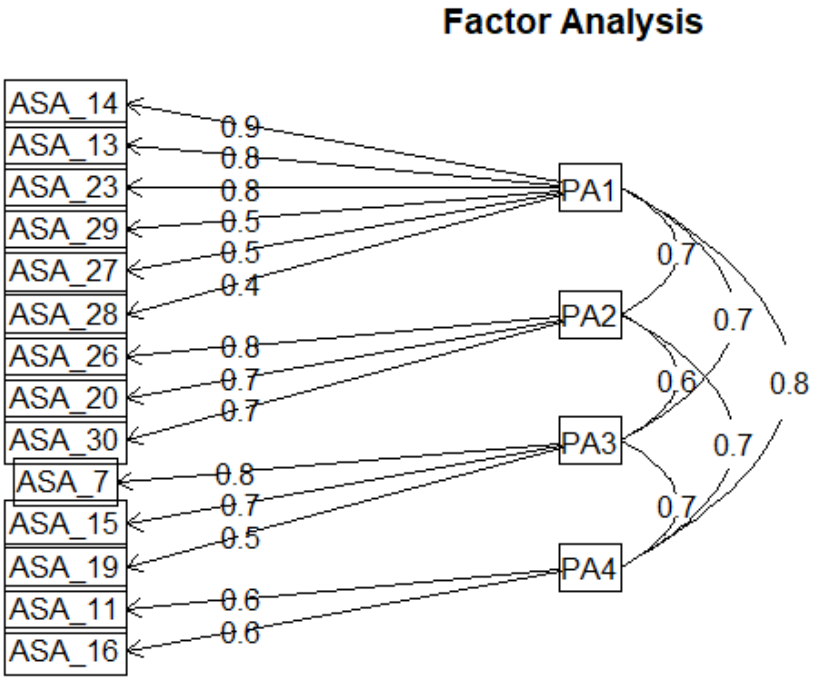
	PA1	PA2	PA3
SS loadings	4.72	1.89	1.87
Proportion Var	0.34	0.14	0.13
Cumulative Var	0.34	0.47	0.61
Proportion Explained	0.56	0.22	0.22
Cumulative Proportion	0.56	0.78	1.00

With factor correlations of

	PA1	PA2	PA3
PA1	1.00	0.70	0.75
PA2	0.70	1.00	0.62
PA3	0.75	0.62	1.00

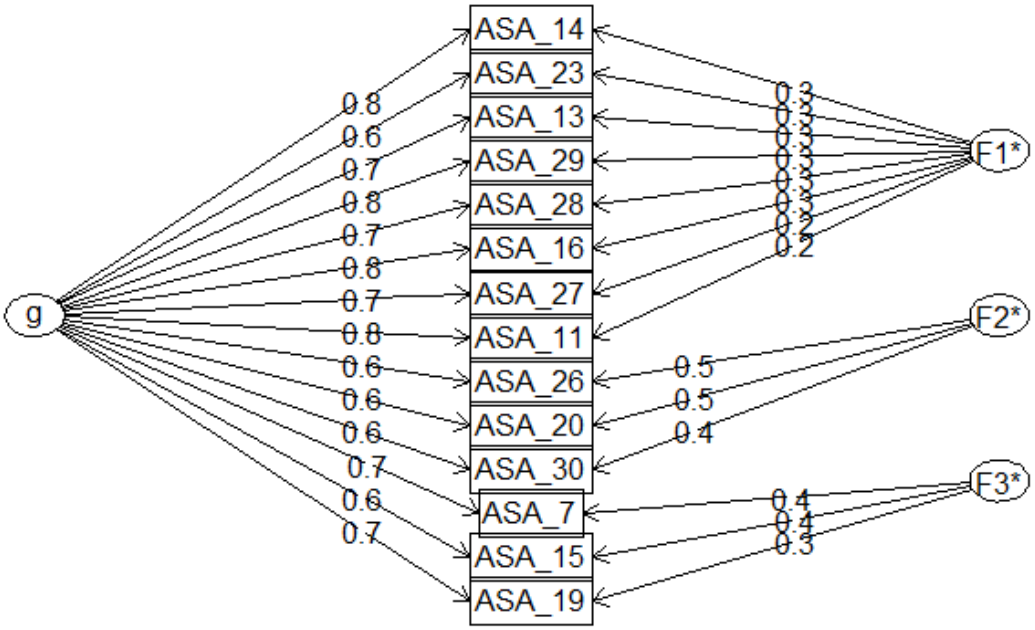
EFA Diagram of Factors (Sample A)



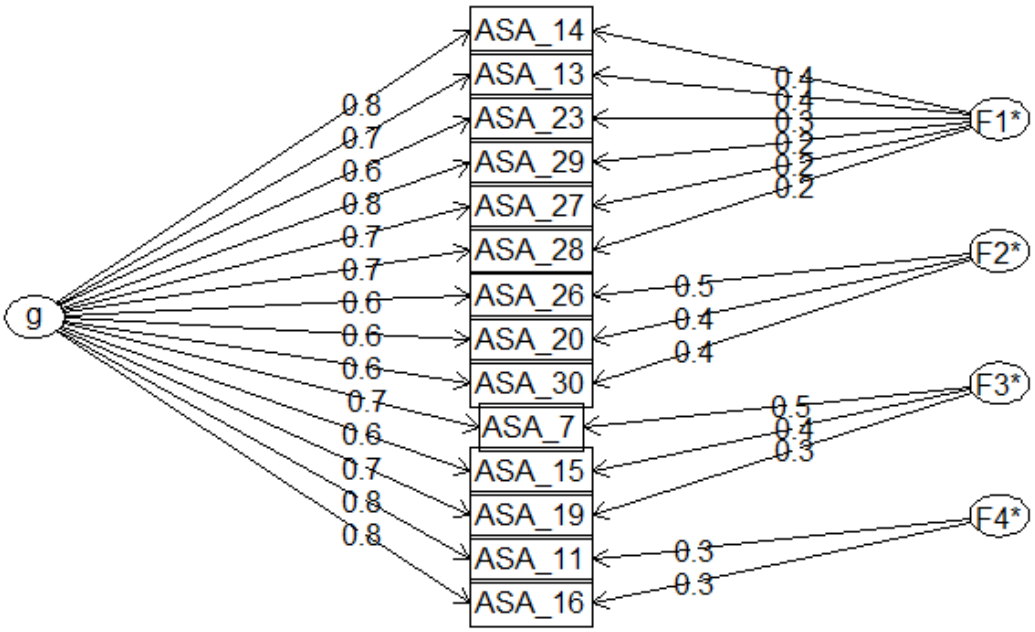


Omega Statistics (Sample A)

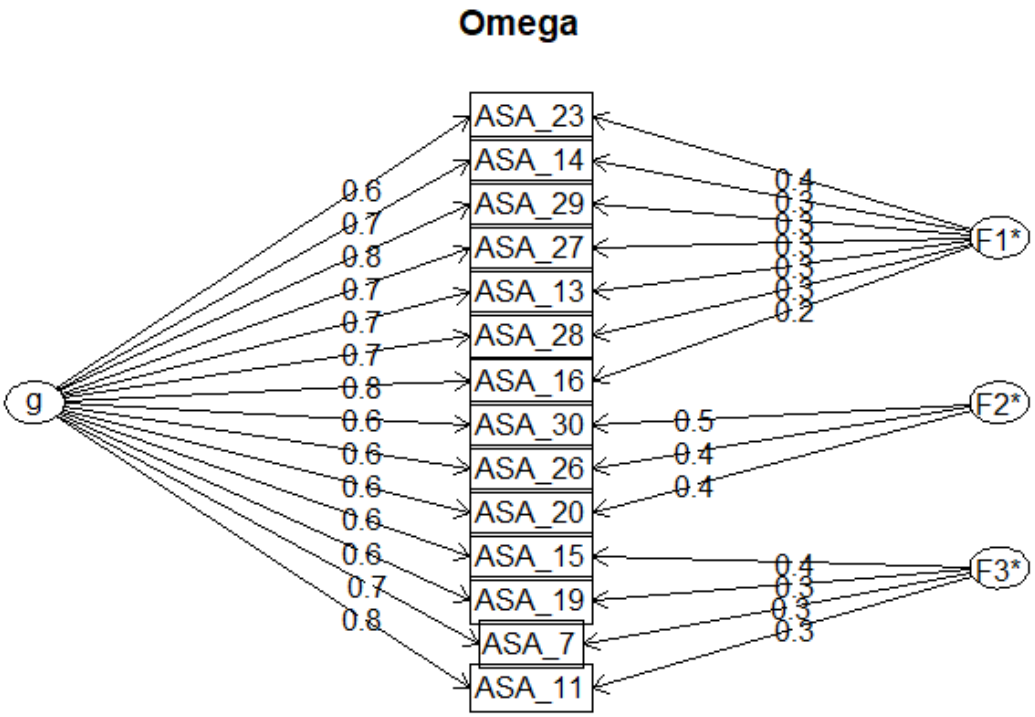
Omega

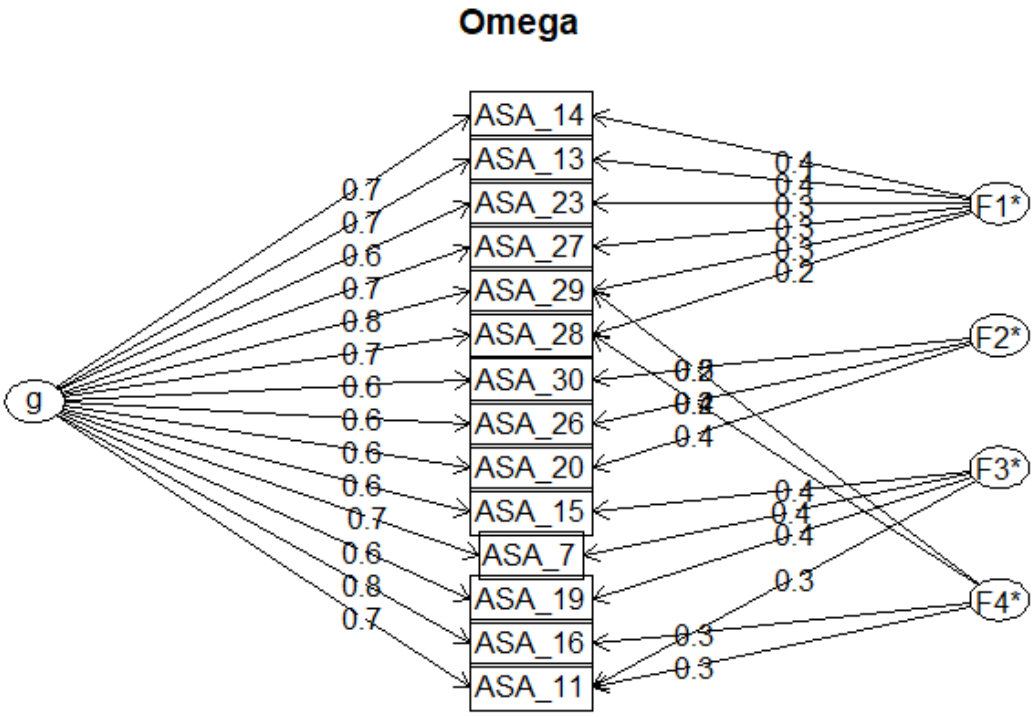

g
ASA_14
ASA_23
ASA_13
ASA_29
ASA_28
ASA_16
ASA_27
ASA_11
ASA_26
ASA_20
ASA_30
ASA_7
ASA_15
ASA_19
F1*
F2*
F3*
0.8
0.6
0.7
0.8
0.7
0.8
0.7
0.8
0.6
0.6
0.6
0.7
0.6
0.7
0.3
0.3
0.3
0.3
0.3
0.3
0.2
0.2
0.5
0.5
0.4
0.4
0.4
0.3

Omega

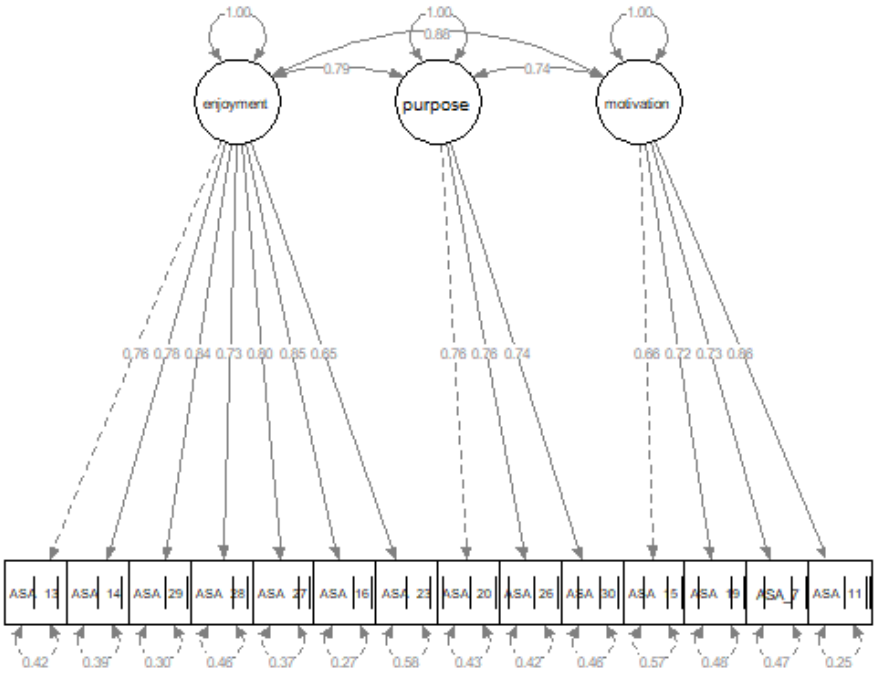

g
ASA_14
ASA_13
ASA_23
ASA_29
ASA_27
ASA_28
ASA_26
ASA_20
ASA_30
ASA_7
ASA_15
ASA_19
ASA_11
ASA_16
F1*
F2*
F3*
F4*
0.8
0.7
0.6
0.8
0.7
0.7
0.6
0.6
0.6
0.7
0.6
0.7
0.8
0.8
0.4
0.4
0.3
0.2
0.2
0.2
0.5
0.4
0.4
0.5
0.4
0.3
0.3
0.3

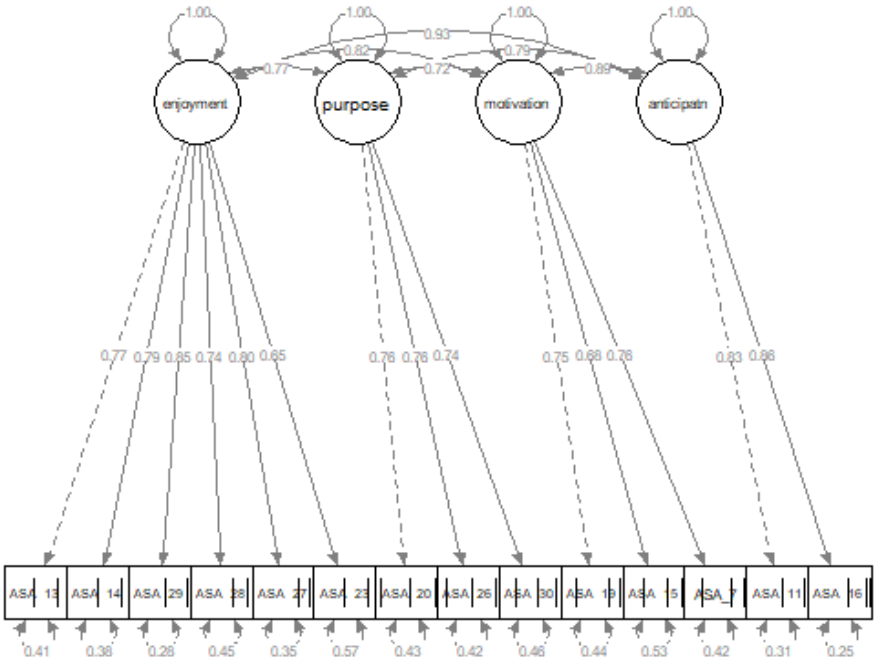
Omega Statistics (Sample B)





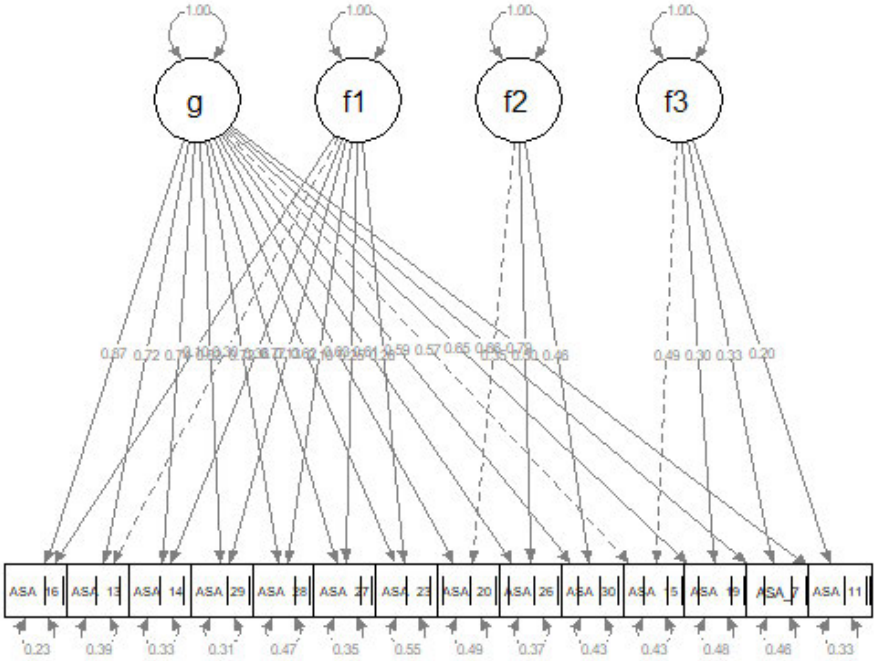
CFA Diagrams of Factors (Sample B) [standardised parameter estimates]



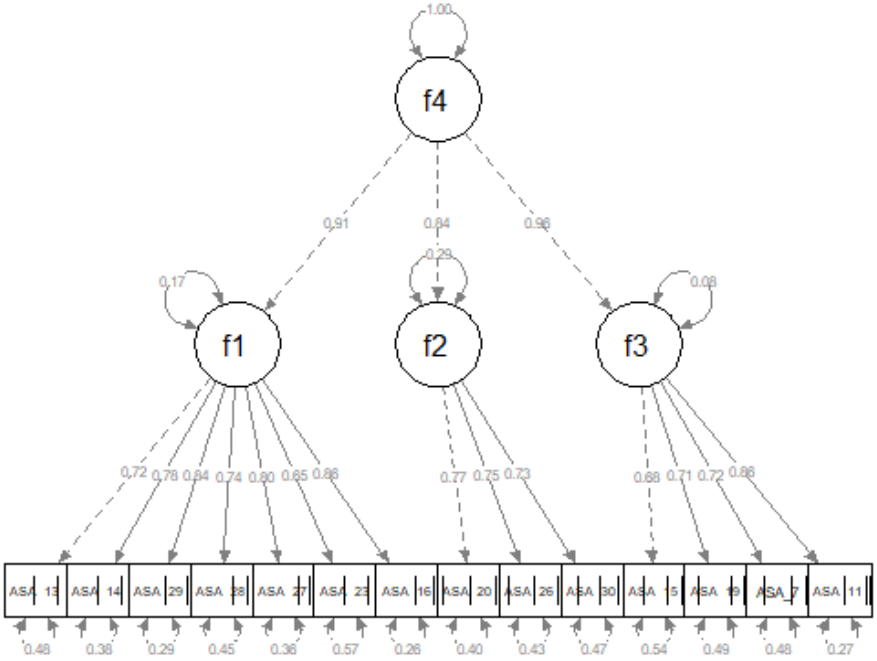


Bifactor CFA model

General factor



Second order

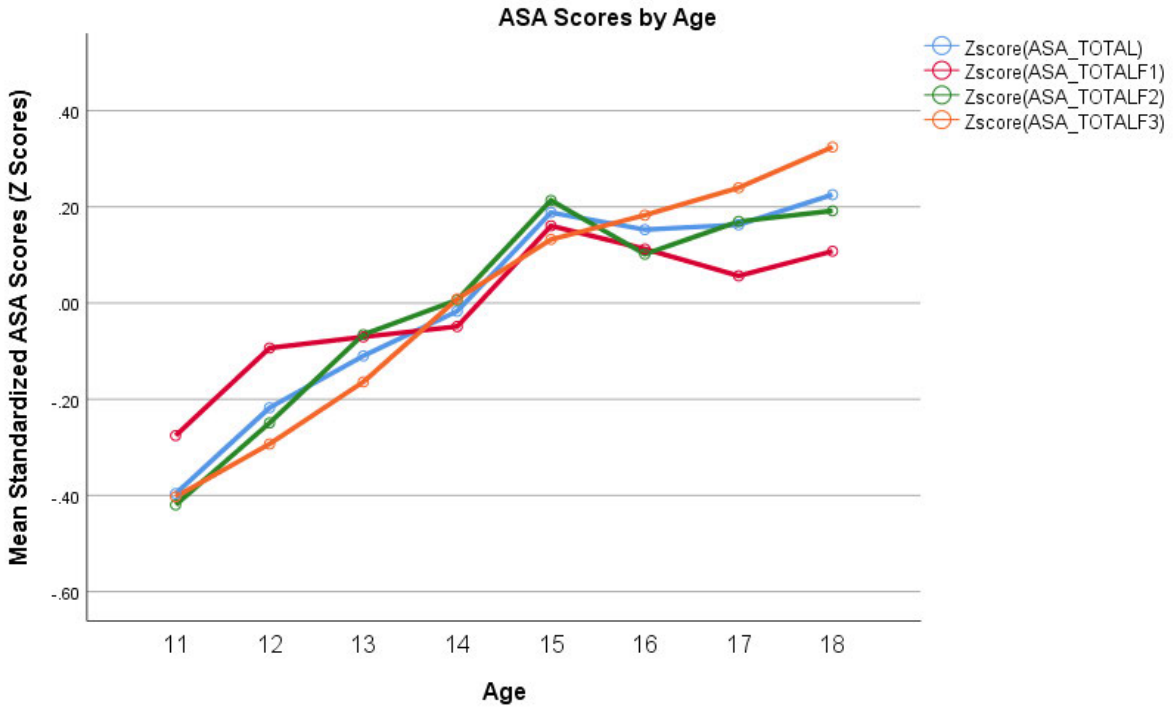


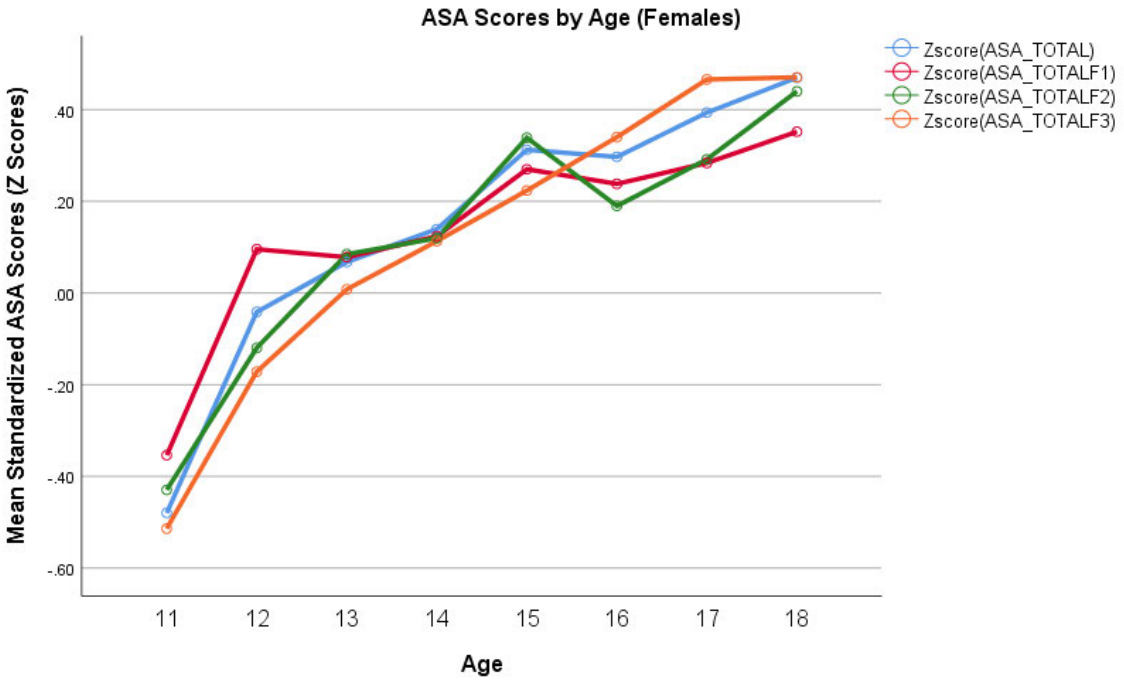
Supplementary Material D: Descriptive statistics for 14-item Anhedonia Scale for Adolescents (ASA) by age and gender

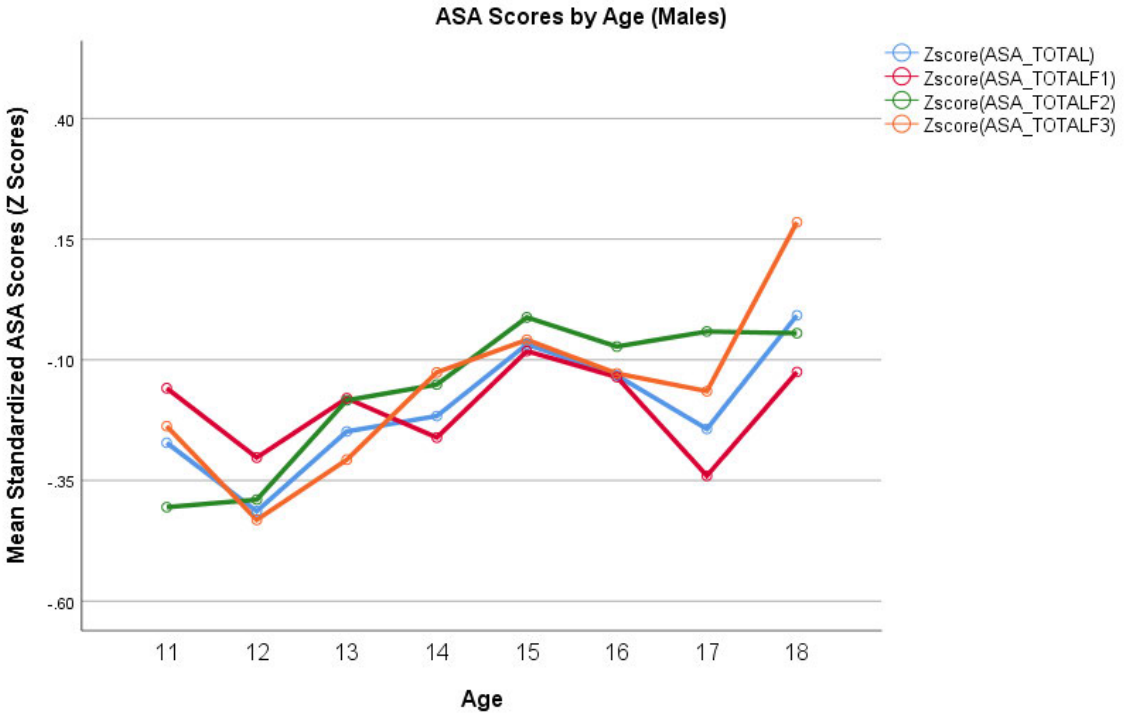
	Gender								Total			
Age	**Male (n = 923)**				**Female (n = 1152)**							
	Total	**F1**	**F2**	**F3**	**Total**	**F1**	**F2**	**F3**	**Total**	**F1**	**F2**	**F3**
11 years (n = 152)	9.0 (6.5)	2.9 (3.0)	3.3 (1.9)	2.8 (2.0)	8.4 (5.0)	2.6 (2.5)	3.3 (1.9)	2.5 (1.7)	9.0 (5.7)	2.9 (3.0)	3.3 (1.9)	2.8 (2.0)
12 years (n = 326)	10.3 (7.1)	3.6 (3.7)	3.7 (2.1)	3.0 (2.3)	11.7 (7.8)	4.3 (4.1)	3.9 (2.0)	3.4 (2.5)	10.3 (7.1)	3.6 (3.1)	3.7 (2.1)	3.0 (2.3)
13 years (n = 343)	11.1 (7.2)	3.7 (3.6)	4.0 (2.1)	3.4 (2.6)	12.5 (7.5)	4.3 (3.6)	4.4 (2.1)	3.8 (2.9)	11.1 (7.2)	3.7 (3.6)	4.0 (2.1)	3.4 (2.6)
14 years (n = 312)	11.7 (7.4)	3.7 (3.8)	4.2 (2.0)	3.8 (2.5)	13.0 (7.8)	4.4 (4.0)	4.4 (2.0)	4.1 (2.7)	11.7 (7.4)	3.7 (3.8)	4.2 (2.0)	3.8 (2.5)
15 years (n = 241)	13.1 (7.6)	4.4 (3.9)	4.6 (2.1)	4.1 (2.7)	14.3 (7.8)	5.0 (4.1)	4.9 (2.1)	4.4 (2.7)	13.1 (7.6)	4.4 (3.9)	4.6 (2.1)	4.1 (2.7)
16 years (n = 267)	13.1 (7.6)	4.4 (4.0)	4.4 (2.0)	4.3 (2.7)	14.2 (7.8)	4.9 (4.3)	4.6 (2.0)	4.7 (2.7)	13.1 (7.6)	4.4 (4.0)	4.4 (2.0)	4.3 (2.7)
17 years (n = 322)	13.2 (7.2)	4.2 (3.8)	4.5 (1.8)	4.4 (2.6)	14.9 (7.5)	5.0 (4.0)	4.8 (1.9)	5.0 (2.6)	13.2 (7.2)	4.2 (3.8)	4.5 (1.8)	4.4 (2.6)
18 years (n = 129)	13.6 (7.3)	4.4 (3.9)	4.6 (1.8)	4.7 (2.6)	15.4 (7.2)	5.3 (3.9)	5.1 (1.8)	5.0 (2.5)	13.6 (7.3)	4.4 (3.9)	4.6 (1.8)	4.7 (2.6)

Note. Total = Total scale score (range 0 - 42); F1 = Factor 1 Subscale Score (range 0 - 21) F2 = Factor 2 Subscale Score (range 0 – 9); F3= Factor 3 Subscale Score (range 0 – 12).

Standardized ASA Scores by Age and Gender




ASA Scores by Age (Females)
Mean Standardized ASA Scores (Z Scores)
.40
.20
.00
-.20
-.40
-.60
11
12
13
14
15
16
17
18
Age
Zscore(ASA_TOTAL)
Zscore(ASA_TOTALF1)
Zscore(ASA_TOTALF2)
Zscore(ASA_TOTALF3)


ASA Scores by Age (Males)
Mean Standardized ASA Scores (Z Scores)
.40
.15
-.10
-.35
-.60
11
12
13
14
15
16
17
18
Age
Zscore(ASA_TOTAL)
Zscore(ASA_TOTALF1)
Zscore(ASA_TOTALF2)
Zscore(ASA_TOTALF3)

Supplementary Material Section E: Correlational analyses for 4 factor ASA solution

Sample A. Correlations between the new The Anhedonia Scale for Adolescents (ASA) and other related measures.

	ASA	ASA-F1	ASA-F2	ASA-F 3	ASA -F4	MFQ	SHAPS	BAS-REWARD	BAS-DRIVE	BAS-FUN	BIS	PANAS-PA	PANAS-NA	RCADS-OCD
ASA	-													
ASA- F1	.883**	-												
ASA- F2	.758**	.541**	-											
ASA- F3	.806**	.612**	.502**	-										
ASA- F4	.771**	.673**	.495**	.566**	-									
MFQ	.785**	.778**	.530**	.628**	.596**	-								
SHAPS	.499**	.402**	.496**	.354**	.429**	.350**	-							
BAS-REWARD	.319**	.227**	.372**	.202**	.301**	.170**	.493**	-						
BAS-DRIVE	.131**	.035	.201**	.112**	.111**	.050	.190**	.396**	-					
BAS-FUN	.188**	.133**	.219**	.125**	.175**	.113**	.308**	.452**	.261**	-				
BIS	-.403**	-.421**	-.247**	-.348**	-.257**	-525**	-.023	.102**	.016	-.084**	-			
PANAS-PA	-.673**	-.577**	-.610**	-.490**	-.518**	-.615	-.491**	-.397**	-.185**	-.263**	.340**	-		
PANAS-NA	.637**	.632**	.461**	.476**	.462**	.756**	.301**	.113**	.032	.104**	-.507**	-.497**	-	
RCADS-OCD	.519**	.538**	.317**	.411**	.382**	.624**	.171**	.058	-.023	.045	-.472**	-.307**	.536**	-

Note. Spearman's Rho correlations are significant ** = p<.001, * = p<.05. ASA = Anhedonia Scale for Adolescents; ASA F1 = Adolescent Anhedonia Subscale 1; ASA F2 = Adolescent Anhedonia Subscale 2; ASA F3 = Adolescent Anhedonia Subscale 3; F4 = Adolescent Anhedonia Subscale 4; MFQ = Mood and Feelings Questionnaire; SHAPS = Snaith Hamilton Pleasure Scale; BAS = Behavioural Approach Subscales; BIS = Behavioural Inhibition Subscale; PANAS = Positive and Negative Affect Scale; RCADS-OCD = Revised Child Anxiety and Depression Scale – Obsessive Compulsive Disorder.

Sample B. Correlations between the new The Anhedonia Scale for Adolescents (ASA) and other related measures.

	ASA	ASA-F1	ASA-F2	ASA-F 3	ASA -F4	MFQ	ACIPS-A	SNS-TOTAL	SNS-APATHY	SNS-EMOTIONAL	RCADS-P	RCADS-G
ASA	-											
ASA- F1	.871**	-										
ASA- F2	.747**	.534**	-									
ASA- F3	.785**	.579**	.502**	-								
ASA- F4	.766**	.650**	.532**	.574**	-							
MFQ	.777**	.752**	.537**	.621**	.595**	-						
ACIPS-A	-.484**	-.428**	-.427**	-.315**	-.404**	-.361**	-					
SNS-TOTAL	706**	.669**	.490**	.565**	.559**	.741**	-.492**	-				
SNS- APATHY	.725**	.674**	.509**	.586**	.571**	.759**	-.490**	.972**	-			
SNS-EMOTIONAL	.393**	.416**	.259**	.289**	.332**	.414**	-.305**	.707**	.534**	-		
RCADS-P	.480**	.480**	.314**	.397**	.338**	.639**	-.146**	.518**	.524**	.311**	-	
RCADS-G	.494**	.496**	.316**	.392**	.349**	.627**	-.187**	.530**	.552**	.275**	.631**	-

Note. Spearman's Rho correlations are significant ** = p<.001, * = p<.05. ASA = Anhedonia Scale for Adolescents; ASA F1 = Adolescent Anhedonia Subscale 1; ASA F2 = Adolescent Anhedonia Subscale 2; ASA F3 = Adolescent Anhedonia Subscale 3; F4 = Adolescent Anhedonia Subscale 4; MFQ = Mood and Feelings Questionnaire; ACIPS-A = Anticipatory and Consummatory Interpersonal Pleasure Scale – Adolescents; SNS = Self-Report Negative Symptoms of Schizophrenia; SNS- APATHY = Self-Report Negative Symptoms of Schizophrenia Apathy (social withdrawal, alogia, avolition and anhedonia), SNS-EMOTIONAL = Self-Report Negative Symptoms of Schizophrenia Emotional (diminished emotional range), RCADS-P = Panic Subscale, RCADS-GAD = Generalised Anxiety Subscale

4.2. Additional Supplementary Material

Two Week Prevalence. Participants were asked to indicate on a four-point Likert scale the amount of time they spent not 'feeling positive'. In the DSM-5 (APA, 2013) a symptom must be present for 'more days than not' in order to meet clinical threshold. Therefore, we considered it important to know how much of the past two weeks young people reported 'not feeling positive'. Of the 2012 participants who answered the question, 75% reported 'not feeling positive' less than half of the time (25% none, 50% several days), and 25% reported 'not feeling positive' more than half the time (15% more than half the days, 10% almost every day). Clinical threshold levels of anhedonia (i.e. 'not feeling positive' more than 50% of the time) was related to clinical levels of depression (above or below clinical threshold on the MFQ); $X^2(2) = 326.184$, $p < .001$.

Events Interfering with Feeling Positive. Little is known about what causes or maintains feelings of anhedonia in adolescents based on their own self-report. In order to explore this, participants were asked the open question 'over the past two weeks has anything stopped you from feeling positive?'. Twelve percent of young people did not respond, and 37% stated no/nothing had stopped them feeling positive/or they did not specify. Of the remaining individuals, the main reasons listed for not feeling positive were: school work/ academic pressure/ tests/results or their academic future (38%); emotional difficulties including anxiety, depression, self-esteem (8%); friendship difficulties/social life/bullying (7%); home/family issues (6%); tiredness/lack of sleep (5%); illness/ injury (4%); and bad news/ death of a person or pet (3%).

Chapter 5.

Paper 4: A Qualitative Study Exploring Adolescents' Experience of Brief Behavioural Activation for Depression and its Impact on the Symptom of Anhedonia

Published in *Psychology and Psychotherapy: Theory, Research and Practice*

Watson, R., Harvey, H., Pass, L., McCabe, C., & Reynolds, C. (2020). A Qualitative Study Exploring Adolescents' Experience of Brief Behavioural Activation for Depression and its Impact on the Symptom of Anhedonia. *Psychology and Psychotherapy: Theory, Research and Practice*. DOI:10.1111/papt.12307

Author Contributions: Rebecca Watson (Conceptualization; Data Curation; Formal analysis; Investigation; Methodology; Writing – original draft) Kate Harvey (Conceptualization; Methodology; Supervision; Writing – review and editing) Laura Pass (Formal analysis; Writing – review and editing) Ciara McCabe (Conceptualization; Supervision) Shirley Reynolds (Conceptualization; Formal analysis; Supervision; Writing – review and editing).

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Abstract

Objectives: Anhedonia, the loss of interest and pleasure, is a core symptom of depression and is associated with deficits in reward processing. Behavioural Activation for depression may address this symptom due to its focus on identifying and increasing intrinsically rewarding activities.

Design: This was a qualitative study employing reflexive Thematic Analysis (TA) to analyse data from semi-structured interviews with young people after treatment.

Methods: Participants were eight treatment-seeking adolescents with a recent primary diagnosis of depression who had received eight sessions of Brief Behavioural Activation. Qualitative semi-structured interviews were conducted after treatment was completed.

Results: Three main themes emerged: 1) Connecting, reviewing and taking action: *'focus on getting better rather than what you're feeling;'* 2) Struggles, restrictors and motivators: *'it seemed really unachievable;'* and 3) Feeling, acting or seeing things differently: *'looking forwards in a more healthy way.'*

Conclusions: Specific Brief Behavioural Activation strategies (e.g. connecting with values) and more generic therapeutic strategies (e.g. self-monitoring) may both be helpful in treating the symptom of anhedonia in adolescents with depression. Motivational aspects of anhedonia, as well as anxiety, fatigue and academic pressures act as potential barriers to recovery. This highlights the need for psychological treatments for adolescent depression to include explicit and targeted strategies to enhance motivation.

Practitioner Points:

- Young people reported that specific Brief Behavioural Activation strategies (e.g. connecting with values) and more generic therapeutic techniques (e.g. self-monitoring) had a role in treating anhedonia.

- Barriers to engaging in Brief BA included: motivational anhedonia, fatigue, and academic demands.

Keywords: Anhedonia; Behavioural Activation; Adolescents; Depression; Qualitative

Introduction

Adolescence is a period of high risk for the development of depression; for example, Major Depressive Disorder (MDD) has a point prevalence estimate of 2.6% (Polanczyk et al., 2015). Adolescent depression is associated with a number of negative outcomes, including failure to complete secondary/high school and unemployment (Clayborne et al., 2019). Anhedonia, the loss of interest and pleasure, is a core symptom of MDD (American Psychiatric Association, 2013) and is reported by at least 50% of adolescents with MDD (Goodyer et al., 2017; Orchard et al., 2017). Anhedonia may have a key role in maintaining depression; it predicts non-response to treatment in adults (Vrieze et al., 2013) and poor treatment outcome in adolescents (McMakin et al., 2012). In a meta-analysis of longitudinal studies, Khazanov and Ruscio (2016) found that positive emotionality (positive affect, extraversion and behavioural activation) was a temperamental vulnerability factor for both depression and anxiety. Furthermore, a secondary analysis of randomised controlled trial of depressed individuals showed that higher baseline distress and anhedonia predicted longer time to remission within one year, and recovery within three years, albeit less than distress (Khazanov et al., 2020).

Anhedonia has been shown to be related to dysfunctional behavioural and neural reward processing in adults (Halahakoon et al., 2020; Rizvi et al., 2016). Reward processing consists of multiple steps such as the anticipatory/motivational i.e. *wanting* step which is followed by the consummatory/hedonic i.e. *liking* step. There is also a reward learning step whereby predictions can be made about positive outcomes (Treadway & Zald, 2011). Further, a recent study found that in adolescents with depression symptoms anhedonia correlated with decreased physical motivation (effort) to gain reward (Rzepa & McCabe, 2019). However, it is less clear which aspects of the reward process are the most impaired or problematic in adolescents with depression (McCabe, 2018). Anhedonia is also conceptualised as low

positive affect. Thus, adolescents' subjective reports of anhedonia highlighted difficulties with lack of enjoyment, boredom, emotional blunting, low motivation, disconnection and loss of purpose (R. Watson et al., 2020). These experiences are distinct from high negative affect, which is typically experienced as sadness and low mood (Clark & Watson, 1991; Watson et al., 1988).

There are a number of evidence-based psychological treatments for adolescents with MDD, including Cognitive Behavioural Therapy, Interpersonal Therapy, Psychodynamic Therapy, and Family Therapy (NICE, 2019). However, in a meta-analysis of psychological treatments for child and adolescent mental health difficulties, Weisz et al., (2017) found that effect sizes following treatment of depression were small, and were consistently smaller than those obtained following psychological treatments for other common youth mental health problems.

Existing evidence-based treatments for depression in adolescents typically target high negative affect (i.e. sadness, low mood) and neglect difficulties with low positive affect (i.e. anhedonia). For example, a recent secondary analysis of two Randomised Controlled Trials (RCTs) with depressed adults showed that two treatments, Cognitive Behavioural Therapy (CBT) and anti-depressant medication (ADM), were better at repairing negative affect than positive affect (Dunn et al., 2020). Some clinical researchers have therefore hypothesised that the effectiveness of treatments for depression may be increased by targeting low positive affect/or anhedonia (e.g. Craske et al., 2019; Dunn et al., 2019). Behavioural Activation treatment (Lejuez et al., 2001, 2011; Martell et al., 2001, 2010) aims to increase positive reinforcement. Forbes (2020) suggested that by increasing participants' contact with rewarding stimuli and thus targeting (low) reward functioning, BA may bring about improvements in depression symptoms. Furthermore, a meta-analysis of RCTs found a

significant effect of BA on subjective wellbeing (which incorporates positive affect), although studies were of mixed quality (Mazzucchelli et al., 2010)

Behavioural Activation for depression is an effective treatment for adults with depression (NICE, 2018). There is accumulating evidence that Behavioural Activation is safe and acceptable to adolescents (e.g. Pass et al., 2018), and one small randomised controlled trial (McCauley et al., 2016) suggests that it is as effective as other evidence-based treatments for adolescent depression. Brief Behavioural Activation (Brief BA; Pass et al., 2015), is an 8-session treatment for adolescents that aims to increase positive reinforcement for healthy behaviours by identifying intrinsically rewarding activities based on an individual's personal values. It also uses other non-specific psychological therapy techniques including collaboration between therapist and client, structured sessions, identifying goals, and self-monitoring.

Previous work has explored the experience of anhedonia in adolescents (e.g. Watson et al., 2020) but no research has explored experiences of anhedonia following a reward focused treatment such as BA. Therefore, the aim of this study is to explore the experiences of adolescents who had received Brief Behavioural Activation for depression, and specifically to focus on changes in anhedonia. Participants were young people who had been referred to a mental health service, were diagnosed with a primary diagnosis of MDD or persistent depressive disorder, and received Brief BA (see Pass et al., 2015) for detailed treatment protocol). After treatment ended participants took part in one-to-one qualitative interviews. Thematic analysis was conducted to explore adolescents' experiences in depth.

Methods

This study received ethical approval from the NHS Research Ethics Committee and University Research Ethics Committee. The COREQ checklist for reporting qualitative data

was followed (Tong et al., 2007), as well as guidelines for ensuring rigour and reflexivity in qualitative research (Harper & Thompson, 2012).

Recruitment

Participants were recruited via a publically funded Child and Adolescent Mental Health Service in the South of England (UK). Eligibility criteria for the low/medium intensity service meant that young people with active suicide plans or co-morbid psychosis were not recruited.

Adolescents were assigned depression diagnoses on the basis of the Kiddie Schedule of Affective Disorders and Schizophrenia (K-SADS; Kaufman et al., 1997), and were diagnosed with comorbid anxiety disorders on the basis of the Anxiety Disorder Interview Schedule for DSM-IV for children, child and parent versions (Anxiety Disorders Interview Schedule – child and parent report; ADIS-C/P; (Silverman, 1996). Both schedules are semi structured diagnostic interviews based on DSM-IV. Minor amendments were made to the interview schedules to enable diagnoses consistent with DSM-5 diagnostic criteria. As is conventional with both assessments, the interviews were conducted with young people and their caregivers separately. (See Supplementary Material).

Individuals were recruited from a pool of twelve young people (aged 11-17) who met DSM-5 criteria for a primary diagnosis of either MDD or persistent depressive disorder and took part in a previous qualitative study (see Watson et al., 2020). Nine young people completed eight sessions of Brief BA and a review session over approximately 10 weeks. This form of BA is based on Behavioral Activation for the Treatment of Depression (BATD; Lejuez et al., 2001, 2011), which explicitly focuses on the client's values, a feature which is less pronounced in treatment protocols developed by Martell et al., (2001, 2010). The remaining three young people did not complete Brief BA: one was referred to a specialist

CAMHS service; one completed a combination of Brief BA and other therapy techniques due to their complex presentation; and one decided not to take part in treatment. Brief BA sessions were delivered by Child and Adolescent Psychological Wellbeing Practitioners, who are clinical staff who have received one-year post-graduate training in brief psychological interventions for children and adolescents. The remaining participants were invited to take part in a second interview, described in the current study.

Participants

Of the nine eligible young people, eight (age, M = 15.8 years, SD = 1.7; gender, 25% male) took part in the current study; and one (male, aged 15) chose not to participate. Participants completed the current study up to 2 months after finishing the eighth treatment session (range 0-2 months).

Table 1 shows clinical data for each participant including previous treatment history (elicited via interview). Seven participants met criteria for primary diagnosis of Major Depressive Disorder (six of whom met threshold for the symptom of anhedonia), and one for Persistent Depressive Disorder. All participants were White British. Most participants also met criteria for comorbid anxiety disorders. Before treatment began six participants reported symptoms of depression in the clinical range on the Mood and Feelings Questionnaire (Angold et al., 1987). Of these, four participants reliably improved on self-report measures of depression (MFQ), pleasure (SHAPS) (Snaith et al., 1995), and overall functioning (ORS) (Bringhurst et al., 2006; COREQ, 2016). One participant had a high depression score before and after treatment, and another deteriorated on all measures. Two participants who had scores below the clinical range at baseline did not show reliable improvement on some measures.

Table 1. Participants' demographic and clinical characteristics

Pseudo-nyms	Age[a]	Gender	Diagnoses	MFQ (/66)[b]			SHAPS [c]			Outcome Rating Scale			Treatment History
				Pre	Post	Reliable Change	Pre	Post	Change (clinical / non clinical)	Pre	Post	Reliable Change	
Adam	17	Male	Major Depressive Disorder*** Persistent Depressive Disorder Generalised Anxiety Disorder	18	-	Below Clinical Threshold Pre-Treatment/ N/a	2	1	Improvement	32	38	Above Clinical Threshold Pre-Treatment / No Change	None
Alice	13	Female	Major Depressive Disorder Social Anxiety Disorder Generalised Anxiety Disorder	37	38	No Change	7	7	No Change	19	35	Improvement	Counselling
Claire	17	Female	Major Depressive Disorder*** Persistent Depressive Disorder Social Anxiety Disorder	56	32	Still in Clinical Range / Improvement	10	2	Still in Clinical Range / Improvement	4	26	Improvement	Counselling
Gary	17	Male	Major Depressive Disorder***	46	7	Improvement	9	0	Improvement	15	37	Improvement	None
Ivy	13	Female	Major Depressive Disorder*** Persistent Depressive Disorder Social Anxiety Disorder Generalised Anxiety Disorder Obsessive Compulsive Disorder	39	47	Decline	7	10	Decline	15	2	Decline	None
India	17	Female	Major Depressive Disorder***	46	11	Improvement	8	0	Improvement	30	38	Above Clinical Threshold Pre-Treatment / Improvement	Counselling
Jasmine	15	Female	Major Depressive Disorder*** Persistent Depressive Disorder Social Anxiety Disorder	26	12	Below Clinical Threshold Pre-Treatment/ Improvement	11	1	Improvement	13	20	Improvement	Counselling
Jennifer	17	Female	Persistent Depressive Disorder Social Anxiety Disorder Generalised Anxiety Disorder	42	25	Improvement	6	0	Improvement	26	22 [session 5]	N/a	Counselling

[a)] Age at interview. [b)] MFQ = Mood and Feelings Questionnaire (higher scores indicate more depression) (Angold et al., 1987). A score of 27 or above indicates clinical levels of depression (Wood et al., 1995). [c)] SHAPS = Snaith Hamilton Pleasure Scale (higher scores indicate more anhedonia), a score of 2 or more when using a dichotomised scoring system indicates clinical levels of anhedonia (Snaith et al., 1995). ORS = Outcome Rating Scale (Bringhurst et al., 2006). Clinical Threshold <= 28 (equal to or below this score is problematic levels of functioning). Reliable Change Index > 6 (Change score 6.55 or more indicates reliable improvement or decline) (CORQ, 2016). *** Met criteria for anhedonia symptom on K-SADS. (-) missing data.

Procedure

Informed written consent/assent was obtained from all participants and from the parents of young people under 16 years of age.

A topic guide was adapted from Watson et al., (2020). This was informed by the research question and the authors' clinical and research expertise in the fields of depression, anhedonia and qualitative methodology. Potential questions and prompts were discussed with a Public and Patient Involvement (PPI) member with personal experience of mental health difficulties and the topic guide was revised in response to these discussions. The final topic guide included open questions relating to changes in anhedonia (i.e. pleasure/enjoyment, anticipation/excitement and motivation/effort), followed by prompts to gather richer data about each experience (see Supplementary Material).

The first author, a female PhD student, conducted the interviews face-to-face in a quiet room in the clinic with only the researcher and participant present. Interviews were audio recorded and lasted an average of 26 minutes (range 13 to 45 minutes). Interviews were transcribed verbatim by RW, all identifying information was removed and pseudonyms assigned. Field notes were made after the interview and Nvivo software used to aid in analysis. Participants received a £10 gift voucher for their participation.

Data Analysis

In this study the researchers adopted a broadly critical realist (post-positivist) perspective (Guba & Lincoln, 1994) which makes the assumption that although aspects of an individuals' experiences are measurable and observable, there is not one objective reality, and participants and researchers are not fully aware of all the factors that influence their experiences and interpretations (Harper & Thompson, 2012). The data were analysed using thematic analysis, which is a method used for identifying, analysing and reporting patterns

within a data set (Braun & Clarke, 2006). A reflexive form of thematic analysis was used that conceptualises themes as patterns of shared meaning that is generated through interpretation of the data (Braun & Clarke, 2019b, 2019a). Developers of reflexive thematic analysis (Braun & Clarke, 2006, 2019b, 2019a) advocate that concepts of data or theoretical saturation are not consistent with reflexive qualitative approaches. The researchers considered their own prior assumptions and sources of bias. The first author (RW) completed the study as part of a PhD exploring anhedonia in adolescent depression; and has experience conducting and supervising diagnostic depression assessments. LP and SR are clinical psychologists who have adapted Brief BA for adolescents; LP has also delivered and supervised diagnostic depression assessments and Brief BA in clinical and community settings. KH has extensive expertise in qualitative methodologies; and CM examines the relationship between reward function and anhedonia using neurocognitive measures. RW, KH and CM have no affiliation with the treatment approach.

Using Braun and Clarke's (2006) six stage approach to Thematic Analysis, in the first stage of the analysis RW became familiar with the data by conducting and transcribing the interviews, and then reading and re-reading the transcripts. In stage two RW conducted line by line coding. This process was inductive and recursive, with constant comparisons made between and within transcripts. In the third stage codes were combined into potential themes, which reflected major features and patterns in the data. In the next stage, as recommended by Saldaña (2015) themes were reviewed by the research team (KH, CM, LP and SR) during six coding meetings. Coding meetings increase the rigour of the analysis by enabling alternative interpretations to be considered and discussed until a consensus on the interpretation of patterns in the data was reached. Later meetings refined the specifics of each themes and the overall story the analysis tells, generating clear definitions and names for each theme (Braun & Clarke, 2006). In the last stage, agreed themes were finalised and considered within the

broader context of Brief BA and more specifically with regards to the symptom of anhedonia and altered reward processing. Quotations illustrative of each theme identified, and Figure 2 was developed to conceptualise how participants' treatment experiences mapped onto components of the reward system.

Results

Three key themes were identified, each with a number of sub-themes. These are displayed in Figure 1. The link between each sub-theme and the reward cycle are displayed in Figure 2. As highlighted in the introduction, anhedonia is known to have a number of reward-related components. Reward processing can be described as a feedback loop that starts with the initial building of a stimulus-reward association (activation/maintenance of emotion or reward representation) that leads to anticipatory pleasure (i.e. predicting an event will be pleasurable and feeling anticipatory pleasure) and then activates approach motivation (i.e. wanting to do something) and approach behaviour (i.e. encouraging an individual to seek out a particular stimulus from which experience pleasure), and finally this feedback is integrated, updating reward presence and values (Kring & Barch, 2014; Rizvi et al., 2016).

See Table 1 for quantitative outcome measures. For simplicity, in the text, participants have been categorised as either a full responder (improvement on outcome measures of depression, anhedonia and functioning, and no longer in the clinical range); mixed responder (improvement on at least one outcome measure, but possibly still in clinical range for some outcome measures); or a non-responder (no change or deterioration on all outcome measures).

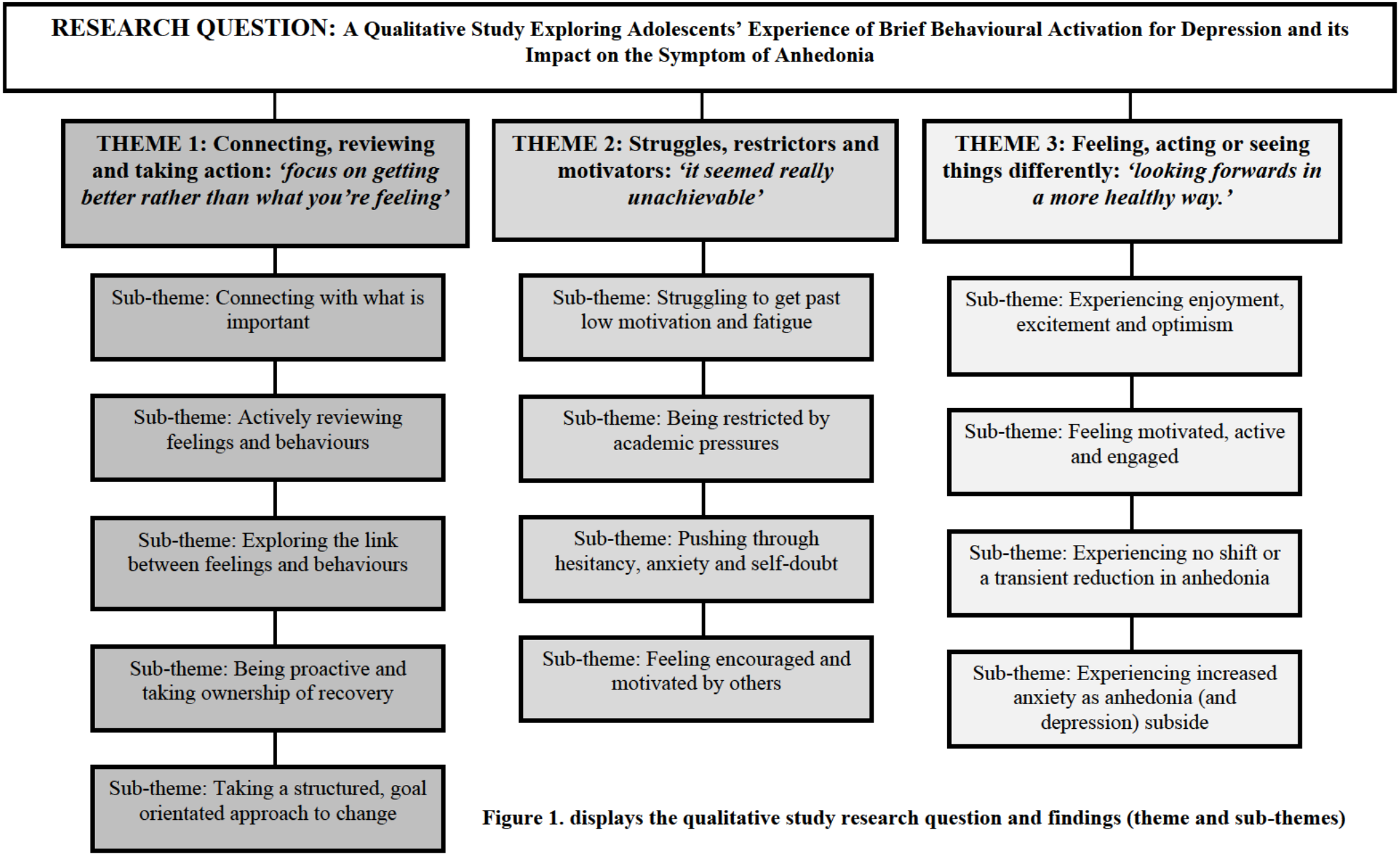

Figure 1. displays the qualitative study research question and findings (theme and sub-themes)

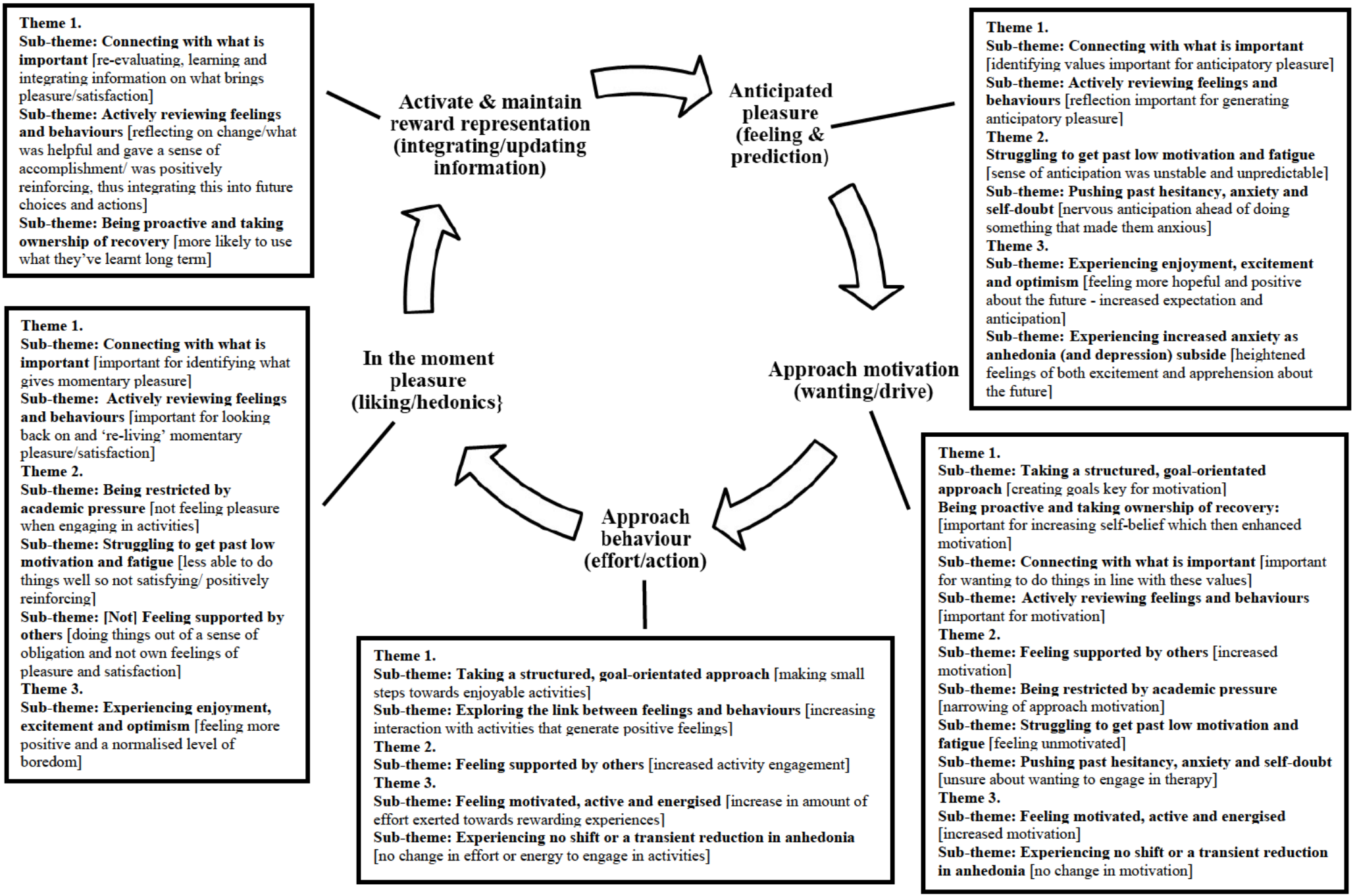

Figure 2. Mapping the impact of adolescents' experiences on to parts of the reward system

Note. Reward processing cycle adapted from Kring & Barch (2014).

Theme 1 – Connecting, reviewing and taking action: *'Focus on getting better rather than what you're feeling'*

Young people identified a range of specific Brief BA strategies that helped them to improve their mood and increase levels of enjoyment and motivation.

Connecting with what is important: *'I just didn't realise I valued it'*

This sub-theme links with a core aspect of Brief BA in which the therapist and young person identify the young person's values and then identify and plan activities that are consistent with these values. Some participants reported that this focus helped them to reconnect with what they used to enjoy before they became depressed, and to feel more motivated to engage in valued activities. For Jasmine (full treatment responder) this helped her to identify what made her feel happy and what didn't, *"found out stuff that makes me low… and stuff that I need to do to make me feel better and happier".*

A number of participants emphasised that it was not necessarily important to do more, or to do different activities, but that it was important to re-evaluate what they were already doing and to consider its value or purpose (a key principle in Brief BA). Adam recognising an activities value helped him feel more motivated to engage in the activity,

"…it helped me think about what was important, but not necessarily trying to find stuff to do, made me feel like the stuff that I was doing I realised what was good and what wasn't…made me more motivated to do it" (Adam, mixed treatment responder).

Beyond just considering what was important to them in the 'here and now', reconnecting with their own values helped some participants feel more motivated to take part in personally valued activities in the future, to consider their passions, and inspired them to become the person they wanted to be.

"…before things started getting really bad I did enjoy like a lot more things, it was quite nice to go, actually no I do love doing this, I do have a passion for this, I think I do like doing things in my spare time then it kind of made me realise I want to keep on doing them [activities] 'cos that's the kind of person I want to be, like I want to be that person that gets up and goes for runs, I want to that person that's asked for notes in class, like they're good, they wanna do good in school and stuff " (India, full treatment responder).

Not all participants found it helpful to focus on their values because they found it difficult to identify what their values were. For example, Alice struggled to identify her personal values. This difficulty was sometimes linked with difficulties discriminating between personal values and those held by family members or friends,

"*I just couldn't really think of anything [I value]…"* (Alice, mixed treatment responder).

Actively reviewing feelings and behaviours: *'Why's it going well?'*

Participants described the benefit of being encouraged to actively think about their feelings and experiences and to review what made them feel more positive, gave them satisfaction or motivated them forwards. As a consequence, sometimes participants were able to derive more enjoyment and meaning from their experiences, *"it gave me a chance to look at what I've done and be happy with myself".* By reflecting on what he had achieved, Gary (full treatment responder) was able to savour the experience of pleasure and satisfaction he felt from completing a task, *"once I've done something I don't see what I have to do next, I see what I've done now, what I've managed to complete, and reflect on that, and sort of be happy with myself."*

Discussing their values and experiences in a more deliberate way with a therapist allowed some participants to really consider what was important to them personally (rather than values deemed important by their peers, family, or wider social group), who they were and how to achieve what they wanted. Self-reflection was most evidence within some of the older participants. For India (full treatment responder), this led her to dig deeper and really consider what brought her a sense of joy,

"Reflecting on what I actually did beforehand, like before things started getting really bad I did enjoy like a lot more things…'cos in everyday conversation when people ask you, oh what do you like to do? I usually go, yeah I like running, I like psychology, I like this and that whatever, when someone actually goes, think what your passion is, what do you wanna get out of life, it kind of forces you to go, yeah reflect on things, to go to things deeper and actually do it actively" (India, full treatment responder).

By looking back and reflecting on her progress through the course of BA, India was motivated to realise her ambition of helping others struggling in a similar way, *"I do see those people [who are struggling] and see where I've been and I'm like, well it can get better, I want to make sure they know that."*

In a similar vein, discussing with a therapist their values and experiences also gave some participants a sense of *'perspective'* (Jennifer), and an ability to look forward in a more solution focused way. It gave them the chance to identify and build on positive, helpful experiences, and not just to focus on processing their depressive feelings.

"…being able to look back at what you're doing and even if something's going well for you to look back and go, 'why's it going well?', to just have that time to actually think and review everything that's going on" (Jennifer, full treatment responder).

Exploring the link between feelings and behaviours: *'If I'm not feeling so great I'll do it anyway'*

A number of participants described a change in their understanding of the connection between their feelings and behaviours. They found that taking action, despite having low motivation, was generally helpful as it meant they were more likely to engage in activities that gave them pleasure. Participants described the benefit of being encouraged by the therapist to engage in activities (despite experiencing motivational anhedonia), and found that they did enjoy activities when they were involved in them. This therefore gave them a direct experience of positive reinforcement. Gary (full treatment responder) explained how, through the process of therapy, he shifted from associating his hobbies with negative emotions to positive emotions. By pushing past his negative feelings, this helped him feel an even greater sense of satisfaction and accomplishment,

"if I'm not feeling so great I'll do it anyway, rather than just putting it off and saying I'll do it when I'm feeling less rubbish about myself, and then as a result it just makes me feel better that I can do it even if I'm not in the best of moods… even when I'm in a low mood, I think well, I can do this because it will make me feel happier" (Gary, full treatment responder).

The link between behaviour and emotions was not always new to participants. For example, Jasmine explained how she was already aware before treatment that if she did the things she enjoyed when unmotivated she would feel better, but it was through therapy that she was able to act on this strategy, which helped her to feel happier and more positive.

"Just knowing if that if I do it, I'll probably feel better and be worth doing… It was something I was already aware of but I just needed to do it. I'd probably feel better, which I always did" (Jasmine, full treatment responder).

Being proactive and taking ownership of recovery: *'I need to learn to do things for myself'*

Adolescents liked how Brief Behavioural Activation was proactive and felt that this helped them to feel they were actively involved in their own recovery. For some individuals having something they could do for themselves increased motivation and self-belief, as they *'……started realising I could actually do it'* (Adam, mixed treatment responder). Claire described how the Brief BA gave her a sense of agency, *"… the treatment was actually me doing things myself, so it's something I can control"* (Claire, mixed treatment responder).

Being organised and managing time effectively were also useful skills that enabled participants to put the time aside to socialise and do the things they had enjoyed before becoming depressed, even in the context of significant academic responsibilities. Gary also identified that he felt equipped with skills to manage his mood long term,

"[the therapy] it's sort of helped me sort of manage myself after treatment as well as it's given me all the things that I can do if I'm not in a great mood, and stuff like that, so as a result I can be proactive about it, rather than relying on other people and just helping yourself out really" (Gary, full treatment responder).

Taking a structured, goal-orientated approach: *'Breaking it up into smaller bits helped'*

Participants described creating manageable and achievable goals as part of therapy which helped them to make small steps towards engaging in activities they had previously enjoyed. These steps were necessary to help adolescents feel able to make these practical steps towards the things they enjoyed.

"*I would just try and get myself to do something, like five minutes just doing the drawing or something* (Jasmine, full treatment responder)."

Furthermore, developing both short and long-term goals was important for increasing motivation and action. Gary said that setting himself goals each day helped motivate him to get out of bed, and when he managed to achieve this goal it increased his positive mood and ultimately initiated a cycle of positive reinforcement,

"I think 'cos now every sort of morning when I get out of bed, I set myself something that I actually need to do or want to do, and as a result I get out of bed to do it and then when it's done I feel sort of feel a certain level of happiness and sort of contentment and as a result I sort of, yeah, it becomes easier to get out of bed" (Gary, full treatment responder).

Another participant compared the more practical Brief BA approach to her previous experiences with counselling. In Brief BA she described her therapist's standpoint as,

"*okay let's focus on getting better rather than just what you're feeling. We know what you're feeling, you're feeling sad, let's try and get away from that"* (India, full treatment responder).

Theme 2 – Struggles, restrictors and motivators: *'it seemed really unachievable'*

Although participants could mostly remember and explain the principles of Brief Behavioural Activation, they were not always able to use the therapy as intended. This theme describes difficulties that they experienced when trying to engage with the key principles of Brief Behavioural Activation; or factors which enabled them to engage effectively.

Struggling to get past low motivation and fatigue: *'I couldn't be bothered'*

Symptoms of depression, specifically low motivation (a part of anhedonia) and fatigue often interfered with young people being able to use the principles of Brief BA. When feeling unmotivated, some participants could not draw on anything they had learned in therapy and simply *"couldn't be bothered"* (Jasmine, full treatment responder). Claire (mixed treatment responder) described how her motivation was changeable, meaning that it was hard to predict whether or not she would be able to engage in activities,

"… so sometimes I'll look forward to things and want to do them, and sometimes I want to do them but won't look forward to them. I dunno, but um, yeah just kind of have the motivation as well, that comes and goes. It's like I'll go through a period of like, probably three days, where I'll be really motivated to do things, then I'll be off for two weeks like no… It's just like I have a battery, the battery lasts for three days and then takes two weeks to charge up again" (Claire, mixed treatment responder).

Similarly, feeling exhausted and fatigued got in the way of adolescents being able to engage in the treatment. These symptoms often coincided with motivational difficulties. For some the effortful nature of therapy was itself a challenge. Ivy (treatment non responder) described how she would sometimes try to engage in activities despite feeling tired and unmotivated, but they were not positively reinforcing as she did not feel able to do them well *"… sometimes I felt kind of too tired to do some of the activities, like homework type things, which made me kind of, stopped me from doing things… I would try do them but I didn't think I did them as well as I could have done"*. Other symptoms sometimes got in the way of engagement, such as concentration.

Being restricted by academic pressures: *'Forget everything else, exams are your life'*

Participants who were enrolled in public examinations frequently stated that academic pressures were overwhelming and stopped them from engaging in things that they wanted to do. This was both practically, in terms of not having time, and also emotionally, not feeling motivated or wanting to engage in other activities. *"…especially with school being so intense like, sometimes I just didn't really have time to do things"* (India, full treatment responder). This pressure stopped adolescents from enjoying things in the moment when they took part in activities, and also stopped them wanting to do things in the first place.

Preparing for and revising for examinations took up most of their 'free' time and therefore got in the way of socialising and other enjoyable activities. This was especially the case for participants who took part in the study in the midst of preparing for exams. When talking about not seeing friends Claire (mixed treatment responder) said, *"I think mainly exams, just thinking I do need to be focusing my time on them 'cos that's the mentality I have at the moment, forget everything else, exams are your life for the next month… [if it was not for exams I would have] met up with a friend or something, gone for lunch, gone out, done somethings, it doesn't matter what it was"* (Claire, mixed treatment responder).

Pushing past hesitancy, anxiety and self-doubt: *'Do I wanna get into this right now?'*

A number of participants struggled with symptoms of anxiety as well as depression and these sometimes got in the way of them actively engaging in positively reinforcing activities, as they wanted to avoid situations that would make them feel anxious, or felt uncomfortable when in those situations or nervous in anticipation of them. *"I was pretty nervous for going [to town] and when I was there I was nervous around everyone that was there, 'cos I'm not great with, I hate being in big crowds of people"* (Jasmine, full treatment responder).

Symptoms of anxiety, including worry could also directly interfere with treatment, especially in early sessions. For example, one participant described being hesitant to open up about her difficulties, therefore possibly not wanting to engage, and was doubtful about what she wanted to get out of the therapy. "*It's really weird there's some things that you just don't really wanna say, and they're completely fine to say, and it's nothing like a, I'm going to get into trouble to say them but 'do I actually wanna say this? Do I wanna get into this right now?' I think like that kind of self-doubt as to what I actually wanted to get out of it at the beginning was um definitely in the way* (Jennifer, full treatment responder)."

Feeling encouraged and motivated by others: *'You can't give up now!'*

Most participants reported the benefits of receiving practical and emotional support from family and/or friends, which helped to increase motivation to engage in rewarding activities. This took the form of both emotional support, and practical help to do activities.

"...like my friends definitely were helping me to motivate to go outside and do things like that it wasn't so much of a 'you said that you need to go outside more, so are you free right now?' like um not giving me a choice, but more of a, kind of encouraging me to know that like, that they want to spend time with me as well... and just to like help them to motivate me when I can't motivate myself" (Jennifer, full treatment responder).

All participants felt supported and listened to by their therapist. Gary also described how being clear about what he needed to do meant he was able to progress in therapy, which enabled him to move forwards.

"We got on well definitely, I mean I never sort of felt like I wasn't being listened to, or I wasn't sort of, everything that we spoke about I understood, I didn't feel like I was missing

anything or not understanding what I needed to do, and as a result I was able to get on with what I needed to do and make a better sort of progress with regards to my treatment" (Gary, full treatment responder).

Although a minority view, doing things (both now and in the future) out of a sense of obligation and to live up to the expectations of others, could also get in the way of fully benefitting from the treatment. This was the case for Alice who said *"[going to university] that's kind of, have to. It's not but everybody else in my family has so it kind of is like the normal"* (Alice, mixed treatment responder).

Theme 3 – Feeling, acting or seeing things differently: *'Looking forwards in a more healthy way'*

Participants described a range of changes that they attributed to Brief BA treatment. Most accounts focused on positive changes but some highlighted lack of change and deterioration in some areas.

Experiencing enjoyment, excitement and optimism: *'Before it was more a chore and now it's more a hobby'*

A number of participants reported that they got more enjoyment and appreciation out of life as a result of Brief BA, with activities feeling like less of a *'chore'* and more of a choice. Gary (full treatment responder) said *"…there's a lot more enjoyment I get out of seeing my friend* and Claire (mixed treatment responder), also commented, *"I think there has been [a change], enjoyed actually seeing people rather than feeling like I had to"* (Claire, mixed treatment responder), feeling a greater sense of pleasure and a reduced sense of obligation.

The majority of participants also felt more positive towards the future. For example, Jasmine looked forward to things more. When asked how she pictured her future she said *"I'm still with my boyfriend. I actually, I'm better at art, maybe selling my art, or doing something I enjoy"* (Jasmine, full treatment responder). This was a very large shift from her initial account before treatment when she was not able to see any positive future for herself. Another participant had a much more positive view of the future in general,

"I'm looking forwards in a more healthy way… I guess the future's not so much of a negative, oh this isn't ever gonna end like kind of thing, it's a kind of like a, yay, yay university and studying and like the course itself is now really exciting to me" (Jennifer, full treatment responder).

Some participants described experiencing feelings of boredom, with certain activities still not feeling fun, but also explained that they found this different from the pervasive lack of interest that they had experienced before they began treatment.

"I mean there are sometimes when I don't enjoy things, but I mean that's mainly associated with the fact that I procrastinate quite a lot, so it's mostly stuff to do with school, coursework, I'll just sort of put it off for a day or two, and as a result when it comes to actually doing it, I feel I haven't really achieved anything, but I mean that's my own problem" (Gary, full treatment responder).

Feeling motivated, active and energised: *'I find it a lot easier to get out of bed every morning'*

Some participants described increased motivation to do leisure and social activities. For example, Adam said *"I'm more motivated to do stuff now"* (Adam, mixed treatment

responder). Similarly Gary stated, *"I've noticed I have a lot more motivation to do things, especially like at school"* (Gary, full treatment responder).

Other participants described increased activity levels, including leisure activities, such as football, and playing games, going shopping, and spending time with other people. This tended to be linked to higher levels of motivation and an increased ability to complete school work and develop a better work-life balance.

"…beforehand I was quite far behind in, like with school work, but now I'm ahead of everyone else. With running I've started doing that, like even with crochet I've picked that up again" (India, full treatment responder).

One participant, who did not appear to benefit from therapy, reported that she *"spent more time like walking the dog or going to gym, more exercise"* (Ivy, treatment non responder). She found being physically active was helpful for her mood, but her major difficulty was still overcoming very low levels of motivation.

Experiencing no shift or a transient reduction in anhedonia: *'I've gone down to zero'*

Some participants reported that increased enjoyment and/or motivation was short-lived. Ivy (treatment non responder) still had to force herself to do things and although her motivation increased, this was temporary and soon returned to the same level as before,

"…after it ended [the therapy] it did make a difference, but kind of, it was better for a while, but it's kind of gone down-hill in the past couple of weeks" (Ivy, treatment non responder).

Alice also reported the same problems that she had been experiencing before treatment, which centred on difficulties with motivation and fatigue. A sense of apathy was

also apparent in her tone throughout the interview. *"…just like no energy, no motivation, like not really wanting to get up, like always tired, not sleeping very well* (Alice, mixed treatment responder)."

Even those who reported sustained improvements in their mood and symptoms after treatment, reported occasional episodes when they felt bad, *"I've gone down to zero for one day, I had a really bad week, did basically nothing"* (Jasmine, full treatment responder).

Claire, who despite reporting important improvements in levels of anhedonia, general symptoms of depression and functioning after treatment, still identified that she had a negative outlook, and was resigned to this as a part of her personality.

"*I'm still very pessimistic, but I don't think that will ever really change, I think that's just who I am"* (Claire, mixed treatment responder).

Experiencing increased anxiety as anhedonia (and depression) subside: *'Now that I'm happier, I'm more anxious'*

As their symptoms of depression reduced some of the participants in the study reported that the intensity of their anxiety symptoms increased. For example, Jasmine said,

"I've had less anxiety attacks, but when I've had them they've been worse… Yeah they've taken a lot more energy out of me to calm them down. Think [after] every one I've gone home… I prefer to have them every few days and not have them as bad, than have them once every few days and have them bad" (Jasmine, full treatment responder).

After treatment India said that she felt a new lease of life, experiencing more enjoyment, fulfilment and motivation. However, this made her also feel more anxious and worried about relapsing into feelings of boredom and depression.

"Yesterday like every hour five things were added to the list of things because I kept on picking them up because if I find myself with nothing do then I might get a little bit bored, then I might get a little bit down so I try and put too many things on my plate, but then with that I do get a bit more anxious, a bit more stressed…I think there's still a bit of a way to go, just because now I'm happier, so to speak, I'm more anxious about things, 'cos I'm thinking about school work more and think about the future a lot more (India, full treatment responder)."

Discussion

This study explored adolescents' experiences of Brief Behavioural Activation treatment for depression. The young people who took part in this study were referred to a UK NHS child and adolescent mental health service and had received a primary diagnosis of depression at assessment. Brief BA is a positively focused treatment, focusing on making small but important changes to improve a young person's experience of life. The main aim of Brief BA treatment is to increase positive reinforcement for healthy behaviours through identifying intrinsically rewarding activities (Pass et al., 2015). Therefore, given the theoretical specificity of positive reinforcement (a core component of Brief Behavioural Activation) on mood and behaviour we were interested in participants' accounts of the impact of Brief BA treatment on their experience of anhedonia. Broadly speaking, adolescents self-reported questionnaire scores reflected their level of anhedonia and depression severity and improvement described during interview. Younger participants did less well than older participants; but it was unclear if this related to developmental factors or differences in their individual experiences.

Thematic analysis of semi-structured interviews after treatment ended yielded a number of themes. Those who experienced a positive shift in mood and motivation typically attributed this to a combination of specific Brief BA strategies such as connecting with values and taking part in valued activities even when unmotivated as well as generic psychotherapy processes, of self-monitoring and goal setting. Adolescents identified learning processes (e.g. discovering values) and practical applications of strategies learned from therapy (e.g. acting despite feelings). It is important to note that this form of BA (Brief BA; Pass et al., 2015) is based on one of the two main contemporary BA approaches, BATD (Lejuez et al., 2001, 2011). While the BA intervention developed by Martell et al., (2001, 2010) shares the same underlying behavioural principles as BATD (Lejuez et al., 2001, 2011), it does not include explicit focus on values and also includes additional treatment components (e.g. a more comprehensive formulation, greater focus on avoidance behaviours). Therefore, adolescents may report slightly different experiences of non-values-based BA and the impact on their symptoms of anhedonia.

When successful, the strategies in Brief BA helped address challenges in all parts of the reward system, namely anticipatory pleasure and expectations, approach motivation, approach behaviour, in the moment pleasure, and learning/ integrating information (as outlined in Figure 2). For most participants, strategies such as 'identifying values' and 'reflecting on experiences' were identified by young people as some of the most helpful strategies that resulted in the most change, particularly with increasing their motivation and their feelings of pleasure in the moment. Other strategies such as breaking down goals and linking feelings and behaviours helped 'kickstart' their movement towards positively reinforcing activities, with the hope that once there, they would feel pleasure in the moment. Reflection, connecting with values, and taking ownership of recovery in the long term all helped adolescents to learn from their experiences, and led them to think and act differently

moving forwards beyond their time in therapy. Concepts such as developing autonomy were also identified in a qualitative study exploring adolescents' changes after Psychodynamic Therapy (Løvgren et al., 2019) and so likely play a role in a number of treatments.

For the younger adolescents in this study who did not respond to the treatment (Ivy and Alice), it is possible that they were less able to engage with these approaches to begin with (i.e. identifying values) and/ or that they were less able to translate what they had experienced (i.e. I felt better when I saw my friends even though I didn't want to) to other situations beyond therapy. It is also possible that Brief BA may lack the components needed to elicit change in anhedonia for some young people. Further quantitative research is needed to understand the specific mechanisms of change in BA, for immediate and longer-term recovery.

Particular barriers prevented some adolescents from fully benefitting from the treatment. Academic pressures, reduced energy and motivation, and lack of support from others all acted to prevent or reduce an increased sense of momentary pleasure and positive affect. Another important barrier to engaging in treatment was the perception that academic demands were currently their highest priority. Academic pressures meant that the positive emotions they would typically feel when engaging in a non-academic activity were dampened due to feelings of guilt and pre-occupation with what they felt they *should* be doing, which also stopped them from *wanting* to do anything other than work.

Adolescents also identified that some symptoms of depression, namely motivational anhedonia and fatigue, interfered with treatment engagement. Lack of motivation and energy were direct barriers to wanting to, and actually engaging in, activities. This lowered satisfaction and positive affect, because pushing past the low motivation led to a sub-optimal performance, which did not elicit positive feelings of achievement and satisfaction, and consequently was not positively reinforcing. It would be interesting to assess if adolescents

who report ongoing motivational difficulties at the end of treatment had specific difficulties engaging with Brief BA strategies.

For most participants, other people supported their engagement in treatment and helped mitigate problems with low motivation. Feeling supported by others acted as a motivator, helping adolescents to want to engage in activities and also to physically put effort in to take part. In contrast, one participant (Alice) took part in the therapy and completed homework tasks at the request of a parent, meaning she acted out of a sense of obligation, and was not being driven by future feelings of reward, and as a result these experiences were not positively reinforcing. When asked, all adolescents described having a positive relationship with their therapist, however the therapeutic alliance did not feature strongly within participants' narratives. However, it is likely that a good relationship was a necessary underlying factor which enabled participants to engage in the specific therapeutic strategies discussed, as participants did not make negative comments about their relationship with their therapist.

A number of participants experienced both depression and anxiety prior to treatment. For some individuals they felt generally happier and more positive after treatment, which may support Kashdan's (2007) work on the presence of positive affect dysregulation in anxiety. However, the impact of Brief BA on anxiety needs to be explored in future work. For a minority of participants feelings of anxiety and apprehension were both a barrier and a potential side effect of Brief BA treatment, even in the context of successful therapy. Feeling anxious or uncertain resulted in feelings of nervous apprehension in advance of an activity (even if they thought they would find it pleasurable), or uncertainty about wanting to engage in therapy early in the process. During treatment, this was likely due to a hesitancy to engage in activities that would elicit both anxiety and pleasure simultaneously i.e. spending time in town with friends (something that was enjoyed) and being in a crowded place (which made

her feel anxious). Therefore, in some instances fear could over-ride adolescents' willingness to engage in an activity and/ or their ability to feel more happy/positive when taking part. A minority of young people who experienced less depression after treatment reported increased anxiety and apprehension about the future, and about the possibility of relapse. Their accounts suggest that for some participants, relief from symptoms of depression may unmask more subtle symptoms of anxiety. It is plausible that after a prolonged period of depression and of not caring about the future some adolescents felt excited about what was to come but they were also apprehensive about what they had missed out on, and about what they were going to do next. Given that co-morbid anxiety disorders and depression are common, additional focused interventions for anxiety or modular treatments for commonly co-occurring mental health conditions may also be useful (e.g. Chorpita & Weisz, 2009)) as might greater focus on strategies identified in transdiagnostic treatments to increase positive affect (e.g. Craske et al., 2016).

In comparison to their reports of anhedonia prior to treatment (see Watson et al., 2020) most participants reported improvements in 'enjoyment in the moment' and 'looking forward to experiences;' as well as feeling generally more hopeful, optimistic and positive about the future. Before treatment some participants found it hard to imagine a positive future for themselves, particularly in the short term. In the longer term many had goals or things they wanted to achieve, but did not necessarily attach these to feeling happy and positive. After Brief BA, several participants felt more positive about the future. Roepke and Seligman (2016) have suggested that imagining a positive future requires experience of a good past; therefore after Brief BA, participants positive experiences in (and out of) therapy (i.e. identifying values, acting in line with these values, feeling more positive), might have helped adolescents build an image of a more positive future. It is important to note that for some participants clinical improvement was short-lived and thus participants may have benefitted

from additional or alternative strategies. A number of treatments have been recently developed to specifically target anhedonia in depression (Augmented Depression Therapy (ADePT; Dunn et al., 2019) and across disorders (Positive Affect Treatment (PAT; Craske et al., 2016, 2019) and these may contain elements could be adapted for adolescents and incorporated into Behavioural Activation.

In comparison to their experiences before treatment, many participants experienced a greater sense of purpose and connection with others, especially in allowing others to support them. The motivational component of reward i.e. wanting to do things/putting in effort (motivational anhedonia) sometimes increased in line with other aspects of reward, however, sometimes (and for specific individuals) low motivation and/or fatigue was a primary barrier to engaging in therapy, experiencing positive reinforcers, and therefore to any improvement in anhedonia and other symptoms of depression. This difficulty suggests that when low motivation prevents young people from engaging in positively reinforced behaviours, explicit and targeted strategies to increase motivation should be incorporated in psychological treatments for adolescent depression. It would be beneficial to understand specific mechanisms that are blocking the repair of anhedonia in adolescents. For example, it might be helpful to target cognitions that reduce positive affect, such as dampening appraisals e.g. "this is too good to last" and enhance motivation (Dunn et al., 2018; Yilmaz et al., 2019).

A strength of this study is that participants were recruited from a publicly funded mental health service in the UK and their diagnosis of depression was confirmed using the gold standard K-SADs semi-structured clinical interview. This is the first study that has focused on adolescents' experiences of anhedonia after a structured, standardised psychological treatment. The research team had a broad range of expertise, including clinical psychologists who developed Brief BA [LP and SR] as well as non-clinical researchers [RW, KH and CM]. It is important to note the possibility of researcher allegiance bias. However,

the first author and two other authors have no allegiance towards this treatment approach. In addition, diagnostic assessments and therapy were delivered and collected independently of the research team. Limitations of the sampling included a lack of geographical and ethnic diversity. This study also included a modest sample size. We employed a reflexive thematic analysis approach (Braun & Clarke, 2019a) which suggests that concepts of saturation are not consistent with the values and assumptions of reflexive types of Thematic Analysis and are not coherent with a post-positivist perspective to scientific discovery (Braun & Clarke, 2019b). However, we acknowledge the possibility that other divergent views could have been captured with a larger sample, and this may have enabled us to garner a more nuanced understanding of the experiences of treatment responders and non-responders. As participants in this study were recruited from an outpatient community service, further exploration is needed into adolescents' experiences of Brief BA and its impact on anhedonia in young people with more severe depression. In addition, because the focus of this study was on anhedonia, the effect of Brief BA on other symptoms depression (e.g. suicidal ideation or cognitive disturbances) was not explored.

Conclusions

Anhedonia is a core symptom of depression that has been identified as having an important role in maintaining depression maintenance and in relapse. Depressed adolescents who received Brief BA treatment described changes in their enjoyment, excitement and motivation after treatment, as well as potential treatment barriers of anxiety, fatigue, academic pressures and motivation. Young people also identified specific Brief BA strategies (such as reconnecting with values) and more generic therapeutic strategies (such as self-monitoring) as helpful ways to reduce their experiences of anhedonia.

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5.1. Supplementary Material

Section A. Topic Guide

Since taking part in treatment, have there been any changes in how much you enjoy things?

If yes,
- How has your enjoyment changed?
- What caused it to change?
- What would make you enjoy things more?
- Is there anything that stops you enjoying things? (what is going through your head? how long does that feeling last? how long have you been having that experience?)

If no,
- If no, why do you think that is? What do you think would change your enjoyment?

Since taking part in this treatment, have there been any changes in how much you feel motivated to do things?

If yes,
- How has your motivation changed?
- What caused it to change?
- What would make you feel more motivated?

If no,
- If no, why do you think that is? What do you think would change your motivation?

Since last time we spoke, have there been any changes in how much you take part in things? (I.e. hobbies, spending time with others, school work)

If yes,
- What are you taking part in more/less? Why?
- Do you ever have to force yourself to do things? (How would you feel if you took part?)

If no,
- Are you happy with the amount of activities you do?
- Would you like how much you take part in things to change?

Since we last spoke, have there been any changes in how excited you get about things?

If yes,
- How has this changed?
- What caused it to change?
- What would make you feel excited?

If no,

- If no, why do you think that is? What do you think would make you feel excited?

Are there times now when nothing seems fun/ or things seem less fun than you would expect?

- How did this make you feel?
- What do you do when you feel like this?
- Does anything change this feeling?
- How does this compare to the feelings you had before BA?

Overall, how did you find taking part in BA?

- What did you like about it?
- Was there anything that you found helpful/unhelpful?
- Was there anything specific about BA that changed how you felt? Or what you did?
- Was there anything you would have found helpful but didn't learn about?

How do you feel about the future?

- Have you got anything planned?
- Would you like to receive more support in the future?

How do you feel in yourself at the moment (today)?

Section B. Training for Delivering Diagnostic Assessments

Assessors, all psychology graduates, were trained to administer and score the ADIS-C/P and K-SADS through verbal instruction, listening to assessment audio-recordings, role-play and participating in diagnostic consensus discussions. Assessor competence was evaluated using an observed structured clinical assessment, which was scored by the trainers. Once trained, all assessments were discussed in supervision with an experienced member of the assessment team, to agree on consensus diagnoses.

Assessment supervisors completed reliability based on independent supervision ratings to ensure consistency across supervision. For the K-SADS, diagnoses were based on the combined information obtained from both interviews. Inter-rater reliability for presence of a K-SADS depression diagnoses was k = 1.00. For the ADIS-C/P, as is standard, overall diagnoses and clinical severity ratings (CSRs) were assigned if the child met diagnostic criteria on the basis of either the child or parent report, and the higher CSR of the two was taken. Following convention, only those with a CSR of ≥ 4 (moderate psychopathology) on a scale from 0 (complete absence of psychopathology) to 8 (severe psychopathology) were considered to meet diagnostic criteria. Reliability for presence or absence of anxiety diagnosis on the ADIS-C/P was $\kappa = 1.00$, and CSR ICC = 0.93.

Section C. Table Displaying the Qualitative Themes, Sub-Themes, and Codes

Themes	Sub-themes	Codes
THEME 1: Connecting, reviewing and taking action: *'Focus on getting better rather than what you're feeling'*	**Connecting with what's important '*I just didn't realise I valued it*'**	Reconnecting with others and what you used to enjoy Increasing focus and having something to aim for Proving something to yourself or others Recognising your personal values Struggling to identify what's important
	Actively reviewing feelings and behaviours: *'Why's it going well?'*	Taking the time to reflect and see things differently Gaining perspective Actively processing what's been learnt Not reflecting and internalising the treatment process Applying skills and knowledge long term
	Exploring the link between feelings and behaviours: *'If I'm not feeling so great I'll do it anyway'*	Changing the association between feelings and actions Understanding the cycle of positive reinforcement Acting despite feelings Understanding the treatment purpose Taking the emotion out of decision making
	Being proactive and taking ownership of recovery: *'I need to learn to do things for myself'*	Taking ownership of your recovery Experiencing a sense of control Being proactive and making the most of opportunities Building confidence and self-belief
	Taking a structured, goal-orientated approach: *'Breaking it up into smaller bits helped'*	Creating manageable and achievable goals Building new habits and routines Learning to use time effectively Having a specified plan in place Taking a practical approach
		Feeling physically fatigued

THEME 2: Struggles, restrictors and motivators: *'it seemed really unachievable'*	**Struggling to get past low motivation and fatigue: *'I couldn't be bothered'***	Feeling unmotivated Feeling physically ill Difficulty concentrating or remembering Mood getting in the way of motivation Feeling emotionally drained
	Being restricted by academic pressures: *'Forget everything else, exams are your life'*	Not engaging in activities due to exams Feeling overwhelmed by school work Not having time to engage with therapy
	Pushing past hesitancy, anxiety and self-doubt: *'Do I wanna get into this right now?'*	Being worries about crowds of people Being worried about approaching others Concern around opening up to others Self-doubt
	Feeling encouraged and motivated by others: *'You can't give up now!'*	Feeling encouraged by others Receiving emotional support Positive therapeutic relationship Being open and honest with others Being given practical support Lack of encouragement from others Expectations of others Not letting other people down Trying to please others

THEME 3: Feeling, acting or seeing things differently: ***'Looking forwards in a more healthy way'***	**Experiencing enjoyment, excitement and optimism:** ***'Before it was more a chore and now it's more a hobby'***	Finding experiences more enjoyable rather than a chore Experiencing a more typical level of boredom and disinterest Experiencing a temporal shift in enjoyment Appreciating experiences more in the moment Feeling happier and more positive Excitement and looking forward to experiences Seeing self in the future Feeling inspired
	Feeling motivated, active and energised: ***'I find it a lot easier to get out of bed every morning'***	Being more active Doing things I didn't do before Increased motivation Having more energy
	Experiencing no shift or a transient reduction in anhedonia: ***'I've gone down to zero'***	Experiencing low mood Experiencing low energy and motivation Experiencing no enjoyment or excitement
	Experiencing increased anxiety as anhedonia (and depression) subside: ***'Now that I'm happier, I'm more anxious'***	Experiencing changes in levels of anxiety A sense of apprehension towards the future

Chapter 6. General Discussion

6.1. Summary of thesis rationale

Anhedonia is a key symptom of depression (APA, 2013), predicts outcome from treatment (McMakin et al., 2012), and is experienced by half to three quarters of adolescents with diagnosis of Major Depressive Disorder (e.g. Goodyear et al., 2017; Orchard et al., 2017). However there is little known about how adolescents experience anhedonia, how anhedonia is implicated in treatment, or how to measure the symptoms of anhedonia in young people. The work described in this thesis attempts to address these gaps in the literature by improving our understanding, measurement and treatment of anhedonia.

Anhedonia is increasingly understood to be a complex and multifaceted construct (Winer et al., 2019). On the basis of neuroscientific discovery, research has begun to differentiate the different facets of reward, particularly making distinctions between consummatory (i.e. in the moment) pleasure and anticipatory (i.e. looking forward) pleasure (e.g. Berridge & Kringelbach, 2015), as well as considering the motivation needed or effort taken to reach something pleasurable or rewarding (e.g. Kring & Barch, 2014). How these distinctions, observed at a neural level, translate onto the self-reported experience of losing interest and/or pleasure is largely unknown. Anhedonia is also understood to be the loss of positive affect, distinct from the presence of negative affect (Watson et al., 1988). No previous studies have focused on how adolescents describe and understand their experiences or have used qualitative methods to explore the nature of this experience. The aim of Paper 1 therefore was to explore adolescents' experiences of anhedonia in the community and a clinical sample.

Paper 2 addresses a related problem, the measurement of anhedonia via self-report. The majority of tools used in clinical settings to assess anhedonia require individuals to self-

report their experiences. There has been no systematic evaluation of the available self-report measures and their psychometric properties. Paper 2 therefore presents a systematic review and critical appraisal of existing measures of anhedonia, including a consideration of how appropriate these are for use with young people. Paper 3 describes the development and validation of the ASA developed specifically for young people, which uses items generated from their own experiences from Paper 1.

The final section of the thesis considers the treatment of anhedonia. The majority of evidence-based treatments for adults and adolescents are only moderately effective and this may be because they do not directly target anhedonia, the reward system or positive emotions (Craske et al., 2016). For adolescents a brief form of Behavioural Activation treatment for depression (Brief BA) has been adapted, which aims to increase adolescents' engagement with positively reinforcing experience (Pass et al., 2015). Theoretically at least, this treatment would be expected to have a direct impact on reward processing and adolescents' experience of rewards. Therefore, Paper 4 explores adolescents' experiences of Brief BA treatment and examines the extent to which the treatment was associated with changes in anhedonia, reward or positive emotion.

Following this set of research papers this discussion chapter synthesises the main findings of each paper, and collectively considers the strengths and limitations of the studies, and the implications of the findings for our theoretical understanding of anhedonia, progress in the research, and application to clinical research and practice.

6.2. Overview of findings

6.2.1. Paper 1: Understanding anhedonia: a qualitative study exploring loss of interest and pleasure in adolescent depression (Watson et al., 2020)

In this qualitative study adolescents with elevated depression symptoms or a diagnosis of depression described a broad range of difficulties which were captured in four main

themes; loss of joy and a flattening of emotion; struggling with motivation and active engagement; losing a sense of connection and belonging; and questioning a sense of self, purpose and the bigger picture. Adolescents often combined their descriptions of consummatory and anticipatory pleasure but differentiated this 'hedonic' pleasure from motivational processes (i.e. effort and drive). Adolescents' descriptions also overlapped with general accounts of depression reported in other qualitative studies e.g. having a bleak view of everything and feelings of isolation or social withdrawal (Midgley et al., 2015). Furthermore, accounts of anhedonia overlapped with descriptions of low motivation or apathy across disorders.

6.1.2. Paper 2: Systematic review and critical evaluation of anhedonia self-report measures

In this systematic review a search of online databases identified 14 self-report scales assessing anhedonia. For each measure all relevant published research assessing its psychometric properties was identified and then critically reviewed using the COSMIN criteria (Mokkink et al., 2018). Quality ratings and a critical appraisal of the evidence demonstrated conceptual and methodological weakness in existing measures of anhedonia – for example no scales were developed in collaboration with input from both the target population and relevant experts. Certain types of validity were rarely assessed, in particular criterion validity i.e. assessing a scale against a gold standard diagnostic interview and establishing clinical cut-offs to clinical/problematic levels of anhedonia. Of particular relevance to this thesis is that few anhedonia self-report scales had been validated for use with adolescents, and those that had assessed only specific components of reward (i.e. consummatory) or responses to certain types of rewarding stimuli (i.e. social).

6.2.3. Paper 3: Development and validation of a new adolescent self-report scale to measure loss of interest and pleasure: The Anhedonia Scale for Adolescents (ASA)

A new adolescent-specific anhedonia self-report scale was created, piloted and validated with a large sample of adolescents recruited from the community. Questionnaire items were generated based on data from paper 1, with further input received from clinical experts and young people. The scale was piloted with young people to establish its feasibility and acceptability, and adolescents' feedback was incorporated into the selection of items for the final scale. The ASA had good psychometric properties and measures a broader range of difficulties than are typically assessed. A bifactor solution, with one general factor and 3 related specific factors produced the best fit to the data. The new scale (ASA) had high internal consistency, and moderate test re-test reliability. The scale correlated significantly (convergent validity) with measures of depression, negative symptoms of schizophrenia, anhedonia/pleasure and anxiety, and demonstrated incremental validity, predicting depressive group status (high vs. low MFQ scores) above and beyond existing measures validated for use with adolescents (i.e. SHAPS, Snaith et al., 1995; ACIPS-A, Gooding et al., 2016).

6.2.4. Paper 4: A qualitative study exploring adolescents' experience of Brief Behavioural Activation for depression focusing on the symptom of anhedonia

In this qualitative study eight participants from paper 1 who received Brief Behavioural Activation for depression took part in a second qualitative interview after completing an 8-session course of treatment. Adolescents' experiences covered three main themes: 1) connecting, reviewing and taking action; 2) struggles, restrictors and motivators; and 3) feeling, acting or seeing things differently. This study highlighted the potential role of both generic and treatment-specific techniques for increasing positive emotional experience. Most adolescents experienced increased enjoyment, excitement, motivation, and energy after

Brief BA. Barriers to improvements were also identified, particularly the motivational components of anhedonia, fatigue and anxiety.

6.3. Strengths and limitations of the current thesis

A strength of this thesis was the use of different research methods to address a range of related but distinct research questions. The use of qualitative method (papers 1 and 4) enabled an in-depth exploration of individuals' experiences building a foundation for further discovery. This was a novel approach to investigate the symptom of anhedonia. Alongside qualitative methods, the use of quantitative survey methods (paper 3) enabled us to capture the experience of anhedonia in adolescents in the general population and to quantify its relationship with other related constructs. A qualitative approach does not lend itself to disambiguating the components of an experience, but the use of survey methods in paper 3 and the systematic evaluation of existing self-report anhedonia scales in paper 2, provides insight into the statistical grouping of some components of anhedonia and the ability of some scales to distinguish quantitatively between components of anhedonia via self-report.

A further strength of this thesis (papers 1 and 4) was the use of standardised assessments to identify adolescents' diagnostic status, including an assessment of DSM-5 depressive disorders (K-SADS; Kaufman et al., 1997) and other comorbid diagnoses such as anxiety disorders (ADIS; Brown et al., 1994). For clinical participants the depression diagnosis (MDD or PDD) was always the primary disorder, which means that depression was likely to be the main clinical issue. A limitation to sampling diversity was the eligibility criteria for the clinical service, which meant that adolescents with active suicidal ideation or plans were not recruited. This meant that some adolescents with depression, particularly those with more severe symptoms, did not have the opportunity to participate.

There were some limitations associated with the assessment of depression in the community samples (paper 1 and paper 3). Adolescents were assessed for depression on the

basis of a self-report measure, the Mood and Feelings Questionnaire (MFQ; (Angold, Costello, & Pickles, 1987), rather than a diagnostic interview (e.g. K-SADS, Kaufman et al., 1997). Although the MFQ is not a diagnostic tool, it is considered to be the gold-standard self-report measure of adolescent depression. The MFQ has good diagnostic accuracy based on the recommended cut-off score (Wood et al., 1995), therefore it provides a good indication of the presence of depressive symptoms. Conversely, the identification of community participants based on the MFQ (paper 1) could be viewed as a strength of the study, as it meant that study sampling did not rely too heavily on the use of one tool to identify depression. The purpose of the thesis was to understand the core nature of anhedonia in adolescents' own experience, and existing tools (e.g. K-SADS, Kaufman et al., 1997; MFQ, Angold, Costello, & Pickles, 1987) are limited in their measurement of anhedonia; therefore, by using different tools it may have helped capture a greater breadth of anhedonic experience.

A strength of recruiting young people from the community was that a large pool of adolescents was recruited. This was facilitated by the use of parental opt-out consent, which is recommended to maximise student participation and increase demographic variability (Eaton et al., 2004; Liu et al., 2017). A potential limitation of community samples was the recruitment of participants from selective grammar schools, alongside mixed comprehensive schools, as pupils attending grammar schools are unlikely to be representative of the general adolescent population. Other limitations were present in the sampling characteristics for example socioeconomic status (SES) and ethnic diversity. A proxy of social economic status, eligibility for free school meals, identified that of seven schools from which students were recruited only one had a greater number of pupils receiving free school meals than the national average. Diversity of gender, age and ethnicity was representative of the community in the survey data (paper 3) and some diversity was present in the first qualitative interview study (paper 1). However, the participants who took part in the qualitative interview after

treatment (paper 4) were predominantly female and all participants were white British adolescents.

Limitations of the systematic review and critical analysis paper should also be considered. Firstly, the breadth of measures included within the review. It could be argued that the inclusion criteria were too narrow, and therefore potentially relevant scales were not considered. This meant that scales developed to assess a construct which captures a core element of anhedonia i.e. low positive affect, were not included despite their potential use for assessing a component of anhedonia. Secondly, questionnaire variants and scoring methods have been conflated. This meant that it was not possible to establish the psychometric properties of shorter and longer versions of self-report measures independently, despite potential differences. Lastly, it is important to consider whether the COSMIN checklist is fit for purpose. COSMIN is intended to aid researchers in systematically evaluating the psychometric properties of self-report scales, however, a number of criteria are not included which would be useful to assess in order to establish the properties of a scale i.e. distribution of scores, availability of normative data, and length.

6.4. Broader implications and recommendations for future research

6.4.1. Implications for understanding the concept of anhedonia

The results of this thesis provide new and theoretically important insights into the subjective experience of anhedonia in adolescents.

Anhedonia as a broad and multifaceted construct. According to the DSM-5 criteria for Major Depressive Disorder, anhedonia is a marked loss of interest and/or pleasure (APA, 2013). This thesis highlighted how adolescents with a depressive disorder or elevated depression symptoms described and endorsed a broad and varied range of reward related difficulties including boredom, emotional flattening, demotivation and lack of effort. This broader experience captures difficulties with multiple aspects of reward processing in

individuals with depression and anhedonia, such as motivation for reward and the anticipation of future rewarding experiences. Understanding the experience of anhedonia as a multifaceted construct supports evidence from neuroscience which suggests that anhedonia is made up of a number of reward related components (e.g. Berridge & Kringelbach, 2008; Rømer Thomsen, 2015). Although there is some disparity in the literature at the neural and behavioural level as to whether consummatory components of anhedonia are impaired in depression (e.g. Dichter et al., 2010), the results reported in this thesis are consistent with previous research using self-report measures, which have repeatedly found that depressed individuals experience reduced positive affect and reduced approach motivation (e.g. see Dunn, 2012; Rømer Thomsen et al., 2015). This contrasts with studies using Experience Sampling Methods (ESM) which capture, in real time, what people do, feel and think in their daily lives. ESM studies with adolescents or young adults have found that individuals with higher levels of depression enjoyed pleasurable events as often as those without elevated depressive symptoms, but experienced greater variability in positive affect (van Roekel et al., 2016; Heininga et al., 2017). These differences suggest that even within self-report measurements each method is capturing a slightly different construct, or experience of anhedonia. Future research could look across multiple types of self-report to establish whether adolescents do indeed experience less pleasure in daily life or whether these feelings predominantly emerge when looking back and remembering.

Anhedonia and related constructs. This thesis has also highlighted the importance of understanding concepts that are closely related to the construct of anhedonia. Qualitative descriptions of anhedonia (paper 1) overlapped with feelings of hopelessness, and behaviours such as social withdrawal or detachment. They also overlapped with descriptions from the DSM-5 for the symptoms of fatigue (‘even the smallest tasks seem to require substantial effort’); suicidal ideation (passive ideation i.e. ‘what’s the point?’; ‘an inability to foresee any

enjoyment in life'); and low/depressed mood (empty, 'blah') (American Psychiatric Association, 2013). Therefore, questions still remain unanswered as to whether anhedonia does (or should) encompass all reward related difficulties in depression, or if in fact there are a range of symptoms or experiences that are linked to reduced reward responsiveness, in which anhedonia is the most closely related. Qualitative interviews and self-report scales are useful tools to help understand clinical experiences. With a construct like anhedonia which is complex and multifaceted, I would argue that the most useful next steps are to understand how each anhedonia questionnaire relates to similar or overlapping constructs and for new measures to capture any gaps in these experiences, rather than to set standards for how closely related anhedonia 'should' be similar or overlapping constructs.

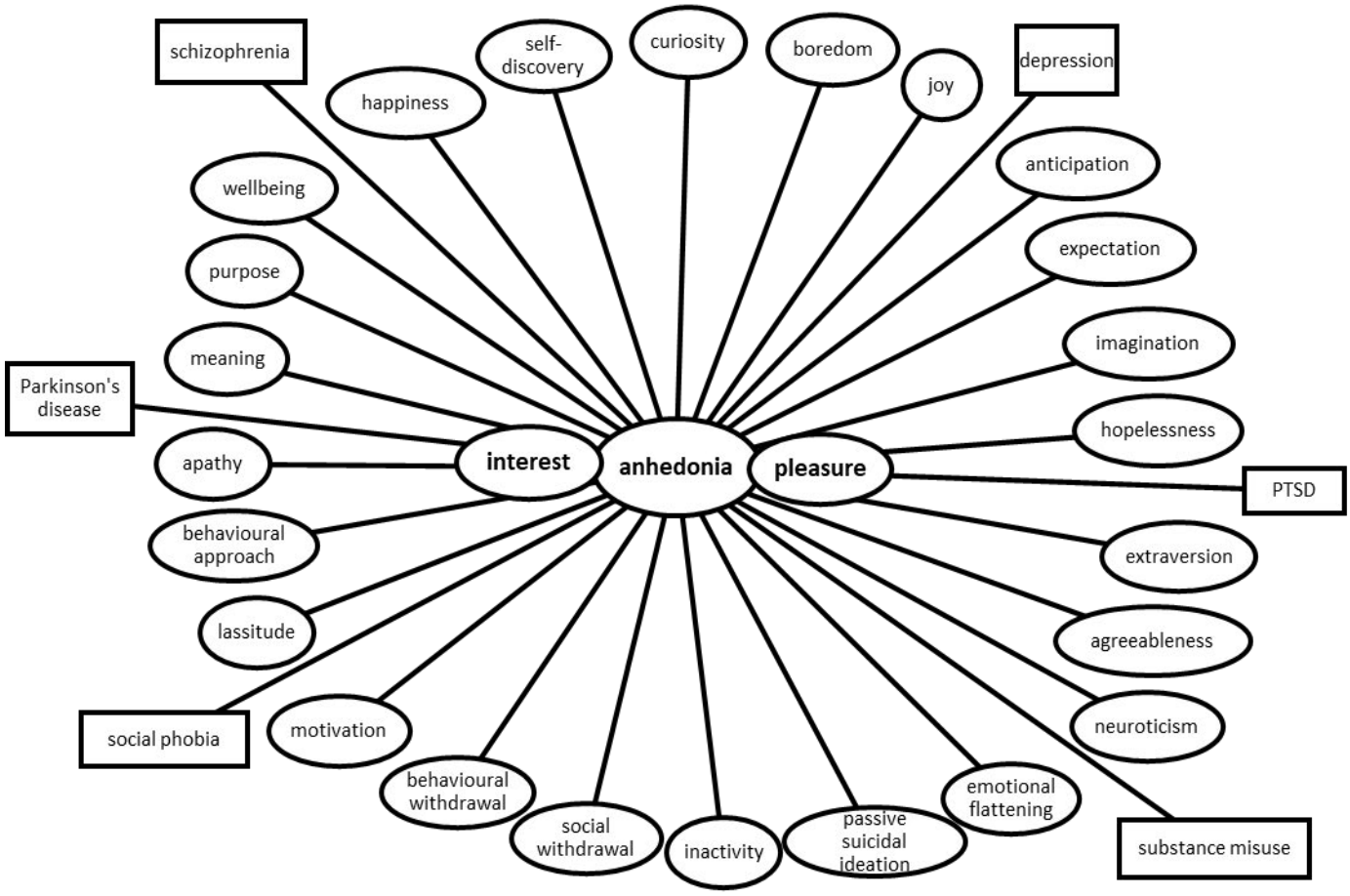

Figure 1. Displaying constructs related to/ overlapping with anhedonia in circles, and disorders in which anhedonia features in squares.

As displayed in Figure 1, self-reported anhedonia is related to a broad array of clinical, personality and behavioural characteristics. Our systematic review and critical evaluation may help to build an understanding of the nomological network of self-report anhedonia scales through pooling results across studies to understand the strength of relationships between anhedonia scales i.e. TEPS (Gard et al., 2006) and other similar constructs. Previous work has already begun to consider these conceptual overlaps. Leventhal et al., (2006) conducted a confirmatory factor analysis with three widely used scales (SHAPS, (Snaith et al., 1995); FCPCS, Fawcett et al., 1983; CPAS, Chapman et al., 1976) designed to assess anhedonia/ hedonic capacity. Items from the SHAPS and FCPCS

(although to a lesser degree) loaded onto a hedonic capacity factor, with minimal relation to constructs of depression and anxiety (BDI, Beck et al., 1988; BAI, Fydrich et al., 1992). In contrast, the CPAS had a small positive loading onto a depression factor, but no relationship with hedonic capacity or anxiety. This suggests that even among widely used measures, each potentially captures a different latent construct and relationship with broader measures of clinical disorders i.e. depression/anxiety. A more recent study (Olino et al., 2018) investigated the multidimensional structure of anhedonia, reward sensitivity and positive emotionality, by conducting exploratory factor analyses on 17 dimensions relevant to approach motivation, spanning anhedonia, behavioural activation system functioning and positive emotionality. A five-factor solution produced the best fit to the data, dissociating: assertiveness, sociability, positive emotions, pleasure seeking and behaviour activation. Most anhedonia measures loaded onto positive emotion and pleasure-seeking factors, with behavioural activation scales loading onto its own factor, and social anhedonia/closeness scales an additional factor. Moving forwards, researchers should continue to build a conceptual network of anhedonia self-report measures to understand the similarities and differences between the concepts measured by different self-report scales.

Anhedonia and wellbeing. Research reported in this thesis identified key conceptual overlaps between anhedonia and the broader construct of wellbeing. Conceptually, there has been a long-standing view that wellbeing or happiness contains two crucial elements 1) positive affect or pleasure (hedonia) and 2) a sense of meaningfulness or engagement in life (eudaimonia) (e.g. Berridge & Kringelbach, 2011). Keyes (2005) identified that being mentally "well" (i.e. not just experiencing the absence of mental health problems), includes high levels of *hedonia*, consisting of 1) positive affect over the past 30 days and 2) overall happiness or life satisfaction; and high levels of *positive functioning* which includes self-acceptance, social acceptance, personal growth, social actualisation, purpose in life, social

contribution, environmental mastery, social coherence, autonomy, positive relations with others, and social integration. A number of these constructs were related to adolescents' qualitative descriptions of anhedonia (paper 1) and formed the basis of item generation for the ASA (paper 3). The positively framed ASA subscale captures concepts such as purpose and meaning, which may, in part, be tapping into the concept of eudaimonic happiness or wellbeing. Most research focuses on pleasure *or* wellbeing, however due to their clear overlap and importance for positive feelings more generally, it might make sense to consider both concepts more readily within measures and treatments for anhedonia, for example the ADepT pilot RCT (Dunn et al., 2019), a new treatment aimed at increasing positive affect as well as reducing negative affect in depression, includes measures of both anhedonia (e.g. SHAPS), wellbeing (e.g. WEMWBS, Tennant et al., 2007) as well as severity of depression symptoms (e.g. PHQ-9, Kroenke & Spitzer, 2002).

Positive and negative emotionality. This thesis has also explored the role of positive and negative emotionality in relation to anhedonia. Our exploratory work highlighted that participants or patients do not experience emotions as isolated, or discrete entities, instead they recognise them as overlapping and ambiguous experiences (Posner et al., 2005). Therefore, understanding depression as a cluster of discrete symptoms may not always reflect the complex nature of an individuals' experience.

Although the reward system underlies the feelings of pleasure and approach towards a rewarding experience, the research reported in this thesis has also highlighted the importance of understanding anhedonia as a concept of 'loss' and absence, or inability to experience pleasure. The RDoC initiative highlights the link between anhedonia and both the positive and negative valence systems (NIMH, 2011) therefore exactly where anhedonia sits along the spectrum of pleasant to unpleasant is still unclear. In our qualitative research, anhedonia was described as a general lack of affect rather than just a lack of 'pleasure and interest.' When

probed, adolescents often said that this affective flattening occurred in response to negative as well as positive events or experiences, despite concurrently experiencing high levels of negative affect, particularly sadness, anxiety and frustration (Paper 1).

Evidence from this thesis may therefore lend support to the Emotion Context Insensitivity (ECI) theory of depression (Rottenberg, 2005) which hypothesises that individuals with depression experience a blunting of emotion in response to both positive and negative stimuli (Bylsma et al., 2008; Rzepa et al., 2017). Therefore, further questions remain unanswered as to whether anhedonia should encapsulate a complete loss or blunting of emotion. De Fruyt et al., (2020) posited that anhedonia may be experienced on its own or as part of a more general blunting of emotions and affect, including a paralysis of feeling and derealisation, which is in line with adolescents' qualitative reports (Watson et al., 2020).

However, when assessed quantitatively, scores on our new measure of anhedonia, the ASA, were moderately correlated with measures of behavioural inhibition and negative affect, as well as with low positive affect. It is unknown whether this is due to issues with the measures themselves, either of BISBAS (Carver & White, 1994), a child version of the PANAS (Ebesutani et al., 2012) or the ASA (Watson et al., in press.), or whether in fact these constructs are more or less related than previously thought.

Anhedonic mood vs. emotional reactivity. A further conceptual consideration that has arisen from this thesis is whether to treat anhedonia as a mood state i.e. a pervasive loss of positive mood, or as an emotional state i.e. loss of pleasurable reactions in response to something positive or rewarding (Rosenberg, 1998). Most self-report scales assess anhedonia as the latter, a loss of emotional reactivity (i.e. TEPS, Gard et al., 2006; SHAPS, Snaith et al., 1995), but subscales of broader clinical measures, such as the Anhedonic Depression Scale (ADS) from the Mood and Anxiety Symptom Questionnaire (MASQ) assesses an anhedonic mood or loss of positive mood state (e.g. Kendall et al., 2016; Watson et al., 1995).

The new scale developed as part of this thesis, the ASA (Watson et al., in press), captures anhedonia as more of a lasting state, which encapsulates a diminished zest for life and feeling of energy, alongside other experiences. This approach was taken as it reflected the experiences that described in qualitative interviews (paper 1). Participants differed in their liking of or preference for activities such as socialising with friends, sports or learning/ school work, but when describing loss of interest and pleasure, they described a global loss of positive feeling, rather than explicit changes towards specific activities or experiences. When anhedonic symptoms are assessed by clinicians, they rely on the patient's verbal account, which may be more applicable for assessing general mood and trait like experiences, rather than recalling memories of specific emotional reactions. In line with this differentiation between mood and emotion, De Fruyt et al., 2020 suggested that conceptualising anhedonia as low positive affect may be more accurate for understanding anhedonia as a mood state, whereas, the pleasure cycle, may lend itself more to describing lack of positive emotions as discrete, shorter, experiences. The findings from this thesis lend some support to this approach and I would iterate that understanding both is useful and informative for developing our understanding of this symptom. However, it is important to recognise that these differences are likely to result in researchers capturing different experiences, and thus lead to variation in research outcomes.

6.4.2. Implications for understanding developmental and group differences in anhedonia

Adolescent development. This thesis contributes to our understanding of anhedonia within its developmental context. As discussed previously, less is known about the symptom of anhedonia in adolescents than in adults. No previous studies have explored the experience of anhedonia in adults or young people qualitatively so it is not possible to compare the nature of their concerns or experiences over time or between different studies. However, the broad nature of adolescents' descriptions of anhedonia are similar to some quantitative self-

reported or behavioural experiences endorsed by adults with depression (e.g. Halahakoon et al., 2020; Rizvi et al., 2016) and with adults' descriptions about their quality of life when they are feeling depressed (e.g. Zimmermann et al., 2018).

All self-report methods used in this thesis (i.e. qualitative interviewing and self-report scales) require adolescents to reflect on their current and past experiences, which may present a challenge because adolescence is a time when introspective abilities are still developing (Blakemore, 2018). Adolescence is also a time when individuals are encouraged to think about their future, particularly in relation to careers and academic choices (Blakemore, 2018). Adolescents recruited through a clinical service and the community described feeling a loss of enjoyment, excitement and anticipation for the future, but generally speaking, their long-term goals for the future remained intact. Research with adults has found that individuals with depression and high levels of hopelessness report a similar number of goals to those with lower levels of hopelessness, but they do not believe that they will achieve their goals (Hadley & Macleod, 2010). Given the theoretical proximity of anticipatory anhedonia to hopelessness, it would be interesting to explore temporal differences in excitement, anticipation or drive in the short and long term in the context of anhedonia, and whether this differs across the lifespan.

Although not unique to the adolescent period, the important role of motivation in experiencing pleasure and positive affect was highlighted within this thesis. The teenage years are associated with heightened reward seeking (e.g. Shulman et al., 2016) but also high levels of boredom and apathy (e.g. Spaeth et al., 2015), which can make it difficult to distinguish normal teenage development from problematic levels of anhedonia or reward-related symptomology. Auerbach et al., (2017) suggested that the initial onset of anhedonia in young people is likely to be characterised by reduced energy and diminished motivation, and subsequently by behavioural withdrawal that then manifests into the broader features of

anhedonia. We developed the ASA specifically for adolescents with a number of items relating to low motivation or a general sense of apathy that were characteristic of adolescents' qualitative experiences. Paying particular attention to the motivational aspects of anhedonia is likely to be important for young people's academic as well as social development. Important decisions and actions made during adolescence are guided by young people's likes/dislikes, their imagination of future rewards, and their willingness to exert effort to reach these future rewarding experiences. Therefore, measurement of multiple facets of pleasure and reward is crucial for understanding and supporting young people in making the best life course decisions.

Additional information collected by the ASA asked adolescents about anything that had stopped them from feeling positive [chapter 4 addendum]. Young people particularly highlighted academic pressures as the main catalyst, indicating some age-specific concerns related to feelings of anhedonia and loss of positive mood. Therefore, understanding anhedonia in adolescents in the context of anxiety and stress (Pizzagalli, 2014) may be a particular avenue of future research with potential implications for education.

Age and gender related differences. Age and gender related differences in anhedonia were identified. Our systematic review and critical evaluation of self-report scales highlighted that a number of scales regularly used to assess adolescent anhedonia are not age-appropriate. For example, some scales contain items around sex or sensory items such as "the sound of the crackling fireplace", the "sound of the rain", or "reading the newspaper", which are unlikely to be relevant for this age group (e.g. Gard et al., 2006). Furthermore, the ACIPS, which has been specifically adapted for adolescents, has differences in the factor structure between the adult and adolescent versions. This raises questions as to whether anhedonia is actually experienced in a different way by adolescent and adults, or whether this is the result of adapting the adult scale for adolescents.

To understand group differences, such as age or gender, it is important to perform an assessment of measurement invariance. Our systematic review and critical evaluation of self-report scales (paper 2) revealed that an assessment of measurement invariance was very rarely performed before reporting on group differences. This limits our understanding of how the construct measured in the scale is similar or different across groups. For example, the assessment of measurement invariance across genders would help to elucidate whether any differences in mean scores relate to actual gender differences rather than to social differences in how young people complete questionnaires or report on their feelings. Fuller investigations of cross-cultural comparisons are also needed to understand whether scales capture a universal construct/ set of constructs.

Potential differences may exist in how adolescents' experience anhedonia as they move through the adolescent period. When measured cross-sectionally using the ASA (paper 3), anhedonia was higher in older adolescents. In addition, and similar to self-reported measures of depression symptoms, anhedonia scores were higher in females than males (NHS_Digital, 2018). Overall, older adolescents reported higher levels of demotivation than emotional flattening on the ASA, particularly in males, and ASA scores correlated strongly with self-reported apathy (SNS, Dollfus et al., 2016). Interestingly, the pattern of scores across the developmental period was much less clear in males, whilst in females anhedonia scores were positively associated with age. However, an assessment of measurement invariance of ASA scores across age and gender is necessary to understand potential group differences. A next step for the validation of the ASA is to explore age and gender differences in adolescents' experiences. From the current work, adolescent males scores were lower (less anhedonic) than females, but the pattern across age was not as clear as in adolescent females, suggesting there are important gender differences in the experience of anhedonia, or the interpretation of self-report scales. More longitudinal studies assessing

anhedonia within individuals across the time course of adolescence would also help describe the developmental trajectory of anhedonia.

6.4.3. Implications for research investigating anhedonia and reward-related difficulties

Measuring sub-components of reward. A number of sub-components of anhedonia and reward have been identified from neuroscience, most notably the distinction between 'wanting' processes driven by dopaminergic projections in the mesolimbic pathway, and 'liking' processes associated with opioid, endocannabinoid and GABA neurotransmitter systems (e.g. Berridge & Robinson, 2003). The research within this thesis offers insight into whether these subcomponents are accessible and meaningful to conscious awareness. The clearest distinction for adolescents was between the hedonic 'emotional' experience, such as the absence of enjoyment, happiness, excitement, and the 'motivational' experience, such as the absence of desire, wanting or willingness to exert effort. The distinction between consummatory (in the moment) pleasure and anticipatory (future orientated) pleasure was less clear. However, unlike previously developed scales developed to assess multiple components of pleasure or reward (e.g. DARS, Rizvi et al., 2015; PVSS, Khazanov et al., 2020) the newly developed ASA was able to disambiguate some motivational/ anticipatory (drive, effort, looking forward) from emotive elements such (enjoyment, emotional detachment and flattening). This calls in to question claims within the literature that it may not be possible to disambiguate components of anhedonia based on self-report (e.g. Khazanov et al., 2020). An initial factor solution was proposed which further disambiguated the anticipatory items from both motivational and emotional factors, but this was not supported in a further sample. This suggests that some distinctions between components (i.e. between anticipatory and motivational elements) are less clear and therefore may reflect a more subtle nuance between experiences.

It is important to identify and explore what different cognitive and emotional processes are at work when answering questions about pleasure and reward retrospectively. Although it is a common criticism of all self-report scales that the recall of an experience is not the same as the actual experience, this is particularly important for translational research mapping experiences across domains of measurement, and therefore warrants further exploration in reward related research. For example, it is likely that some cognitive processes involved in the memory of past events are necessary for retrospective recall but are not necessary to activate the neural response in anticipation of a rewarding stimulus. Memory biases are an important and widely researched phenomena in adult and adolescent depression, with depressed individuals less likely to recall positive experience (e.g. Morina et al., 2011) than non-depressed individuals. Therefore, retrospective recall of rewarding experiences could also be capturing biases in memory as well as deficits in the feeling of anticipated or momentary pleasure. This may explain potential differences between findings from ESM (i.e. van Roekel et al., 2016) and self-report questionnaire studies.

As discussed previously, 'wanting' and 'liking' reward processes are underpinned by different neurobiology, therefore for translational research to be meaningful, it is important to understand how (and if) self-reported constructs map onto these neural processes. This may be hampered by inconsistency in the terminology or operationalisation of definitions of the sub-components of reward. For example, the Temporal Experience of Pleasure Scale (TEPS; Gard et al., 2006) was the first self-report scale developed to assess both liking and wanting components of reward, and this was done by rating consummatory 'momentary' pleasure, and anticipatory pleasure when imagining a pleasant future event. However, the findings from this thesis and some researchers (e.g. McCabe, 2018) suggest that asking questions about feeling 'excited' or imagining future events may capture the liking or more 'emotive' element of pleasure and reward rather than the wanting or 'motivational' element.

Alternatively asking questions about approach, desire, and effort may be more closely related to or act as a proxy for 'wanting' reward processes.

Disorder-specific and transdiagnostic approaches. Research in this thesis has highlighted the benefits of taking both a diagnostic and transdiagnostic approach to understanding reward related difficulties in mental health. Anhedonia is a transdiagnostic symptom which features in a range of disorders most notably as a negative symptom of schizophrenia (APA, 2013). In the research reported in this thesis anhedonic experiences clustered both within diagnostic categories (i.e. close relationship of anhedonia with hopelessness) and spanned across disorders (i.e. loss of pleasure which is a feature of multiple psychiatric disorders). The focus of this thesis was on anhedonia in the context of adolescent depression; however measurement tools available across a range of disorders and overlaps across diagnostic boundaries were also considered. The qualitative research highlighted similarities between the experience of anhedonia in depressed young people and of amotivation in schizophrenia (e.g. Gee et al., 2019), as well as in the descriptions of apathy across neuropsychiatric conditions such as Parkinson's and Alzheimer's disease (e.g. Husain & Roiser, 2018; Lambert et al., 2018). For this reason it may be helpful for future research to explore how anhedonia differs across disorders by recruiting various clinical or high-risk groups and exploring their experiences using a battery of qualitative and quantitative methods.

6.4.4. Implications for the clinical assessment and treatment of anhedonia in research and recommendations for clinical practice

Assessment of anhedonia. The result of this thesis provide a detailed understanding of adolescent anhedonia that could inform the assessment of anhedonia in clinical practice. If a multifaceted definition of anhedonia is clinically useful, this should be more routinely

assessed. At present the DSM-5 (APA, 2013) definition of anhedonia in MDD does not state that levels of interest and pleasure need to be assessed before (anticipatory) and during (consummatory) experiences. However, for a more comprehensive assessment of pleasure capacity, it may be necessary to routinely assess multiple components of reward including consummatory and anticipatory pleasure, as well as motivational difficulties. Diagnostic tools such as the Kiddie- Schedule for Affective Disorders (K-SADS) (Kaufman et al., 1997) and the Child and Adolescent Psychiatric Assessment (CAPA; Angold & Costello, 2000) should state that an assessment of anhedonia should include all components of this experience.

A similar point can be made about the assessment of anhedonia using self-report scales. On the basis of the systematic review and critical evaluation (paper 2) recommendations were made for using these measures in clinical and research settings. Newer scales, including the recently developed Anhedonia Scale for Adolescents (ASA) assess a broader construct of anhedonia e.g. consummatory, anticipatory, effort (e.g. ASA, Watson et al., in press; DARS, Rizvi et al., 2015; PVSS, Khazanov et al., 2020) and show promising psychometric data to support their validity and reliability, but require further validation. The Anhedonia Scale for Adolescents (ASA) is the only measure developed specifically for this age group that is based on adolescents' qualitative reports; it therefore could be a useful clinical tool. Next steps will need to involve validating the ASA in clinical samples, to establish potential cut offs, and the relationship with clinician reported symptom severity.

Treatment of anhedonia. The results of this thesis highlight the importance of treating the symptom of anhedonia. They therefore support the general movement towards treating the absence of "positive" emotions as well as the surfeit of "negative" symptoms of depression (e.g. Craske et al., 2019; Dunn et al., 2019).

This thesis presents the first study to explore the impact of Brief Behavioural Activation on the symptom of anhedonia. This qualitative investigation supports previous research which suggests that by increasing participants' contact with rewarding stimuli and thus targeting (low) reward functioning, BA may bring about improvements in depression symptoms (Forbes, 2020). However, the link between BA and reward has not been explored empirically, and research on the mechanisms of change in BA is limited.

BA has been successfully adapted for adolescents (e.g. McCauley et al., 2016; Pass et al., 2015) and adolescents found it to be an acceptable treatment approach. Adolescents identified strategies such as activity monitoring, breaking down tasks and identifying values as helpful tools for enhancing positive mood and motivation. However, quantitative studies are needed to explore the mechanisms of change in BA to refine this treatment approach, and to consider whether sub-types of adolescents' experiences i.e. those with predominantly hedonic or motivational difficulties, require a different focus or emphasis during treatment. The use of the new self-report tool for adolescent anhedonia (ASA) would help to distinguish differences between individuals with more 'affective' or 'motivational' difficulties before and after treatment.

Future research will need to consider the relative effectiveness of disorder-specific or 'anhedonia or positive affect' specific psychological treatments. Although most disorders in which anhedonia features do not develop until adulthood, low positive affect is also a feature of anxiety disorders, particularly social anxiety (Kashdan et al., 2011). Craske et al., (2019) have piloted a new psychological intervention, Positive Affect Treatment (PAT), a transdiagnostic treatment for low positive affect in both depression and anxiety, with promising preliminary findings. However, it is important to consider that by only focusing on positive affect or anhedonia related difficulties, there is a danger of neglecting the treatment of negative affect (Dunn, 2012; Dunn et al., 2019). Therefore, it would be interesting to

explore whether treatments targeting both key elements of depression in adolescents are more effective than those targeting positive affect or anhedonia alone.

It may also be useful to consider specific cognitive processes that might help or hinder changes in Brief BA. For example, depression is characterised by impoverished positive memories. Depressed individuals recall positive memories that are less vivid and emotionally intense (Dalgleish & Werner-Seidler, 2014; Pile & Lau, 2018), therefore incorporating strategies that directly target these cognitive elements may help in treating reward related cognitions. A brief intervention for adolescents that targets both positive and negative mental imagery, Imagery Based Cognitive Behavioural Intervention (IBCBI) aims to target memory processes in adolescent depression as well as addressing problems with anticipatory pleasure (Pile et al., 2018). This four-session intervention that uses imagery rescripting and memory specificity training was evaluated with nine adolescents. This suggested that the intervention was acceptable and participants reported fewer depression symptoms (Pile et al., 2020). Further RCTs are needed to establish the effectiveness of this intervention and whether it has a direct impact on anhedonia. Other new treatments, such as ADePT and PAT, have been developed for adults and aim to directly target elements of the positive valence system through use of both cognitive and behavioural strategies. Evidence supports the benefits of targeting cognitive dampening appraisals in adults (Dunn et al., 2018) and community samples of adolescents (Yilmaz et al., 2019). However, further research is needed to establish whether cognitive strategies similar to those outlined in ADePT and PAT would be acceptable for adolescent clinical samples, or if they would have an impact on anhedonia.

6.5. Conclusions

Anhedonia is an important and debilitating symptom of depression and is commonly experienced by adolescents with depression. It is typically neglected within the treatment of

depression and has been identified as a predictor of poor outcomes. The findings from this thesis highlight the subjective experiences of anhedonia in young people and show that young people experience this symptom as a complex and multifaceted construct. The systematic review and critical appraisal of self-report measures of anhedonia demonstrated that there are no well-validated measures of anhedonia that have been designed for use with adolescents. This may mean that important facets of adolescents' experiences are not captured in these measures. Building on this, a new measure to assess anhedonia in adolescents was developed and validated. Finally, in line with behavioural approaches which aim to treat depression through increasing positive reinforcement my final study explored the impact of a brief Behavioural Activation treatment for depression on adolescents' experiences of anhedonia.

Avenues for future research include more direct mapping of adolescents' experiences of anhedonia across different methods of assessment e.g. clinician report, retrospective self-report, experience sampling, and neural activation, to build a more comprehensive picture of anhedonia. In terms of self- report measures the ASA holds promise but future research needs to establish its criterion validity in clinical samples, and to establish clinical cut-off scores. In terms of treatment, it would be of interest to further evaluate Brief BA as a treatment for adolescent depression in large scale randomised controlled trials, and to understand if (and if so how) it reduces anhedonia and improves positive affect in adolescents with depression.

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Appendices

Appendix A. Ethics Approvals

Appendix B. Information Sheets and Consent Forms

Appendix C. Self-Report Measures

Appendix A. Ethical Approvals

1. Paper 1 – Community Sample UREC

University of Reading

Coordinator for Quality Assurance in Research
Dr Mike Proven, BSc(Hons), PhD

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Professor Shirley Reynolds
School of Psychology and Clinical Language Sciences
University of Reading
RG6 6AL

13 February 2017

Dear Shirley

UREC 17/11: Exploring adolescents experiences of pleasure and enjoyment. *Favourable opinion*

Thank you for the response (email dated 13 February, from Rebecca Watson and including attachment, refers) addressing the issues raised by the UREC Sub-committee at its January 2017 meeting. On the basis of these responses, I can confirm that the Chair is pleased to confirm a favourable ethical opinion.

Please note that the Committee will monitor the progress of projects to which it has given favourable ethical opinion approximately one year after such agreement, and then on a regular basis until its completion.

Please also find attached Safety Note 59: Incident Reporting in Human Interventional Studies at the University of Reading, to be followed should there be an incident arising from the conduct of this research.

The University Board for Research and Innovation has also asked that recipients of favourable ethical opinions from UREC be reminded of the provisions of the University Code of Good Practice in Research. A copy is attached and further information may be obtained here:

http://www.reading.ac.uk/internal/res/QualityAssuranceInResearch/reas-RSqar.aspx .

Yours sincerely

Dr M J Proven
Coordinator for Quality Assurance in Research (UREC Secretary)
cc: Dr John Wright (Chair); Dr Laurie Butler (Head of School); Rebecca Watson (Doctoral Research Fellow)

2. Papers 1 & 4 – Clinical Sample UREC

University of Reading

Coordinator for Quality Assurance in Research
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Professor Shirley Reynolds
School of Psychology and Clinical Language Studies
University of Reading

27 September 2017

Dear Shirley

UREC 17/41: Exploring Loss of Interest and Pleasure in Adolescent Depression. *Favourable opinion*

Thank you for your application (email, dated 11 August 2017 and including attachments, from Becca Watson refers) for review of the above project which was considered by a UREC Sub-committee on Wednesday 6 September 2017. I can confirm that the Chair is pleased to confirm a favourable ethical opinion on the basis of the information that was reviewed by the sub-committee.

Separately (and not as a specific condition), the Committee would like to ask you to consider the recent advice – from UREC and the University's Research Data Manager, and given via Heads of Schools – to include a statement in the Consent form that would facilitate the 'downstream' sharing of data. The advice was that the researcher should check that:

"The consent form asks the research participant for permission to preserve some or all of the data they provide over the long term, and to make the data available, in anonymised form if required, either openly or subject to appropriate safeguards, so that they can be consulted and re-used by others, in accordance with the University's Research Data Management Policy."

Please note that the Committee will monitor the progress of projects to which it has given favourable ethical opinion approximately one year after such agreement, and then on a regular basis until its completion.

Please also find attached Safety Note 59: Incident Reporting in Human Interventional Studies at the University of Reading, to be followed should there be an incident arising from the conduct of this research.

The University Board for Research and Innovation has also asked that recipients of favourable ethical opinions from UREC be reminded of the provisions of the University Code of Good Practice in Research. A copy is attached and further information may be obtained here: http://www.reading.ac.uk/internal/res/QualityAssuranceInResearch/reas-RSqar.aspx.

Yours sincerely

Dr M J Proven
Coordinator for Quality Assurance in Research (UREC Secretary)

cc. Dr John Wright (Chair); Professor Laurie Butler (Head of Department); Becca Watson (Doctoral Researcher)

3. Papers 1 and 4. Clinical Samples - NHS Ethics

NHS
Health Research Authority

London - Bloomsbury Research Ethics Committee
HRA RES Centre Manchester
Barlow House 3rd Floor
4 Minshull Street
Manchester
M1 3DZ

Telephone:

Please note: This is the favourable opinion of the REC only and does not allow you to start your study at NHS sites in England until you receive HRA Approval

30 October 2017

Miss Rebecca Watson
School of Psychology and Clinical Language Sciences
Earley Gate
Whiteknights Road
RG6 6AL

Dear Miss Watson

Study title:	**Exploring loss of interest and pleasure in depressed adolescents**
REC reference:	**17/LO/1328**
Protocol number:	**N/A**
IRAS project ID:	**224531**

Thank you for your letter of 19 September 2017, responding to the Committee's request for further information on the above research and submitting revised documentation.

The further information has been considered on behalf of the Committee by the Chair.

We plan to publish your research summary wording for the above study on the HRA website, together with your contact details. Publication will be no earlier than three months from the date of this opinion letter. Should you wish to provide a substitute contact point, require further information, or wish to make a request to postpone publication, please contact hra.studyregistration@nhs.net outlining the reasons for your request.

Confirmation of ethical opinion

On behalf of the Committee, I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form, protocol and supporting documentation as revised, subject to the conditions specified below.

3. Paper 3 – Community Sample UREC

University of Reading

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Professor Shirley Reynolds
Charlie Waller Institute
School of Psychology and Clinical Language Sciences
University of Reading
RG6 6AL

19 September 2018

Dear Shirley,

UREC 18/31: Measuring Anhedonia in Adolescents – A Scale Development Study. *Favourable opinion*

Thank you for the response (your email, dated 10 September 2018, from Becca Watson refers) addressing the issues raised by the UREC Sub-committee at its June 2017 meeting (*my Provisional Opinion email of 16 July including attachments refers*). On the basis of these responses and addition of minor amendments, I can confirm that the Chair is pleased to confirm a favourable ethical opinion.

Please note that the Committee will monitor the progress of projects to which it has given favourable ethical opinion approximately one year after such agreement, and then on a regular basis until its completion.

Please also find attached Safety Note 59: Incident Reporting in Human Interventional Studies at the University of Reading, to be followed should there be an incident arising from the conduct of this research.

The University Board for Research and Innovation has also asked that recipients of favourable ethical opinions from UREC be reminded of the provisions of the University Code of Good Practice in Research. A copy is attached and further information may be obtained here:

http://www.reading.ac.uk/internal/res/QualityAssuranceInResearch/reas-RSqar.aspx

Yours sincerely

Dr M J Proven
Coordinator for Quality Assurance in Research (UREC Secretary)
cc: Dr John Wright (Chair); Professor Laurie Butler (Head of School); Becca Watson (Doctoral Researcher);

Appendix B. Information, Consent, Debrief and Sources of Support

Paper 1. Community sample – Adolescent Information Sheet (ages 12 – 15): Part 1

School of Psychology and Clinical Language Sciences

University of Reading

Harry Pitt Building

Whiteknights Road

Reading

RG6 6AL

INFORMATION FOR 12-15 YEAR OLDS

Project Title: **Exploring Adolescents Experiences of Pleasure and Enjoyment**

Hello,

We are inviting you to take part in a research study.

Why is this project being done?

We are exploring adolescents' enjoyment of activities in order to help us better understand mood problems, such as depression, in adolescents.

Why have I been asked to take part?

You have been asked to take part because your school has agreed to help us with this project. We are inviting you because you are aged between 12 and 18 years old.

Do I have to take part?

No. Because you are under 16, your parents have been asked if they are happy for you to take part, and they will have had the choice to opt you out of the study. But even if your parents have agreed, you still do not have to take part, it is completely up to you. Also, if you decide to take part and then change your mind, this won't matter at all. You won't have to give us a reason.

What will happen if I take part in the project?

We would like you to complete some questionnaires at school. They will take about 10-15 minutes. They include questions about your feelings, thoughts and experiences.

Might anything about the research upset me?

Some of the questions about your thoughts and feelings might remind you of both happy and sad feelings. This is completely normal and OK. If you want to stop at any time, or take a break this will be fine. We can talk about this at the time or you might want to talk to your friends or a teacher or parent about it.

Will my information be kept private if I take part? Will anyone else know I'm doing this?

Everything you tell us as part of this project is treated as confidential; this means that nobody other than us will ever know what you have told us. Your answers will be kept in locked cabinets and won't have your name on it.

The only time we would not be able to keep information confidential is if you tell us something which makes us worried about you or someone else. If this were to happen we would pass on this information to someone at your school who can help you.

Did anyone else check the project is okay to do?

Before any research is allowed, it has to be checked by a group of people called an Ethics Committee. They make sure the research is safe. This study has been looked at by the University of Reading Ethics Committee and they were happy for it to go ahead. Everyone working on this study has been through the formal Disclosure Barring Service (DBS) checks and has been approved by the School of Psychology, University of Reading to work with young people.

An opportunity to take part in the next stage of the research!

Whilst you are completing the questionnaires, you have the option to give us your contact details so you can take part in the next stage of the study. This will also take place at your school/college and will involve talking to the researcher about what you find fun and enjoyable. This will also involve a computer task, and a few more questionnaires. We will select about 60 people to take part, and if you do this you will receive a £10 Amazon voucher as a thank you for your time. We will give you more information about this later on.

What if I have more questions?

If you have any questions about our study, either now or later, please feel free to email us or phone to speak to us. You have a right to know everything and we will be happy to tell you everything. Also please feel free to talk about this study with your friends, parents and/or teachers.

Thank you very much,

Becca Watson, MSc (Researcher) email: r.watson2@pgr.reading.ac.uk

Dr. Ciara McCabe (Supervisor) email: c.mccabe@reading.ac.uk

Prof. Shirley Reynolds (Supervisor) email: s.a.reynolds@reading.ac.uk

tel:

Website: andyresearchclinic.com

Paper 1. Community sample – Adolescent Information Sheet (ages 16 – 18): Part 1

School of Psychology and Clinical Language Sciences

University of Reading

Harry Pitt Building

Whiteknights Road

Reading

RG6 6AL

University of Reading

INFORMATION FOR 16-18 YEAR OLDS

Project Title: **Exploring Adolescents Experiences of Pleasure and Enjoyment**

Hello,

We are inviting you to take part in a research study.

Why is this project being done?

We are exploring adolescents' enjoyment of activities in order to help us better understand mood problems, such as depression, in adolescents.

Why have I been asked to take part?

You have been asked to take part because your school/college has agreed to help us with this project. We are inviting you because you are aged between 12 and 18 years old.

Do I have to take part?

No. You do not have to take part. Also, if you decide to take part and then change your mind, this won't matter at all. You won't have to give us a reason.

What will happen if I take part in the project?

We would like you to complete some questionnaires at school. They will take about 10-15 minutes. They include questions about your feelings, thoughts and experiences.

Might anything about the research upset me?

Some of the questions about your thoughts and feelings might remind you of both happy and sad feelings. This is completely normal and OK. If you want to stop at any time, or take a break this will be fine. We can talk about this at the time or you might want to talk to your friends or a teacher or parent about it.

Will my information be kept private if I take part? Will anyone else know I'm doing this?

Everything you tell us as part of this project is treated as confidential; this means that nobody other than us will ever know what you have told us. Your answers will be kept in locked cabinets and won't have your

name on it. You will be assigned a research ID number so no one will know who has filled out the questionnaires. Your answers will be kept in locked cabinets and nothing will have your name on it. Once we have finished the project the questionnaires will be destroyed.

The only time we would not be able to keep information confidential is if you tell us something which makes us worried about you or someone else. If this were to happen we would pass on this information to someone at your school who can help you.

Did anyone else check the project is okay to do?

Before any research is allowed, it has to be checked by a group of people called an Ethics Committee. They make sure the research is safe. This study has been looked at by the University of Reading Ethics Committee and they were happy for it to go ahead. Everyone working on this study has been through the formal Disclosure Barring Service (DBS) checks and has been approved by the School of Psychology, University of Reading to work with young people.

An opportunity to take part in the next stage of the research!

Whilst you are completing the questionnaires, you have the option to give us your contact details so you can take part in the next stage of the study. This will also take place at your school/college and will involve talking to the researcher about what you find fun and enjoyable. This will also involve a computer task, and a few more questionnaires. We will select about 60 people to take part, and if you do this you will receive a £10 Amazon voucher as a thank you for your time. We will give you more information about this later on.

What if I have more questions?

If you have any questions about our study, either now or later, please feel free to email us or phone to speak to us. You have a right to know everything and we will be happy to tell you everything. Also please feel free to talk about this study with your friends, parents and/or teachers.

Thank you very much,

Becca Watson, MSc (Researcher) email: r.watson2@pgr.reading.ac.uk

Dr. Ciara McCabe (Supervisor) email: c.mccabe@reading.ac.uk

Prof. Shirley Reynolds (Supervisor) email: s.a.reynolds@reading.ac.uk

tel:

Website: andyresearchclinic.com

Paper 1. Community sample – Parents of Adolescent Information Sheet (ages 12 - 18): Part 1

School of Psychology and Clinical Language Sciences

University of Reading

Harry Pitt Building

Whiteknights Road

Reading

RG6 6AL

University of Reading

RESEARCH INFORMATION FOR PARENTS

***Project Title*: Exploring Adolescents Experiences of Pleasure and Enjoyment**

What is the purpose of the study?

We are investigating adolescents' enjoyment of activities in order to help us better understand mood problems, such as depression, in adolescents.

Why are we inviting your son/daughter to take part?

We are a child and adolescent depression research team at the University of Reading. We are specifically interested in understanding loss of pleasure and reward in adolescents. We hope to use this information to further our understanding of depressive symptoms and improve the treatments and support offered to young people suffering with depression. Your son/daughter has been invited to take part because their school/college has agreed be part of this research project. Your child is also aged between 12 and 18 and therefore in the age group we are working with.

Does my child have to take part?

Participation in this research is entirely voluntary.

12-15 year olds

This is an opt-out study. This means that if your child is under 16 and you DO NOT want them to take part, please sign and return the attached 'opt-out' form. If you do not return this form (or tell the school/college in another way) we will assume that you are happy for your child to take part in this research. If your child is under 16 they will also be asked if they are happy to take part and are free to opt out themselves. Either you or your child can withdraw your child from the study at any time without giving a reason.

16 years and above

If your child is aged 16 or over they do not need parental consent. However, they will be asked if they are happy to take part and they are free to opt-out themselves. If they agree to take part, they are still free to withdraw at any time without giving any reason.

What will happen if my child takes part?

Your son/daughter will complete several questionnaires during a brief slot in the school/college day. The questions will ask about feelings and enjoyment of activities.

What are the possible disadvantages and risks of taking part?

We do not expect there to be any disadvantages or risks involved in taking part in this research. Some of the questions are personal and ask about feelings of being unhappy, and it is possible that some adolescents may find this upsetting. It is important to highlight that many of these questions are unlikely to be relevant to the young person, however if they are, it is important for us to know this.

If anyone was upset by any of the questions we would offer to stop the research immediately (and your child can choose not to answer questions if they wish). During the research we will follow all school/college safeguarding and child protection policies. Additionally, all children will be given a support sheet to keep. The list contains helpful resources for those who want to learn more about mental health, who want to get involved in volunteering opportunities or would like to seek advice.

As the research will be carried out in school/college we do not require you or your child to come to the university at any point during the research. The study will be carried out on whole classes so your child will not miss any teaching.

What are the possible benefits?

Taking part will contribute to developing a greater understanding of how teenagers think and how this may relate to how they are feeling. Research investigating symptoms of depression in adolescents is limited and we hope to use this information to evaluate and understand how clinical treatments should be specifically designed for this age group.

What if there is a problem?

If you have any concern about any aspect of the study, you should ask to speak to Becca Watson, the researcher on this project. Please see the last page for contact details. If you remain unhappy and wish to complain formally, you can contact the Principle Investigator of this research, Professor Shirley Reynolds, who will discuss any concerns you may have.

Will our taking part in the study be kept confidential?

All the information provided will be kept confidential. The information we collect will not have any names on and will be kept strictly in locked cabinets in locked offices at the university. All the information collected for the project will be destroyed as soon as they are no longer needed. The consent forms, however, will be kept for 5 years before disposal.

The only exception to this is if your child tells us something, which puts them, or someone else, at risk. If this happens we will inform the school who will follow their risk and safeguarding policies. We are asking young people about symptoms of depression. If we feel any young person is at risk of harm or radicalization we will alert a nominated member of the school/college staff who will then follow the school procedures.

What will happen to the results of the research study?

We hope to write these results up for publication in a scientific journal and present our findings at professional academic conferences. No personal information will be given and any material used will be anonymous and not be traceable to a particular person. If you would like a report of the findings of our

study, we will be happy to provide it. Please note that the publication of any such data may take a year or more after the completion of the study.

Who has reviewed the study?

All research at the University of Reading is reviewed by an independent group of people, called a Research Ethics Committee, to protect your interests. This application has been reviewed and given a favourable opinion by the University of Reading Research Ethics Committee. Everyone working on this study has been through the formal Criminal Records Bureau Disclosure process and has been approved by the School of Psychology at the University of Reading to work with children and adolescents.

An opportunity to take part in the next stage of the research!

Whilst your son/daughter is completing the questionnaires, they have the option to give us their contact details so they can take part in the next stage of the study. This will also take place at the school/college and will involve talking to the researcher about what they find fun and enjoyable. This will also involve a computer task, and a few more questionnaires. We will select about 60 people to take part, and they will receive a £10 Amazon voucher as a thank you for their time. We will give you more information about this later on.

Any questions?

If you have any questions please do not hesitate to contact us by phone or email. We will be happy to tell you more about the research and to discuss any questions or concerns you might have.

Thank you very much,

Becca Watson, MSc (Researcher) email: r.watson2@pgr.reading.ac.uk

Dr. Ciara McCabe (Supervisor) email: c.mccabe@reading.ac.uk

Prof. Shirley Reynolds (Supervisor) email: s.a.reynolds@reading.ac.uk

tel:

Website: andyresearchclinic.com

Paper 1. Community sample – Adolescent Information Sheet (ages 11 – 15): Part 2

School of Psychology and Clinical Language Sciences
University of Reading
Harry Pitt Building
Whiteknights Road
Reading
RG6 6AL

University of Reading

INFORMATION FOR 12-15 YEAR OLDS

Project Title: **Exploring Adolescents Experiences of Pleasure and Enjoyment – Part 2**

We are inviting you to take part in a study we are doing.

Why is this project being done?

As you might remember we are interested in teenagers' experiences of pleasure and enjoyment. This is important because it could help us prevent depression and improve treatments for young people.

Why have I been asked to take part?

You took part in Part 1 in your classroom and filled out some questionnaires. You told us that you were interested in taking part in Part 2.

What do I gain if I take part?

If you agree to take part you will be given a £10 Amazon voucher as a thank you for taking part.

Do I have to take part?

No. Whether or not you take part in this study is completely up to you and your parents. You do not have to do this. Also, if you decide to take part and then change your mind, this won't matter at all. You won't have to give us a reason.

What will I be asked to do if I take part in Part 2?

In Part 2 we want to meet young people individually. There will be an interview asking you a bit more about what you find interesting and enjoyable. There will be a short computer task which involves making key presses based on what you see on the screen. You will then fill in some more questionnaires. This will take up

to an hour to complete. Some of the tasks are timed and we will audio record our meeting to help us collect accurate data and to use in supervision.

Might anything about the research upset me?

Some of the questions about your thoughts and feelings might remind you of both happy and sad feelings. This is completely normal and OK. If you want to stop at any time, or take a break this will be fine. We can talk about this at the time or you might want to talk to your friends or a teacher or parent about it.

Will my information be kept private if I take part? Will anyone else know I'm doing this?

Everything you tell us is treated as confidential; this means that nobody other than us will ever know what you have told us. The only time we would not be able to keep your information confidential is if tell us something which makes us worried about you or someone else. If this were to happen we would pass on this information to a member of staff. Your answers will be kept in locked cabinets and nothing will have your name on it. Audio-recordings will be kept on the computer and will need a password to get onto them. Once we have finished the project all of the questionnaires will be shredded.

Did anyone else check the project is okay to do?

Before any research is allowed, it has to be checked by a group of people called an Ethics Committee. They make sure the research is safe. This study has been looked at by the Reading University Ethics Committee and they were happy for it to go ahead. Everyone working on this study has been through the formal Disclosure and Barring Service process and has been approved by the School of Psychology of the University of Reading to work with young people.

What if I have more questions?

If you have any questions about our study, either now or later, please feel free to email us or phone to speak to us. You have a right to know everything and we will be happy to tell you everything. Also please discuss this with your parents, teachers and/or your friends.

Thank you very much,

Becca Watson, MSc (Researcher) email: r.watson2@pgr.reading.ac.uk

Dr. Ciara McCabe (Supervisor) email: c.mccabe@reading.ac.uk

Prof. Shirley Reynolds (Supervisor) email: s.a.reynolds@reading.ac.uk

tel:

Website: andyresearchclinic.com

Paper 1. Community sample – Adolescent Information Sheet (ages 16 - 18): Part 2

School of Psychology and Clinical Language Sciences
University of Reading
Harry Pitt Building
Whiteknights Road
Reading
RG6 6AL

INFORMATION FOR 16-18 YEAR OLDS

Project Title: **Exploring Adolescents Experiences of Pleasure and Enjoyment – Part 2**

We are inviting you to take part in a study we are doing.

Why is this project being done?

As you might remember we are interested in teenagers' experiences of pleasure and enjoyment. Depression is a major health problem for young people but we still do not really understand why depression develops or how best to prevent it. This research aims to help us understand depression in young people and how it relates to not enjoying activities and experiences. We hope that it will help us develop new and better ways to help young people and to prevent depression.

Why have I been asked to take part?

You took part in Part 1 in your classroom and filled out some questionnaires. You told us that you were interested in taking part in Part 2.

What do I gain if I take part?

If you agree to take part you will be given a £10 Amazon voucher as a thank you for taking part.

Do I have to take part?

No. Whether or not you take part in this study is **completely up to you**. You do not have to do this. Also, if you decide to take part and then change your mind, this won't matter at all. You won't have to give us a reason.

What will I be asked to do if I take part in Part 2?

In Part 2 we want to meet young people individually. There will be an interview asking you a bit more about what you find interesting and enjoyable. There will be a short computer task which involves making key

presses based on what you see on the screen. You will then fill in some more questionnaires. This will take up to an hour to complete. Some of the tasks are timed and we will audio record our meeting to help us collect accurate data and to use in supervision.

Might anything about the research upset me?

Some of the questions about your thoughts and feelings might remind you of both happy and sad feelings. This is completely normal and OK. If you want to stop at any time, or take a break this will be fine. We can talk about this at the time or you might want to talk to your friends or a teacher or parent about it.

Will my information be kept private if I take part? Will anyone else know I'm doing this?

Everything you tell us is treated as confidential; this means that nobody other than us will ever know what you have told us. The only time we would not be able to keep your information confidential is if tell us something which makes us worried about you or someone else. If this were to happen we would pass on this information to a member of staff. Your answers will be kept in locked cabinets and nothing will have your name on it. Audio-recordings will be kept on the computer and will need a password to get onto them. Once we have finished the project all of the questionnaires will be shredded.

Did anyone else check the project is okay to do?

Before any research is allowed, it has to be checked by a group of people called an Ethics Committee. They make sure the research is safe. This study has been looked at by the Reading University Ethics Committee and they were happy for it to go ahead. Everyone working on this study has been through the formal Disclosure and Barring Service process and has been approved by the School of Psychology of the University of Reading to work with young people.

What if I have more questions?

If you have any questions about our study, either now or later, please feel free to email us or phone to speak to us. You have a right to know everything and we will be happy to tell you everything. Also please discuss this with your parents, teachers and/or your friends.

Thank you very much,

Becca Watson, MSc (Researcher) email: r.watson2@pgr.reading.ac.uk

Dr. Ciara McCabe (Supervisor) email: c.mccabe@reading.ac.uk

Prof. Shirley Reynolds (Supervisor) email: s.a.reynolds@reading.ac.uk

tel:

Website: andyresearchclinic.com

Paper 1. Community sample – Parents of Adolescent Information Sheet (ages 12 - 18): Part 2

Appendix 2.1: Parent Information Sheet Part 2

School of Psychology and Clinical Language Sciences

University of Reading

Harry Pitt Building

Whiteknights Road

Reading

RG6 6AL

University of Reading

RESEARCH INFORMATION FOR PARENTS

***Project Title*: Exploring Adolescents Experiences of Pleasure and Enjoyment – Part 2**

Dear parent/ guardian,

Your son or daughter has already helped us with our research and told us that they would be interested in taking part in the second part of our study. This information sheet is to help you support your son or daughter's decision to decide whether to be part of the next stage of our research. We have tried to include the most important information here – if you have any questions that are not answered here, or if you just want to know more please get in touch with us. Our contact details are at the end of this information sheet.

What is the purpose of the study?

Depression and low mood is a major health problem for young people but we still do not really understand why it develops or how best to prevent it. This research project aims to help us understand depression by understanding what young people enjoy and find pleasurable. We hope that it will help us develop new and better ways to help young people and to prevent depression.

Why are we inviting your son/daughter to take part?

Your son or daughter's school/ college has agreed to help us with this research. Your son/daughter took part in a part 1 of a previous study and filled in some questionnaires. They indicated that they would be interested in taking part in the next stage of the study.

Does my child have to take part?

No. It is completely up to your son/daughter to decide whether to join the study. If they agree to take part, they are free to withdraw their permission at any time, without giving any reason.

This is an opt-in study.

This means that if your child is under 16 years, then they will need your written consent to take part (please see 'parent opt-in consent form'). If you are happy for your son/daughter take part, you will need to sign and return the attached form via email or post to the school/college.

If your child is over 16 years, they can consent on their own behalf, they do not need parental consent.

What will my child gain from taking part?

Most young people enjoy the research tasks and they will also have an important opportunity to experience a real research study. If your son/daughter takes part they will be given a £10 Amazon voucher as a thank you for taking part. If you would like to find out more about our research, we will be happy to give you a summary.

What will happen if my child takes part?

Your son/daughter will complete some tasks with the researcher. These include an interview, some more questionnaires and a short computer task. The interview will be audio recorded. During the interview, your son/daughter will be asked about what they find fun and enjoyable. We have tried to make the tasks as short and straightforward as possible.

What are the possible disadvantages and risks of taking part?

We do not expect there to be any disadvantages or risks involved in taking part in this research. Some of the tasks require answering questions about mood and their future plans. Your son or daughter can choose not to answer any questions. They can stop at any time and we would immediately offer support if they were upset or distressed. During research we will adhere to all school safeguarding and child protection policies. Additionally, all children will be given a resource list about well-being, sources and support and advice and opportunities to volunteer or work with others.

What if there is a problem?

If you have any concern about the study, please contact Becca Watson, the researcher. Her contact details are at the end of this information sheet. If you remain unhappy and wish to complain formally, you can contact the Principle Investigator of this research, Professor Shirley Reynolds, who will discuss any concerns you may have.

Will the information provided be kept confidential?

All the information provided will be kept confidential and will be kept anonymous. The questionnaires will be kept strictly confidential in locked cabinets in locked offices at the University of Reading. All written information will be destroyed as soon as it is no longer needed. The consent forms, however, will be kept for 5 years before disposal. The only exception to this is if your child tells us something, which puts them, or someone else, at risk. If this happens we will inform a member of staff who will follow the school/college risk and safeguarding policies. If we feel any young person is at risk of harm or radicalization we will alert a nominated member of the school/college staff who will then follow the school procedures.

What will happen to the results of the research study?

We will present the results of our research as part of a doctoral thesis and publish our findings in scientific journals. No personal information will be given. We will be happy to send you a summary of our results.

Who has reviewed the study?

All research at the University of Reading is reviewed by an independent group of people, called a Research Ethics Committee, to protect your interests. This application has been reviewed and given a favourable opinion by the University of Reading Research Ethics Committee. Everyone working on this study has been through the formal Criminal Records Bureau Disclosure process and has been approved by the School of Psychology at the University of Reading to work with children and adolescents.

Any questions?

If you have any questions please do not hesitate to contact us by phone or email. We will be happy to tell you more about the research and to discuss any questions or concerns you might have.

Thank you very much,

Becca Watson, MSc (Researcher) email: r.watson2@pgr.reading.ac.uk

Dr. Ciara McCabe (Supervisor) email: c.mccabe@reading.ac.uk

Prof. Shirley Reynolds (Supervisor) email: s.a.reynolds@reading.ac.uk

tel:

Website: andyresearchclinic.com

Paper 1. Community sample – Parental Opt-Out Consent Form (12 – 15): Part 1

School of Psychology and Clinical Language Sciences
University of Reading
Harry Pitt Building
Whiteknights Road
Reading
RG6 6AL

University of Reading

OPT-OUT FORM

Project Title: **Exploring Adolescents Experiences of Pleasure and Enjoyment**

Researcher: Becca Watson

Supervisors: Professor Shirley Reynolds & Dr Ciara McCabe

Please only complete and return this form if you DO NOT want your child to take part in this research.

I **do not** agree to my child participating in this research.

Your child's name: _____

Child's form/ tutor group: _____

Your name: _____

Date: _____

Paper 1. Community sample – Adolescent Assent Form (ages 12 – 15): Part 1

School of Psychology and Clinical Language Sciences
University of Reading
Harry Pitt Building
Whiteknights Road
Reading
RG6 6AL

University of Reading

ASSENT FORM FOR ADOLESCENTS AGED 12-15

(to be completed by the young person)

Project Title: **Exploring Adolescents Experiences of Pleasure and Enjoyment**

Please circle all you agree with (yes or no):

Have you read (or had read to you) the information about this project?	YES/NO
Has somebody explained this project to you?	YES/NO
Do you understand what this project is about?	YES/NO
Have you asked all the questions you want?	YES/NO
Have you had all your questions answered in a way you understand?	YES/NO
Do you understand it is okay to stop taking part at any time?	YES/NO
Are you happy to take part?	YES/NO

PLEASE SIGN YOUR NAME HERE IF YOU ARE HAPPY TO TAKE PART:

Name: _____

Date: _____

We are also running another study which involves meeting the researcher one to one for about 50 minutes and talking about your own experiences of enjoyment and pleasure in more detail. If you are invited to take and complete the research you will win a £10 Amazon voucher!

If you are interested in taking part in the next study please give us your contact details:

Name: _____

Phone Number: _____

Email Address: _____

Please circle how you would rather be contacted? Text/ Phone Call/ Email

Paper 1. Community sample – Adolescent Consent Form (ages 16 - 18): Part 1

School of Psychology and Clinical Language Sciences
University of Reading
Harry Pitt Building
Whiteknights Road
Reading
RG6 6AL

University of Reading

CONSENT FORM FOR ADOLESCENTS AGED 16-18

Project Title: **Exploring Adolescents Experiences of Pleasure and Enjoyment – Part 1**

If your answer is yes to each questions, please put your INITIALS in each box:

Have you read (or had read to you) the information about this project?	☐
Has somebody explained this project to you?	☐
Do you understand what this project is about?	☐
Have you asked all the questions you want?	☐
Have you had your questions answered in a way you understand?	☐
Do you understand it is okay to stop taking part at any time?	☐
Are you happy to take part?	☐

PLEASE SIGN YOUR NAME HERE IF YOU ARE HAPPY TO TAKE PART:

Name: _____

Date: _____

We are also running another study which involves meeting the researcher one to one for about 50 minutes and talking about your own experiences of enjoyment and pleasure in more detail. If you are invited to take and complete the research you will win a £10 Amazon voucher!

If you are interested in taking part please give us your contact details:

Name _____

Phone Number: _____

Email Address: _____

Please circle how you would rather be contacted? Text/ Phone Call/ Email

Paper 1. Community sample – Parental Opt-In Consent Form (12 – 15): Part 2

School of Psychology and Clinical Language Sciences
University of Reading
Harry Pitt Building
Whiteknights Road
Reading RG6 6AL

University of Reading

PARENT OPT-IN CONSENT FORM

Project Title: **Exploring Adolescents Experiences of Pleasure and Enjoyment – Part 2**

Researcher: Becca Watson
Supervisors: Prof. Shirley Reynolds & Dr. Ciara McCabe

(Please initial each box)

1. I confirm that I have read and understand the Information Sheet for the above study and that I have had the opportunity to consider the information. ☐
2. I understand that my son/daughter's participation is voluntary and that we are free to withdraw at any time ☐
3. I agree that my child can be audio-recorded. I understand that this recording will be heard only by members of the research team and they will be destroyed at the end of the research study. ☐
4. I agree for my son/daughter to take part in the above study. ☐

The study was reviewed and given a favourable ethical opinion for conduct by the University of Reading Research Ethics Committee.

Your child's name: _____

Your name: _____

Signature: _____ Date: _____

Name of Researcher: Becca Watson Date: _____

Signature: _____

Paper 1. Community sample – Adolescent Assent Form (ages 12 – 15): Part 2

School of Psychology and Clinical Language Sciences
University of Reading
Harry Pitt Building
Whiteknights Road
Reading RG6 6AL

University of Reading

ASSENT FORM FOR ADOLESCENTS AGED 12-15

(to be completed by the young person)

Project Title: **Exploring Adolescents Experiences of Pleasure and Enjoyment – Part 2**

Please circle all you agree with (yes or no):

Have you read (or had read to you) the information about this project?	YES/NO
Has somebody explained this project to you?	YES/NO
Do you understand what this project is about?	YES/NO
Have you asked all the questions you want?	YES/NO
Have you had your questions answered in a way you understand?	YES/NO
Do you understand it's OK to stop taking part at any time?	YES/NO
Is it ok to audio record the session?	YES/NO
Are you happy to take part?	YES/NO

PLEASE SIGN YOUR NAME HERE IF YOU ARE HAPPY TO TAKE PART:

Name: _____

Date: _____

The person who explained this project to you needs to sign too:

Name of Researcher: Becca Watson

Paper 1. Community sample – Adolescent Consent Form (ages 16 - 18): Part 2

School of Psychology and Clinical Language Sciences
University of Reading
Harry Pitt Building
Whiteknights Road
Reading RG6 6AL

University of Reading

CONSENT FORM FOR ADOLESCENTS AGED 16-18

(to be completed by the young person)

Project Title: **Exploring Adolescents Experiences of Pleasure and Enjoyment – Part 2**

Please initial each box:

Have you read (or had read to you) the information about this project?	☐
Has somebody explained this project to you?	☐
Do you understand what this project is about?	☐
Have you asked all the questions you want?	☐
Have you had your questions answered in a way you understand?	☐
Do you understand it's OK to stop taking part at any time?	☐
Is it ok to audio record the session?	☐
Are you happy to take part?	☐

PLEASE SIGN YOUR NAME HERE IF YOU ARE HAPPY TO TAKE PART:

Name: _____

Date: _____

The person who explained this project to you needs to sign too:

Name of Researcher: Becca Watson

Paper 1. Community Participants - Debrief Form Part 1

School of Psychology and Clinical Language Sciences

University of Reading

Harry Pitt Building

Whiteknights Road

Reading

RG6 6AL

DEBRIEF FORM

Project Title: **Exploring Adolescents Experiences of Pleasure and Enjoyment – Part 1**

Researcher:	Becca Watson:	r.watson2@pgr.reading.ac.uk
Project Supervisors:	Prof Shirley Reynolds:	s.a.reynolds@reading.ac.uk
	Dr. Ciara McCabe:	c.mccabe@reading.ac.uk

Thanks for taking part in our research. The aim of this study was to find out about what you find enjoyable. We are particularly interested in learning more about this, as the loss of interest and pleasure is a symptom of depression. The other questionnaire you filled in also tell us more about how pleasure and fun relates to your mood and well-being.

Your answers will be kept confidential. If at any point you wish to withdraw your answers or ask any questions about this study please email me or my supervisors (contact details above). The project was approved by the University of Reading research Ethics Committee

We also asked you about your mood and how you are feeling. Everyone's feelings go up and down from time to time. This is perfectly normal and nothing to worry about. Sometimes we feel down for quite a while. If you, or a friend, are feeling down there are lots of places that can help.

Usually people you already know can help; for example, your parents, other family, a teacher, or a friend. Sometimes it's useful to talk to someone else so we have included information about other organizations that can help young people. Do have a look at this.

Thank you very much for helping us with this research. We hope you have found it interesting. If you would like to know more about our results please let your teacher know and we would be happy to come back and tell you want we found out. If you would like us to send you a brief summary of what we found you can email us at this address r.watson2@pgr.reading.ac.uk.

Paper 1. Community Participants - Debrief Form Part 2

School of Psychology and Clinical Language Sciences

University of Reading

Harry Pitt Building

Whiteknights Road

Reading

RG6 6AL

DEBRIEF FORM

Project Title: **Exploring Adolescents Experiences of Pleasure and Enjoyment – Part 2**

Researcher:	Becca Watson:	r.watson2@pgr.reading.ac.uk
Project Supervisors:	Prof Shirley Reynolds:	s.a.reynolds@reading.ac.uk
	Dr. Ciara McCabe:	c.mccabe@reading.ac.uk

Thanks for taking part in our research. As you know, we wanted to find out more about what you find enjoyable, as the loss of interest and pleasure is a symptom of depression. The questionnaires you filled in also tell us more about how this relates to your mood and well-being. The computer task you completed also helps us understand more about pleasure and reward in adolescents. This is very important because depression is a major problem for many adolescents and we want to develop better ways to identify depression and to prevent it developing.

We interviewed a lot of young people who were very different from each other and who were generous enough to give up their time to meet and talk about their experiences.

We will take a while to analyse all the data you have given us but we hope that it will help us develop better ways to treat depression in young people and to understand more about why some young people become depressed.

All of your data will be kept completely confidential. If, at any time, you would like to withdraw your results or ask any questions about the research please contact me (Becca Watson) or my project supervisors (our contact details are above).

Thanks again for helping us with this research. We hope you have found it interesting. If you would like us to send you a brief summary of what we found you can email me r.watson2@pgr.reading.ac.uk.

Paper 1. Community Participants – Sources of Support

School of Psychology and Clinical Language Sciences
University of Reading
Harry Pitt Building
Whiteknights Road
Reading
RG6 6AL

In this study you answered questions about your mood, enjoyment and feelings. Sometimes these things can be upsetting, or draw attention to difficulties you may not have noticed before. We are giving this leaflet to everyone who has taken part in our research at your school. It includes information about different types of support that you and/or your friends might find useful.

Where to Find Support & Advice:

Your General Practitioner (GP) (contact details vary)

Your GP will be able to offer support and advice on possible treatment options for any mental health difficulties. It can be helpful to take someone with you if you are not used to talking to them.

Samaritans: Tel: 08457 90 90 90, Email: Jo@Samaritans.org

Samaritans provides confidential emotional support, 24 hours a day for people who are experiencing feelings of distress or despair. They are there to listen if you're worried about something, feel upset or confused, or you just want to talk to someone.

Childline: 0800 11 11

Free confidential 24hr helpline for young people who are aged up to 19 years old

Papyrus: Tel: 0800 068 41 41/ SMS: 0776 209 697, Email: pat@papyrus-uk.org

Papyrus is a UK national charity dedicated to the promotion of positive mental health and emotional wellbeing in young people.

NHS Direct (England & Wales): 111

For health, advice and reassurance, 24 hours a day, 365 days a year.

Young Minds

Section 2.

Papers 1 and 4. Clinical sample – Adolescent Information Sheet (ages 11 – 15)

University of Reading

Healthcare from the heart of your community

Berkshire Healthcare NHS
NHS Foundation Trust

INFORMATION SHEET

FOR ADOLESCENTS WITH DEPRESSION (AGES 11-15)

Project Title: **Exploring Loss of Pleasure and Interest in Adolescent Depression**

We are inviting you to take part in a study we are doing.

Why is this project being done?

The aim of this study is to help us better understand mood problems in young people; specifically the loss of interest and pleasure in previously enjoyable activities.

Why have I been asked to take part?

You have been asked to take part because you have come to the Anxiety and Depression in Young People (AnDY) Research Clinic at the University of Reading. We are inviting up to 20 teenagers to take part.

Do I have to take part?

No. Whether or not you take part in this study is **completely up to you and your parent/guardian**. You do not have to do this. We will also need your parent/guardian's consent for you to take part. Even if your parent/guardian gives consent, you still do not have to take part. If you decide not to take part you will still get the usual help that we give young people. Also, if you decide to take part and then change your mind, this won't matter at all. You won't have to give us a reason and we will still help you with your problems.

What will happen to me if I take part in the project?

There will be an interview asking you a bit more about what you find interesting and enjoyable. You will then fill in a couple of questionnaires. This will take around an hour. We will audio record our meeting to help us collect accurate data and to use in supervision.

Might anything about the research upset me?

Some of the questions about your thoughts and feelings might remind you of both happy and sad feelings. This is completely normal and OK. If you want to stop at any time, or take a break this will be fine. We can talk about this at the time or you might want to talk to your friends or a teacher or parent about it.

What do I gain if I take part?

If you agree to take part, you will be given a £10 Amazon voucher.

Will joining in help me?

You will be helping teenagers with depression, as taking part will help us understand what happens to young people when they feel unhappy and this will help us to improve treatments.

Will my information be kept private if I take part? Will anyone else know I'm doing this?

Everything you tell us as part of this project is treated as confidential; this means that nobody other than us will ever know what you have told us. The only time we would not be able to keep something to ourselves is if you told us that you or someone else was at risk of real danger. In this situation we would have to make sure you were safe. This might mean taking to an adult, possibly your parents or your GP.

All your answers will be kept in locked cabinets and nothing will have your name on it. Audio-recordings will be kept on the computer and will need a password to get into them.

Did anyone else check the project is okay to do?

Before any research is allowed to happen, it has to be checked by a group of people called an Ethics Committee. They make sure the research is okay to do. This study has been looked at by the Reading University Ethics Committee and the National Research Ethics Service (NRES) Committee, and they were happy for it to go ahead.

What if I have more questions?

If you have any questions about our study, either now or later, please feel free to email us or phone to speak to us. You have a right to know everything and we will be happy to tell you everything about the study.

Can I take part in future research?

The main aim of all the research we conduct is to improve our understanding and treatment of mental health difficulties in children and young people. If you are interested in taking part in other research please look on the AnDY and NRG websites (see links below).

Thanks,

Becca Watson r.watson2@pgr.reading.ac.uk

Shirley Reynolds s.a.reynolds@reading.ac.uk

Ciara McCabe c.mccabe@reading.ac.uk

AnDY: https://andyresearchclinic.com/

NRG: http://www.ciaramccabe.co.uk/nrg.html

Paper 1 and 4. Clinical sample – Parents of Adolescents Information Sheet (ages 11 – 15)

Anxiety and Depression in Young People (AnDY) Research Clinic
School of Psychology and Clinical Language Sciences
University of Reading
Harry Pitt Building
Whiteknights Road
Reading RG6 6AL

FOR PARENTS OF ADOLESCENTS (AGES 11-15) WITH DEPRESSION

Project Title: **Exploring Loss of Pleasure and Interest in Adolescent Depression**

Researcher: Becca Watson
Principal Investigator: Professor Shirley Reynolds

PART 1

What is the purpose of the study?

The aim of this study is to help us better understand mood problems in adolescents; specifically the loss of interest and pleasure in previously enjoyable activities.

Why have we been invited?

Your son/daughter has been invited because he/she has been referred to the Anxiety and Depression in Young People (AnDY) Research Clinic at the University of Reading for difficulties with depression (and possibly anxiety) and is between 11-18 years of age. Approximately 20 adolescents referred to the clinic will take part in the study. This will involve the young person taking part in a one to one interview with the researcher and completing some questionnaires about their interests.

Do we have to take part?

No. It is up to you and your son/daughter to decide whether to join the study. If you are interested in taking part we will arrange a time to discuss this information with you. If you agree to take part we will then ask you to sign a consent form. You are free to withdraw at any time, without giving any reason. This would not affect the standard of care or the treatment your son/daughter will receive.

What will happen if we take part?

During the first visit to our clinic, you and your son/daughter will have completed a clinical interview to see if they have depression. You will then have received this

information about the project. If you are both happy to take part in the study, you will both be asked to sign the consent/assent forms.

If you decide to take part in the study, your son/daughter will complete another interview with the researcher. They will be asked to talk about their interests and about times when activities are not enjoyable. This will take around 45 minutes, and will be audio-recorded. Your son/daughter will then be given two questionnaires to complete; this will take around 5 minutes. If needed the researcher will be available to help him/her.

What are the possible disadvantages and risks of taking part?

The research will take about an hour. We will arrange a time that is convenient for you and your son or daughter. Most young people enjoy the interview but it is possible that some young people may become upset. The researcher has been trained to work with young people who have depression and if necessary will stop the interview immediately. There is always a clinically qualified member of staff on duty who can provide support if necessary.

What are the possible benefits?

Taking part will help us improve our understanding of depression in adolescents. This may help us to improve prevention and treatment for young people.

Your son/daughter will receive a £10 Amazon voucher for taking part in this

research. **What if there is a problem?**

We would take any problem you or your son or daughter reported very seriously. There is more information about this in Part 2.

Will our taking part in the study be kept confidential?

Yes. We will follow ethical and legal practice and all information will be handled in confidence. The only exception is if we learn that you or your son/daughter is at risk of harm. The detailed information on this is given in Part 2.

If the information in Part 1 has interested you and you are considering participation, please read the additional information in Part 2 before making any decision. Please discuss the project with a member of our team and make sure all your questions have been answered before signing the consent form and returning it to us.

PART 2

What will happen if we don't want to carry on with the study?

You can decide not to take part in the study for any reason and at any time. This will not affect the care your son/daughter receives. If you would prefer that we don't use the information that you have given us please tell us and we will destroy the information.

What if there is a problem?

If you have any concern about any aspect of the study, you should ask to speak to Becca Watson, the researcher, or Professor Shirley Reynolds, the principal investigator of the project. Please see the last page for contact details.

All research conducted by the University of Reading is covered by Employer's Liability, Public Liability, and Professional Indemnity insurance policies actively in place.

Will our taking part in this study be kept confidential?

All the information provided will be kept confidential, unless we are concerned about the welfare or safety of your son/daughter, in which case we will raise this with you and/or your son/daughter's GP. Any written information we collect (e.g. questionnaire responses) will not have any names on and will be kept n locked cabinets in a password-protected area of the university. The consent/assent forms will be kept for 5 years before disposal.

What will happen to the results of the research study?

The results of the study will be included in a PhD thesis, published in scientific and professional journals and shared at professional academic conferences. No personal information will ever be used. Any identifying information is removed and nothing can be traced to a particular person. If you would like a report of the findings of our study we will be happy to provide it. Please note that the publication of any such data usually takes at least a year after all data is collected.

Who is organising and funding the research?

The research is organised and funded by the University of Reading, and the Economic and Social Research Council (ESRC).

Who has reviewed the study?

All research at the University of Reading is reviewed by an independent group of people, called a Research Ethics Committee, to protect your interests. This application has been reviewed and given a favourable opinion by the University of Reading Research Ethics Committee and by the National Research Ethics Service (NRES) Committee. Everyone working on this study has been through the formal Disclosure & Barring (DBS) process and has been approved by the School of Psychology & Clinical Language Sciences at the University of Reading to work with children and adolescents.

What future research could we get involved in?

The main aim of all the research we conduct is to improve our understanding and treatment of mental health difficulties in children and young people. If you are interested in taking part in other research please look on the AnDY and NRG websites (see links below).

Further Information and Contact Details

Researcher: Becca Watson
Email: r.watson2@pgr.reading.ac.uk

Principal Investigator & Academic Supervisor: Prof Shirley Reynolds
Email: s.a.reynolds@reading.ac.uk
Phone:

Academic Supervisor: Assoc. Prof Ciara McCabe
Email: c.mccabe@reading.ac.uk

Websites:

AnDY Research Clinic https://andyresearchclinic.com/

NRG Research Group http://www.ciaramccabe.co.uk/nrg.html

Papers 1 and 4. Clinical sample – Adolescents Information Sheet (ages 16 – 18)

University of Reading

Healthcare from the heart of your community

Berkshire Healthcare NHS

INFORMATION SHEET

FOR ADOLESCENTS WITH DEPRESSION (AGES 16-18)

Project Title: **Exploring Loss of Pleasure and Interest in Adolescent Depression**

We are inviting you to take part in a study we are doing.

Why is this project being done?

We want to understand more about teenagers' experiences of pleasure and enjoyment. This research aims to help us understand depression in young people and how it relates to not enjoying activities and experiences. We hope that it will help us develop new and better ways to help young people and to prevent depression.

Why have I been asked to take part?

You have been asked to take part because you have come to the Anxiety and Depression in Young People (AnDY) Research Clinic at the University of Reading. We are inviting up to 20 teenagers to take part.

Do I have to take part?

No. Whether or not you take part in this study is **completely up to you**. We have also provided your parent/guardian with an information sheet, so they can help support you in deciding whether or not you wish to take part. However, as you are 16 or over, you do not need parental consent to take part. If you decide not to take part you will still get the usual help that we give young people. Also, if you decide to take part and then change your mind, this won't matter at all. You won't have to give us a reason and we will still help you with your problems. You may also be asked to take part in this study again at a later date.

What will happen to me if I take part in the project?

There will be an interview asking you a bit more about what you find interesting and enjoyable. You will then fill in a questionnaire. This will take around an hour. We will audio record our meeting to help us collect accurate data and to use in supervision.

Might anything about the research upset or distress me?

The researcher will ask you questions about your thoughts and feelings. It is possible that some of these questions may make you feel sad or upset. If this happens we can stop the interview, or you can take a break. You can also talk more with the researcher, who is trained to work with young people who are feeling distressed. You can also talk more with your family, friends or teachers as well. It is completely up to you.

Why would I want to take part?

A lot of young people experience feelings of depression. By telling us about your experiences, you may be able to help us to understand what happens to young

people when they feel sad or unhappy. This may help us to improve the treatment and support we offer to teenagers with depression. You will also be given a £10 Amazon voucher as a thank you for taking part in this study.

Will my information be kept private if I take part? Will anyone else know I'm doing this?

Everything you tell us as part of this project is treated as confidential; this means that nobody other than us will ever know what you have told us. The only time we would not be able to keep something to ourselves is if you told us, or we have reason to believe, that you or someone else was at risk of harm. This means if someone had hurt you or was planning to hurt you; if you had or were planning to deliberately harm yourself; or if you had or were planning to harm someone else. In this situation we would have to tell someone, for example the person who looks after you or your family doctor.

All the answers you give to interview questions will be audio-recorded, and these recordings will be kept on a computer and will need a password to get into them. All the answers you write down will be kept in locked cabinets and nothing will have your name on it.

Did anyone else check the project is okay to do?

Before any research is allowed to happen, it has to be checked by a group of people called an Ethics Committee. They make sure the research is okay to do. This study has been looked at by the Reading University Ethics Committee (UREC 17/41/SR) and the National Research Ethics Service (NRES) Committee (IRAS ID 224531), and they were happy for it to go ahead.

What if I have more questions?

If you have any questions about our study, either now or later, please feel free to email us or phone to speak to us. You have a right to know everything and we will be happy to tell you everything about the study.

Can I take part in future research?

The main aim of all the research we conduct is to improve our understanding and treatment of mental health conditions. You do not have to take part in any further research. Whether or not you take part is completely up to you, and will not affect your current involvement in this research. For more information on specific research projects, please look on the AnDY and NRG websites (see links below).

Thanks,

Becca Watson r.watson2@pgr.reading.ac.uk
Shirley Reynolds s.a.reynolds@reading.ac.uk
Ciara McCabe c.mccabe@reading.ac.uk

AnDY: https://andyresearchclinic.com/

NRG: http://www.ciaramccabe.co.uk/nrg.html

Papers 1 and 4. Clinical sample – Parents of Adolescents Information Sheet (ages 16 – 18)

Anxiety and Depression in Young People (AnDY) Research Clinic
School of Psychology and Clinical Language Sciences
University of Reading
Harry Pitt Building
Whiteknights Road
Reading RG6 6AL

INFORMATION SHEET

FOR PARENTS OF ADOLESCENTS (AGES 16-18) WITH DEPRESSION

Project Title: **Exploring Loss of Pleasure and Interest in Adolescent Depression**

Researcher: Becca Watson
Principal Investigator: Professor Shirley Reynolds

PART 1

What is the purpose of the study?

The aim of this study is to help us better understand mood problems in adolescents; specifically the loss of interest and pleasure in previously enjoyable activities. We are providing you with this information sheet to help support your son/daughter in deciding whether or not they wish to take part in this study.

Why has my son/daughter been invited?

Your son/daughter has been invited because he/she has been referred to the Anxiety and Depression in Young People (AnDY) Research Clinic at the University of Reading for difficulties with depression (and possibly anxiety) and is between 13-18 years of age. Approximately 20 adolescents referred to the clinic will take part in the study. This will involve the young person taking part in a one to one interview with the researcher and completing some questionnaires about their interests.

Do they have to take part?

No. **It is up to your son/daughter to decide whether to join the study.** As they are 16 or over, they do not need parental consent to take part. If they are interested in taking part we will arrange a time to discuss this information with them. If they agree to take part we will then ask them to sign a consent form. Your son/daughter is free to withdraw at any time, without giving any reason. This would not affect the care or the treatment your son/daughter will receive. Your son/daughter may also be asked to take part in this study again at a later date.

What will happen if they take part?

During the first visit to our clinic, you and your son/daughter will have completed a clinical interview to see if they have depression. Your son/daughter will then have received an information sheet about the project. If your son/daughter is happy to take part in the study, they will be asked to sign a consent form.

If they decide to take part in the study, your son/daughter will complete another interview with the researcher. They will be asked to talk about their interests and about times when activities are not enjoyable. This will take around 45 minutes, and will be audio-recorded. Your son/daughter will then be given a questionnaires to complete; which will take around 5 minutes. If needed the researcher will be available to help him/her.

What are the possible risks of my son/daughter taking part?

The researcher will ask your son/daughter questions about their thoughts and feelings. It is possible that some of these questions may make them feel sad or upset. If this happens we can stop the interview, or they can take a break. Your son/daughter can also talk more with the researcher, who is trained to work with young people who are feeling distressed. We would also suggest that your son/daughter may want to talk more with you, and/or other family, friends or teachers."

What are the possible benefits of taking part?

A lot of young people experience feelings of depression. By hearing from your son/daughter about their experiences, this may help us to understand what happens to young people when they feel depressed, or do not enjoy life. This may help us to improve the treatment and support we offer teenagers with depression. Your son/daughter will also receive a £10 Amazon voucher as a thank you for taking part in this study.

What if there is a problem?

We would take any problem your son or daughter reported very seriously. There is more information about this in Part 2.

Will taking part in the study be kept confidential?

Yes. We will follow ethical and legal practice and all information will be handled in confidence. The only exception is if we learn that your son/daughter is at risk of harm. The detailed information on this is given in Part 2.

If the information in Part 1 has interested you and you are considering participation, please read the additional information in Part 2 before making any decision. Please discuss the project with a member of our team and make sure all your questions have been answered before signing the consent form and returning it to us.

PART 2

What will happen if my son/daughter does not want to carry on with the study?

Your son/daughter can decide not to take part in the study for any reason and at any time. This will not affect the care your son/daughter receives. If you would prefer that we don't use the information that you have given us please tell us and we will destroy the information.

What if there is a problem?

If you have any concern about any aspect of the study, you should ask to speak to Becca Watson, the researcher, or Professor Shirley Reynolds, the principal investigator of the project. Please see the last page for contact details.

All research conducted by the University of Reading is covered by Employer's Liability, Public Liability, and Professional Indemnity insurance policies actively in place.

Will taking part in this study be kept confidential?

Everything your son/daughter tells us as part of this study is treated as confidential; this means that nobody other than us will ever know what they have told us. The only time we would not be able to keep something to ourselves is if your son/daughter told us, or we have reason to believe, that your son/daughter or someone else is at risk of harm. This means if someone had hurt them or was planning to hurt them; if they had or were planning to deliberately harm themselves; or if they had or were planning to harm someone else. In this situation we would have to tell someone, for example a parent/guardian or a family doctor.

All the answers you give to interview questions will be audio-recorded, and these recordings will be kept on a computer and will need a password to get into them. All the answers your son/daughter writes down will be kept in locked cabinets and nothing will have their name on it.

What will happen to the results of the research study?

The results of the current study are intended for publication in a scientific journal and at professional academic conferences. When we do this, no personal information will be given and if we quote anything that has been said by people taking part in the study, this will be anonymous and will not be traceable to a particular person. If you would like a report of the findings of our study, we will be happy to provide it. Please note that the publication of any such data may take a year or more after the completion of the study.

Who is organising and funding the research?

The research is organised and funded by the University of Reading, and the Economic and Social Research Council (ESRC).

Who has reviewed the study?

All research at the University of Reading is reviewed by an independent group of people, called a Research Ethics Committee, to protect your interests. This application has been reviewed and given a favourable opinion by the University of Reading Research Ethics Committee (UREC 17/41/SR) and by the National Research Ethics Service (NRES) Committee (IRAS ID 224531). Everyone working on this study has been through the formal Disclosure & Barring (DBS) process and has been approved by the School of Psychology & Clinical Language Sciences at the University of Reading to work with children and adolescents.

What future research could we get involved in?

The main aim of all the research we conduct is to improve our understanding and treatment of mental health difficulties in children and young people. If you are interested in taking part in other research please look on the AnDY and NRG websites (see links below).

Further Information and Contact Details

Researcher: Becca Watson
Email: r.watson2@pgr.reading.ac.uk

Principal Investigator & Academic Supervisor: Prof Shirley Reynolds
Email: s.a.reynolds@reading.ac.uk
Phone:

Academic Supervisor: Assoc. Prof Ciara McCabe
Email: c.mccabe@reading.ac.uk

Websites:

AnDY Research Clinic https://andyresearchclinic.com/

NRG Research Group http://www.ciaramccabe.co.uk/nrg.html

Papers 1 & 4. Clinical sample - Parental Opt-In Consent Form (11 – 15)

University of Reading

NHS Berkshire Healthcare NHS Foundation Trust

CONSENT FORM

FOR PARENTS OF ADOLESCENTS (AGED 11-15) WITH DEPRESSION

Project Title: **Exploring Loss of Pleasure and Interest in Adolescent Depression**

Researcher: Becca Watson
Principal Investigator: Professor Shirley Reynolds

(Please initial each box)

1. I confirm that I have read and understand the Information Sheet dated 04.06.18 (Version 3) for the above study. I have had the opportunity to consider the information, ask questions, and have had these answered satisfactorily. ☐
2. I understand that my son/daughter's participation is voluntary and that we are free to withdraw at any time, without giving any reason, without our medical care or legal rights being affected. ☐
3. I give permission for the researcher to access relevant information collected routinely by the AnDY clinic. ☐
4. I agree for the interview with my son/daughter to be audio recorded. ☐
5. I agree for my son/daughter to take part in the above study. ☐

Future Research:
I agree for my son/daughter to be contacted about other research studies being conducted at the University of Reading (see Information Sheet for details). ☐

I have spoken to: _____ (name of researcher)

Your child's name: _____

Your name: _____ Date: _____

Your signature: _____

Name of researcher: _____ Date: _____

Researcher's signature: _____

The study was reviewed and given a favourable ethical opinion for conduct by the National Research Ethics Service (NRES) Committee (IRAS ID 224531), and the University of Reading Research Ethics Committee (UREC 17/41/SR).

Papers 1 & 4. Clinical sample – Adolescent Assent Form (11 – 15)

University of Reading

Healthcare from the heart of your community

Berkshire Healthcare NHS
NHS Foundation Trust

ASSENT FORM

FOR ADOLESCENTS WITH DEPRESSION (AGED 11-15 YEARS)

Project Title: Exploring Loss of Pleasure and Interest in Adolescent Depression
Researcher: Becca Watson
Principal Investigator: Professor Shirley Reynolds

Please circle all you agree with:

Have you read (or had read to you) the information (version 3, dated 04.06.18) about this project?	YES/ NO
Has somebody else explained this project to you?	YES/ NO
Do you understand what this project is about?	YES/ NO
Have you asked all the questions you want?	YES/ NO
Have you had your questions answered in a way you understand?	YES/ NO/no questions
Do you understand it's OK to stop taking part at any time?	YES/ NO
Are you happy for us to audio record the interview?	YES/ NO
Are you happy to take part?	YES/ NO

If any answers are 'no' or you don't want to take part, don't sign your name!

If you do want to take part, please write your name and today's date:

Your name _____ Date _____ Signature _____

The person who explained this project to you needs to sign too:

Print name _____ Date _____ Signature _____

Future Research:
I agree to be contacted about other research studies being conducted at the University of Reading (see Information Sheet for details). **YES/ NO**

The study was reviewed and given a favourable ethical opinion for conduct by the National Research Ethics Service (NRES) Committee (IRAS ID 224531), and the University of Reading Research Ethics Committee UREC 17/41/SR).

Papers 1 & 4. Clinical sample - Adolescent Consent Form (16-18)

University of Reading

Healthcare from the heart of your community

Berkshire Healthcare NHS
NHS Foundation Trust

CONSENT FORM

FOR ADOLESCENTS WITH DEPRESSION
(AGED 16-18)

Project Title: Exploring the Loss of Pleasure and Interest in Adolescent Depression

Researcher: Becca Watson
Principal Investigator: Professor Shirley Reynolds

(Please initial each box)

1. I confirm that I have read and understand the Information Sheet dated 19.07.17 (Version 3) for the above study. I have had the opportunity to consider the information, ask questions, and have had these answered satisfactorily. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected. ☐
3. I give permission for the researcher to access relevant information collected routinely by the AnDY clinic. ☐
4. I agree that the research interview can be audio recorded. ☐
5. I agree to take part in the above study. ☐

Future Research:
I agree to be contacted about other research studies being conducted at the University of Reading (see Information Sheet for details). ☐

I have spoken to: _____ (name of researcher)

Your name: _____ Date: _____

Your signature: _____

Name of researcher: _____ Date: _____

Researcher's signature: _____

The study was reviewed and given a favourable ethical opinion for conduct by the National Research Ethics Service (NRES) Committee (IRAS ID 224531), and the University of Reading Research Ethics Committee UREC 17/41/SR).

Section 3.

Paper 3. Adolescent Information Sheet (ages 11 – 15)

School of Psychology and Clinical Language Sciences

University of Reading

Harry Pitt Building

Whiteknights Road

Reading

RG6 6AL

INFORMATION FOR 11-15 YEAR OLDS

Project Title: **Exploring Enjoyment and Interest in Young People**

Hello,

We are inviting you to take part in a research study.

Why is this project being done?

We are exploring young peoples' enjoyment of activities in order to help us better understand mood problems, such as depression, in adolescents.

Why have I been asked to take part?

You have been asked to take part because your school has agreed to help us with this project. We are inviting you because you are aged between 11 and 18 years old.

Do I have to take part?

No. Because you are under 16, your parents have been asked if they are happy for you to take part, and they will have had the choice to opt you out of the study. But even if your parents have not opted you out, you still do not have to take part, it is completely up to you. Also, if you decide to take part and then change your mind, this won't matter at all. You won't have to give us a reason.

What will happen if I take part in the project?

We would like you to complete some questionnaires at school. They will take about 20 minutes. They include questions about your feelings, thoughts and experiences. You will be entered into a prize draw to win a £10 Amazon voucher.

We are inviting a number of young people who took part in this study to complete some of the questionnaires again for a second time at school. This will help us to understand whether your mood and enjoyment has changed or stayed the same over time.

Might anything about the research upset me?
Some of the questions about your thoughts and feelings might remind you of both happy and sad feelings. This is completely normal and OK. If you want to stop at any time, or take a break this will be fine. We can talk about this at the time or you might want to talk to your friends or a teacher or parent about it.

Will my information be kept private if I take part? Will anyone else know I'm doing this?
Everything you tell us as part of this project is treated as confidential; this means that nobody other than us will ever know what you have told us. Your answers will be kept in locked cabinets and won't have your name on it.

The only time we would not be able to keep information confidential is if you tell us something which makes us worried about you or someone else. If this were to happen we would pass on this information to someone at your school who can help you.

What personal data will be held?
We will collect, use and store personal information in this study for the purpose of conducting research in the public interest. Personal information we collect, such as age, gender and ethnicity, helps us to understand and describe the research findings. If you wished to withdraw from the study after this has been collected, processing of this data may still continue. For more information on your rights please see https://ico.org.uk

Did anyone else check the project is okay to do?
Before any research is allowed, it has to be checked by a group of people called an Ethics Committee. They make sure the research is safe. This study has been looked at by the University of Reading Ethics Committee and they were happy for it to go ahead. Everyone working on this study has been through the formal Disclosure Barring Service (DBS) checks and has been approved by the School of Psychology, University of Reading to work with young people.

What if I have more questions?
If you have any questions about our study, either now or later, please feel free to email us. You have a right to know everything and we will be happy to tell you everything. Also please feel free to talk about this study with your friends, parents and/or teachers.

Thank you very much,

Becca Watson, MSc (Researcher) email: r.watson2@pgr.reading.ac.uk

Dr. Ciara McCabe (Supervisor) email: c.mccabe@reading.ac.uk
Dr. Kate Harvey (Supervisor) email: k.n.harvey@reading.ac.uk
Prof. Shirley Reynolds (Supervisor) email: s.a.reynolds@reading.ac.uk

Website: andyresearchclinic.com

Paper 3. Adolescent Information Sheet (ages 16– 18)

School of Psychology and Clinical Language Sciences

University of Reading

Harry Pitt Building

Whiteknights Road

Reading

RG6 6AL

INFORMATION FOR 16-18 YEAR OLDS

Project Title: **Exploring Enjoyment and Interest in Young People**

Hello,

We are inviting you to take part in a research study.

Why is this project being done?

We are exploring young people's enjoyment of activities in order to help us better understand mood problems, such as depression, in young people.

Why have I been asked to take part?

You have been asked to take part because your school has agreed to help us with this project. We are inviting you because you are aged between 11 and 18 years old.

Do I have to take part?

No. You do not have to take part. Also, if you decide to take part and then change your mind, this won't matter at all. You won't have to give us a reason.

What will happen if I take part in the project?

We would like you to complete some questionnaires at school. They will take about 20 minutes. They include questions about your feelings, thoughts and experiences. You will be entered into a prize draw to win a £10 Amazon voucher. We are inviting a number of young people who took part in this study to complete some of the questionnaires again for a second time at school. This will help us to understand whether your mood and enjoyment has changed or stayed the same over time.

Might anything about the research upset me?
Some of the questions about your thoughts and feelings might remind you of both happy and sad feelings. This is completely normal and OK. If you want to stop at any time, or take a break this will be fine. We can talk about this at the time or you might want to talk to your friends or a teacher or parent about it.

Will my information be kept private if I take part? Will anyone else know I'm doing this?
Everything you tell us as part of this project is treated as confidential; this means that nobody other than us will ever know what you have told us. Your answers will be kept in locked cabinets and won't have your name on it. You will be assigned a research ID number so no one will know who has filled out the questionnaires. Your answers will be kept in locked cabinets and nothing will have your name on it. Once we have finished the project the questionnaires will be destroyed.

The only time we would not be able to keep information confidential is if you tell us something which makes us worried about you or someone else. If this were to happen we would pass on this information to someone at your school who can help you.

What personal data will be held?
We will collect, use and store personal information in this study for the purpose of conducting research in the public interest. Personal information we collect, such as age, gender and ethnicity, helps us to understand and describe the research findings. If you wished to withdraw from the study after this has been collected, processing of this data may still continue. For more information on your rights please see https://ico.org.uk

Did anyone else check the project is okay to do?
Before any research is allowed, it has to be checked by a group of people called an Ethics Committee. They make sure the research is safe. This study has been looked at by the University of Reading Ethics Committee and they were happy for it to go ahead. Everyone working on this study has been through the formal Disclosure Barring Service (DBS) checks and has been approved by the School of Psychology, University of Reading to work with young people.

What if I have more questions?
If you have any questions about our study, either now or later, please feel free to email us. You have a right to know everything and we will be happy to tell you everything. Also please feel free to talk about this study with your friends, parents and/or teachers.

Thank you very much,

Becca Watson, MSc (Researcher) email: r.watson2@pgr.reading.ac.uk

Dr. Ciara McCabe (Supervisor) email: c.mccabe@reading.ac.uk
Dr. Kate Harvey (Supervisor) email: k.n.harvey@reading.ac.uk
Prof. Shirley Reynolds (Supervisor) email: s.a.reynolds@reading.ac.uk

Website: andyresearchclinic.com

Paper 3. Parent Information Sheet (ages 11 – 18)

School of Psychology and Clinical Language Sciences

University of Reading

Harry Pitt Building

Whiteknights Road

Reading

RG6 6AL

RESEARCH INFORMATION FOR PARENTS

***Project Title*: Exploring Enjoyment and Interest in Young People**

What is the purpose of the study?

We are investigating adolescents' enjoyment of activities in order to help us better understand mood problems, such as depression, in adolescents.

Why are we inviting your son/daughter to take part?

We are a child and adolescent depression research team at the University of Reading. We are specifically interested in understanding loss of pleasure and reward in adolescents. We hope to use this information to further our understanding of symptoms and improve the treatments and support offered to young people suffering with depression. Your son/daughter has been invited to take part because their school/college has agreed be part of this research project. Your child is also aged between 11 and 18 and therefore in the age group we are working with.

Does my child have to take part?

Participation in this research is entirely voluntary.

11-15 year olds

This is an opt-out study. This means that if your child is under 16 and you DO NOT want them to take part, please sign and return the attached 'opt-out' form. If you do not return this form (or tell the school in another way) we will assume that you are happy for your child to take part in this research. If your child is under 16 they will also be asked if they are happy to take part and are free to opt out themselves. Either you or your child can withdraw your child from the study at any time without giving a reason.

16 years and above

If your child is aged 16 or over they do not need their parent(s) to opt-out of the study. However, they will be asked if they are happy to take part and they are free to opt-out themselves. If they agree to take part, they are still free to withdraw at any time without giving any reason.

What will happen if my child takes part?

Your son/daughter will complete several questionnaires during a brief slot in the school/college day. The questions will ask about feelings, and enjoyment of activities, and demographic information, such as age and gender.

We are inviting a number of young people who took part in this study to complete some of the questionnaires again for a second time at school. This will help us to understand whether their mood and enjoyment has changed or stayed the same over time.

What are the possible disadvantages and risks of taking part?

We do not expect there to be any disadvantages or risks involved in taking part in this research. Some of the questions ask about feelings, and it is possible that some adolescents may find this upsetting. Some of the questions are personal and ask about feelings of being unhappy. It is important to highlight that many of these questions are unlikely to be relevant to the young person, however if they are, it is important for us to know this.

If anyone was upset by any of the questions we would offer to stop the research immediately (and your child can choose not to answer questions if they wish). During the research we will follow all school safeguarding and child protection policies. If you would like more information on the school's safeguarding policies and procedures, please contact the school directly. Additionally, all children will be given a support sheet to keep. The list contains helpful resources for those who want to learn more about mental health, who want to get involved in volunteering opportunities or would like to seek advice.

As the research will be carried out in school we do not require you or your child to come to the University at any point during the research. The study will be carried out on whole classes.

What are the possible benefits?

Taking part will contribute to our gaining a greater understanding of how teenagers think and how this may relate to how they are feeling. Research investigating low mood in adolescents is limited and we hope to use this information to evaluate and understand how clinical treatments should be specifically designed for this age group. Your son/daughter will be entered into a prize draw to win a £10 Amazon voucher.

What if there is a problem?

If you have any concern about any aspect of the study, you should ask to speak to Becca Watson, the researcher on this project. Please see the last page for contact details. If you remain unhappy and wish to complain formally, you can contact the Principle

Investigator of this research, Professor Shirley Reynolds, who will discuss any concerns you may have.

Will our taking part in the study be kept confidential?

All the information provided will be kept confidential. The information we collect (questionnaire answers) will not have any names on and will be kept strictly in locked cabinets in locked offices at the university. All the information collected for the project will be destroyed as soon as they are no longer needed. The consent forms, however, will be kept for 5 years before disposal.

The only exception to this is if your child tells us something, which puts them, or someone else, at risk of harm. If this happens we will inform the school who will follow their risk and safeguarding policies. We are asking young people about symptoms of depression. If we feel any young person is at risk of harm or radicalization we will alert a nominated member of the school staff who will then follow the school procedures. If you would like more information on the school's safeguarding policies and procedures, please contact the school directly.

What personal data will be held?

We will collect, use and store personal information in this study for the purpose of conducting research in the public interest. Personal information we collect, such as age, gender and ethnicity, helps us to understand and describe the research findings. If you wished to withdraw from the study after this has been collected, processing of this data may still continue. For more information on your rights please see https://ico.org.uk

What will happen to the results of the research study?

We hope to write these results up for publication in a scientific journal and to deliver at professional academic conferences. No personal information will be given and any material used will be anonymous and not be traceable to a particular person. If you would like a report of the findings of our study, we will be happy to provide it. Please note that the publication of any such data may take a year or more after the completion of the study.

Who has reviewed the study?

All research at the University of Reading is reviewed by an independent group of people, called a Research Ethics Committee, to protect your interests. This application has been reviewed and given a favourable opinion by the University of Reading Research Ethics Committee. Everyone working on this study has been through the formal Criminal Records Bureau Disclosure process and has been approved by the School of Psychology at the University of Reading to work with children and adolescents.

Any questions?

If you have any questions please do not hesitate to contact us by email. We will be happy to tell you more about the research and to discuss any questions or concerns you might have.

Thank you very much,

Rebecca Watson, MSc (Researcher) email: r.watson2@pgr.reading.ac.uk

Dr. Ciara McCabe (Supervisor) email: c.mccabe@reading.ac.uk

Dr. Kate Harvey (Supervisor) email: k.n.harvey@reading.ac.uk

Prof. Shirley Reynolds (Supervisor) email: s.a.reynolds@reading.ac.uk

Website: andyresearchclinic.com

Paper 3. Community sample – Parental Opt-Out Consent Form (11 – 15)

School of Psychology and Clinical Language Sciences

University of Reading

Harry Pitt Building

Whiteknights Road

Reading

RG6 6AL

PARENT OPT-OUT FORM

Project Title: **Exploring Enjoyment and Interest in Young People**

Researcher: Becca Watson

Supervisors: Professor Shirley Reynolds, Dr Kate Harvey & Dr Ciara McCabe

Please only complete and return this form if you DO NOT want your child to take part in this research.

I **do not** agree to my child participating in this research.

Your child's name: _____

Your name: _____

Date: _____

Paper 3. Community sample – Adolescent Assent Form (ages 11 – 15)

School of Psychology and Clinical Language Sciences
University of Reading
Harry Pitt Building
Whiteknights Road
Reading
RG6 6AL

University of Reading

ASSENT FORM FOR YOUNG PEOPLE (AGED 11-15)

Project Title: **Exploring Enjoyment and Interest in Young People**

Please circle yes or no:

Have you read (or had read to you) the information about this project?	YES/NO
Has somebody explained this project to you?	YES/NO
Do you understand what this project is about?	YES/NO
Have you asked all the questions you want?	YES/NO
Have you had all your questions answered in a way you understand?	YES/NO
Do you understand it is okay to stop taking part at any time?	YES/NO
Are you happy to take part?	YES/NO

PLEASE WRITE YOUR FULL NAME HERE IF YOU ARE HAPPY TO TAKE PART:

Name: _____ Date: _____

(You can still take part if you do not circle yes to the statement below):
I understand that my responses will be stored and made available to other researchers who agree to maintain the confidentiality of this information YES/NO

Paper 3. Community sample – Adolescent Consent Form (ages 16 - 18)

School of Psychology and Clinical Language Sciences
University of Reading
Harry Pitt Building
Whiteknights Road
Reading
RG6 6AL

University of Reading

CONSENT FORM FOR YOUNG PEOPLE AGED 16-18

Project Title: **Exploring Enjoyment and Interest in Young People**

If your answer is YES, please put your initials in each box:

Have you read (or had read to you) the information about this project?	☐
Has somebody explained this project to you?	☐
Do you understand what this project is about?	☐
Have you asked all the questions you want?	☐
Have you had your questions answered in a way you understand?	☐
Do you understand it is okay to stop taking part at any time?	☐
Are you happy to take part?	☐

PLEASE SIGN YOUR FULL NAME HERE IF YOU ARE HAPPY TO TAKE PART:
Name:_____Date:_____

(You can still take part if you do not circle yes to the statement below):
I understand that my responses will be stored and made available to other researchers who agree to maintain the confidentiality of this information YES/NO

Paper 3. Debrief Form

University of Reading

ADOLESCENT DEBRIEF SHEET

***Project Title*: Exploring enjoyment and interest in young people**

Project Supervisors:	Prof Shirley Reynolds:	s.a.reynolds@reading.ac.uk
	Dr. Ciara McCabe:	c.mccabe@reading.ac.uk
	Dr. Kate Harvey:	k.n.harvey@reading.ac.uk
Researchers:	Becca Watson:	r.watson2@pgr.reading.ac.uk

The aim of this study was to investigate mood and enjoyment in young people.

Your results will be anonymously (your name will be removed) compared with those of other young people part in the study. If at any point you wish to withdraw your results or ask any questions about this study please email me or my supervisors (contact details above). The project was approved by the University of Reading Research Ethics Committee (UREC).

The different questionnaires ask about mood and tell us about how you have been feeling. Everyone's feelings go up and down from time to time. This is perfectly normal and nothing to worry about. Sometimes we do go through times when we feel down for quite a while. If you, or a friend, are feeling down there are lots of places that can help.

Usually people you already know can help; for example, your parents, other family, a teacher, or a friend. Sometimes it's useful to talk to someone else so we have included information about other organisations that can help young people. Do have a look at this. If you feel that you definitely would like some help you can also talk to a teacher at school/college.

Thank you very much for helping us with this research. We hope you have found it interesting. If you would like to know more about our results please let your teacher know and we would be happy to come back and tell you want we found out. If you would like us to send you a brief summary of what we found you can email us at this address r.watson2@pgr.reading.ac.uk.

Paper 3. Sources of Support

School of Psychology and Clinical Language Sciences
University of Reading
Harry Pitt Building
Whiteknights Road
Reading
RG6 6AL

In this study you answered questions about your mood, enjoyment and feelings. Sometimes these things can be upsetting, or draw attention to difficulties you may not have noticed before. We are giving this leaflet to everyone who has taken part in our research at your school. It includes information about different types of support that you and/or your friends might find useful.

Where to Find Support & Advice:

Your General Practitioner (GP) (contact details vary)

Your GP will be able to offer support and advice on possible treatment options for any mental health difficulties. It can be helpful to take someone with you if you are not used to talking to them.

Samaritans: Tel: 08457 90 90 90, Email: Jo@Samaritans.org

Samaritans provides confidential emotional support, 24 hours a day for people who are experiencing feelings of distress or despair. They are there to listen if you're worried about something, feel upset or confused, or you just want to talk to someone.

Childline: 0800 11 11

Free confidential 24hr helpline for young people who are aged up to 19 years old

Papyrus: Tel: 0800 068 41 41/ SMS: 0776 209 697, Email: pat@papyrus-uk.org

Papyrus is a UK national charity dedicated to the promotion of positive mental health and emotional wellbeing in young people.

NHS Direct (England & Wales): 111

For health, advice and reassurance, 24 hours a day, 365 days a year.

Young Minds

Charity committed to improving the mental health of young people. Learn about mental health and hear others' storieswww.youngminds.org.uk

MoodGYM: https://moodgym.anu.edu.au/welcome

This is a free, interactive web programme for young people that is designed to prevent and reduce depression

Reynolds, S. & Parkinson, M. (2015) Am I depressed? And what can I do about it?

The book adopts a narrative approach with graphic elements, incorporating case studies and including some interactive exercises. It provides an essential bridge for young people who have not yet asked for professional help as well as support for those who are waiting for treatment.

Reynolds S. & Parkinson, M. (2015) Teenage depression: A CBT guide for parents

This accessible companion book to Am I Depressed and What Can I do About it? makes use of the case studies, looking at the issues from the parents' point of view, and incorporates additional strategies for parents. From 'what to look out for', through what the evidence says about different forms of treatment, to family communication and relapse prevention. Each section includes troubleshooting boxes.

Think Good – Feel Good

This is a workbook for children and young people. Stallard, P. (2002). Chichester: John Wiley & Sons. (plus additional online resources after purchasing book http://www.wileyeurope.com/go/thinkgoodfeelgood).

Appendix C. Self-Report Measures

1. Mood and Feelings Questionnaire (MFQ) [Papers 1, 3, 4]

This questionnaire is about how you might have been feeling or acting recently. For each question, please tick the option which best describes how you have been feeling or acting in the past two weeks.

	NOT TRUE	SOME TIMES	TRUE
1. I felt miserable or unhappy. *			
2. I didn't enjoy anything at all. *			
3. I was less hungry than usual.			
4. I ate more than usual.			
5. I felt so tired I just sat around and did nothing. *			
6. I was moving and walking more slowly than usual.			
7. I was very restless. *			
8. I felt I was no good anymore.			
9. I blamed myself for things that weren't my fault.			
10. It was hard for me to make up my mind.			
11. I felt grumpy and cross with my parents.			
12. I felt like talking less than usual.			
13. I was talking more slowly than usual.			
14. I cried a lot. *			
15. I thought there was nothing good for me in the future.			
16. I thought that life wasn't worth living.			
17. I thought about death or dying.			
18. I thought my family would be better off without me.			
19. I thought about killing myself.			

	NOT TRUE	SOME TIMES	TRUE
1. I didn't want to see my friends.			
2. I found it hard to think properly or concentrate. *			
3. I thought bad things would happen to me.			
4. I hated myself. *			
5. I felt I was a bad person. *			
6. I thought I looked ugly.			
7. I worried about aches and pains.			
8. I felt lonely. *			
9. I thought nobody loved me. *			
10. I didn't have any fun in school.			
11. I thought I could never be as good as other kids. *			
12. I did everything wrong. *			
13. I didn't sleep as well as I usually sleep.			
14. I slept a lot more than usual.			

* Items in 13-item Short Form – Mood and Feelings Questionnaire (MFQ-SF)

Angold, A., & Costello, E. J. (1987). Mood and feelings questionnaire (MFQ). *Durham: Developmental Epidemiology Program, Duke University.*

Thapar, A., & McGuffin, P. (1998). Validity of the shortened Mood and Feelings Questionnaire in a community sample of children and adolescents: a preliminary research note. *Psychiatry research, 81(2),* 259-268.

2. Snaith Hamilton Pleasure Scale (SHAPS) [Papers 1, 2, 3, 4]

This questionnaire is about how much you have enjoyed things in the last few days. Tick one box to indicate how much you agree or disagree with each statement.

	STRONGLY DISAGREE	DISAGREE	AGREE	STRONGLY AGREE
1. I would enjoy my favourite television or radio programme				
2. I would enjoy being with my family or close friends				
3. I would find pleasure in my hobbies and pastimes				
4. I would be able to enjoy my favourite meal				
5. I would enjoy a warm bath or refreshing shower				
6. I would find pleasure in the scent of flowers or the smell of a fresh sea breeze or freshly baked bread:				
7. I would enjoy seeing other people's smiling faces				
8. I would enjoy looking smart when I have made an effort with my appearance				
9. I would enjoy reading a book, magazine or newspaper				
10. I would enjoy a cup of tea or coffee or my favourite drink				

11. I would find pleasure in small things, e.g. bright sunny day, a telephone call from a friend				
12. I would be able to enjoy a beautiful landscape or view				
13. I would get pleasure from helping others				
14. I would feel pleasure when I receive praise from other people				

Snaith, R. P., Hamilton, M., Morley, S., Humayan, A., Hargreaves, D., & Trigwell, P. (1995). A scale for the assessment of hedonic tone the Snaith–Hamilton Pleasure Scale. *The British Journal of Psychiatry, 167(1)*, 99-103.

3. **Anticipatory and Consummatory Interpersonal Pleasure Scale – Adolescent Version (ACIPS-A) [Papers 1, 2, 3]**

This questionnaire is about how much you enjoy and look forward to things in general. If you have not had the experience that is described in the statement (that is, it has never happened to you), think about the most similar experience that you've had and use that experience to make your response. Please circle one number for each statement.

	Very false for me	Some-what false for me	Some-what true for me	Very true for me
1. I look forward to seeing people when I'm on my way to a party or get-together				
2. I enjoy looking at photographs of my friends and family				
3. I don't really look forward to family get-togethers or gatherings				
4. I enjoy joking and talking with a friend or co-worker.				
5. A good meal always tastes better when you eat it with someone you feel close to.				
6. I like it when people call or text me to say hi				
7. When something good happens to me, I can't wait to share the news with others.				
8. If I learned of a group where the people shared similar interests as me, I would be interested in joining it.				
9. I enjoy watching films about friendships or relationships with my friends				
10. I imagine how much fun it would be to go on vacation with a friend or someone I love.				
11. I appreciate being invited to hang out with people I know after school or work				

12. I am pleased when I see a friend or someone I love who I haven't seen for a while.				
13. I enjoy going on group activities like attending sports events or concerts with my friends				
14. I look forward to watching my favourite TV shows with my friends.				
15. I am excited when a friend that I haven't seen in a while contacts me to make plans.				
16. I like talking with others while waiting in line.				
17. I enjoy it when a friend and I can discuss important things.				

Gooding, D. C., & Pflum, M. J. (2011). Anticipatory and consummatory interpersonal pleasure scale (ACIPS). *Madison, WI: University of Wisconsin-Madison.*

Gooding, D. C., Pflum, M. J., Fonseca-Pedero, E., & Paino, M. (2016). Assessing social anhedonia in adolescence: the ACIPS-A in a community sample. *European Psychiatry, 37,* 49-55.

4. Positive and Negative Affect Scale – Child Version [Paper 3]

Think about how you have been feeling over the past two weeks. Please write a number next to each word to reflect how strongly you have had each feeling.

1 VERY SLIGHTLY, OR NOT AT ALL	2 A LITTLE	3 MODERATELY	4 QUITE A BIT	5 EXTREMELY

_____ CHEERFUL
_____ AFRAID
_____ HAPPY
_____ MAD
_____ LIVELY
_____ SCARED
_____ PROUD
_____ SAD
_____ JOYFUL
_____ MISERABLE

Adapted from Watson, D. & Clark, L.A. (1999). The PANAS-X: Manual for the Positive and Negative Affect Schedule—Expanded form-Revised. Copyright 1994 by D. Watson and L. A. Clark; all rights reserved. PANAS-X adapted with permission.

Ebesutani, C., Regan, J., Smith, A., Reise, S., Higa-McMillan, C., & Chorpita, B. F. (2012). The 10-item positive and negative affect schedule for children, child and parent shortened versions: application of item response theory for more efficient assessment. *Journal of Psychopathology and behavioral Assessment*, *34*(2), 191-203.

5. Behavioural Activation and Behavioural Inhibition Scale (BISBAS) [Paper 3]

Each item of this questionnaire is a statement that a person may either agree with or disagree with. For each item, indicate how much you agree or disagree with what the item says. Choose only one response to each statement.

	Very true for me	Some-what true for me	Some-what false for me	Very false for me
1. A person's family is the most important thing in life.				
2. Even if something bad is about to happen to me, I rarely experience fear or nervousness.				
3. I go out of my way to get things I want.				
4. When I am doing well at something I love to keep at it.				
5. I am always willing to try something new if I think it will be fun.				
6. How I dress is important to me				
7. When I get something I want, I feel excited and energized.				
8. Criticism or scolding hurts me quite a bit.				
9. When I want something I usually go all-out to get it.				
10. I will often do things for no other reason than that they might be fun.				

	Very true for me	Some-what true for me	Some-what false for me	Very false for me
11. It is hard for me to find the time to do things such as get a haircut.				
12. If I see a chance to get something I want I move on it right away.				
13. I feel pretty worried or upset when I think or know somebody is angry at me.				
14. When I see an opportunity for something I like I get excited right away.				
15. I often act on the spur of the moment.				
16. If I think something unpleasant is going to happen I usually get pretty 'worked up.				
17. I often wonder why people act the way they do.				
18. When good things happen to me, it affects me strongly.				
19. I feel worried when I think I have done poorly at something important.				
20. I crave excitement and new sensations.				
21. When I go after something I use a 'no holds barred' approach.				
22. I have very few fears compared to my friends.				
23. It would excite me to win a contest.				
24. I worry about making mistakes.				

Carver, C. S., & White, T. L. (1994). Behavioral inhibition, behavioral activation, and affective responses to impending reward and punishment: The BIS/BAS scales. Journal of Personality and Social Psychology, 67, 319-333.

6. Self-Evaluation of Negative Symptoms (SNS) [Paper 3]

For each statement, put a cross in the box which best corresponds to your current feelings (based on the previous week).

	STRONGLY DISAGREE	SOME-WHAT AGREE	STRONGLY AGREE
1. I prefer to be alone in my corner			
2. I'm better off alone, because I feel uncomfortable when anyone is near me			
3. I'm not interested in going out with friends or family			
4. I don't particularly try to contact and meet friends (letters, telephone, text messaging, etc.)			
5. People say I'm not sad or happy and that I'm not often angry			
6. There are many happy or sad things in life but I don't feel concerned by them			
7. Watching a sad or happy film, reading or listening to a sad or happy story does not especially make me want to cry or laugh			
8. It is difficult for people to know how I feel			
9. I don't have as much to talk about as most people			
10. I find it 10 times harder to talk than most people do			
11. People often say that I don't talk much			
12. With friends and family, I want to talk about things but it doesn't come out			
13. I find it difficult to meet the objectives I set myself			
14. It's hard to stick to doing things on an everyday regular basis			
15. There are many things I don't do through lack of motivation or because I don't feel like it			
16. I know there are things I must do (get up or wash			

myself for example) but I have no energy			
17. I don't take any great pleasure in talking to people			
18. I find it hard to take pleasure even when doing things I have chosen to do			
19. When I imagine doing one thing or another, I don't feel any particular pleasure in the idea			

Dollfus, S., Mach, C., & Morello, R. (2016). Self-evaluation of negative symptoms: a novel tool to assess negative symptoms. *Schizophrenia bulletin*, *42*(3), 571-578.

7. Generalised Anxiety Disorder Assessment (GAD-7) [Paper 3]

This questionnaire is about feeling worried. Over the last 2 weeks, how often have you been bothered by the following problems? Please circle a number for each statement.

	Not at all	Several days	More than half the days	Nearly everyday
1. Feeling nervous, anxious or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid as if something awful might happen	0	1	2	3

Spitzer, R. L., Kroenke, K., Williams, J. B., & Löwe, B. (2006). A brief measure for assessing generalized anxiety disorder: the GAD-7. *Archives of internal medicine, 166(10),* 1092-1097.

8. Revised Child Anxiety and Depression Scale (RCADS) [Paper 3]