

## **Young people's future thinking and mental health: the development and validation of the *Adolescent Future Thinking Rating Scale (AFTRS)*.**

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### **Conflict of Interest**

The authors report no financial, non-financial interests or potential conflicts of interest.

### **Ethics Approval**

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. The studies in the article have obtained full ethical approval from the Health Faculties Research Ethics Sub-committee at King's College London, reference number HR/DP-20/21-21394, HR/DP-21/22-26458, and LRS/DP-21/22-28467. All participants provided written consent prior to participation in the studies.

### **Data availability statement**

The data used in this study are available upon request to the corresponding author.

## **Abstract**

**Objectives.** We aimed to develop and validate a new scale of future thinking and adolescent mental health – the *Adolescent Future Thinking Rating Scale (AFTRS)*.

**Methods.** A provisional AFTRS was developed from interviews with 19 adolescents. It was completed by three samples: exploratory (n=161) aged 16-21 years, who also completed established measures of future thinking, cognitive risk factors, depression and anxiety; replication (n=209) aged 16-25 years; and test-retest (n=102) aged 17-23 years. The reliability, convergent, predictive, and discriminant validity were examined.

**Results.** Exploratory factor analyses identified the AFTRS-18 and AFTRS-12. Both had three sub-scales: (i) *Concerns about Maladaptive Future Thinking*, (ii) *Future Positivity*, and (iii) *Ability to Visualise the Future*. Established future thinking measures were combined into two factors: *Negative Future Emotions (Cognitive Triad Inventory – View of Future and Beck’s Hopelessness Scale)* and *Immediacy Preference (Consideration of Future Consequences and Quick Delay Questionnaire)*. The AFTRS-18 and AFTRS-12 were similarly associated with both factors and with depression/anxiety. Internal consistency and test-retest reliability were high.

**Conclusions.** The AFTRS-12 and AFTRS-18 are reliable and valid measures of the three key dimensions of adolescent future thinking and mental health. The first subscale remained significant in predicting depression and anxiety after controlling for general cognitive risks.

**Keywords** Depression, generalised anxiety, young people, future thinking, scale validation

## Introduction

Episodic future thinking refers to the capacity to visualise and mentally simulate experiences relevant to one's personal future (Schacter et al., 2017). It is particularly important in late adolescence and young adulthood, a challenging period of transition and personal development, when young people make life-changing decisions about their future (Steinberg & Morris, 2001). Previous studies have shown that the decisions made during this period can have life-long consequences, and may be influenced by the amount and quality of thinking about one's future self, which is important for adolescent self-concept development (Eaton et al., 2012; Reyna & Farley, 2006; Sebastian et al., 2008; Sonuga-Barke et al., 2016; Zahavi, 2000). For example, more detailed imagery and greater feelings of connectedness to one's future self are related to a more realistic and efficient approach to planning, whereas alienation and avoidance of the future are related to increased impulsive and risk-taking behaviours in adolescents aged 12-16 years (Atance & O'Neill, 2001; Bromberg et al., 2015, 2017; Eskritt et al., 2014; McCue et al., 2019).

Late adolescence is also a time when the risk for mental health problems, for instance, depression and anxiety, increases sharply (Kessler et al., 2007; Thapar et al., 2012). These conditions could produce states of mind that are detrimental to adolescents' ability and motivation to envision and plan for their future (Costello et al., 2003; Grupe, 2017; Sonuga-Barke et al., 2016). In Beck's Cognitive triad theory, 'negative views of the future', where depressed individuals hold irrational and persistent negative views about their future, is one of three key defining features of depression (Beck, 1979; Beckham et al., 1986). Therefore, understanding how mental health problems in adolescence impact future thinking in a way

that could potentially constrain future life chances is important both scientifically and clinically.

Existing studies have adopted three main approaches to measuring episodic future thinking (Cheke, 2012). First, a phenomenological approach in which participants are asked to report positive and negative events that could reasonably happen in the future based on personal, interpersonal scenarios, or cue words (Addis et al., 2007, 2008; MacLeod et al., 1996; MacLeod & Salaminiou, 2001a; Miles et al., 2004; Takano et al., 2014; Wang et al., 2011). The phenomenological characteristics of these future events, such as vividness, emotional intensity, visual perspective, and personal importance are then coded by researchers or self-reported using a mix of different standalone questionnaires (D'Argembeau & van der Linden, 2006; Johnson et al., 1988; Rubin et al., 2003). As a result, these instruments typically measure a limited number of aspects of future thought, such as its content or valence, rather than giving a multi-faceted picture of future thinking.

The second approach involves behavioural tasks, such as the Implicit Relations Assessment that probes the degree of positivity and negativity in an individual's future outlook (Kosnes et al., 2013). Alternatively, participants narrated personal worries for the future and then the amount of judgement error in their estimation of time was measured in a neutral task, where more errors suggested a higher cognitive burden from a negative future outlook (Takano et al. 2014).

Third, episodic future thinking has also been measured with questionnaires. The *Future Events Prediction* and *Subjective Probability Task* involve participants rating the likelihood of pre-defined positive and negative events happening to them in the future (Boland et al., 2018; MacLeod et al., 1996). In the *Hopes and Fears Questionnaire*, participants

report hoped-for or feared-for future events (Nurmi et al., 1994; Zhao et al., 2018). More general and non-episodic future thinking has also been captured by existing scales, measuring the tendency to think positively/negatively, agency beliefs, and more broadly, the time perspective (Lalot et al., 2019; Miranda et al., 2017; Rizzo & Chaoyun, 2017; Zimbardo & Boyd, 2015).

However, established instruments are limited in addressing the links between future thinking and mental health in adolescence in several ways. First, they each measure a limited number of future thinking concepts, such as valance, content, or frequency, so an overview of personal future thinking requires using multiple scales. Second, most of them were initially developed and tested in adults rather than adolescents. The period of adolescence, however, is characterised by developmentally unique aspects of both future thinking and mental health, therefore, the constructs most relevant to adolescence may have been overlooked when developing scales for adult use (Kosnes et al., 2013; MacLeod et al., 1996; MacLeod & Salaminiou, 2001b; Takano et al., 2014). Third, most existing measures and studies did not differentiate future-related thinking from more general cognitive risks for depression, such as negative cognitive bias, dysfunctional attribution style, and negative repetitive thinking. Considering these limitations, there is a need for an easy-to-complete and short scale tapping multiple aspects of future thinking relevant to mental health for use with adolescents.

Here, we describe the co-development and validation of a scale specifically designed to measure the multiple dimensions of future thinking that are most relevant to adolescent depression and anxiety – the Adolescent Future Thinking Rating Scale (AFTRS). Section one describes the generation of AFTRS items from thematic content analyses of qualitative interview data (reported in detail in Tang et al., in preparation). Section two reports the

process of item reduction and the exploration of the scales properties. Specifically, we tested the added value of the AFTRS in predicting depression and anxiety on top of the effects of general cognitive risk factors. Section three reports the replication and test-retest data for the AFTRS.

## **Section one: Item generation**

### **Methods**

#### **Participants**

We identified and individually interviewed 19 community-based young people through research advertisements. They were aged 16-19 years (mean=18.2, standard deviation; SD=1.2), and had prior depression and/or anxiety but were managing well at the time of participation. The participants were mostly female (84%); 42% were White/White British, 26% were Asian, 21% Black and 11% mixed race. Sixty-eight percent of participants received prior psychotherapy and/or medication treatment.

#### **Procedure**

Working closely with the participants, we formulated 28 statements covering the seven themes derived from the interviews about future thinking and its relationship to mental health (see Tang et al., in preparation). These were (1) *motivation*: whether a person was excited and motivated to think about the future; (2) *capability/vividness*: whether a person could picture a future self and if so, was the image clear, ambiguous, or blank; (3) *valence*: whether the content of the future thinking was positive, negative, or neutral; (4) *agency*: whether a person felt in control of the future; (5) *structure*: whether future thinking was repetitive, linear-serial or spiral in nature; (6) *coping*: how a person dealt with the emotions

related to future thinking, especially the worries and anxieties, and (7) *future thinking and mood*: whether future thinking was different according to mood state, and vice versa.

Statements tapping each theme were framed negatively and positively: *“It’s impossible for me to visualise the future even when I try”* and *“When I think about my future, I can visualise what it will be like”*. Different wording of the same thinking style was also used: *“I... follow my daily routines, OR run on autopilot, OR get on with life day to day ... without any consideration for my future”*. To choose the 28 statements, a larger set of candidate statements was presented to participants using Microsoft PowerPoint, with each slide showing one or a few versions of a single item. Sessions were held individually and remotely using Microsoft Teams. Participants were asked: (1) about the clarity of the statement, (2) whether they could understand and rate it in a questionnaire using the Likert scale, (3) whether the statement was relatable to their past experiences, and (4) whether they would modify the wording in any way. They elaborated on what they thought each item meant and their thought process behind answering it. The order in which the statements appeared was randomised, and participants were not aware of which future thinking aspect the statement was specifically related to. The statements that participants judged as being the clearest and best reflecting their future thinking during poor mental health were selected. Ambiguous items that were likely to cause multiple interpretations were removed.

## **Results**

Table 1 presents the 28 statements mapping onto the seven themes. The statements were then formulated into items of a provisional version of the AFTRS.

## **Section two: Item reduction and scale properties**

### **Methods**

## Participants

We recruited a community sample of adolescents through advertisements in the university research volunteer circular, social media, mental health support groups, charity websites and the Prolific platform (<https://www.prolific.co>). Eligible participants were aged between 16-21 years, studying or living in the UK, and had never been diagnosed with depression, anxiety, or any other psychiatric disorder.

Overall, 161 participants aged 16-21 years (mean=19.5, SD=1.5) took part (49% female); 44% were White, 48% were Asian/Asian British, 2% were Black/Black British, 5% were mixed race and 1% were Central/Latin American. The majority (73%) were in university or college education, while 13% were in sixth form or secondary school, 9% were in full or part-time employment, and 6% were looking for jobs or waiting to continue with education. Although participants did not have a previous diagnosis of psychiatric disorders, 32% and 27% were screened positive for clinical depression and generalised anxiety disorder respectively, using a cut-off point of 10 of self-reported depression and anxiety symptoms using the Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) and the Generalised Anxiety Disorder Scale (GAD-7; Spitzer et al., 2006b; Williams et al., 2007).

Each participant was asked to nominate a proxy-rater (i.e., a friend, peer, sibling, parent, or romantic partner) to give an independent view of their mental health by completing the PHQ-9 and GAD-7; 84% of participants had proxy ratings available. This supplemented self-ratings of mental health with another perspective, a procedure adopted in previous health research (Long et al., 1998; Lynn Snow et al., 2005; Magaziner et al., 1996, 1997; Oltean & Ferro, 2019). Proxy-raters were aged 16-56 years, (mean=25.9, SD = 11.4) and most were the participant's friend (41%), followed by sibling (27%), parent (18%) and partner



(15%). Participants knew the proxy-raters extremely or very well (n=127), or only slightly well or not well at all (n=14). Demographic information for the participants and proxy-raters is presented in Table 2.

## **Measures**

### ***The 28-item provisional Adolescent Future Thinking Rating Scale (AFTRS; self-report)***

The 28-item provisional AFTRS measures personal thoughts and feelings about one's future. It contains equal numbers of positively and negatively worded items (14 each). Respondents rate how much they agree with the statements as they relate to them currently on a scale of 1 (strongly disagree) to 5 (strongly agree). Positively worded items are reverse-coded and higher scores indicate a more negative future thinking style. A total score is calculated by summing individual items scores.

### ***Existing measures of future-related thinking (self-report)***

***Consideration of Future Consequences (CFC).*** The 12-item CFC measures whether individuals consider the distant outcomes of their current behaviours and how much influence these outcomes have on their immediate choices (Rappange et al., 2009; Strathman et al., 1994). It contains 5 future-oriented and 7 immediacy-oriented items. Respondents rate each item on a scale ranging from 1 (extremely uncharacteristic) to 5 (extremely characteristic). Total scores are calculated for the future and immediacy-oriented sub-scales by summing scores for corresponding items.

***Quick Delay Questionnaire (QDQ).*** The QDQ (Clare et al., 2010) includes two 5-item subscales measuring emotional responses to having to wait for outcomes (delay aversion), and how much value individuals put on larger rewards in the future (delay discounting). Respondents

rate each item on a 5-point scale (1=not like me at all, 5=very much like me). A total score is calculated for each sub-scale by summing scores for corresponding items.

***Beck's Hopelessness Scale (BHS).*** This scale measures the level of hopelessness or negative expectations individuals hold about their future (Beck et al., 1974). It contains 20 items answered either True or False. The BHS measures three aspects: feelings about the future, loss of motivation and future expectations. A total BHS score was calculated by first reversing positive items and summing scores of individual items, where a higher score indicates more hopelessness about the future.

***The Cognitive Triad Inventory (CTI) – View of Future subscale.*** The CTI measures an individual's positive and negative cognitions of three aspects: View of Self, View of World and View of Future (Kaslow et al., 1992; Pössel, 2009). The View of Future sub-scale contains 12 items, and respondents rate each item on a scale ranging from 1 (strongly disagree) to 7 (strongly agree). A total score is calculated by summing scores of individual items and higher scores suggest a more negative view of the future.

#### ***Background cognitive risk factors (self-report)***

***The Cognitive Triad Inventory (CTI) – View of Self and World subscales.*** The View of Self and View of World sub-scale each contains 12 items. They were rated the same as the View of Future subscale described above. A total score is calculated by summing scores of individual items and higher scores suggest a more negative view of the self and the world.

***The Children's Attributional Style Questionnaire (CASQ).*** The CASQ measured individuals' causal explanations for 24 hypothetical positive and negative events in three dimensions: internal-external, stable-unstable, and global-specific (Lewis et al., 2014; Thompson et al., 1998). Total scores for each dimension and a combined total score were calculated by

summing scores on individual items, where higher scores indicate a more negative/maladaptive attributional style.

***The Repetitive Thinking Questionnaire (RTQ).*** The RTQ measured individuals' tendency to ruminate, worry and repetitively think about negative events that had happened in the past (McEvoy et al., 2010). It contained 31 items and respondents rated how true each item reflected their experience from 1=not true at all to 5=very true. A total score was calculated by summing scores on individual items, where a higher score indicated more repetitive negative thinking following a negative event.

***The Scrambled Sentence Task (SST).*** The SST measured the tendency towards negative thinking and asked respondents to produce statements by unscrambling a set of words (Wenzlaff & Bates, 1998). It contained 20 trials, and each trial has six words, from which respondents chose five to produce a meaningful sentence. The proportion of negative statements produced out of all valid trials was calculated, and a higher proportion indicates a tendency to think more negatively.

#### ***Mental Health outcomes (self and proxy-report)***

***The Patient Health Questionnaire (PHQ-9).*** This is a 9-item self-report measure of depressive symptoms (Kroenke et al., 2001; Rooney et al., 2013). Respondents rate how much they were affected by symptoms experienced during the past two weeks on a 4-point Likert scale ranging from 0 (not at all) to 3 (nearly every day). The total PHQ-9 score is calculated by summing individual items scores, with higher scores indicating more severe depressive symptoms.

***The Generalised Anxiety Disorder Scale (GAD-7).*** This is a 7-item self-report measure of generalised anxiety symptoms experienced during the past two weeks (Spitzer et al., 2006a).

Items are rated on a 4-point Likert scale. The total GAD-7 score is calculated by summing individual items scores, with higher scores indicating more severe anxiety symptoms.

### **Statistical analysis**

Analyses were performed using SPSS Statistics (Version 28.0; IBM, Inc., Chicago, Illinois).

### ***Exploratory factor analyses and item reduction***

Three factor analyses were performed. First, an exploratory analysis was conducted to examine the underlying factor structure of the provisional 28-item AFTRS. We excluded items that: (1) had loadings lower than 0.6 or cross-loaded on two or more factors (MacCallum et al., 1999) and (2) only loaded as a single item on a factor. Second, the remaining items were refactored to create an 18-item scale. Finally, items that most differentiated between the factors in terms of absolute values were retained for a 12-item version, while keeping the number of items ( $n=4$ ) balanced across the factors. Finally, a third exploratory factor analysis was conducted on the 12-item scale to check its final structure.

### ***Psychometric properties***

For all analyses, we compared the 18 and 12-item versions to examine whether reducing the number of items affected the reliability and validity.

***Reliability.*** Cronbach's alpha was calculated for the AFTRS sub-scales.

***Convergent validity (relationship with existing future thinking measures).*** First, a series of Pearson's correlation analyses were conducted between subscale scores of existing future-thinking measures (i.e., CFC, QDQ, BHS and CTI – View of Future). Second, a principal component analysis combined these subscales and reduced the number of variables to simplify the interpretation of the main analyses. Correlation analyses were then run to test the relationships between the AFTRS sub-scales and factors identified from existing future-

thinking measures. We calculated the average difference between the AFTRS-18 and AFTRS-12 by adding up the differences in the correlation coefficients between each sub-scale and dividing them by three.

***Predictive validity (relationship with mental health).*** We first tested the agreement between proxy and self-reported outcomes. This was done for participants altogether and by breaking them down by the proxy-rater type (e.g., partner, sibling, friend, or parent). One-way ANOVA was conducted to test if self-reported depression and anxiety were different according to the nominated proxy-rater type, using self-reported PHQ and GAD-7 as the dependent variable, and nominated proxy-rater type as the independent variable. Next, bivariate Pearson's correlations were conducted to test the relationships between the AFTRS subscales and mental health, using both self and proxy-report.

***Discriminant validity (comparing to background cognitive risks).*** First, we conducted a principal component analysis combining the CTI (View of Self and World), CASQ, RTQ and SST subscales. Second, correlation analyses were run to test the relationships between the identified factor and AFTRS sub-scales. Finally, we conducted a two-step multiple regression, where the AFTRS sub-scales were added as predictors in step one, and the background cognitive risk factor in step two, in predicting self-report mental health.

### **Procedure**

Potential participants were first screened for any previous diagnosis of a psychiatric disorder. Those who were eligible provided consent and completed the questionnaires online using Qualtrics. Participants were also asked to forward the proxy-rater link to their nominated person and received a £10 shopping voucher as a thank you. The study was approved by *[removed for peer review]*.

## Results

### Exploratory factor analyses and item reduction

**Provisional AFTRS.** The 28 items loaded on four factors, which explained 63.6% of the variance. Based on the criteria set out above, 10 items were removed (See Appendix A; MacCallum et al., 1999).

**AFTTRS-18.** The remaining 18 items were refactored. Three factors were extracted with 7 items loading on factor one, 7 on factor two and 4 on factor three (Table 3). These factors accounted for 65.5% of the variance. Factor one (26.1% of the variance) reflected *Concerns about Maladaptive Future Thinking*: being worried and concerned about negative feelings about the future. Factor two (24.4% of the variance) reflected *Future Positivity*: feeling positive, excited and optimistic about the future. Factor three (15.0% of the variance) reflected the *Ability to Visualise the Future*: the ability to imagine and describe what the future looks like and plan for it accordingly.

**AFTRS-12.** To create a 12-item scale, we reduced both 7-item factors to 4 items as described above. AFTRS-12 had the same factor structure as AFTRS-18. The three factors accounted for 69.8% of the variance, each explaining 26.9%, 22.7% and 20.3% of the total variance, respectively.

Table 3 presents the item factor loadings from the three exploratory factor analyses described above.

### Psychometric properties

#### *Reliability*

The Cronbach's alpha of the three subscales were 0.90, 0.92, and 0.79 for the AFTRS-18, and 0.86, 0.87, and 0.79 for the AFTRS-12.

### ***Convergent validity – the AFTRS and existing future-related thinking measures***

***Preparatory analysis.*** There were significant medium-to-large correlations between the subscales of future thinking measures **Error! Reference source not found.**. Two factors were extracted with corresponding factor scores generated (Supplementary Table 1-2 **Error! Reference source not found.**). Factor one represented *Negative Future Emotions*: being negative and hopeless about the future. Factor two represented *Immediacy Preferences*: a preference for small immediate rewards over larger future rewards.

***Correlations with existing future thinking factor scores.*** The patterns of correlations were the same for AFTRS-12 and AFTRS-18. *Concerns about Maladaptive Future Thinking* subscale was positively correlated with *Negative Future Emotions*. *Future Positivity* was negatively correlated with *Negative Future Emotions*. The *Ability to Visualise* was found to be negatively correlated with both *Negative Future Emotions* and *Immediacy Preferences*.

### ***Predictive validity – the AFTRS and mental health***

***Self and proxy-report agreement.*** Bivariate correlations were conducted to test the agreement between self and proxy-reported outcomes (Table 5). Moderate to large correlations were found for depression and anxiety. We further broke down the participants according to proxy-raters type. For depression, ratings from partners had the highest correlations with self-reported depression, followed by sibling/cousin, parent, and friend/peer. For anxiety, partners' ratings again had the highest correlations with self-report, followed by sibling/cousin, friend/peer, and parent, which was no longer significant. One-way ANOVA showed there was no significant difference in reported outcomes between proxy-rater types for either depression,  $F(3, 132)=1.08, p=.361$ , or generalised anxiety,  $F(3, 132)=1.31, p=.273$ .

**Correlations between the AFTRS and mental health.** *Concerns about Maladaptive Future Thinking* measured with the AFTRS-12 and AFTRS-18 was positively correlated with both self and proxy-reported depression and anxiety. *Future Positivity* on the AFTRS-18 was negatively correlated with these outcomes, and *Future Positivity* on the AFTRS-12 was only negatively correlated with self-reported depression and anxiety. The *Ability to Visualise* on the AFTRS-12 and AFTRS-18 correlated negatively with self-reported depression (Table 6).

#### ***Discriminant validity – the AFTRS and background cognitive risks***

**Preparatory analysis.** One factor was extracted which represented *General Cognitive Risk*: depressogenic factors that predispose individuals to process information in a negatively biased way (Supplementary Table 3).

**Correlation analyses.** *Concerns about Maladaptive Future Thinking* subscale of the AFTRS-12 and AFTRS-18 was positively correlated with *General Cognitive Risk* factor. *Future Positivity* and the *Ability to Visualise* subscales both negatively correlated with *General Cognitive Risk* (Table 4).

**Multiple Regression analyses (using AFTRS-12).** For depression, in step one, all three AFTRS-12 subscales were significant predictors of self-report depression. After adjusting for *General Cognitive Risk* in step 2, the *Concerns about Maladaptive Future Thinking* and *Future Positivity* subscales remained to be significant independent predictors (Table 7).

For generalised anxiety, the *Concerns about Maladaptive Future Thinking* and *Future Positivity* subscales were significant predictors. However, after adjusting for *General Cognitive Risk* in step 2, only *Concerns about Maladaptive Future Thinking* remained significant (Table 8).

#### **Section three: Replication and test-retest data**



## **Methods**

### **Participants**

Two community samples (replication and test-retest) were recruited via platforms accessible to university staff and students. Eligible participants were aged between 16-25 years, studying or living in the UK, and did not have an existing clinical diagnosis of a psychiatric disorder. Eligible participants provided consent and completed the questionnaires online using Qualtrics. The study was approved by *[removed for peer review]*.

The replication sample included 209 participants (88% female) aged 16-25 years (mean=19.5, SD=1.8); 35% participants were White, 43% were Asian/Asian British, 7% were Black/Black British, 14% were mixed race, and 1% were Central American. The majority of participants (97%) were in university or college education, while 3% were in sixth form or secondary school. The test-retest sample included 102 young people aged 17-23 years (mean=18.7 years, SD=0.8).

### **Measures**

The replication sample completed the 18 and 12-item AFTRS, the Consideration of Future Consequences (CFC) and the Quick Delay Questionnaire (QDQ). For CFC and QDQ, both subscale scores and total scores were calculated. The CFC total score was calculated by reversing future-oriented items and summing all items, where a higher score indicated less consideration for the future. The QDQ total score was calculated by summing the delay aversion and discounting subscales, and a higher score suggested more aversion and discounting of delay. The test-retest sample completed the 28-item provisional AFTRS two times at a one-week interval.

### **Statistical analysis**

Analyses were performed using SPSS Statistics and SPSS Amos (Version 28; IBM Inc., Chicago, Illinois).

### ***Confirmatory factor analysis***

A confirmatory factor analysis was conducted using SPSS Amos to examine the goodness-of-fit of the three-factor structure identified from the exploratory factor analyses. The Comparative Fit Index ( $>.90$ ), Tucker-Lewis Index ( $>.90$ ), Root Mean Square Error of Approximation ( $<.07$ ) and Standardised Root Mean Residual ( $<.08$ ) were used as indicators of a good model fit (Hu & Bentler, 1998; Kenny et al., 2015; Marsh et al., 1988; Rigdon, 1996). The model fit was compared with a one-factor solution, where all items were placed under one single factor.

### ***Replication – Psychometric properties***

***Reliability.*** We calculated the Cronbach's Alpha of the AFTRS-18 and AFTRS-12 subscales based on the replication sample. One-week test-retest reliability was assessed using the test-retest sample.

***Convergent validity.*** Pearson's bivariate correlations were conducted to test the relationships between the AFTRS-12, AFTRS-18, the CFC and the QDQ.

## **Results**

### **Confirmatory factor Analysis**

The three-factor model had a moderate-to-good fit for both the AFTRS-18 and AFTRS-12, with 63.1% and 67.2% of the total variance explained, respectively. Although both models had a good fit (Table 9), the model of AFTRS-12 fitted the data better than AFTRS-18.

### **Replication – psychometric properties**

#### ***Reliability***

The Cronbach's alphas for the three subscales were 0.88, 0.89, and 0.81 for AFTRS-18, and 0.84, 0.82, and 0.81 for AFTRS-12. One-week test-retest reliability was 0.87, 0.89, and 0.86 (all  $p < .001$ ) for AFTRS-18, and 0.84, 0.85, and 0.86 (all  $p < .001$ ) for AFTRS-12.

### ***Convergent validity – the AFTRS and CFC & QDQ***

The patterns of correlations were the same for AFTRS-12 and AFTRS-18. *Concerns about Maladaptive Future Thinking* was positively correlated with the QDQ subscales and total score. *Future Positivity* was positively correlated with CFC *Future* subscale and QDQ delay aversion, but negatively correlated with QDQ delay discounting. The *Ability to Visualise* was positively correlated with CFC *Future*, and negatively correlated with both CFC *Immediacy* subscale, QDQ delay aversion and discounting, suggesting individuals with better ability to visualise the future were more future-oriented and less delay aversive.

### **General Discussion**

In this paper, we described the process of designing and refining the Adolescent Future Thinking Rating scale (AFTRS), which captures the key aspects of adolescent future thinking in the three sub-scales. *Concerns about Maladaptive Future Thinking* represents worries about the negative nature of one's future thinking, *Future Positivity* represents being hopeful and motivated about the future, and *the Ability to Visualise the Future* represents the capability of imagining the future. We examined the scale's reliability and validity. Our goal was to create a short, easy-to-complete questionnaire that tapped concepts relating to future thinking relevant to adolescent mental health. In this regard, this research also provides important insights into the underlying structure of adolescent future thinking and its relationship to mental health. Crucially, our bottom-up approach was grounded in the personal experience of young people with a history of depression and anxiety, rather than

involving a downward translational approach of adult-related future thinking concepts developed in general community samples. This participatory approach allowed us to ask the most pertinent questions and capture the key aspects of future thinking most relevant to adolescents' mental health, from their experience and perspective. There were five findings of note.

First, the interviews with the young people identified seven themes (i.e., motivation, capability/vividness, valence, agency, structure, coping, and future thinking and mood), the 28 statements generated from these themes collapsed into four and then, following item reduction, three factors. This highlights the value of combining qualitative and quantitative approaches in scale development, and also the differences they produce in terms of understanding the phenomenon they are exploring. For example, the *Valence* and *Agency* themes loaded on the *Concerns about Maladaptive Future Thinking* factor, and the theme *Motivation* was incorporated into *Future Positivity*. One further theme, which emerged from the item generation study and was subjectively labelled '*Coping*', loaded on a separate factor. However, this factor was subsequently dropped, as the *Coping* items cross-loaded with *Future Positivity*. This suggests that these items may be less differentiating between future-related thinking constructs, as there was not enough evidence from the factor analysis to treat it as a separate stand-alone construct. Similarly, the other future-thinking themes identified in the process of item generation were likely to have been incorporated into the existing subscales, without enough evidence from the quantitative analysis using the validation sample supporting them as separate constructs. Second, although the content of the three sub-scales seemed to map onto concepts of pre-existing measures, they captured novel elements and added a new perspective on adolescent future thinking. First, *Concerns about Maladaptive Future Thinking* seemed quite similar to the content of previous measures, such

as the Beck's Hopelessness Scale (BHS) and the Cognitive Triad Inventory (CTI) – View of Future subscale. However, it added a meta-cognitive quality that may be especially relevant to mental health, which refers to being concerned about the negative nature of one's future thinking. The second sub-scale that offers a novel insight is *Ability to Visualise the Future*, which included items such as “*When I think about my future, I can see clearly what I want to achieve*”, and “*I can't get a clear picture of my future even when I try*”. This is one of the most unique features of the AFTRS to detect whether one is able to imagine and visualise the future at all, and no equivalent quantitative measure exists.

Third, these differences and overlapping elements of the AFTRS subscales are confirmed by the associations between them and the pre-existing measures. The *Concerns about Maladaptive Future Thinking* subscale was positively, and the *Future Positivity* subscale negatively correlated with *Negative Future Emotions* (BHS and CTI – View of Future), as expected. The *Ability to Visualise* was negatively correlated with both *Negative Future Emotions* and *Immediacy Preferences* (CFC and QDQ – delay discounting), suggesting that individuals who can better visualise the future have a more optimistic future thinking style overall, and also place more value on future rewards. Furthermore, the convergent validity analysis showed that the AFTRS had stronger associations with *Immediacy Preferences* than with mental health. Given that intertemporal choices are associated with a range of psychopathologies, the scores of the AFTRS, particularly on the *Ability to Visualise* subscale, could potentially be used as an indicator of some conditions, such as attention deficit hyperactivity disorder (ADHD).

Fourth, and highlighting their relevance to mental health, the sub-scales displayed differential patterns of associations with depression and anxiety symptoms. A better *Ability to Visualise* was correlated with less depression, but not less anxiety.

Fifth, when background cognitive risks were additionally adjusted for in the analysis, *Concerns about Maladaptive Future Thinking* remained significant in predicting both depression and anxiety, and *Future Positivity* in predicting depression. This demonstrated the unique predictive value of future-related thinking concepts on top of the common depressogenic cognitive risks.

Sixth, from a practical point of view, the AFTRS-12 and AFTRS-18 had similar psychometric qualities, suggesting that no information is lost in reducing the item number by a third. This could be important for researchers working under time constraints within large cohort studies. Both versions demonstrated equally good internal consistency and validity and had the same predictive power in terms of their correlations with the existing future-related thinking and mental health measures. One exception was the AFTRS-18 *Future Positivity* subscale, which negatively correlated with proxy-reported depression and anxiety symptoms. This association was not detected by the AFTRS-12. Overall, the AFTRS is an easy and fast-to-administer scale.

**Strengths.** Using the newly designed AFTRS, this is the first study to examine how future thinking relates to adolescent mental health problems. We recruited young people who have never had a clinical diagnosis of mental illnesses. This allowed us to test the AFTRS in a community sample rather than a clinical sample as a starting point. Moreover, more than 25% of the study sample met the screening threshold for clinical-level depressive and generalised anxiety disorder symptoms, which increased the potential to generalise these findings to

clinical populations. We replicated the scale structure in another community sample, which further confirmed the AFTRS as a valid and reliable new measure. The development of the AFTRS will allow a more detailed characterisation of how future thinking is associated with adolescent mental health.

**Limitations.** Our study has several limitations. First, as the study recruited community-based participants who were free of a previous diagnosis of any psychiatric disorder, we cannot test whether the AFTRS is sensitive enough to detect variations in future thinking in a clinical sample. Second, we did not include laboratory measures, and therefore cannot test whether the AFTRS agrees with cognitive and behavioural tasks typically used to assess future orientation. Third, as participants were 16 and older, we do not know how the AFTRS works for younger adolescents. Recruiting over 16s was based on the consideration that this age group were more likely to have developed a stable self-concept and could form deep and abstract consideration of the future.

Furthermore, factor analysis of the AFTRS did not identify a few factors which we initially included when developing the scale statements, such as agency belief and coping strategies. This could be because they had been collapsed into other factors. Fifth, some AFTRS items had a compound structure in that they required respondents to feel a certain way about the future to answer the question. For example, “my worries and fears about the future are out of my control” requires respondents to have some worries or fears. The justification for including items of this sort was that we wanted to authentically represent the experiences of the adolescents recorded in the interviews – thus the items had high ecological validity. It is worth noting that in neither our pilot study nor the main study did participants have difficulties responding to such items. However, in future versions of the AFTRS, we will

consider including a “Not Applicable” option. Also, as data from this study were cross-sectional, we do not know whether the AFTRS will be associated with mental health longitudinally, but we have been collecting longitudinal data and will test how the AFTRS predicts subsequent mental health.

**Research implications.** Future studies should first aim to test whether the AFTRS is associated with mental health over time and use the AFTRS to examine the temporality of changes in future thinking and in depressive and anxiety symptom severity. That is, do maladaptive future thinking styles and intertemporal preferences emerge before, simultaneously, or after increased mental health symptoms? Future studies should also investigate the predictive power of the AFTRS above the known risk factors of depression and anxiety, such as cognitive bias, attributional style, and negative repetitive thinking. How much variance in the risk could the AFTRS explain on top of these established factors? In future, we also aim to explore how the AFTRS works in early to mid-adolescence, which is a time when affective disorders symptoms emerge, especially in girls.

**Clinical implications.** Future studies should aim to administer the AFTRS to young people from a clinical setting, including those with affective disorders, such as depression and anxiety, and neurodiverse individuals, such as those with autism and ADHD. This will allow us to examine how different clinical groups interact with the AFTRS, and if the AFTRS could detect and predict distinct features of these conditions.

The unique feature of the AFTRS to detect the capability to visualise the future could be highly relevant to an individual’s insight in weighing up choices and consequences, and making decisions in the long-term. Not having the capacity to look into the future is entirely different from not having the motivation, and these phenomena can indicate mental disorder



severity. Future studies should examine how the AFTRS performs in clinical groups. This could potentially contribute to policy and debate around mental capacity for adolescent decision-making, as well as being a tool to support these decisions in clinical practice.

*Table 1.* The 28 statements mapping onto the seven themes from qualitative interviews.

| <b>Theme</b>                            | <b>Statements</b>   |
|---|---|
| Motivation                              | 1. My future excites me.<br>2. I am interested in my future.<br>3. When I think about my future, I lose my motivation.<br>23. I can't be bothered to plan for my future.  |
| Capacity/vividness                      | 13. When I think about my future, I can see clearly what I want to achieve.<br>19. I can imagine what my future will be like.<br>25. I can't get a clear picture of my future even when I try.  |
| Valence                                 | 7. My inability to see my future clearly makes me feel unhappy.<br>8. When I think about my future, I tend to focus more on good rather than bad things.<br>9. I fear my worries and fears about my future will come true.<br>21. When I think about my future, I feel overwhelmed.<br>26. My future looks bright.  |
| Agency                                  | 5. My worries and fears about my future are out of my control.<br>6. My lack of control over my future scares me.<br>22. I feel in control over how things will turn out for me in the future.  |
| Structure                               | 10. When I imagine my future, I always end up in a negative spiral - bad things leading to something even worse.<br>16. Just because something bad happened in the past does not mean it will lead to something bad in the future again.<br>24. I get into negative loops thinking about my future.<br>27. I repeat the same negative thoughts every time I think about my future.<br>28. I keep thinking about the same positive and exciting things when I think about my future. |
| Coping                                  | 4. I actively avoid thinking about my future because what might happen frightens me.<br>12. I can cope with the worries I have about my future when they come into my mind.<br>18. I worry about my future instead of enjoying every present moment.<br>20. I don't let worries about my future get in the way of enjoying the present moment.  |
| Relationship of future thinking to mood | 11. Thinking about my future lifts my mood when I feel down.<br>14. I feel happy when thinking about my future.<br>15. Thinking about my future brings me anxiety and worry.<br>17. The way I think about my future stays the same, no matter how I am feeling at the time.   |

Table 2. Demographic characteristics of the sample (n=161) and proxy-raters (n=136) recruited for the item reduction and exploratory psychometric properties analysis.

| <b>Demographics</b>   | <b>n (%)</b> |
|---|--------------|
| <b>Primary respondent</b>                                   | <b>n=161</b> |
| <b>Sex</b>  |              |
| Male  | 82 (51)      |
| Female  | 79 (49)      |
| <b>Age (years)</b>  |              |
| Mean (SD)   | 19.5 (1.5)   |
| <b>Ethnicity</b>  |              |
| White – British; Irish; other                               | 70 (44)      |
| Asian/Asian British – Indian; Pakistani; Bangladeshi; other | 78 (48)      |
| Mixed race  | 3 (2)        |
| Black/Black British   | 8 (5)        |
| Central/Latin American                                      | 2 (1)        |
| <b>Current Education or Employment Status</b>               |              |
| University or College                                       | 118 (73)     |
| Sixth Form or Secondary school                              | 20 (13)      |
| Full or part-time working                                   | 14 (9)       |
| Looking for jobs or waiting to continue with education      | 9 (6)        |
| <b>How well do you know the proxy-rater?</b>                |              |
| Not well at all   | 8 (5)        |
| Slightly well   | 6 (4)        |
| Moderately well   | 21 (13)      |
| Very well   | 48 (30)      |
| Extremely well  | 78 (48)      |
| <b>Proxy-rater sample</b>                                   | <b>n=136</b> |
| <b>Age (years)</b>  |              |
| Mean (SD)   | 25.9 (11.4)  |
| <b>Relationship with the participant</b>                    |              |
| Parent or guardian  | 24 (18)      |
| Friend or peer  | 55 (40)      |
| Partner   | 20 (15)      |
| Sibling or cousin   | 37 (27)      |

**How well do you know the participant?**

|                 |         |
|-----------------|---------|
| Not well at all | 1 (1)   |
| Slightly well   | 3 (2)   |
| Moderately well | 6 (4)   |
| Very well       | 49 (36) |
| Extremely well  | 77 (57) |

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Table 3. Exploratory factor analyses of the provisional AFTRS (28 items), the AFTRS-18, and the AFTRS-12.

|  | Component            |      |      |      |            |             |   |     |          |   |             |  |
|--|----------------------|------|------|------|------------|-------------|---|-----|----------|---|-------------|--|
|  | Provisional 28 items |      |      |      | AFTRS-18   |             |   |     | AFTRS-12 |   |             |  |
|  | 1                    | 2    | 3    | 4    | 1          | 2           | 3 | 4   | 1        | 2 | 3           |  |
| 6. My lack of control over my future scares me.  | .73                  |      |      |      | <b>.75</b> |             |   |     |          |   | <b>.76</b>  |  |
| 9. I fear my worries and fears about my future will come true.   | .65                  |      |      |      | <b>.69</b> |             |   |     |          |   | <b>.83</b>  |  |
| 15. Thinking about my future brings me anxiety and worry.  | .65                  |      |      |      | <b>.69</b> |             |   |     |          |   | <b>.75</b>  |  |
| 27. I repeat the same negative thoughts every time I think about my future.  | .73                  |      |      |      | <b>.73</b> |             |   |     |          |   | <b>.77</b>  |  |
| 4. I actively avoid thinking about my future because what might happen frightens me.                                 | .67                  |      |      |      | <b>.68</b> |             |   |     |          |   |             |  |
| 5. My worries and fears about my future are out of my control.   | .74                  |      |      |      | <b>.73</b> |             |   |     |          |   |             |  |
| 21. When I think about my future, I feel overwhelmed.  | .73                  |      |      |      | <b>.75</b> |             |   |     |          |   |             |  |
| 7. My inability to see my future clearly makes me feel unhappy.  | .65                  |      |      |      | .67        | -.43        |   |     |          |   |             |  |
| 10. When I imagine my future, I always end up in a negative spiral - bad things leading to something even worse.     | .66                  | -.55 |      |      |            |             |   |     |          |   |             |  |
| 24. I get into negative loops thinking about my future.  | .65                  | -.48 |      |      |            |             |   |     |          |   |             |  |
| 18. I worry about my future instead of enjoying every present moment.  | .56                  |      |      | -.42 |            |             |   |     |          |   |             |  |
| 3. When I think about my future, I lose my motivation.   | .42                  | -.42 |      |      |            |             |   |     |          |   |             |  |
| 1. My future excites me.   |                      | .78  |      |      | <b>.79</b> |             |   |     |          |   | <b>.81</b>  |  |
| 2. I am interested in my future.   |                      | .70  |      |      | <b>.66</b> |             |   |     |          |   | <b>.83</b>  |  |
| 8. When I think about my future, I tend to focus more on good rather than bad things.                                |                      | .76  |      |      | <b>.77</b> |             |   |     |          |   | <b>.67</b>  |  |
| 26. My future looks bright.  |                      | .74  |      |      | <b>.73</b> |             |   |     |          |   | <b>.70</b>  |  |
| 11. Thinking about my future lifts my mood when I feel down.   |                      | .61  |      |      | <b>.69</b> |             |   |     |          |   |             |  |
| 14. I feel happy when thinking about my future.  |                      | .72  |      |      | <b>.75</b> |             |   |     |          |   |             |  |
| 28. I keep thinking about the same positive and exciting things when I think about my future.                        |                      | .74  |      |      | <b>.77</b> |             |   |     |          |   |             |  |
| 22. I feel in control over how things will turn out for me in the future.  |                      | .57  |      |      |            |             |   |     |          |   |             |  |
| 16. Just because something bad happened in the past does not mean it will lead to something bad in the future again. |                      | .49  |      |      |            |             |   |     |          |   |             |  |
| 13. When I think about my future, I can see clearly what I want to achieve.  |                      |      | .65  |      |            | <b>.62</b>  |   |     |          |   | <b>.71</b>  |  |
| 19. I can imagine what my future will be like.   |                      |      | .75  |      |            | <b>.64</b>  |   |     |          |   | <b>.85</b>  |  |
| 23. I can't be bothered to plan for my future.   |                      |      | -.64 |      |            | <b>-.77</b> |   |     |          |   | <b>-.63</b> |  |
| 25. I can't get a clear picture of my future even when I try.  |                      |      | -.61 |      |            | <b>-.61</b> |   |     |          |   | <b>-.71</b> |  |
| 17. The way I think about my future stays the same, no matter how I am feeling at the time.                          |                      |      |      | .78  |            |             |   | .86 |          |   |             |  |
| 12. I can cope with the worries I have about my future when they come into my mind.                                  |                      | .42  |      | .47  |            |             |   |     |          |   |             |  |
| 20. I don't let worries about my future get in the way of enjoying the present moment.                               |                      | .42  |      | .50  |            |             |   |     |          |   |             |  |

Note. Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Factor loadings smaller than 0.4 were not shown.

*Table 4.* Bivariate correlations between the AFTRS-12, AFTRS-18, existing future-related thinking measures, and background cognitive risks.

|                          | AFTRS-12 |        |        | AFTRS-18 |        |        | Ave. diff. |
|--------------------------|----------|--------|--------|----------|--------|--------|------------|
|                          | CaMFT    | FP     | AtV    | CaMFT    | FP     | AtV    |            |
| Negative future emotions | .54**    | -.60** | -.30** | .46**    | -.64** | -.27** | 0.03       |
| Immediacy preferences    | .03      | -.17*  | -.44** | .08      | -.08   | -.48** | 0.00       |
| General cognitive risk   | .54**    | -.48** | -.23** | .48**    | -.53** | -.19*  | 0.02       |

Note. \*\* $p < .01$ . \*  $p < .05$ . CaMFT=Concerns about maladaptive future thinking; FP=Future positivity; AtV=Ability to visualise; Ave. diff.=average difference between the correlation coefficients of AFTRS-12 and AFTRS-18 subscales.

Table 5. Mean (SD) of self and proxy-reported mental health and their correlations.

| <b>Mean (SD)</b>                      | <b>Depression</b>             | <b>Generalised anxiety</b> |
|---------------------------------------|-------------------------------|----------------------------|
| <b>Self-report</b>                    | 7.9 (5.8)                     | 6.2 (5.3)                  |
| <b>Proxy-report</b>                   | 5.1 (5.3)                     | 4.6 (4.9)                  |
| <b>Correlations with proxy-report</b> | <b>Self-report depression</b> | <b>Self-report anxiety</b> |
| All participants                      | .53**                         | .61**                      |
| By proxy-rater type                   |                               |                            |
| Partner                               | .76**                         | .70**                      |
| Sibling or cousin                     | .65**                         | .65**                      |
| Friend or peer                        | .42**                         | .61**                      |
| Parent or guardian                    | .47*                          | .40                        |

Note. \*\* $p < .01$ , \* $p < .05$ .

*Table 6.* Bivariate correlations between the AFTRS-12, AFTRS-18, and self and proxy-reported mental health.

|              | AFTRS-12 |        |       | AFTRS-18 |        |       |
|--------------|----------|--------|-------|----------|--------|-------|
|              | CaMFT    | FP     | AtV   | CaMFT    | FP     | AtV   |
| Self-report  |          |        |       |          |        |       |
| Depression   | .48**    | -.39** | -.17* | .43**    | -.42** | -.15* |
| Anxiety      | .51**    | -.26** | -.02  | .48**    | -.30** | .02   |
| Proxy-report |          |        |       |          |        |       |
| Depression   | .34**    | -.16   | -.11  | .29**    | -.25** | -.05  |
| Anxiety      | .44**    | -.11   | -.05  | .38**    | -.22** | .02   |

Note. \*\* $p < .01$ , \* $p < .05$ . CaMFT=Concerns about maladaptive future thinking; FP=Future positivity; AtV=Ability to visualise.

*Table 7.* Associations between AFTRS-12, background cognitive risks and self-report depression.

| <i>n</i> =161                     | Step 1  |                |                 | Step 2  |                |                 |
|-----------------------------------|---------|----------------|-----------------|---------|----------------|-----------------|
|                                   | Coef    | 95% CI         | <i>p</i> -value | Coef    | 95% CI         | <i>p</i> -value |
| AFTRS12 CaMFT                     | 2.68**  | 1.94 to 3.42   | <.001           | 1.56**  | 0.70 to 2.42   | <.001           |
| AFTRS12 Future Positivity         | -2.09** | -2.80 to -1.37 | <.001           | -1.12** | -1.92 to -0.31 | .007            |
| AFTRS12 Ability to Visualise      | -0.87*  | -1.61 to -0.13 | .021            | -0.42   | -1.15 to 0.31  | .257            |
| <i>General cognitive thinking</i> |         |                |                 | 2.18**  | 1.20 to 3.16   | <.001           |

Note. PHQ-9 was used as the outcome variable. CaMFT=Concerns about Maladaptive future thinking; Coef=unstandardised B; CI=Confidence Interval. Step 2 added *general cognitive thinking*. \*\* $p < .01$ , \* $p < .05$ .



*Table 8.* Associations between AFTRS-12, background cognitive risks and self-report generalised anxiety.

| <i>n=161</i>                      | <i>Step 1</i> |                |                 | <i>Step 2</i> |               |                 |
|-----------------------------------|---------------|----------------|-----------------|---------------|---------------|-----------------|
|                                   | Coef          | 95% CI         | <i>p</i> -value | Coef          | 95% CI        | <i>p</i> -value |
| AFTRS12 CaMFT                     | 2.73**        | 2.02 to 3.45   | <.001           | 1.72**        | 0.87 to 2.57  | <.001           |
| AFTRS12 Future Positivity         | -1.24**       | -1.93 to -0.55 | <.001           | -0.36         | -1.15 to 0.42 | .363            |
| AFTRS12 Ability to Visualise      | 0.53          | -0.67 to 0.77  | .884            | 0.46          | -0.25 to 1.18 | .203            |
| <i>General cognitive thinking</i> |               |                |                 | 1.97**        | 1.01 to 2.94  | <.001           |

Note. GAD-7 was used as the outcome variable. CaMFT=Concerns about Maladaptive future thinking; Coef=unstandardised B; CI=Confidence Interval. Step 2 added *general cognitive thinking*. \*\**p*<.01, \**p*<.05.

*Table 9.* The goodness of fit indices of the three-factor and one-factor model.

|              | $\chi^2$   | CFI  | TLI  | RMSEA [90% CI]      | SRMR  |
|--------------|------------|------|------|---------------------|-------|
| AFTRS-18     |            |      |      |                     |       |
| Three-factor | 289.840*** | .922 | .910 | 0.076 [0.064-0.088] | 0.058 |
| One-factor   | 596.794*** | .773 | .743 | 0.128 [0.118-0.139] | 0.090 |
| AFTRS-12     |            |      |      |                     |       |
| Three-factor | 124.563*** | .935 | .916 | 0.083 [0.065-0.102] | 0.055 |
| One-factor   | 330.280*** | .756 | .702 | 0.157 [0.141-0.173] | 0.100 |

Note. \*\*\* $p < .001$ . CFI=Comparative Fit Index; TLI=Tucker-Lewis Index; RMSEA=Root Mean Square Error of Approximation; CI=Confidence Interval; SRMR=Standardized Root Mean Residual.

Table 10. Bivariate correlations between the AFTRS-12, AFTRS-18, CFC and QDQ.

|                        | AFTRS-12 |       |        | AFTRS-18 |       |        | Ave. diff. |
|------------------------|----------|-------|--------|----------|-------|--------|------------|
|                        | CaMFT    | FP    | AtV    | CaMFT    | FP    | AtV    |            |
| CFC: Immediacy         | -.08     | .06   | -.31** | .01      | .15*  | -.36** | 0.01       |
| CFC: Future            | -.08     | .31** | .37**  | -.09     | .30** | .36**  | -0.04      |
| CFC total score        | -.02     | -.10  | -.39** | .05      | -.03  | -.41** | -0.04      |
| QDQ: Delay aversion    | .23**    | .19** | -.03   | .26**    | .13*  | -.02   | 0.00       |
| QDQ: Delay discounting | .15*     | -.14* | -.51** | .18**    | -.14* | -.51** | -0.04      |
| QDQ total score        | .25**    | .07   | -.30** | .29**    | .02   | -.29** | 0.00       |

Note. \*\* $p < .01$ . CaMFT=Concerns about Maladaptive future thinking; FP=Future positivity; AtV=Ability to visualise; Ave. diff.=average difference between the correlation coefficients of AFTRS-12 and AFTRS-18 subscales. Higher CFC total scores indicate more preference for immediacy; higher QDQ total scores indicate more delay aversion and discounting.

*Supplementary Table 1. Correlations between existing future thinking related measures.*

|  | 1      | 2      | 3     | 4     | 5     | 6     | 7     |
|--|--------|--------|-------|-------|-------|-------|-------|
| 1. CFC: Immediacy                      | -      |        |       |       |       |       |       |
| 2. CFC: Future                         | -.37** | -      |       |       |       |       |       |
| 3. QDQ: Delay aversion                 | .12    | -.12   | -     |       |       |       |       |
| 4. QDQ: Delay discounting              | .55**  | -.61** | .30** | -     |       |       |       |
| 5. CTI: Future                         | .23**  | -.47** | .32** | .54** | -     |       |       |
| 6. BHS: Negative Feelings about Future | .07    | -.29** | .26** | .35** | .78** | -     |       |
| 7. BHS: Loss of Motivation             | .14    | -.31** | .31** | .42** | .78** | .67** | -     |
| 8. BHS: Negative Future Expectation    | .17*   | -.33** | .23** | .31** | .71** | .67** | .58** |

Note. \*\* $p < .01$ , \* $p < .05$ . 1-2: Consideration of Future Consequences Scale (CFC); 3-4: Quick Delay Questionnaire (QDQ); 5: Cognitive Triad Inventory (CTI); 6-8: Beck's Hopelessness Scale (BHS).

*Supplementary Table 2.* Dimension reduction of existing future thinking related measures.

|                                     | Component |      |
|-------------------------------------|-----------|------|
|                                     | 1         | 2    |
| CFC: Immediacy                      |           | .85  |
| CFC: Future                         |           | -.71 |
| QDQ: Delay aversion                 | .39       |      |
| QDQ: Delay discounting              | .33       | .83  |
| CTI: View of Future                 | .88       | .31  |
| BHS: Negative Feelings About Future | .89       |      |
| BHS: Loss of Motivation             | .84       |      |
| BHS: Negative Future Expectation    | .81       |      |

Note. Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization. Factor loadings smaller than 0.3 were not shown.

*Supplementary Table 3.* Dimension reduction of background cognitive risk factors.

|                          | <u>Component</u> |
|--------------------------|------------------|
|                          | <u>1</u>         |
| CTI: Self                | .867             |
| CTI: World               | .773             |
| CASQ: Stable-unstable    | .769             |
| CASQ: Global-specific    | .746             |
| CASQ: Internal-external  | .638             |
| SST: Percentage negative | .839             |
| RTQ                      | .571             |

Note. Extraction Method: Principal Component Analysis.

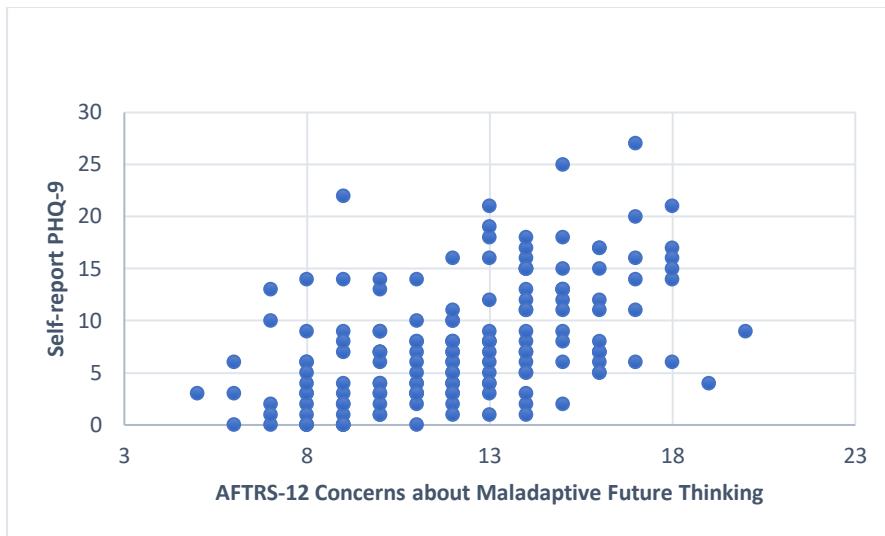
Supplementary Table 4. The distribution of item scores of the AFTRS-18 and AFTRS-12.

|  | Total<br>Sample<br>(n=176) | Gender      |             | p-<br>value | Age   | Ethnicity       |             | p-<br>value | Education                           |             |
|--|----------------------------|-------------|-------------|-------------|-------|-----------------|-------------|-------------|-------------------------------------|-------------|
|  |                            | Male (n=88) | Female      |             |       | White<br>(n=74) | Other       |             | University or<br>college<br>(n=130) | Other       |
| 6. My lack of control over my future scares me.  | 2.99 (1.25)                | 2.68 (1.24) | 3.30 (1.19) | <.001       | .02   | 2.82 (1.19)     | 3.11 (1.28) |             | 3.03 (1.29)                         | 2.87 (1.13) |
| 9. I fear my worries and fears about my future will come true.                                 | 3.29 (1.19)                | 3.09 (1.21) | 3.49 (1.14) | .026        | -.07  | 3.08 (1.20)     | 3.44 (1.16) | .046        | 3.28 (1.19)                         | 3.30 (1.19) |
| 15. Thinking about my future brings me anxiety and worry.                                      | 3.22 (1.28)                | 2.91 (1.24) | 3.52 (1.26) | .001        | -.01  | 3.04 (1.30)     | 3.34 (1.26) |             | 3.25 (1.28)                         | 3.13 (1.31) |
| 27. I repeat the same negative thoughts every time I think about my future.                    | 2.78 (1.30)                | 2.52 (1.27) | 3.05 (1.30) | .007        | .00   | 2.69 (1.31)     | 2.85 (1.30) |             | 2.75 (1.30)                         | 2.87 (1.33) |
| 4†. I actively avoid thinking about my future because what might happen frightens me.          | 2.84 (1.30)                | 2.69 (1.31) | 2.98 (1.28) |             | .02   | 2.64 (1.27)     | 2.98 (1.31) |             | 2.91 (1.29)                         | 2.63 (1.30) |
| 5†. My worries and fears about my future are out of my control.                                | 2.77 (1.23)                | 2.75 (1.25) | 2.80 (1.21) |             | .08   | 2.73 (1.25)     | 2.80 (1.22) |             | 2.81 (1.23)                         | 2.67 (1.23) |
| 21†. When I think about my future, I feel overwhelmed.   | 3.26 (1.22)                | 2.78 (1.25) | 3.74 (1.00) | <.001       | -.19* | 3.15 (1.20)     | 3.34 (1.24) |             | 3.28 (1.22)                         | 3.20 (1.24) |
| 1. My future excites me.   | 3.82 (1.08)                | 3.84 (1.08) | 3.80 (1.07) |             | .02   | 4.05 (1.06)     | 3.65 (1.06) | .013        | 3.77 (1.05)                         | 3.96 (1.14) |
| 2. I am interested in my future.   | 4.21 (0.90)                | 4.22 (0.95) | 4.20 (0.85) |             | -.05  | 4.38 (0.84)     | 4.09 (0.92) | .034        | 4.16 (0.89)                         | 4.35 (0.92) |
| 8. When I think about my future, I tend to focus more on good rather than bad things.          | 3.49 (1.15)                | 3.60 (1.09) | 3.38 (1.20) |             | -.03  | 3.82 (1.05)     | 3.25 (1.16) | <.001       | 3.42 (1.18)                         | 3.67 (1.03) |
| 26. My future looks bright.  | 3.55 (1.01)                | 3.63 (1.00) | 3.47 (1.03) |             | .01   | 3.74 (1.05)     | 3.40 (0.97) | .027        | 3.52 (1.02)                         | 3.61 (1.00) |
| 11†. Thinking about my future lifts my mood when I feel down.                                  | 2.95 (1.16)                | 3.14 (1.04) | 2.77 (1.24) | .037        | .00   | 3.23 (1.24)     | 2.75 (1.05) | .009        | 2.90 (1.15)                         | 3.11 (1.16) |
| 14†. I feel happy when thinking about my future.   | 3.36 (1.10)                | 3.57 (1.04) | 3.16 (1.12) | .013        | -.03  | 3.69 (1.01)     | 3.13 (1.11) | <.001       | 3.27 (1.10)                         | 3.63 (1.06) |
| 28†. I keep thinking about the same positive and exciting things when I think about my future. | 3.36 (1.10)                | 3.41 (0.99) | 3.31 (1.16) |             | .03   | 3.61 (1.04)     | 3.18 (1.07) | .008        | 3.27 (1.08)                         | 3.61 (1.02) |
| 13. When I think about my future, I can see clearly what I want to achieve.                    | 3.35 (1.21)                | 3.55 (1.12) | 3.15 (1.26) | .029        | .01   | 3.41 (1.29)     | 3.30 (1.15) |             | 3.35 (1.16)                         | 3.35 (1.35) |
| 19. I can imagine what my future will be like.   | 3.23 (1.16)                | 3.39 (1.14) | 3.07 (1.16) |             | .01   | 3.16 (1.21)     | 3.27 (1.13) |             | 3.22 (1.14)                         | 3.24 (1.21) |
| 23. I can't be bothered to plan for my future.   | 2.24 (1.16)                | 2.38 (1.18) | 2.11 (1.14) |             | -.01  | 2.20 (1.22)     | 2.27 (1.13) |             | 2.34 (1.16)                         | 1.98 (1.15) |

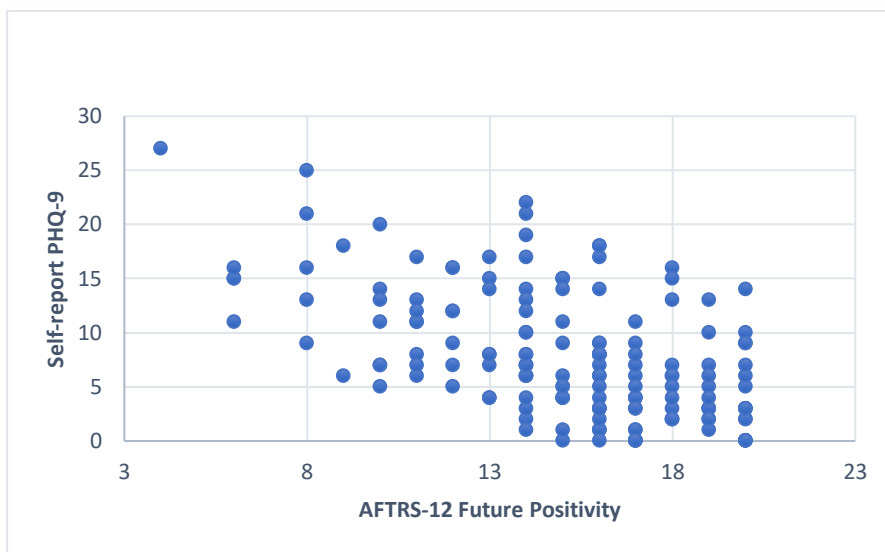
|   |             |             |             |      |             |             |             |             |
|---|-------------|-------------|-------------|------|-------------|-------------|-------------|-------------|
| 25. I can't get a clear picture of my future even when I try. | 2.72 (1.24) | 2.59 (1.21) | 2.85 (1.26) | -.05 | 2.69 (1.35) | 2.75 (1.15) | 2.73 (1.23) | 2.70 (1.28) |
|---|-------------|-------------|-------------|------|-------------|-------------|-------------|-------------|

Note. \* $p < .05$ . SD=Standard Deviation. All item scores had a range of 1-5. †Items only in AFTRS-18. Data is Pearson's correlation for age and mean (SD) for the other demographics. All  $p$ -values for Education  $> .05$ .

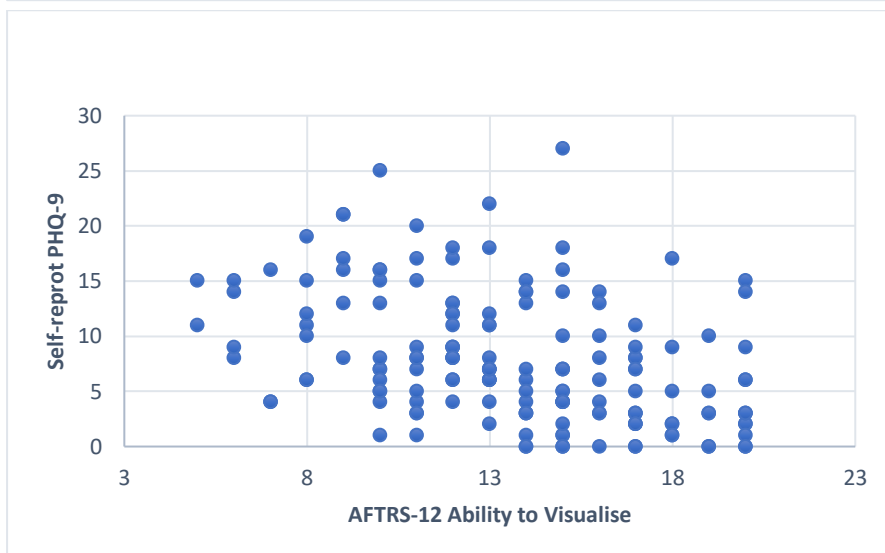




(a)

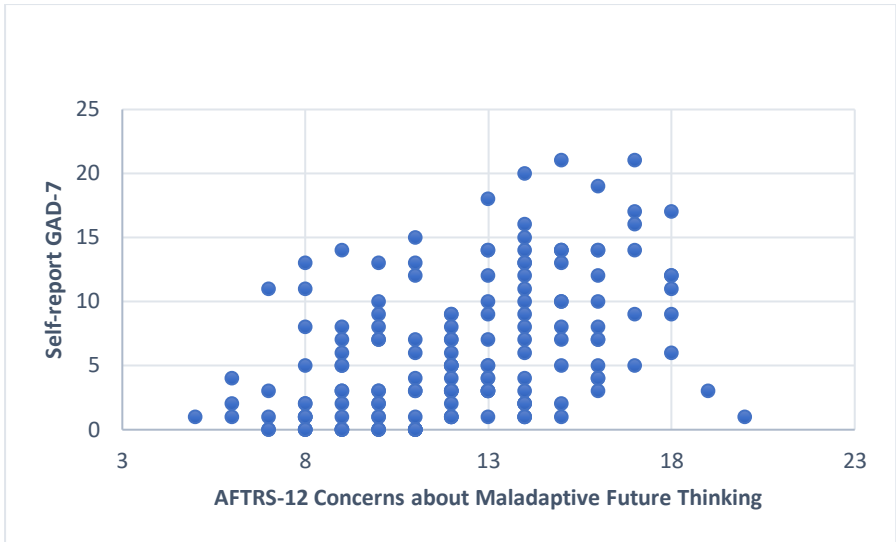


(b)

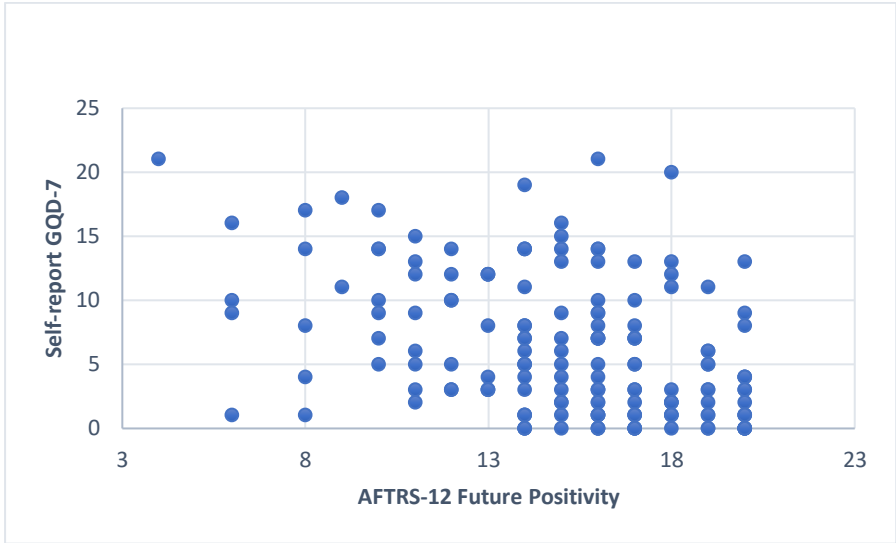


(c)

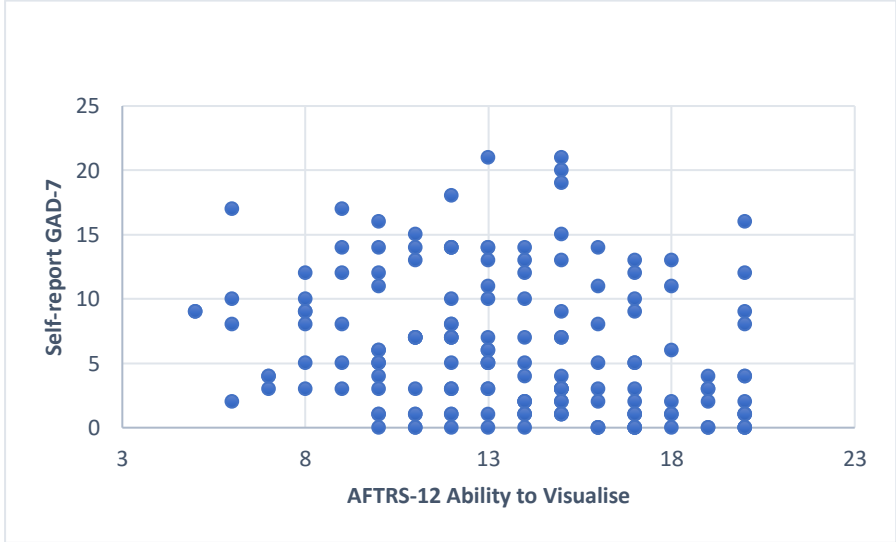
Supplementary Figure 1. The scatterplots showing the correlations between the AFTRS-12 Concerns about Maladaptive Future Thinking (a), Future Positivity (b), and Ability to Visualise (c) subscale total score and self-report depression.



(a)



(b)



(c)

Supplementary Figure 2. The scatterplots showing the correlations between the AFTRS-12 Concerns about Maladaptive Future Thinking (a), Future Positivity (b), and Ability to Visualise (c) subscale total score and self-report generalised anxiety.

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## Appendix A: AFTRS-18, AFTRS-12 and item deletion in exploratory factor analyses

### \* Items of the AFTRS-12.

#### *Concerns about Maladaptive Future Thinking*

- 6.\* My lack of control over my future scares me.
- 9.\* I fear my worries and fears about my future will come true.
- 15.\* Thinking about my future brings me anxiety and worry.
- 27.\* I repeat the same negative thoughts every time I think about my future.
- 4. I actively avoid thinking about my future because what might happen frightens me.
- 5. My worries and fears about my future are out of my control.
- 21. When I think about my future, I feel overwhelmed.

#### *Future Positivity*

- 1.\* My future excites me.
- 2.\* I am interested in my future.
- 8.\* When I think about my future, I tend to focus more on good rather than bad things.
- 26.\* My future looks bright.
- 11. Thinking about my future lifts my mood when I feel down.
- 14. I feel happy when thinking about my future.
- 28. I keep thinking about the same positive and exciting things when I think about my future.

#### *Ability to Visualise the Future*

- 13.\* When I think about my future, I can see clearly what I want to achieve.
- 19.\* I can imagine what my future will be like.
- 23.\* I can't be bothered to plan for my future.
- 25.\* I can't get a clear picture of my future even when I try.

† Ten items removed following the initial exploratory factor analysis:

- 3. When I think about my future, I lose my motivation.
- 7. My inability to see my future clearly makes me feel unhappy.
- 10. When I imagine my future, I always end up in a negative spiral - bad things leading to something even worse.
- 12. I can cope with the worries I have about my future when they come into my mind.
- 16. Just because something bad happened in the past does not mean it will lead to something bad in the future again.
- 17. The way I think about my future stays the same, no matter how I am feeling at the time.
- 18. I worry about my future instead of enjoying every present moment.

20. I don't let worries about my future get in the way of enjoying the present moment.
22. I feel in control over how things will turn out for me in the future.
24. I get into negative loops thinking about my future.