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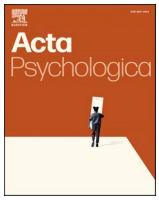

Testing alternative models and predictive utility of the Death Anxiety Inventory-Revised: A COVID-19 related longitudinal population based study

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ABSTRACT

The beginning of the COVID-19 pandemic had a profound effect on all aspects of daily life and triggered a swell of anxiety across the world. Some suggest this emotional response to the pandemic can be explained through death anxiety (DA), a transdiagnostic dimension associated with numerous psychological disorders. However, it remains unclear as to whether DA is a unidimensional or multidimensional construct. The primary aim of this study was to examine the underlying structure of the Death Anxiety Inventory-Revised (DAI-R; Tomás-Sábado et al., 2005) and assess its associations with mental health and demographic variables during the COVID-19 pandemic. To achieve these aims, we utilized data from Waves 1 ($N = 2205$: collected between March 23 and March 28, 2020) and 2 ($N = 1406$: collected between April 22 and May 1, 2020) of the COVID-19 Psychological Research Consortium (C19PRC), a multi-wave nationally representative study. Results showed that a 4-factor model provided the best fit to the data compared to a unidimensional and 4-factor second-order model. Further analyses showed that DA at Wave 1 was positively associated with somatic symptoms, paranoia, depression, anxiety, and traumatic stress symptoms at Wave 2, supporting previous research that suggests that the fear of death is predictive of psychopathology. Significantly, the factor labelled 'Thoughts about Death' at Wave 1 was the strongest predictor of the five main psychological variables at Wave 2, after statistically controlling for the other latent variables. These findings highlight the transdiagnostic nature of DA and support this important diagnostic construct becoming a measure of mental health more generally within the population. It is hoped that this research will shine a light on those suffering from DA and become a catalyst for increased therapeutic intervention, funding, and research in this area.

1. Introduction

Death anxiety (DA) refers to an individual's emotional reaction when experiencing negative thoughts relating to death. These can include, but are not limited to, the fear of the unknown, the fear of the process of death, the fear of losing loved ones, and the fear of one's own death (Zuccala et al., 2019). Consequently, unlike many worries that may or may not be realised within Common Mental Disorders (CMD), the person thinking about death is dreading an outcome that will inevitably occur at some point in the future (Menzies & Menzies, 2018). Terror management theory (TMT) posits that this inevitability can exert a profound influence over human cognition, feeling, motivation, and behaviour (Pyszczynski et al., 2015). Therefore, some prominent theorists have suggested that the awareness of death, and the fear and trepidation it entails, is a fundamental cause of psychopathology (e.g., Yalom, 2008). Similarly, Becker (1973) explains that individuals attempt to transform the underlying dread of death into smaller, more manageable fears that can be managed daily, although tragedy, illness, and unforeseen global events (such as COVID-19) act to remind individuals of their own mortality.

The original DA scale, The Templer Death Anxiety Scale (TDAS; Templer, 1970), conceptualised DA as a facet of generalized anxiety. However, a substantial amount of literature has demonstrated the transdiagnostic nature of DA (Iverach et al., 2014), associated with

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somatic symptoms (Furer & Walker, 2008), paranoia (Lopes & Jaspal, 2015), depression (Ongider & Eyuboglu, 2013), anxiety (Maxfield et al., 2014), and traumatic stress (Chatard et al., 2012). The TDAS (Templer, 1970) included 15 items that were scored as being true or false to provide a single measure of DA (i.e., the total amount of DA; Lester, 2007). The scale was constructed to reflect a wider range of life experiences than its predecessor, the Fear of Death Scale (FODS; Boyar, 1964), which was described in a doctoral dissertation and mainly covered the act of dying, the finality of death, corpses, and their burial. Whilst some have described the TDAS as a valid, widely used, and reliable measure of DA (Iverach et al., 2014; Royal & Elahi, 2011), others have questioned its psychometric properties, specifically its factorial validity, discriminant power, internal consistency, and forced choice response format have been criticized (Abdel-Khalek, 1997; Durlak, 1982). Furthermore, as Conte et al. (1982) suggest, some items offer unrelated, ambiguous expressions of DA, such as "I am distressed by the way time flies so rapidly" (Templer, 1970, p. 167). The 51-item Death Anxiety Scale-Extended (Templer et al., 2006) received similar criticism for its true/false, forced response format (Iverach et al., 2014).

In contrast, a growing amount of empirical evidence has confirmed the multifaceted nature of DA, thereby highlighting the need for multidimensional assessment tools (Iverach et al., 2014; Zuccala et al., 2019). The Death Anxiety Inventory (DAI; Tomás-Sábado & Gómez-Benito, 2005) was originally developed to address this need. It was first used as a psychometric instrument to measure DA among Spanish-speaking subjects, though an English form of the scale was also created, in the hope of future cross-cultural comparative studies. Based on Templer's (1976) two-factor theory, levels of DA were hypothesised to vary depending on an individual's psychological well-being and personal experience with respect to death. This 20-item, self-administered questionnaire could be administered with either six-point Likert scales or with dichotomous true/false items and held high internal consistency ($\alpha = 0.90$) and test–retest reliability at 4 weeks ($r = 0.94$). The five factors were labelled as follows: (1) Externally generated death anxiety, (2) Meaning and acceptance of death, (3) Thoughts about death, (4) Life and death, and (5) Brevity of life (Tomás-Sábado & Gómez-Benito, 2005). Nevertheless, studies on Spanish nursing professionals and undergraduate students (Limonero et al., 2003; Tomás-Sábado & Limonero, 2004) highlighted several items that did not correlate well with the total score and that inconsistently factor loaded onto the five main factors. Considering these findings, three items related to duration of life and getting old were omitted, to create the new 17-item DAI-R, which had improved internal consistency ($\alpha = 0.92$). The revised scale had four factors: (1) Death acceptance, (2) Externally generated death anxiety, (3) Death finality, and (4) Thoughts about death. A factor analytic study based on data from 866 Spanish participants showed that these four factors accounted for 65.8% of the total variance and all yielded eigenvalues greater than 1.00. All 17 items presented factor loadings greater than 0.40, making the structure more coherent than the previous 20-item scale (Tomás-Sábado et al., 2005).

The 17-item DAI-R scale has been utilized to test DA among a variety of samples and in studies considering a diverse range of other variables. Of these, Edo-Gual et al. (2015) found, in a sample of 760 Spanish nursing undergraduates, that those who scored higher on resilience reported lower levels of DA, promoting the need within the nursing curriculum to teach positive coping strategies. Moreover, attention to feelings, and self-esteem also predicted lower levels of DA among nursing undergraduates. The Cronbach's alpha coefficient for this sample was 0.89, compared to 0.92 in the original validation study (Tomás-Sábado et al., 2005). More recently, Vèsall-Fructuoso et al. (2019) reported a Cronbach's alpha of 0.91 when using the scale to examine the psychometric properties of the Self Competence in Death Work Scale (SC-DWS), in a cohort of Spanish nursing professionals ($N = 106$). Here, higher scores on the SC-DWS were positively correlated with measures of self-efficacy and meaning of life whilst being negatively correlated with DA. In a further study demonstrating high internal consistency ($\alpha = 0.92$), DA was found to be associated with three dimensions of health-related quality of life (physical health, mental health, and social relationships) among people living with HIV/AIDS ($N = 201$) (Onu et al., 2020). However, the underlying dimensional structure of the DAI-R scale is yet to be tested in a larger representative sample of the population.

On 11 March 2020, the World Health Organisation (WHO) described the coronavirus 2019 disease (COVID-19) as a global pandemic, triggered by a novel coronavirus pathogen named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2; WHO, 2019). In the UK 211,264 patients tested positive for COVID-19 between 31 January 2020 and 11 May 2020 (Baker et al., 2020), placing the National Health Service (NHS) under significant pressure (Willan et al., 2020). The first COVID-19 related death was reported in the UK on 5 March 2020, rising to 9875 deaths in hospitals by 9 April 2020, and 29,427 deaths in hospitals and care homes by 5 May 2020 (Maben & Bridges, 2020). Williamson et al. (2020), in an NHS England study ($N = 5683$) conducted between 1 February 2020 and 25 April 2020, found death from COVID-19 to be strongly associated with uncontrolled diabetes, severe asthma, prior medical conditions, older age, deprivation, and being male. In response, on 23 March 2020 the UK Prime Minister announced strict physical distancing measures (widely referred to as lockdown), which severely restricted freedom of movement, sought the temporary closure of non-essential businesses, and promoted working from home, for all but essential keyworkers. These public health measures were important to protect physical health, though the effect on mental health and existential well-being throughout the UK population during this initial phase of the pandemic remains poorly understood (Douglas et al., 2020).

The beginning of the pandemic had a profound effect on all aspects of daily life across the world (Salari et al., 2020) and psychological support networks became compromised through reduced access to family, friends, recreation, and places of employment and worship. Indeed, in this initial phase of the pandemic, during March and April 2020, loneliness was seen as a significant risk factor towards anxiety, depression, and their comorbidity (Palgi et al., 2020). As COVID-19 related deaths, hospitalisations, and case numbers were widely reported daily (Pyszczynski et al., 2021), it is conceivable that DA (the negative emotional reaction to the awareness of death) was particularly prevalent during this period (Zuccala et al., 2019). In fact, a further study conducted around the same time concluded that older adults who reported higher levels of COVID-19 related health worries also reported higher levels of DA (Ring et al., 2020). The associations between loneliness, age, and psychiatric correlates were also found to be more pronounced in those who felt subjectively older around this time (Shrira et al., 2020). Additionally, Satici et al. (2020) found that intolerance of uncertainty (which has similarities with DA) had a considerable direct influence on mental wellbeing during the early stages of the pandemic. Shevlin et al. (2020) also found COVID-19 related anxiety to be correlated with physical/somatic symptoms, including gastrointestinal discomfort, pain, and fatigue. Although the marked relationship between COVID-19 related stress and PTSD (Chen et al., 2021), paranoia (Lopes et al., 2020), obsessive compulsive disorder (OCD; Fineberg et al., 2020), and intolerance of uncertainty (IOU; Satici et al., 2020) has been well documented during the early phase of the pandemic, less is known about their association with DA, throughout this uncertain time.

The primary aim of this study was to examine the underlying structure of the DAI-R and its associations with mental health and demographic variables in a representative sample of the British population during the early phase (March and April 2020) of the COVID-19 pandemic. We hypothesised that the 4-factor model would provide the best fit to the data compared to the unidimensional and 4-factor second-order models, based on previous confirmatory factor analyses (DAI-R; Tomás-Sábado et al., 2005). We also hypothesised that the four DA factors at Wave 1 would be strong predictors of mental health variables (somatic symptoms, paranoia, depression, anxiety, and traumatic stress symptoms), and a broad range of additional demographic and mental

health variables at Wave 2, in both bivariate and multivariate models, aiming to further establish DA as a transdiagnostic construct.

2. Methods

2.1. Participants

Full details of the sample, procedures, and measures have already been documented (McBride et al., 2020). Wave 1 data collection started on March 23, 2020, and was completed on March 28, 2020. Participants ($N = 2025$) were recruited from an online research panel using stratified quota sampling methods to ensure that the sample characteristics of sex, age, and household income were comprehensively represented. Participants were recruited from the four countries of the UK: England (86.9%), Northern Ireland (2.3%), Scotland (7.8%), and Wales (3.1%). The mean age of the sample was 45.44 years ($SD = 15.90$, range 18–83), and 51.7% ($n = 1047$) were female, 48.0% were male ($n = 972$), and 0.3% ($n = 6$) checked the transgender/prefer not to say/other option. The majority of the sample were born in the UK (96%, $n = 1834$) and were of White British/Irish ($n = 1732$, 85.5%) or White non-British/Irish ($n = 116$, 5.7%) ethnicity. A binary variable was computed to represent "White British/Irish" (1) and "Other" (0). Nearly half of the respondents were in full-time employment (48.8%, $n = 988$), 15.0% ($n = 303$) were in part-time employment, 16.5% ($n = 334$) were retired, 4.7% ($n = 95$) were students, 5.1% ($n = 103$) were currently unemployed and seeking work, 3.4% ($n = 69$) were not working due to disability, and 6.6% ($n = 133$) were unemployed and not seeking work. Regarding urbanicity, 24% ($n = 498$) resided in a city, 28.2% ($n = 573$) in a suburb, 30% ($n = 620$) in a town, and 16.5% ($n = 335$) in a rural area. Relating to post-secondary education, 28.2% of the participants had completed an undergraduate degree. Participants also completed measures relating to religious beliefs, pre-existing health conditions, perceived risk of COVID 19, and levels of COVID-19 infection. The follow up rate for Wave 2 was 69.4% ($N = 1406$: collected between April 22 and May 1, 2020). Certain variables were only measured by the C19PRC in Wave 1 and not Wave 2, and vice-versa.

2.2. Measures

2.2.1. Variables measured in Wave 1

2.2.1.1. Demographics. Demographic variables of age (years), gender (female = 1; male = 0).

Urbanicity: Participants were asked "Do you consider yourself to live in:" and were required to choose one of the options provided: 'City', 'Suburb', 'Town', or 'Rural'. The variable was recoded to a binary variable representing urbanicity (1 = City; 0 = Suburb, Town, or Rural).

Participants were asked "Were you born in the UK?" and "Did you grow up (spend most of your life up to 16 years) in the UK?" and responded to as (1) Yes or (0) No.

Participants were asked about their highest educational attainment, and this was recoded into 'Did not attend post-secondary education' and (1) 'Post-secondary education'.

Participants were asked to select their religious identity from a drop-down menu of religious belief systems. Responses were recoded to (0) 'Atheist or agnostic' and (1) 'Any religion'.

2.2.1.2. Income. At Wave 1, participants were asked to choose one of the five following categories to represent their gross household income: "£0 - £300 per week (equals about £0 - 15,490 per year)", "£301 - £490 per week (equals about £15,491 - £25,340 per year)", "£491 - £740 per week (equals about £25,341 - £38,740 per year)", "£741 - £1,111 per week (equals about £38,741 - £57,930 per year)", and "£1,112 or more per week (equals about £57,931 or more per year)".

2.2.1.3. Health characteristics. Participants were asked if they had any pre-existing health conditions in Wave 1. This question used (1) Yes and (0) No binary response options. Participants were then asked whether they and members of their immediate family were living with lung disease, diabetes, or heart disease at the time of the survey, and/or prior to the COVID-19 outbreak (i.e., before December 31, 2019). This question used (1) Yes and (0) No binary response options.

2.2.1.4. Anxiety relating to COVID-19. Respondents' degree of anxiety specific to the COVID-19 pandemic was assessed at Wave 1 using a single visual slider scale, ranging from 0 = *not at all anxious* on the left-hand side to 100 = *extremely anxious* on the right-hand side.

2.2.1.5. Perceived risk of contracting COVID-19. Using a visual slider, respondents estimated their perceived percentage risk of contracting COVID-19 within one-month, three-months, and six-months of the survey (ranging from 0% on the left-hand side to 100% on the right-hand side) at Wave 1. With the same visual slider, they were also asked to estimate the perceived risk within different vulnerable groups, including the elderly, children, pregnant women, those with underlying chronic health conditions, those experiencing serious illness, and those who had experienced the death of a loved one following a diagnosis of COVID-19.

2.2.1.6. Experiences of COVID-19 symptoms, testing, and diagnosis. To ascertain levels of COVID-19 infection, participants were asked whether they or someone close to them (e.g., a family member or friend), at the time of the survey (March 2020), had experienced symptoms of COVID-19, whether they had been tested for the virus, and, if so, what the outcome of test was (positive/negative).

2.2.1.7. Monotheist and atheist beliefs scale (Alsuhibani et al., 2021). Religiosity was assessed at Wave 1 using a shortened version of the Monotheist and Atheist Belief Scale, with four items measuring atheism and four items measuring religiosity. Response options were scored using a 5-point scale ranging from 1 = *Strongly disagree* to 5 = *Strongly agree*. Higher scores indicated higher levels of atheism or religious beliefs and total scores ranged from 4 to 20. The alpha coefficients were 0.96 and 0.83 for the monotheism and atheism subscales, respectively (Alsuhibani et al., 2021) and 0.86 and 0.72 in this sample.

2.2.1.8. Death Anxiety Inventory-Revised (DAI-R; Tomás-Sábado et al., 2005). Participants' attitudes towards death were assessed at Wave 1 using the 17-item DAI-R, which measures four death-related anxiety factors: death acceptance, externally generated death anxiety, death finality, and thoughts about death. Responses were scored on a 5-point Likert scale ranging from 1 = *totally disagree* to 5 = *totally agree*. The DAI-R had excellent internal consistency both in the original validation ($\alpha = 0.92$: Tomás-Sábado et al., 2005) and in this sample ($\alpha = 0.94$).

2.2.2. Variables measured in Wave 1 and Wave 2

2.2.2.1. Patient Health Questionnaire (PHQ-15; Kroenke et al., 2002). The presence and severity of somatic symptoms were assessed in Waves 1 and 2 using the PHQ-15, a 15-item measure for which respondents were asked to rate the severity of symptoms (e.g., stomach pain, headaches, and dizziness), experienced over the last seven days as 0 = *Not bothered at all*, 1 = *Bothered a little*, or 2 = *Bothered a lot*. Scale scores are produced by summing the scores for all the items, producing possible scores between 0 and 28, with higher scores indicating higher levels of distress associated with somatic symptoms. The reliability and validity of the PHQ-15 has been shown to be high in clinical and occupational health care settings (Kroenke et al., 2002; Kroenke et al., 2010). Wave 1 ($\alpha = 0.91$) and Wave 2 ($\alpha = 0.88$) of this sample showed good internal consistency.

2.2.2.2. Persecution and Deservedness Scale (PADS; Melo et al., 2009). Paranoia was assessed at Waves 1 and 2 using a 5-items version of the PADS, a measure that has been validated against both questionnaire and clinical measures of paranoia (Elahi et al., 2017; Melo et al., 2009). Participants were asked to indicate the extent to which each statement was true of false using response options, 1 = *Strongly disagree,* 2 = *Disagree*, 3 = *Neither agree nor disagree*, 4 = *Agree*, and 5 = *Strongly agree*. Scale scores are produced by summing the scores for all the items, producing possible scores between 5 and 25, with higher scores indicating higher levels of distress associated with paranoia. The 5-item scale was found to have high internal reliability in a former epidemiological study of UK citizens (α = 0.84) (McIntyre et al., 2018), and in Wave 1 (α = 0.86) and Wave 2 (α = 0.86) of this sample.

2.2.2.3. Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001). Depression was assessed at Waves 1 and 2 using the PHQ-9, a nine-item measure that corresponds to the DSM-IV Diagnostic Criterion A symptoms for major depressive disorder (American Psychiatric Association, 2000). Participants were asked how often, over the last two weeks, they had been bothered by each of the depressive symptoms. Response options were *Not at all*, *Several days*, *More than half the days*, and *Nearly every day*, scored as 0, 1, 2, and 3, respectively. Scale scores are produced by summing the scores for all the items, producing possible scores between 0 and 27, with higher PHQ-9 scores indicating higher levels of depression. The PHQ-9 has shown good sensitivity and specificity for detecting depressive disorders in a variety of clinical and occupational settings (see Kroenke et al., 2010 for an overview). Internal consistency scores remained high in both Wave 1 (α = 0.92) and Wave 2 (α = 0.92) of this study.

2.2.2.4. Generalized Anxiety Disorder Scale (GAD-7; Spitzer et al., 2006). Symptoms of generalized anxiety were assessed at Waves 1 and 2 using the GAD-7. Respondents were asked to report how often in the past 7 days they had been bothered by seven anxiety symptoms (e.g., trouble relaxing, becoming easily annoyed or irritable). Response options were *Not at all, Several days*, *More than half the days*, and *Nearly every day*, scored as 0, 1, 2, and 3, respectively. Scale scores are produced by summing the scores for all the items, producing possible scores between 0 and 21, with higher GAD-7 scores indicating higher levels of anxiety. The GAD-7 has good reliability and construct validity, as evidenced by strong associations with other established measures of anxiety, diagnoses of GAD, depression, self-esteem, life satisfaction, and resilience (Löwe et al., 2008). Internal consistency scores remained high in both Wave 1 (α = 0.94) and Wave 2 (α = 0.94) of this sample.

2.2.2.5. International Trauma Questionnaire (ITQ; Cloitre et al., 2018). The ITQ is a self-report measure of ICD-11 posttraumatic stress disorder (PTSD) based on a total of six symptoms across the three symptom clusters of *Re*-experiencing, Avoidance, and Sense of Threat and was used in Waves 1 and 2 of this study. Each symptom cluster is comprised of two symptoms. All items are answered on a 5-point Likert scale, ranging from 0 = *Not at all* to 4 = *Extremely*, with possible PTSD scores ranging from 0 to 24, with higher ITQ scores indicating higher levels of PTSD. The psychometric properties of the ITQ have been demonstrated in multiple general population (Ben-Ezra et al., 2018; Cloitre et al., 2019) and clinical and high-risk samples (Hyland et al., 2017; Karatzias et al., 2016). In this study a modified version of the ITQ was used in relation to individual experiences of the COVID-19 pandemic to assess PTSD whereby participants were asked, "In this section, you will be asked questions about different ways that people sometimes react following a traumatic or stressful life event. Please answer the following questions in relation to your experience of the COVID-19 pandemic."). Internal consistency scores remained high in both Wave 1 (α = 0.93) and Wave 2 (α = 0.93) of this study.

2.2.2.6. Loneliness scale (Hughes et al., 2004). Social connectedness was assessed at Waves 1 and 2 using a three-item loneliness scale. Participants were asked how often they felt the way described in each of the statements, which referred to (1) lack of companionship, (2) feeling left out, and (3) feeling isolated from others. Response options were *Never*, *Hardly ever*, and *Often,* scored as 1, 2, and 3, respectively. Scale scores are produced by summing the scores for all the items, producing possible scores between 3 and 9, with higher scores indicating higher levels of distress associated with loneliness. The test was specifically designed for use in large-scale population surveys and has displayed satisfactory reliability and both discriminant and concurrent validity previously (Hughes et al., 2004). Internal consistency scores remained relatively high in both Wave 1 (α = 0.88) and Wave 2 (α = 0.87) of this sample.

2.2.3. Variables measured in Wave 2

2.2.3.1. Intolerance of Uncertainty Scale, Short Form (IUS-12; Carleton et al., 2007). The IUS-12, administered in Wave 2, was developed to measure negative beliefs about and reactions to uncertainty. Participants answer the items on a 5-point scale ranging from 1 = *Not at all characteristic of me* to 5 = *Entirely characteristic of me.* 12 items measure intolerance of uncertainty. Scale scores are produced by summing the scores for all the items, producing possible scores between 12 and 60, with higher scores indicating higher levels of uncertainty. The IUS has high internal consistency (α = 0.85) and convergent and divergent validity when assessed alongside symptom measures of worry and anxiety (Carleton et al., 2007; Mahoney & McEvoy, 2012). Internal consistency was high in Wave 2 (α = 0.91).

2.2.3.2. Obsessive Compulsive Inventory-Revised (OCI-R; Foa et al., 2002). The OCI-R is an 18-item scale that is used to assess the degree of distress caused by six types of obsessive-compulsive behaviours: washing, checking, doubting, obsessing, mental neutralising (ordering), and hoarding. This measure was administered at Wave 2. All items are scored on a 5-point Likert scale ranging from 1 = *Not at all bothered/ distressed* to 5 = *Extremely distressed/bothered*. The total score ranges from 0 to 72, with higher scores indicating higher levels of distress associated with obsessive compulsive behaviours. The OCI-R has good to excellent internal consistency, test–retest reliability, and convergent validity (Foa et al., 2002). Internal consistency was high in Wave 2 (α = 0.96).

2.3. Design procedure

The data used in this study were collected in the first two survey waves of the C19PRC: https://www.sheffield.ac.uk/psychology-consortium-covid19 research programme, which was established in March 2020 to assess the long-term psychological, social, and economic impact of the pandemic (McBride et al., 2020). This study adds to the existing research as (1) it was based on a large nationally representative sample of the UK population, (2) it used a wide range of standardised measures of mental health related variables, (3) it measured the data at two time points, with the DAI-R model predicting mental health variables approximately 1 month later, and (4) data were collected during the initial phase of the COVID pandemic in the UK, at a time of unprecedented global uncertainty.

2.4. Data analysis

The latent structure of the DAI-R was tested using confirmatory factor analysis (CFA). Three models were specified and estimated in Mplus 8.2 (Muthén & Muthén, 2015). Model 1 was a unidimensional model with all 17 items loading on a single latent variable labelled 'Death Anxiety'. Model 2 was a correlated 4-factor model with 6 items loading on the latent variable 'Death Acceptance', 4 items loading on

'Externally Generated Death Anxiety', 4 items loading on 'Death Finality' and 3 items loading on 'Thoughts About Death' (representing the 4 sub-scales of the DAI-R). Model 3 was a 4-factor second-order model that was used to explain the correlations among the first order factors as specified in Model 2, with the inclusion of a 2nd order latent variable labelled 'Death Anxiety'. To determine the best fitting model, several standard goodness-of-fit indices were used (Hu & Bentler, 1999), which included a non-significant chi-square (χ^2) statistic, and the Comparative Fit Index (CFI) and Tucker–Lewis index (TLI), for which values ⩾0.90 indicate acceptable fit. The root mean square error of approximation (RMSEA) and standardised root mean square residual (SRMR) values were also used, for which values ⩽0.08 indicate acceptable model fit. The Bayesian information criterion (BIC) values can be used to compare nested and non-nested models, and the model with the lowest BIC value is considered to be statistically superior, with a difference of 10 points considered evidence for the superiority of the model with the lower value (Raftery, 1995).

The cross-sectional associations between the DAI-R sub-scale and total scale scores were assessed using bivariate correlations. The longitudinal associations between the DAI-R at wave 1 and psychological variables at wave 2 were assessed in both bivariate and multivariate models. For the bivariate models, each of the DAI-R latent variables from Model 2 (at wave 1) was specified to predict the wave 2 mental health variables – these models were estimated separately for each of the four DAI-R latent variables. In addition, the second order latent variable was used as a predictor of the psychological variables at wave 2. These analyses were analogous to using the summed sub-scale scores and total scores as predictors. In the multivariate model all four latent variables were used as predictors of the wave 2 mental health variables in the same model. The estimates from this model indicate the unique effects of each latent variable, whilst statistically controlling for the other latent variables (analogous to a multiple regression model).

The missing data at Wave 2 were accounted for by using full-information maximum likelihood estimation, so the factor analytic models and the regression analysis were based on an effective sample size of 2025.

3. Results

The total scores on the DAI-R ranged from 17 to 85, covering almost the entire possible range of scores, with a mean of 43.78 ($SD = 14.89$) which is slightly lower than the theoretical mean of the possible scale scores. This was similar for all the subscales: Acceptance (Mean = 5.08, $SD = 5.58$), External (Mean = 10.85, $SD = 3.83$), Finality (Mean = 10.60, $SD = 4.45$), Thoughts (Mean = 7.23, $SD = 3.18$). The bivariate correlations of the DA scale and outcome measures are presented in Table 1.

Higher DA scores were significantly associated with younger age, female gender, urban living, lower levels of educational attainment, religious beliefs, lower income, and the presence of diabetes, lung, or heart disease. The total DA score, and subscale scores, were all positively and moderately associated with the mental health variables of somatic symptoms, paranoia, depression, anxiety, and traumatic stress ($r = 0.33$ to 0.48), with lower correlations for COVID-19 related anxiety, risk of COVID-19 infection, and loneliness ($r = 0.23$ to 0.28). The Wave 1 DA scores had high internal reliability ($\alpha = 0.94$).

The fit statistics for the three measurement models of the DA scale are provided in Table 2. Model 1, the unidimensional model, was a poor fit for the data. Fit indices for the 4-factor model (model 2) were superior to the indices for the 4-factor second-order model (model 3) and BIC was also lower in model 2 (BIC = 92,726.91) compared to model 3 (BIC = 92,731.98).

Table 3 presents the standardised factor loadings and factor correlations from the CFA of the Death Anxiety Inventory-Revised. All factor loadings were statistically significant ($p < .001$) and ranged from $r = 0.52$ to $r = 0.87$. Additionally, all factor correlations were statistically significant ($p < .001$) and ranged from $r = 0.67$ to $r = 0.93$.

Table 4 presents the standardised regression coefficients for DA at Wave 1 predicting psychological variables at Wave 2. All the latent variables were positively associated with somatic symptoms, paranoia, depression, anxiety, and traumatic stress symptoms at Wave 2 ($r = 0.33$ to 0.43).

Table 5 presents the standardised regression coefficients for the Latent Variable Model with the DA CFA at Wave 1 predicting the psychological variables at Wave 2. After statistically controlling for the other latent variables, only the *Thoughts about Death* variable was positively associated with the five mental health measures of somatic symptoms, paranoia, depression, anxiety, and traumatic stress symptoms at Wave 2 ($r = 0.35$ to 0.44).

Table 1
Correlations between demographic and psychological variables and Death Anxiety Scale and sub-scale scores at Wave 1.

	Mean (SD)/N (%)	Acceptance	External	Finality	Thoughts	Total DA
Age	45.44 (15.9)	−0.23***	−0.24***	−0.25***	−0.20***	−0.26***
Gender (female)	1047 (51.8%)	0.04*	0.11***	0.15***	0.00*	0.09**
Born in the UK? (yes)	1834 (90.6%)	−0.02*	0.02	−0.00*	0.02*	−0.00*
Grow up in the UK? (yes)	1872 (92.4%)	−0.04*	−0.01*	−0.01*	−0.01*	−0.03*
Urbanicity (town)	620 (30.6%)	0.08**	0.10***	0.10***	0.09**	0.10***
Post-secondary education? (yes)	1215 (60.0%)	−0.09**	−0.04*	−0.05**	−0.07**	−0.08**
Religion (any)	1257 (62.1%)	0.12***	0.11***	0.15***	0.07**	0.13***
Income ⩾ £38,741	887 (43.8%)	−0.05**	−0.05**	−0.07**	−0.11***	−0.08**
Pre-existing health condition?	347 (17.1%)	0.01*	0.02*	0.01*	−0.07**	−0.01*
Do you have diabetes, lung disease, or heart disease?	311 (15.4%)	0.04*	0.01*	0.04*	0.09**	0.05**
COVID-19 anxiety	67.72 (24.6)	0.20***	0.27***	0.24***	0.20***	0.26***
Perceived risk COVID-19	48.0 (26.13)	0.20***	0.20***	0.19***	0.20***	0.23***
Infected	8 (2.4%)	0.04*	0.02*	0.02*	0.08**	0.04*
Somatic symptoms	3.93 (5.10)	0.26***	0.25***	0.27***	0.39***	0.33***
Paranoia	12.45 (4.97)	0.42***	0.33***	0.36***	0.50***	0.45***
Depression	5.38 (6.33)	0.30***	0.25***	0.30***	0.42***	0.35***
Anxiety	5.16 (5.69)	0.33***	0.32***	0.36***	0.43***	0.40***
Traumatic stress	4.58 (5.82)	0.44***	0.38***	0.38***	0.50***	0.48***
Religious Beliefs	13.39 (4.00)	0.25***	0.18***	0.23***	0.29***	0.17***
Atheist Beliefs	9.98 (3.36)	−0.13***	−0.10***	−0.12***	−0.16***	−0.08**
Loneliness	4.77 (1.86)	0.23***	0.20***	0.24***	0.33***	0.28***

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Table 2
Goodness-of-Fit statistics for the measurement models of death anxiety at Wave 1.

	χ^2 (df)	CFI	TLI	RMSEA	SRMR	BIC
Model 1 Unidimensional	2227.40 (119)	0.85	0.83	0.09 (0.09, 0.10)	0.06	94,424.18
Model 2 4-Factor	1046.25 (113)	0.93	0.92	0.06 (0.06, 0.07)	0.04	92,726.91
Model 3 4-Factor second-order	1058.94 (115)	0.93	0.92	0.06 (0.06, 0.07)	0.04	92,731.98

Note. χ^2 (df) = chi square and degrees of freedom; CFI = comparative fit index; TLI = Tucker-Lewis fit index; RMSEA = root mean square error of approximation; CI = confidence interval; SRMR = Standardised Root Mean Square Residual; BIC = Bayesian information criteria.

Table 3
Standardised factor loadings and factor correlations from the CFA of the Death Anxiety Inventory-Revised.

Item	Acceptance	External	Finality	Thoughts
I think I am more afraid of death than most people.	0.85			
The certainty of death makes life meaningless.	0.58			
It annoys me to hear about death.	0.65			
I find it really difficult to accept that I have to die.	0.87			
I think I would be happier if I ignored the fact that I have to die.	0.71			
Dying is the worst thing that could happen to me.	0.64			
Coffins make me nervous.		0.86		
I get upset when I am in a cemetery.		0.64		
The sight of a corpse deeply shocks me.		0.70		
I would never accept a job in a funeral home.		0.52		
The idea that there is nothing after death frightens me.			0.83	
I am worried about what's after death.			0.83	
I find it difficult to accept the idea that it all finishes with death.			0.76	
The idea of death troubles me.			0.86	
I very often think about the cause of my death.				0.85
I frequently think of my own death.				0.84
I often think I may have a serious disease.				0.72
Factor correlations				
Acceptance	1.00			
External	0.81	1.00		
Finality	0.93	0.81	1.00	
Thoughts	0.73	0.67	0.70	1.00

Note: All loadings and correlations significant $p < 0.001$.

4. Discussion

This study examined the underlying structure of the Death Anxiety Inventory-Revised (Tomás-Sábado et al., 2005) and its associations with mental health and demographic variables during the start of the COVID-19 pandemic. Triggering a surge in anxiety across the world, the initial phase of the COVID-19 pandemic had a profound impact on all aspects of daily life (Salari et al., 2020). As pandemic related deaths, hospitalisations, and case numbers were reported daily, thoughts of one's own death and mortality were compounded by the enforced isolation created by the lockdown, stay-at-home message, and associated movement restrictions (Pyszczynski et al., 2021). These unique circumstances were also shown to have had a detrimental effect on the overall mental health of the population at this time (Hyland et al., 2020; Shevlin et al., 2020). Moreover, the effect of the COVID-19 pandemic on mental health was reminiscent of the anxiety observed in relation to other world events, such as the outbreak of severe acute respiratory syndrome (SARS) (Hawryluck et al., 2004), Ebola (Arrowood et al., 2017), and swine flu (Bélanger et al., 2013), and the aftermath of the 911 terrorist attacks on the World Trade Centre (Brackbill et al., 2013). Therefore, assessing DA and mental health in the general population at the beginning of COVID-19 pandemic may provide insights into how to protect the mental health of vulnerable populations during future crises.

Surprisingly, the overall mean score for the DAI-R at Wave 1 in the current study was 43.78, only marginally higher than that reported in medical and community settings. Indeed, Edo-Gual et al. (2015), in a sample of Spanish nursing undergraduates, reported a score of 41.52, whilst Vèsall-Fructuoso et al. (2019) reported one of 41.51, in a study of individuals living with HIV/Aids. Some theorists suggested that DA and levels of psychological equanimity might have a more pronounced increase due to the pandemic (Pyszczynski et al., 2021). However, placing these findings in a wider context, an Austrian study conducted at the start of the pandemic in lockdown conditions comparable to those in the United Kingdom found that greater social connectedness was associated with lower levels of general stress and worry. Equally, those who reported less social connectedness also reported greater COVID-19 related anxieties (Nitschke et al., 2021). Indeed, whilst in-person communication decreased during the pandemic, online communication (Nitschke et al., 2021) and community spirit increased significantly (Fransen et al., 2021). Therefore, it is conceivable that, for some, social connectedness may have helped to foster resilience and positive coping mechanisms in response to DA, psychological distress, and the pandemic. This view

Table 4
Bivariate standardised regression coefficients for death anxiety latent variables at Wave 1 predicting psychological variables at Wave 2.

	Somatic	Paranoia	Dep	GAD	Traumatic stress	Loneliness	IoU	OCD
Acceptance	0.27***,*,**	0.35***	0.29***	0.32***	0.38***	0.24***	0.36***	0.43***
External	0.26***	0.30***	0.23***	0.30***	0.34***	0.21***	0.34***	0.37***
Finality	0.28***	0.32***	0.27***	0.34***	0.37***	0.24***	0.35***	0.39***
Thoughts	0.39***	0.41***	0.39***	0.41***	0.44***	0.32***	0.35***	0.50***
2nd order DA	0.33***	0.39***	0.33***	0.39***	0.43***	0.28***	0.40***	0.48***

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Table 5
Standardised regression coefficients for latent variable model with death anxiety CFA at Wave 1 predicting psychological variables at Wave 2.

	Somatic	Paranoia	Dep	GAD	Traumatic stress	Loneliness	IoU	OCD
Acceptance	0.22*	0.02	−0.04	−0.18	−0.03	−0.11	0.06	0.16
External	0.08	0.19**	0.02	0.10	0.17**	0.06	0.16**	0.17**
Finality	0.15	−0.08	0.01	0.17	0.04	0.08	0.07	−0.17
Thoughts	0.42***	0.35***	0.44***	0.40***	0.35***	0.33***	0.19***	0.42***

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

resonates with the work of Shevlin et al. (2021, p.1), which refutes "the myth of a 'tsunami' of mental ill-health in populations affected by COVID-19." In fact, in a one-year longitudinal follow-up of the COVID-19 C19PRC study, Shevlin et al. (2021, p.2) found that over two-thirds of the sample were members of a relatively stable "resilient" class over this time. However, the same study found a sub-group with pre-existing mental health issues (4.7% of the sample) experienced a marked deterioration of symptoms during the first year of the pandemic, indicating heterogeneity. Conversely, the marginally higher score observed in the current study could be due to a greater level of mortality salience associated with COVID-19, echoing Becker's (1973) view that the fear of death is exacerbated by intrusive thoughts of serious illness and unforeseen global events.

It was predicted that a 4-factor model would provide the best fit to the data compared to a unidimensional and 4-factor second-order model, based on previous confirmatory factor analyses (Tomás-Sábado et al., 2005). We also hypothesised that DA at Wave 1 would be a strong predictor of mental health variables (somatic symptoms, paranoia, depression, anxiety, and traumatic stress symptoms) at Wave 2. Results indicated that the 4-factor model provided the best fit to the data and that DA at Wave 1 was positively associated with somatic symptoms, paranoia, depression, anxiety, and traumatic stress symptoms at Wave 2. As such, the main hypotheses were supported.

As stated, the confirmatory factor analyses indicated that the 4-factor model had superior fit to the data compared to the other models, providing an indication that the DAI-R has strong structural validity. Based on data from 2205 participants, the four factors accounted for 57% of the total variance. Out of the 17 items in the scale, 16 items presented a strong factor loading of 0.58 or above. Item 8, which related to accepting a job at a funeral home, had a slightly lower loading of 0.52. Moreover, the Wave 1 DA scores had high internal reliability ($\alpha = 0.94$), exceeding the level of reliability identified during the original validation of the scale ($\alpha = 0.92$; Tomás-Sábado et al., 2005). As such, the efficacy of this multidimensional measure has been confirmed in this population-level sample. Importantly, this model affords academics the opportunity to assess four important components of DA: (1) Death acceptance, (2) Externally generated death anxiety, (3) Death finality, and (4) Thoughts about death.

Overall, higher DA scores were significantly associated with younger age, female gender, urban living, lower levels of educational attainment, lower income, and the presence of diabetes, lung, or heart disease at Wave 1. Notably, Hyland et al. (2020) and Shevlin et al. (2020), in studies in Ireland and the UK, found GAD and depression to be significantly associated with younger age, female gender, and lower income, during the pandemic. These findings are also consistent with a study in Austria that indicated that young adults, women, and those with lower income were more susceptible to anxiety and depression during lockdown (Pieh et al., 2020).

Additionally, Rudenstine et al. (2021) highlighted that those individuals from urban areas in the US and with less disposable income were especially vulnerable to mental health difficulties during the pandemic ($N = 1821$). Moreover, Blundell et al. (2020) revealed that those with lower levels of educational attainment were more likely to worry about catching COVID-19 in the workplace, were less likely to work from home, and were more likely to be adversely affected by furlough or sector shutdowns. Hitherto, Koçak et al. (2021) discovered that fear of COVID-19 increases if individuals are in poor health or have an underlying illness. These findings highlight the need for specific interventions, particularly for vulnerable groups, to minimise the stress caused by DA during the pandemic and at other such times.

In Wave 1, DA was positively associated with the mental health variables of somatic symptoms, paranoia, depression, anxiety, loneliness, and traumatic stress. Of these, the strongest association was with traumatic stress. Some theorists believe that traumatic stress is closely associated with a reduced sense of meaning (Herman, 1997; Janoff-Bulmann, 1992). This is consistent with terror management theory (TMT; Pyszczynski et al., 2015) which posits challenges to preconceived worldviews can breach anxiety-buffering systems and can lead to elevated rates of DA. It is, therefore, possible that the high association between DA and traumatic stress can be explained by the increased infection rates, threat to well-being, and death attributed to the pandemic (Pyszczynski et al., 2021).

Moreover, some argue that disruption to the anxiety-buffering system can generate transdiagnostic vulnerability that can lead to psychological disorder (Yetzer & Pyszczynski, 2019). Taken together, these results endorse previous research that suggests that DA is a transdiagnostic construct (Iverach et al., 2014), associated with somatic symptoms (Furer & Walker, 2008), paranoia (Lopes & Jaspal, 2015), depression (Ongider & Eyuboglu, 2013), anxiety (Maxfield et al., 2014), and traumatic stress (Chatard et al., 2012). In this sample, the results support Yalom's (2008) suggestion that the fear of death is a fundamental source of psychopathology.

As hypothesised, DA at Wave 1 was a strong predictor of mental health variables (somatic symptoms, paranoia, depression, anxiety, and traumatic stress symptoms) at Wave 2. Likewise, DA at Wave 1 was also predictive of IOU, OCD, and loneliness at Wave 2, extending the transdiagnostic nature of this construct. Interestingly, the factor labelled *Thoughts about death* had the strongest correlations with the five mental health variables and it was the strongest predictor of these variables ($r = 0.39$ to 0.44). It is plausible that, at the time of this study (March, April, and May 2020), these thoughts were perpetuated by the 24/7 news coverage around the pandemic, the first national lockdown, and the absence of a viable vaccine. In fact, after an initial peak at the start of the pandemic other studies conducted in the UK and US have found declining levels of anxiety and depressive symptoms during the pandemic (Daly & Robinson, 2021; Fancourt et al., 2021).

It is conceivable that the lockdown and enforced isolation had created more time for rumination, thereby creating a vicious circle of negative thoughts around DA (Menzies & Menzies, 2018). This view is reinforced in the latent variable model that showed that 'Thoughts about Death' at Wave 1 was the strongest predictor of the five main psychological variables (somatic symptoms, paranoia, depression, anxiety, and traumatic stress symptoms) at Wave 2, after statistically controlling for the other latent variables. It is also possible that the high frequency of upsetting COVID-19 imagery in the media (particularly around deaths, case numbers, and hospitalisations) during the initial stages of the pandemic (when these data were gathered) could have exacerbated thoughts of one's own death. This instance supports Becker's (1973)

intimation, that the dread of death is intensified by thoughts of serious illness, actual mortality, and unforeseen global events.

The present study highlights the transdiagnostic nature of DA and the effects of 'Thoughts about Death' at the beginning of the COVID-19 pandemic. In line with this, Taylor and Clark (2009) suggest that the benefit of transdiagnostic research is the identification of common factors that might be a target for psychological intervention. Furthermore, the strong correlations between DA and a variety of indicators of psychopathology shown within this study support the use of the DAI-R as a more general indicator of mental health in the population. As such, it might be prudent for those of influence in mental health treatment to address DA and specifically 'Thoughts about Death' directly, to manage current worry, and prevent future re-occurrence (Iverach et al., 2014). Fortunately, CBT exposure therapy has been shown to be particularly effective for reducing DA, so this could be used to improve long-term outcomes and protect individuals from future mental health disorders (Menzies & Menzies, 2020).

This study has several strengths. First, all the measurement scales that were used have been validated and used in previous research. Second, despite theoretical accounts claiming that DA is a transdiagnostic construct, this study was the first of its kind to test this claim in a longitudinal nationally representative sample. Third, to the authors' knowledge, this was the first study to examine the underlying structure of the DAI-R using CFA. Nonetheless, this study is not without limitations. First, Wave 1 and Wave 2 data were collected at the height of the pandemic, during the first UK lockdown. It is therefore conceivable that levels of DA were partially inflated, making comparisons with previous or future studies difficult. Second, due to the pandemic, all mental health assessments were completed via online self-report, and not by clinicians, which might have led to an over or underestimation of DA. Third, measuring the mental health trajectories of specific at-risk groups, such as those who are older or front-line workers, was beyond the remit of this study, though has been completed comprehensively elsewhere (see Billings et al., 2021; Shevlin et al., 2021). Future work might measure levels of DA longitudinally over the entire course of the pandemic. Additionally, the distinctive reaction to 'Thoughts of Death', found during the beginning of the COVID-19 pandemic may warrant further empirical investigation.

5. Conclusion

In conclusion, the current study confirms the validity of a 4-factor model of the DAI-R and supports its utility as a multidimensional measure when investigating DA at population level. 'Thoughts about Death' at Wave 1 was the strongest predictor of the five main psychological variables (somatic symptoms, paranoia, depression, anxiety, and traumatic stress symptoms) at Wave 2. These findings highlight the transdiagnostic nature of DA and support this important diagnostic construct becoming a measure of mental health more generally within the population. It is hoped this research will shine a light on those suffering from DA and become a catalyst for increased therapeutic intervention, funding, and study into this important though under-researched area.

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Declaration of competing interest

All authors have no conflicts of interest to declare.

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