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Age moderates associations between dementia worry and subjective cognition

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ABSTRACT

The present study assessed whether dementia worry is associated with adults' subjective cognitive difficulties, and whether any associations are moderated by age. Participants were 477 adults aged 18–90 years. They completed standard, subjective measures of dementia worry and everyday cognitive difficulties (i.e. attention, language, verbal and visual-spatial memory, and visual-perceptual ability). Moderated regression analyses included dementia worry as a predictor of specific cognitive difficulties, and age as a moderator. Covariates included gender, trait cognitive and somatic anxiety, general aging-related anxiety, depression, stress, mental health treatment status, and health status. Greater overall dementia worry, and specifically more frequent dementia worry, were both associated with greater attentional difficulty in middle-aged and older adults, but not in young adults. Cognitions about developing dementia in reaction to memory lapses were also associated with greater cognitive difficulties across the adult lifespan for multiple cognitive domains. Results highlight a robust relationship between dementia worry and subjective attentional difficulties, especially in middle-aged and older adults. Worry frequency is also more influential with adult aging. A cognitive or meta-cognitive mechanism may underlie subjective cognitive concerns across the adult lifespan.

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Both trait anxiety and healthy adult aging are independently associated with declines in attentional control and other cognitive abilities (e.g. Harada et al., 2013; Shi, Sharpe, & Abbott, 2019). However, according to the Strength and Vulnerability Integration model (SAVI; Charles, 2010), older adults possess age-related strengths in emotion regulation (Charles & Luong, 2013). Therefore, age may moderate the relationship between anxiety and cognitive abilities. Indeed, recent research showed that, in those with lower trait anxiety, older people reported fewer subjective cognitive difficulties (i.e. self-reported difficulties with everyday cognitive functioning; Spalding et al., 2021a). The same research also found, though, that in middle-aged and older adults (and not in young adults), as trait anxiety increased, so too did subjective cognitive difficulties. It is now important to examine whether self-relevance of more specific forms of worry associated with older age could explain this pattern of findings.

One relevant form of worry is the threat of developing cognitive impairment. "Dementia worry" (Kessler et al., 2012) is associated with both trait anxiety and subjective attentional functioning (Divers et al., 2021). Cognitive ability influences quality of life and functional independence in older age, and dementia worry has been associated with extensive healthcare costs (Kessler et al., 2012).

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However, as an emerging area of research, the associations between dementia worry and cognition require further exploration (Jessen et al., 2020). It is also necessary to investigate the specific dimensions of dementia worry (such as worry frequency or emotional responses) that may be most impactful (Werner et al., 2021), and in which age groups. Thus, the purpose of the present study was to investigate, cross-sectionally, the relationship between dementia worry and subjective cognitive functioning across the adult lifespan.

Anxiety, cognition and aging

According to Attentional Control Theory (ACT; Eysenck et al., 2007), anxiety reduces executive control of attention. Anxiety increases bottom-up processing of irrelevant stimuli, thus reducing already limited attentional resources for top-down attentional control (Eysenck & Derakshan, 2011). Another assumption of ACT is that anxious individuals will preferentially attend to threatening rather than neutral stimuli (Eysenck et al., 2007), which can reduce cognitive performance (Bar-Haim et al., 2007; Cisler & Koster, 2010). Anxiety is further separable by cognitive experiences (particularly worried thoughts; Goodwin et al., 2017) and somatic experiences (e.g. muscle tension and fast heart rate; Ree et al., 2008). It has been assumed that worry, as the key cognitive component of anxiety, is primarily responsible for effects on cognition (Eysenck et al., 2007). This may be because subvocalized worry attracts attentional resources, impairing top-down attentional control (Hirsch & Mathews, 2012). Indeed, self-reported cognitive anxiety has been found to affect central executive processes in behavioural tasks, whereas somatic symptoms typically have not (e.g. Edwards et al., 2017; Mella et al., 2020; but see Spalding et al., 2021b; Schoen & Holtzer, 2017).

There are also age-related changes in cognition. Typically, speeded and processing-intensive, "fluid" abilities decline with age (Harada et al., 2013; Salthouse, 2019). Core abilities like information processing speed (Salthouse, 2010, 2019), inhibition of irrelevant information (Reuter-Lorenz & Lustig, 2016), and dual-tasking/divided attention (Glisky, 2007) are especially impacted by aging. These abilities are closely linked to many other aspects of cognition and therefore other functions such as visual cognition and memory are also typically affected (Brown et al., 2012; Deary et al., 2010; Salthouse, 2019). In contrast, "crystallized" abilities are learned knowledge and skills acquired over the lifespan, including vocabulary size and general knowledge (Harada et al., 2013). These abilities typically remain relatively stable or continue to increase until very late adulthood (Park et al., 2002; Salthouse, 2019). Less is known about older adults' subjective (self-reported) cognition (Newson & Kemps, 2006). Similar to more ecological or naturalistic measures of cognition that often show weaker, or even reversed, effects of aging (Aberle et al., 2010; Hering et al., 2014; Kosowicz & MacPherson, 2017; Schnitzspahn et al., 2020; see also Salthouse, 2012), subjective measures of cognition provide unique insight to lived experience, which cannot necessarily be captured by objective, especially computerised, measures. Interestingly, and contrary to declines often observed in lab-based cognitive tests, subjective cognitive difficulties do not always increase with adult aging (Carrigan & Barkus, 2016; Spalding et al., 2021a), suggesting that older adults do not necessarily perceive and/or experience cognitive decline in everyday life (Fernandez-Ballesteros, 2011). While the subjective experience of cognitive difficulties increases the risk for mild cognitive impairment and dementia, the majority of people who report subjective difficulties will not exhibit progressive decline (Jessen et al., 2020). Nevertheless, more subjective cognitive concerns are associated with higher healthcare costs, in terms of the potential for frequent medical consultations, or avoidance of early intervention due to fear of diagnosis (Kessler et al., 2012, 2014). It is important, then, to develop our understanding of concerns about one's own cognitive decline and the links with aging and anxiety.

Strengths and vulnerabilities in emotion regulation with aging

Importantly, while cognitive abilities can be impacted by both aging and anxiety separately, age may moderate the relationship between anxiety and cognition. According to the SAVI model (Charles, 2010), older adults possess both age-related strengths and vulnerabilities in their emotion regulation, and these interact to affect emotional wellbeing. Strengths are observed in older adults' successful use of attentional strategies, appraisals, and behaviours to regulate everyday emotional experiences (Charles, 2010; Charles & Luong, 2013). Relative to perceived time left to live, older adults are more motivated than young adults to regulate their negative affect in

highly emotional situations (Charles & Luong, 2013; Scott et al., 2013). For this reason, older adults are believed to experience a positivity bias, through which they reappraise thoughts more positively and focus attention away from negativity. As a result, affective wellbeing is positively associated with older age, with happiness peaking around the late 60s-early 70s (Charles, 2010; Charles & Luong, 2013). However, according to the SAVI model, in situations in which older adults cannot avoid negative situations or experiences, age-related strengths in emotion regulation can be attenuated or depleted (Charles, 2010). Age-related reductions in physiological flexibility can mean older adults recover more slowly from negative experiences (Charles, 2010; Charles & Luong, 2013; Teachman, 2006). Self-reported chronic stress, for example, removes the positive associations observed between aging and self-reported well-being (Sliwinski et al., 2021). The theory of cognitive control suggests that older adults need sufficient cognitive processing resources to use their emotion regulation strategies successfully, but anxiety limits the availability of these resources (e.g. Mather & Knight, 2005; Teachman, 2006). For instance, negative situations which are uncontrollable and more commonly experienced in older age, such as bereavement and illness, can cause feelings of anxiety and threaten vulnerable physiological and cognitive processing systems in older age (Ong et al., 2012). Indeed, a recent meta-analysis has shown that negative associations between anxiety and behavioural attentional control strengthen with age (Shi et al., 2019).

Thus, the demands that worried thoughts place on cognitive resources necessary for successful emotion regulation may become most apparent in older age, where resources are typically more limited. Spalding et al. (2021a) found evidence to this effect for subjective cognition, investigating the relative associations between self-reported cognitive and somatic anxiety respectively and subjective cognition across the adult lifespan. Associations between anxiety and subjective cognition differed by age and the specific dimension of anxiety. Trait cognitive anxiety was positively associated with difficulties in attention, verbal memory, visual-spatial memory, and language across the adult lifespan, with associations tending to be greatest in middle-aged and/or older adults. By comparison, fewer associations were observed for trait somatic anxiety. Given the observed moderating effect of age, self-relevance of specific age-related worries could be involved in any interactions between trait anxiety and age. Based on Spalding, MacAngus, et al., cognitive anxiety, as compared with somatic anxiety, may be more robustly associated with subjective cognitive difficulties as people age. Indeed, the relationship between anxiety and subjective cognition in older adults has been suggested to be driven by worries about cognitive decline (for a review, see Hill et al., 2016).

Aging and dementia worry

Within the context of global population aging, dementia is increasingly prevalent, inducing fear and anxiety around developing age-related cognitive impairment (Gale et al., 2018). Dementia worry (Kessler et al., 2012) is a multidimensional concept, comprising emotions (e.g. fear) and cognitions (i.e. thoughts) surrounding the threat of developing dementia (Kessler et al., 2014). Dementia worry is significantly correlated with trait anxiety (French et al., 2012; Fresson et al., 2017; Norman et al., 2020) and can vary from comparatively benign, slight concern to phobia (Kessler et al., 2012). Individuals who regularly experience higher levels of anxiety may appraise dementia as more threatening. Therefore, those who experience higher levels of trait anxiety may direct their attention towards the threat of developing dementia and worry more that this will occur. Although, correlations between trait anxiety and dementia worry tend to be moderate, with substantial variance left unexplained (French et al., 2012). Thus, while dementia worry is associated with anxiety, these are separable constructs. Importantly, people who are cognitively healthy can experience significant worry about dementia, while those experiencing decline may not necessarily worry (Kessler et al., 2012; see also Norman et al., 2020).

Older adults may be more likely to exhibit dementia worry (Kessler et al., 2012). As people age, the thought of experiencing cognitive decline may become more self-relevant, increasing worry. While dementia worry has been found to be related to generalised aging anxiety (Bowen et al., 2019; Kessler et al., 2014), again, the constructs are separable, due to the specific focus on concerns over cognitive decline. This relationship is likely influenced by the common belief that normal aging inevitably results in marked cognitive decline, especially memory loss (Molden & Maxfield, 2017; Suhr & Kinkela, 2007). Few studies have investigated levels of dementia worry across the adult lifespan and results are

inconsistent. Some research has demonstrated a significant linear relationship between dementia worry and age in adulthood, with older adults being the most worried (Cantegreil-Kallen & Pin, 2012). However, in a sample of adults aged over 50, dementia worry was highest in adults in their 50s as compared with older ages (Cutler, 2015; see also Bowen et al., 2019, who demonstrated a peak in adults in their 70s). Therefore, there may be an age-related threshold for dementia worry such that, beyond this, individuals begin to feel relief about not having developed dementia and worry less (Cutler, 2015). Yet, other research has not found significant correlations between dementia worry and age (e.g. Cutler & Hodgson, 2001; Kinzer & Suhr, 2016; Maxfield & Greenberg, 2020; see Werner et al., 2021, for a review). These mixed findings may be due to methodological differences. For instance, dementia worry has been described as representing a complex hybrid of psychological distress, perceptions regarding aging, specific types of health concerns, individual psychological characteristics, and individual experiences. For example, 'dementia exposure', or contact with people with dementia, has been found to correlate with dementia worry and subjective memory impairment (Bell et al., 2022; Kessler et al., 2012; Lee et al., 2021), but not all studies have observed this (Bowen et al., 2019). Furthermore, studies including a single-item measure of dementia worry (e.g. Cutler, 2015; Cutler & Hodgson, 2001) may not be sufficiently sensitive and more prone to inconsistent results. Therefore, in the current study we assessed dementia worry across the adult lifespan, controlling for relevant external factors and using a validated scale to measure dementia worry (Dementia Worry Scale; Kessler et al., 2014). This includes the single item typically used to assess dementia worry (i.e. *How concerned are you about developing dementia*?) alongside a measure of dementia worry frequency, cognitions about developing dementia in reaction to memory lapses, and emotional reactions to the threat of developing dementia.

The current study

The purpose of the current study was to investigate whether the effect of anxiety on subjective cognitive difficulties is due to increased self-relevance of dementia worry in older age. Whilst some cognitive aging studies have specifically investigated cognitive decline (i.e. longitudinally measured change over time) across the adult lifespan, the present study is a cross-sectional investigation of relationships between dementia worry and specific, self-reported (subjective) cognitive difficulties. To our knowledge, no studies have investigated potential relationships amongst age, dementia worry and specific domains of subjective cognition across adulthood. It was predicted that higher levels of dementia worry would be associated with more frequent experience of subjective cognitive difficulties. Importantly, while it was predicted that, overall, age would be related to fewer subjective cognitive difficulties, the effect of dementia worry on cognition was predicted to be strongest in older adults, due to higher self-relevance of dementia worry in older age and age-related vulnerabilities in emotional regulation (e.g. Charles, 2010). Furthermore, in line with cognitive models of worry and anxiety (e.g. Eysenck et al., 2007; Hirsch & Mathews, 2012), it was expected that associations would be more robust (i.e. larger and/or occur across more cognitive domains) when the cognitive aspect of dementia worry (i.e. cognitions about developing dementia in reaction to memory lapses) was treated as a predictor variable, as opposed to the emotional reactions to the threat of developing dementia worry.

Method

Participants

This study was ethically approved by the School of Psychological Sciences and Health Ethics Committee at the University of Strathclyde. The survey was administered online via Qualtrics between 9th February 2022 and 23rd February 2022. The initial sample comprised 480 participants who all provided informed consent. Two participants were excluded due to lack of response to most or all questions, and one participant was excluded as their reported age was an extreme outlier. The final sample consisted of 477 adults aged 18–90 years ($M = 39.35$, $SD = 17.42$), recruited through participant panels at the University of Strathclyde, and by local advertising, including through social media and word of mouth. Participants who were students at the University of Strathclyde were granted course credit for participation. All other participants received no compensation or incentives. Participants all self-reported meeting the following inclusion criteria: being aged 18 years or

Table 1. Participants' sociodemographic data.

	Overall	Young (18–35 yrs)	Middle-aged (36–59 yrs)	Older (60+ yrs)
***N* (% of sample)**	477 (100%)	230 (48.22%)	176 (36.90%)	71 (14.88%)
Age, *M* (SD)	39.35 (17.42)	23.66 (4.20)	48.05 (6.27)	68.59 (6.46)
Gender				
Male	105 (22.01%)	53 (23.04%)	38 (21.59%)	14 (19.72%)
Female	372 (77.99%)	177 (76.96%)	138 (78.41%)	57 (80.28%)
Ethnicity				
White	467 (97.90%)	226 (98.26%)	172 (97.73%)	69 (97.18%)
Mixed/Multiple	2 (0.42%)	1 (0.43%)	1 (0.57%)	-
Asian, or Asian Scottish/British	3 (0.63%)	2 (0.87%)	1 (0.57%)	-
Caribbean, or Black	1 (0.21%)	1 (0.43%)	-	-
Other/Self-reported (1 "Caribbean Spanish", 2 "Scottish")	3 (0.63%)	-	2 (1.14%)	1 (1.41%)
Missing responses	1 (0.21%)	-	-	1 (1.41%)
English first language				
Yes	468 (98.11%)	227 (98.70%)	171 (97.16%)	70 (98.59%)
No	8 (1.68%)	3 (1.30%)	5 (2.84%)	-
Missing responses	1 (0.21%)	-	-	1 (1.41%)
Education				
No schooling completed	3 (0.63%)	-	3 (1.70%)	-
Secondary/high school	138 (28.93%)	59 (25.65%)	52 (29.55%)	27 (38.03%)
Further education/college	174 (36.48%)	80 (34.78%)	67 (38.07%)	27 (38.03%)
University undergraduate	107 (22.43%)	75 (32.61%)	27 (15.34%)	5 (7.04%)
Postgraduate	49 (10.27%)	15 (6.52%)	22 (12.50%)	12 (16.90%)
Doctorate	3 (0.63%)	1 (0.43%)	2 (1.14%)	-
Prefer not to say	3 (0.63%)	-	3 (1.70%)	-
Employment status				
Full-time employment	213 (44.65%)	95 (41.30%)	112 (63.64%)	6 (8.45%)
Part-time employment	79 (16.56%)	36 (15.65%)	36 (20.45%)	7 (9.86%)
Unemployed	20 (4.19%)	13 (5.65%)	6 (3.41%)	1 (1.41%)
Self-employed	19 (3.98%)	7 (3.04%)	9 (5.11%)	3 (4.23%)
Homemaker	11 (2.31%)	3 (1.33%)	7 (3.98%)	1 (1.41%)
Student	79 (16.56%)	76 (33.04%)	3 (1.70%)	-
Retired	56 (11.74%)	-	3 (1.70%)	53 (74.65%)
Relationship status				
Partner	329 (68.97%)	138 (60.00%)	145 (82.39%)	46 (64.79%)
No partner	140 (29.35%)	88 (38.26%)	28 (15.91%)	24 (33.80%)
Prefer not to say	8 (1.68%)	4 (1.74%)	3 (1.70%)	1 (1.41%)
General health status				
Very poor	3 (0.63%)	2 (0.87%)	1 (0.57%)	-
Quite poor	26 (5.45%)	14 (6.09%)	11 (6.25%)	1 (1.41%)
Fair	107 (22.43%)	53 (23.04%)	36 (20.46%)	18 (25.35%)
Quite good	223 (46.75%)	109 (47.39%)	83 (47.16%)	31 (43.66%)
Very good	117 (24.53%)	52 (22.61%)	44 (25.00%)	21 (29.58%)
Missing responses	1 (0.21%)	-	1 (0.57%)	-
Lifetime diagnosis of mental health disorder				
Yes	149 (31.24%)	89 (38.70%)	55 (31.25%)	5 (7.04%)
No	326 (68.34%)	141 (61.30%)	120 (68.18%)	65 (91.55%)
Prefer not to say	2 (0.42%)	-	1 (0.57%)	1 (1.41%)
Currently receiving mental health treatment				
Yes	86 (18.03%)	50 (21.74%)	33 (18.75%)	3 (4.23%)
No	390 (81.76%)	180 (78.26%)	143 (81.25%)	67 (94.37%)
Prefer not to say	1 (0.21%)	-	-	1 (1.41%)
Close contact with someone with dementia				
Yes	330 (69.18%)	151 (65.65%)	126 (71.59%)	53 (74.65%)
No	141 (29.56%)	76 (33.04%)	47 (26.70%)	18 (25.35%)
Prefer not to say	5 (1.05%)	3 (1.30%)	2 (1.14%)	-
Missing responses	1 (0.21%)	-	1 (0.57%)	-

Note: Percentages are calculated within groups. Due to rounding, percentages do not always total 100.

above; currently residing in the UK; not being diagnosed with any cognitive impairments or neurological conditions; and being fluent in English. Participant demographics are presented in Table 1, both for the overall sample and broken down by young, middle-aged, and older adult age groupings typically used in aging research. A power analysis for a linear regression with three predictor variables (predictor

variable, moderator variable, their interaction term) and nine control variables was calculated in G*Power 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009). This indicated a required sample size of 119, to detect a medium effect size with high power (f^2 = 0.15; α = 0.05; power = 0.95).

Design

A cross-sectional survey design was used. The outcome variables were subjective difficulties with everyday language, attention/concentration, verbal memory, visual-spatial memory, and visual-perceptual ability. The predictor variable in each analysis was dementia worry, and age was included as a moderator variable. Covariates were selected based on previous associations with dementia worry, anxiety, and/or objective or subjective cognitive ability: gender (McLean & Anderson, 2009); depression, stress, current mental health treatment status (yes, no) – all reflecting mental wellbeing – and general health status (very poor-to-fair, or good-to-very good; Salthouse, 2014; Spalding et al., 2021a); close personal contact with someone with dementia (yes, no; Bell et al., 2022; Kessler et al., 2012; Lee et al., 2021); trait cognitive and somatic anxiety (Spalding et al., 2021a; Spalding et al., 2021b); and general aging anxiety (Bowen et al., 2019; Kessler et al., 2014).

Measures

Dementia worry

Dementia worry was assessed using the 10-item Dementia Worry Scale (DWS; Kessler et al., 2014), a brief assessment of cognitions and emotions related to dementia. Item 1 reflects general concern about developing dementia (*How concerned are you about developing dementia?;* 1 = *not at all*, 4 = *very much).* Item 2 reflects frequency of dementia worry (*How often do you worry about developing dementia?*; 1 = *never concerned*, 5 = *always concerned*). Items 3–5 reflect concerns about developing dementia that arise in response to memory lapses (e.g. *When I notice that I have trouble remembering things, I am afraid this might be the first step toward dementia*; 1 = *strongly disagree*, 4 = *strongly agree*). Items 6–10 reflect affective reactions to the threat of developing dementia (e.g. *When I think about developing dementia, I feel anxious*; 1 = *strongly disagree*, 4 = *strongly agree*). The DWS has excellent reliability in a non-clinical sample and good reliability in memory clinic patients for whom diagnoses of mild cognitive impairment have been excluded (Kessler et al., 2014). Reliability was excellent in the present sample (Cronbach's α = .94; *N* = 469). Scores were converted to *z*-scores because item 2 is uniquely measured on a 5-point Likert scale (Kessler et al., 2014). Higher scores indicate greater levels of worry.

Cognitive and somatic anxiety

Trait cognitive and somatic anxiety were measured using the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA; Ree et al., 2008), a 21-item measure of cognitive anxiety (10 items; e.g. *I think that the worst will happen*) and somatic anxiety (11 items; e.g. *My heart beats fast*), as experienced *in general*. Participants respond via a 4-point Likert scale (1 = *almost never*, 4 = *almost always*). The STICSA has demonstrated excellent reliability (Grös et al., 2007). In the present sample, the cognitive subscale demonstrated excellent reliability (Cronbach's α = .91; *N* = 473) and the somatic subscale demonstrated good reliability (Cronbach's α = .86; *N* = 468). The STICSA has been successfully administered with older adults in previous research (e.g. Balsamo et al., 2015; Spalding et al., 2021a). Higher summed scores on each subscale indicate higher levels of anxiety.

Depression and stress

The Depression Anxiety Stress Scales (DASS-21; Henry & Crawford, 2005; Lovibond & Lovibond, 1995) were used to measure experiences of depression (7 items; e.g. *I felt down-hearted and blue)* and stress (7 items; e.g. *I found it hard to wind down*) in the past week, via a 4-point Likert scale (0 = *never*, 3 = *almost always*). The DASS is well-established for measuring symptoms of depression, anxiety, and stress (Antony et al., 1998), including in older samples (Gloster et al., 2008; Wood et al., 2010). Reliability was excellent in the present sample for both the depression (Cronbach's α = .92; *N* = 462) and stress subscales (Cronbach's α = .90; *N* = 460). Higher summed scores (multiplied by 2) indicate higher levels of depression, anxiety, and stress.

Aging anxiety

Aging anxiety was measured using a modified 7-item version of the Aging Anxiety Scale, validated across the adult lifespan (AAS; Kafer et al., 1980; Lynch,

2000). Participants respond to age-related concerns (e.g. *I always worried about the day I would look into the mirror and see gray hairs*) on a 4-point Likert scale (1 = *strongly disagree*, 4 = *strongly agree*). This scale has been found to have excellent structural validity (Faudzi et al., 2019), and demonstrated acceptable reliability in the present sample (Cronbach's α = .73; $N = 474$). Item 6 was reverse scored, and higher summed scores indicate greater levels of anxiety.

Cognitive difficulties

Everyday difficulties across core cognitive domains were measured using the Multiple Abilities Self-Report Questionnaire (MASQ; Seidenberg et al., 1994). Cognitive domains include: attention/concentration (8 items; e.g. *I am easily distracted from my work by things going on around me*); language (8 items; e.g. *When talking, I have difficulty conveying precisely what I mean*); verbal memory (8 items; e.g. *I forget to mention important issues during conversations*); visual-perceptual ability (6 items; e.g. *I have difficulty locating a friend in a crowd of people*); and visual-spatial memory (8 items; e.g. *After putting something away for safekeeping, I am able to recall its location*). Participants were asked to indicate, on a 5-point Likert scale (1 = *Never*, 5 = *Always*), how often the statement was true of them. The MASQ has been found to have moderately high internal consistency and excellent reliability (Seidenberg et al., 1994). Reliability of the overall scale was excellent in the present sample (Cronbach's $\alpha = 0.94$; $N = 457$) and was acceptable-to-good across the individual cognitive domains (all Cronbach's $\alpha > .78$). Furthermore, the MASQ has previously been used to assess both young and older adults' cognition (e.g. Nicholls et al., 2021; Spalding et al., 2021a), and scores may predict objectively measured memory performance (Tyndall et al., 2020). Higher scores indicate greater cognitive difficulties.

Dementia exposure

Participants were asked to indicate any close personal contact with someone with dementia via the following question: *Have you ever had any close personal contact with someone with dementia (e.g. a grandparent, parent, other close family member or friend, or as a caregiver)?* Response options were *yes*, *no*, or *prefer not to say*.

Procedure

Participants completed the survey in their chosen location (e.g. their home), and accessed it via a weblink provided by the researcher. Participants were asked to confirm that they met the inclusion criteria, before providing informed consent. Demographic questions were first administered, followed by the STICSA trait then state subscales (Ree et al., 2008), the DASS-21 (Lovibond & Lovibond, 1995), the MASQ (Seidenberg et al., 1994), the AAS (Lynch, 2000), and the DWS (Kessler et al., 2014). Finally, participants responded to the dementia exposure question. Participants were then thanked and provided with a digital debrief sheet. The survey took approximately 20 min to complete. To facilitate participation, participants could pause the survey and return to complete it up to 48 hr later. However, 92% of the sample had completed the survey within 30 min of starting.

Data analyses

Correlations between all predictor variables, covariates, and outcome variables were first examined to determine, descriptively, the pattern of relationships amongst the variables. Moderated regression analyses including overall dementia worry scores, age, the dementia worry x age interaction, and the nine covariates were conducted using the Process v4.2 macro for SPSS version 28 (Hayes, 2018) for each cognitive domain. The age and dementia worry predictors were mean-centered prior to creation of interaction terms and treated as continuous variables in subsequent analyses. Covariates were also mean-centered. Subsequent moderated regression analyses replaced the overall dementia worry score with dementia worry domains, to determine the specificity of any associations to the cognitive and/or emotional aspects of dementia worry (Kessler et al., 2014).

To control the false discovery rate in our hypothesis testing via regression analyses, the Benjamini and Hochberg (1995) procedure was applied in Microsoft Excel, using calculations from McDonald (2014). The procedure adjusts the critical *p*-value for statistical significance. The main effect of age, each dementia worry domain, and their interaction were corrected within each MASQ outcome, resulting in a correction for 15 tests of significance per MASQ outcome. Note that for all analyses we report the unadjusted *p*-

value as opposed to the Benjamini-Hochberg adjusted *p*-value, unless explicitly stated.

Simple slopes were used to follow up any significant interactions between dementia worry and age, using the mean-centered values generated by the Process analysis. Relative 'low', 'middle' and 'high' values for dementia worry and age were determined, respectively, as scores at the 16th, 50th, and 84th percentiles of score distributions (Hayes, 2018). Effects of dementia worry at each percentile of the age variable were also adjusted via the Benjamini and Hochberg (1995) procedure, correcting for three *p*-values per significant interaction.

Results

Correlations

Mean scores, both overall and by age group, across all scales or sub-scales, may be viewed in Table 2. Correlations amongst independent, control, and dependent variables are reported in Table 3. Age and dementia worry were both significantly correlated with all cognitive domains. Age showed small-to-moderate negative correlations with difficulties across all cognitive domains, indicating less subjective difficulty with age. Age exhibited only a very small correlation with dementia worry, showing that this was generally evident across the adult lifespan. Across domains, cognitive difficulties showed small-to-moderate positive correlations with dementia worry, trait cognitive and somatic anxiety, depression, and stress. Dementia worry was also significantly correlated with all measures of mental wellbeing, including small-to-moderate positive correlations with trait cognitive anxiety, trait somatic anxiety, stress, and depression, and a moderate positive correlation with aging anxiety. Notably, close personal contact with someone with dementia had a small, significant correlation with dementia worry only, in that contact was associated with greater dementia worry. Correlations amongst MASQ subscales were generally moderate, although verbal memory was highly correlated with attention and language. Note that MASQ subscales were analysed individually, as outcomes across separate analyses.

Moderated regression analyses

Models including overall dementia worry, age, and their interaction were significant across all cognitive domains, specifically: attention, $F(12, 409) = 31.61$, $R^2 = .48$, $MSE = 18.47$, $p < .001$; visual-perceptual ability, $F(12, 410) = 7.92$, $R^2 = .19$, $MSE = 19.48$, $p < .001$; visual-spatial memory, $F(12, 413) = 8.25$, $R^2 = .19$, $MSE = 22.35$, $p < .001$; verbal memory, $F(12, 413) = 14.59$, $R^2 = .30$, $MSE = 28.88$, $p < .001$; and language, $F(12, 411) = 25.89$, $R^2 = .42$, $MSE = 17.03$, $p < .001$. Similarly, for all analyses involving the specific DWS domains, and for all MASQ measures, the overall models were significant (all $p < .001$).

Regarding attentional difficulties (Table 4), a significant interaction was observed between overall dementia worry and age, $F(1, 409) = 4.93$, $p = .027$. Following up this interaction, dementia worry was not significantly associated with young adults' attentional difficulty, $b = 0.32$, 95% CI (−0.51, 1.15), $t = 0.75$, $p = .45$, but was associated with middle-aged, $b = 0.80$, 95% CI (0.14, 1.45), $t = 2.38$, $p = .018$, and older adults' attention, $b = 1.50$, 95% CI (0.66, 2.34), $t = 3.52$, $p < .001$ (Figure 1). This was in the direction that greater worry was associated with greater reported difficulty. Note, the effect size was also numerically greater in older than middle-aged adults.

Specifically dementia worry frequency also interacted with age to predict attentional difficulties, $F(1, 416) = 5.19$, $p = .023$. Dementia worry frequency was

Table 2. Participants' mean scores (with *SD*s) for each scale/subscale, including by age group.

	Overall	Younger Adults (18–35 yrs)	Middle-aged Adults (36–59 yrs)	Older Adults (60 + yrs)
Age	39.35 (17.42)	23.66 (4.20)	48.05 (6.27)	68.59 (6.46)
Dementia worry (*z*-scores)	−0.00 (0.81)	−0.08 (0.80)	0.05 (0.85)	0.14 (0.74)
Aging anxiety	2.61 (0.64)	2.66 (0.62)	2.58 (0.68)	2.53 (0.59)
Depression (DASS-21)	12.00 (10.99)	15.53 (11.54)	9.35 (9.59)	6.62 (8.06)
Stress (DASS-21)	14.97 (10.17)	18.41 (10.09)	12.98 (9.60)	8.53 (7.00)
Trait cognitive anxiety (STICSA)	21.75 (7.13)	24.83 (7.00)	19.57 (6.21)	16.99 (4.80)
Trait somatic anxiety (STICSA)	19.01 (5.27)	19.87 (5.44)	18.54 (5.33)	17.26 (3.81)
Attention (MASQ)	20.31 (5.84)	22.81 (5.35)	18.49 (5.40)	16.48 (4.72)
Language (MASQ)	17.75 (5.33)	19.15 (5.35)	16.73 (5.21)	15.68 (4.30)
Verbal memory (MASQ)	19.74 (6.23)	21.10 (6.78)	18.78 (5.68)	17.67 (4.74)
Visual-perceptual ability (MASQ)	13.03 (4.83)	13.85 (4.90)	12.48 (4.82)	11.67 (4.13)
Visual-spatial memory (MASQ)	17.07 (5.23)	17.76 (5.52)	16.80 (5.15)	15.52 (4.02)

Table 3. Pearson's correlations amongst predictor, control, and outcome variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Age															
2. Gender	-.04														
3. Mental health treatment	.14**	.13**													
4. General health status	.05	.00	.20***												
5. Close dementia contact	-.08	.02	-.002	-.01											
6. Dementia worry	.09*	-.17***	-.10*	-.17***	-.14**										
7. Aging anxiety	-.08	-.18***	-.09*	-.20***	-.05	.58***									
8. Depression (DASS-21)	-.33***	-.14**	-.31***	-.29***	.00	.28***	.44***								
9. Stress (DASS-21)	-.35***	-.20***	-.33***	-.26***	-.01	.35***	.44***	.76***							
10. Trait cognitive anxiety (STICSA)	-.43***	-.16***	-.34***	-.23***	.01	.32***	.48***	.72***	.75***						
11. Trait somatic anxiety (STICSA)	-.20***	-.25***	-.37***	-.31***	-.03	.38***	.40***	.60***	.70***	.68***					
12. Attention (MASQ)	-.46***	-.15***	-.27***	-.20***	.07	.29***	.37***	.54***	.53***	.60***	.49***				
13. Language (MASQ)	-.27***	-.12*	-.26***	-.23***	.03	.30***	.40***	.52***	.51***	.57***	.56***	.64***			
14. Verbal memory (MASQ)	-.23***	-.10*	-.19***	-.25***	.06	.25***	.32***	.46***	.40***	.49***	.43***	.71***	.70***		
15. Visual-perceptual ability (MASQ)	-.19***	-.17***	-.17***	-.14**	.04	.18***	.27***	.32***	.30***	.38***	.35***	.52***	.52***	.54***	
16. Visual-spatial memory (MASQ)	-.17***	-.10*	-.18***	-.19***	.05	.22***	.27***	.30***	.28***	.37***	.34***	.59***	.53***	.64***	.66***

Note. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 4. Results of regression analyses including attention difficulties as the dependent variable (organised by dementia worry domain).

	N	Unstandardized coefficients				95% confidence intervals for B	
		B	*SE*	*t*	*p*	Lower bound	Upper bound
Overall dementia worry	422						
Overall dementia worry		.90	.33	2.72	**.007**	.249	1.548
Age		-.11	.01	−7.62	**< .001**	-.136	-.080
Dementia worry x age		.03	.01	2.22	**.027**	.004	.062
Cognitive concerns	428						
Cognitive concerns		1.20	.27	4.47	**<.001**	.670	1.720
Age		-.12	.01	−8.51	**<.001**	-.152	-.095
Cognitive concerns x age		.02	.01	1.61	.108	-.005	.046
Dementia worry frequency	429						
Frequency		.66	.25	2.62	**.009**	.164	1.155
Age		-.11	.01	−7.76	**< .001**	-.140	-.084
Frequency x age		.03	.01	2.28	**.023**	.004	.052
Affective reactions	423						
Affective reactions		.32	.29	1.10	.271	-.251	.891
Age		-.10	.01	−7.07	**<.001**	-.127	-.072
Affective reactions x age		.03	.01	2.26	**.024**	.004	.057
General concern	429						
General concern		.23	.25	0.94	.349	-.254	.716
Age		-.10	.01	−7.18	**< .001**	-.129	-.074
General concern x age		.01	.01	1.16	.249	-.010	.039

Note. Significant *p*-values (that survived correcting the false discovery rate) are in bold.

not associated with young adults' attentional difficulty, $b = 0.17$, 95% CI (−0.45, 0.79), $t = 0.55$, $p = .58$, but was associated with greater difficulty in middle-aged adults, $b = 0.56$, 95% CI (0.07, 1.06), $t = 2.23$, $p = .026$, and older adults, $b = 1.17$, 95% CI (0.48, 1.87), $t = 3.32$, $p = .001$ (Figure 1). The effect size was again numerically greater in older than middle-aged adults.

A final significant interaction was observed between affective reactions towards the threat of developing dementia and age regarding attentional difficulties, $F(1, 410) = 5.13$, $p = .024$. However, there were no significant associations between affective reactions and attention within any age group, after controlling the false discovery rate. Affective reactions were not significantly associated with attentional difficulties in young adults, $b = -0.22$, 95% CI (−0.95, 0.51), $t = -0.58$, $p = .560$, middle-aged adults, $b = 0.21$, 95% CI (−0.37, 0.79), $t = 0.72$, $p = .474$, and older adults, $b = 0.88$, 95% CI (0.13, 1.64), $t = 2.29$, $p = .022$ (note, Benjamini-Hochberg *p*-value = .067).

Considering main effects, overall dementia worry, and two DWS domains (cognitive concerns about developing dementia and worry frequency) were significantly associated with attentional difficulty (Table 4). Cognitive concerns about developing dementia was also significantly associated with difficulties in visual-spatial memory (Table 5), verbal memory (Table 6), and language (Table 7), but not visual-perceptual ability (Table 8). Age was significantly and independently associated with attentional difficulties, in that older age was associated with lower reported difficulty, and this was consistent across DWS analyses (Table 4). However, age was not a reliable predictor when considering other cognitive domains (Tables 5–8).

Discussion

This research was aimed at understanding whether dementia worry is associated with subjective cognitive difficulties across the adult lifespan, and whether any effect is moderated by age. We predicted that dementia worry would be associated with greater subjective cognitive difficulties, following the previous observation that associations between anxious thoughts and subjective cognition increased with age (Spalding et al., 2021a). Overall dementia worry was independently associated with greater subjective difficulty with attention only. It was further predicted that any significant associations involving dementia worry would be strongest in older adults, as dementia worry would be more self-relevant, commensurate with the Strength and Vulnerability Integration model (SAVI; e.g. Charles & Luong, 2013). Indeed, age moderated the relationship between dementia worry and attention, with the effect size being numerically largest in older adults. Importantly, when looking at specific dementia worry domains, frequency of dementia worry was associated with

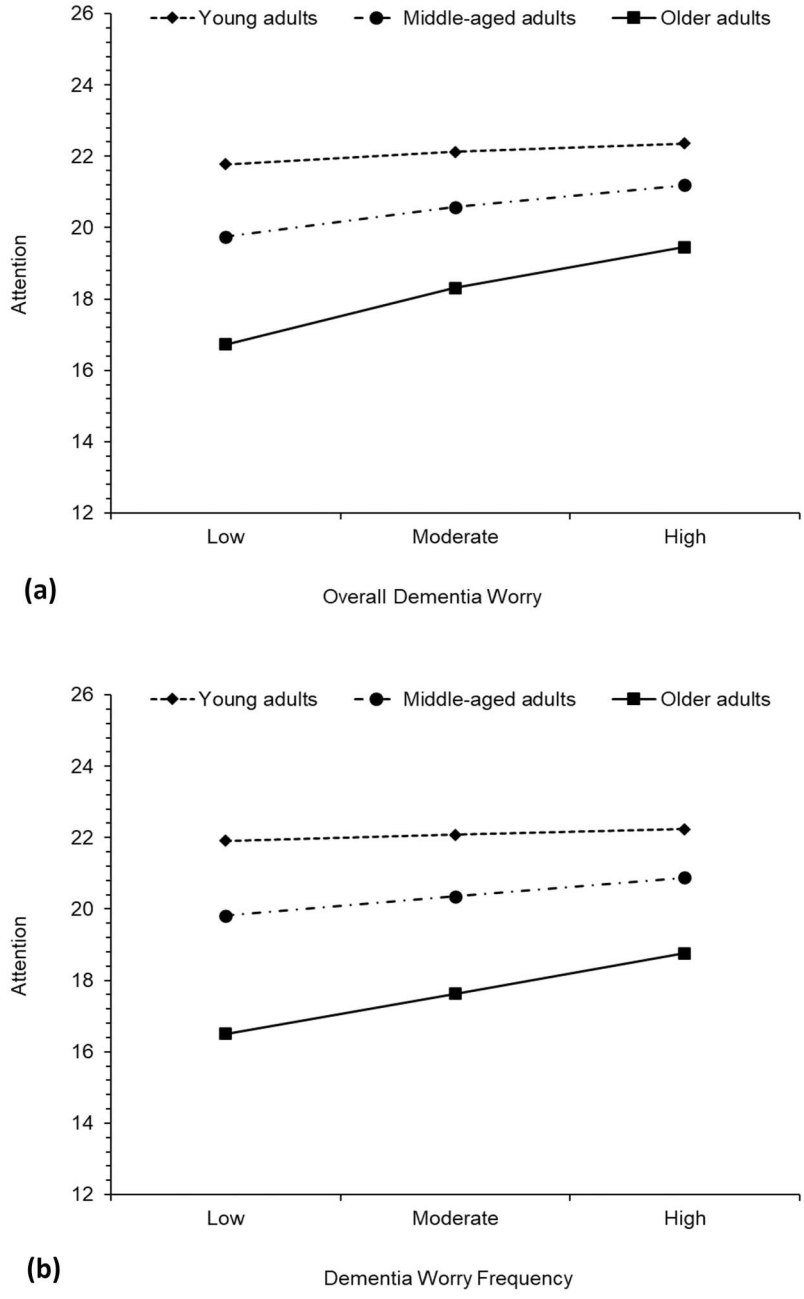

Figure 1. Simple slopes illustrating the moderation effect of age on the relationship between subjective attentional difficulties and: (a) overall dementia worry; (b) frequency of dementia worry. Higher values indicate greater levels of subjective attentional difficulty.

greater attention difficulties in middle-aged and older adults, but not young adults. These interactions were not robust for any other cognitive domains, showing the sensitivity of attention to this effect.

We also predicted that associations involving dementia worry would be most reliable when worry was cognitive in nature (i.e. worry consisting of cognitions about developing dementia that occurred in reaction to memory lapses). This would be in line with cognitive models of worry and anxiety, which suggest that worried thoughts occupy cognitive resources, negatively impacting cognitive performance (e.g. Eysenck et al., 2007; Hirsch & Mathews, 2012). Cognitive concerns about developing dementia in response to memory

Table 5. Results of regression analyses including difficulties with visual-spatial memory as the dependent variable (organised by dementia worry domain).

	N	Unstandardized coefficients				95% confidence intervals for B	
		B	*SE*	*t*	*p*	Lower bound	Upper bound
Overall dementia worry	426						
Overall dementia worry		.67	.36	1.84	.066	-.045	1.380
Age		-.02	.02	−1.54	.125	-.054	.007
Dementia worry x age		.02	.02	1.39	.167	-.009	.054
Cognitive concerns	432						
Cognitive concerns		1.06	.30	3.60	**<.001**	.482	1.642
Age		-.04	.02	−2.26	.024	-.067	-.005
Cognitive concerns x age		-.002	.014	−0.14	.888	-.030	.026
Dementia worry frequency	433						
Frequency		.59	.28	2.15	.032	.051	1.138
Age		-.03	.02	−1.78	.076	-.059	.003
Frequency x age		.02	.01	1.28	.200	-.009	.043
Affective reactions	427						
Affective reactions		.20	.32	0.64	.521	-.418	.824
Age		-.02	.02	−1.15	.250	-.048	.012
Affective reactions x age		.03	.01	2.02	.044	-.001	.059
General concern	433						
General concern		-.22	.27	-.83	.408	-.749	.305
Age		-.02	.02	−1.16	.249	-.048	.012
General concern x age		.02	.01	1.39	.164	-.008	.046

Note. Significant *p*-values (that survived correcting the false discovery rate) are in bold.

Table 6. Results of regression analyses including difficulties with verbal memory as the dependent variable (organised by dementia worry domain).

	N	Unstandardized coefficients				95% confidence intervals for B	
		B	*SE*	*t*	*p*	Lower bound	Upper bound
Overall dementia worry	426						
Overall dementia worry		.53	.41	1.28	.202	-.283	1.336
Age		-.03	.02	−1.94	.053	-.069	.000
Dementia worry x age		.02	.02	1.02	.307	-.018	.056
Cognitive concerns	432						
Cognitive concerns		1.38	.33	4.16	**<.001**	.730	2.040
Age		-.05	.02	−2.92	**.004**	-.089	-.017
Cognitive concerns x age		-.01	.02	−0.31	.759	-.037	.027
Dementia worry frequency	433						
Frequency		.71	.31	2.26	.024	.092	1.325
Age		-.04	.02	−2.32	.021	-.077	-.006
Frequency x age		.02	.02	1.20	.231	-.012	.048
Affective reactions	427						
Affective reactions		-.25	.36	−0.70	.485	-.956	.455
Age		-.03	.02	−1.70	.090	-.064	.005
Affective reactions x age		.02	.02	1.34	.183	-.011	.056
General concern	433						
General concern		-.07	.30	−0.24	.809	-.673	.526
Age		-.03	.02	−1.71	.087	-.064	.004
General concern x age		.01	.02	0.80	.424	-.018	.043

Note. Significant *p*-values (that survived correcting the false discovery rate) are in bold.

lapses were significantly associated with greater difficulty in all cognitive domains other than visual-perceptual ability. However, these associations were not moderated by age, suggesting stability of this association across the adult lifespan.

The commonly used generic, single-item assessment of dementia worry, reflecting overall concern about developing dementia, was not associated with subjective difficulty in any cognitive domain. This reflects the inconsistent findings in previous

Table 7. Results of regression analyses including difficulties with language as the dependent variable (organised by dementia worry domain).

	N	Unstandardized coefficients				95% confidence intervals for B	
		B	*SE*	*t*	*p*	Lower bound	Upper bound
Overall dementia worry	424						
Overall dementia worry		.35	.32	1.10	.270	-.276	.982
Age		-.03	.01	−2.18	.030	-.056	-.003
Dementia worry x age		.02	.01	1.68	.093	-.004	.052
Cognitive concerns	430						
Cognitive concerns		.85	.26	3.28	**.001**	.341	1.365
Age		-.04	.01	−2.98	**.003**	-.069	-.014
Cognitive concerns x age		.01	.01	0.85	.396	-.014	.035
Dementia worry frequency	431						
Frequency		.47	.24	1.94	.053	-.006	.951
Age		-.03	.01	−2.47	.014	-.061	-.007
Frequency x age		.02	.01	1.54	.125	-.005	.041
Affective reactions	425						
Affective reactions		-.14	.28	-.50	.615	-.684	.405
Age		-.03	.01	−1.91	.057	-.051	.001
Affective reactions x age		.02	.013	1.80	.072	-.002	.048
General concern	431						
General concern		.01	.24	-.04	.966	-.454	.474
Age		.-.03	.01	−1.97	.049	-.053	-.000
General concern x age		.02	.01	1.30	.194	-.008	.039

Note. Significant *p*-values (that survived correcting the false discovery rate) are in bold.

Table 8. Results of regression analyses including difficulties with visual-perceptual ability as the dependent variable (organised by dementia worry domain).

	N	Unstandardized coefficients				95% confidence intervals for B	
		B	*SE*	*t*	*p*	Lower bound	Upper bound
Overall dementia worry	423						
Overall dementia worry		.14	.34	0.41	.683	-.535	.816
Age		-.03	.01	−2.27	.024	-.062	-.004
Dementia worry x age		.01	.02	0.64	.522	-.020	.040
Cognitive concerns	429						
Cognitive concerns		.09	.28	0.33	.743	-.463	.649
Age		-.03	.02	−2.19	.029	-.063	-.003
Cognitive concerns x age		-.001	.014	-.08	.933	-.028	.026
Dementia worry frequency	430						
Frequency		.02	.26	0.06	.953	-.499	.530
Age		-.03	.01	−2.22	.027	-.062	-.004
Frequency x age		.01	.01	0.40	.690	-.020	.030
Affective reactions	424						
Affective reactions		.20	.30	0.67	.504	-.386	.784
Age		-.03	.01	−2.22	.027	-.060	-.004
Affective reactions x age		.01	.01	1.01	.311	-.013	.041
General concern	430						
General concern		-.21	.25	−0.84	.401	-.709	.284
Age		-.03	.01	−2.15	.032	-.059	-.003
General concern x age		-.001	.01	-.04	.969	-.026	.025

Note. Significant *p*-values did not survive correcting the false discovery rate.

studies using a single-item measure of dementia worry (Cutler, 2015; Cutler & Hodgson, 2001).

Dementia worry, aging and SAVI

The present results provide support for the SAVI model (Charles, 2010; Charles & Luong, 2013). Age was associated with less reported everyday cognitive difficulty in three of five cognitive domains but the effect was not consistent across analyses including different dementia worry domains. The significant association between age and less difficulty with attention was however consistent across analyses, in line with previous findings (Spalding et al., 2021a). Older adults are

assumed to have strengths in avoiding negative affective situations and reappraising thoughts and emotions more positively through compensatory strategies (Charles, 2010; Charles & Luong, 2013). The present findings suggest this may apply to subjective attention abilities, but less reliably across cognitive domains, particularly when adjusting for multiple comparisons.

A key finding with respect to our predictions was that dementia worry was associated with greater difficulties with attention in middle-aged and older adults when considering both overall dementia worry and frequency of dementia worry. Thus, worry, particularly when more frequent, was associated with a reduced age-related positivity effect regarding subjective cognitive ability. With greater dementia worry, and specifically worry that is pervasive, the vulnerabilities of aging may be more likely to emerge, resulting in greater subjective cognitive difficulties. Notably, despite moderate-to-high correlations amongst MASQ subscales, different patterns emerged. This suggests that the cognitive domains maintained enough unique variance to be explained differentially by the different worry domains captured by the Dementia Worry Scale (DWS; Kessler et al., 2014).

Dementia worry and subjective cognitive difficulty across the lifespan

We also observed that cognitive aspects of dementia worry (e.g. worry in response to memory lapses) were associated with cognitive difficulties, independently of age. This occurred robustly, across most cognitive domains (i.e. attention, visual-spatial memory, verbal memory and language).

The cognitive items of the DWS (Kessler et al., 2014) relate to worry about developing dementia that arise in response to memory lapses. The finding that these specific cognitions are associated with increased subjective difficulty across the adult lifespan is consistent with cognitive models of worry and anxiety (e.g. Eysenck et al., 2007; Hirsch & Mathews, 2012). Wells (1995) suggested that, if an individual is unable to control intrusive, worried thoughts, this may cause further worry about their cognitive control abilities and contribute to a subjective sense of reduced cognitive control. Applied to the present results, which, notably, are not specifically focused on a clinical sample, individuals who experience higher levels of worry about developing dementia when they experience memory lapses tend to report greater difficulty with cognitive control (i.e. reduced attentional abilities).

More recent cognitive theories of anxiety may also explain why associations were observed across the lifespan in all cognitive abilities other than visual-perceptual ability. It is assumed that worry is primarily verbal in nature and worried thoughts occupy available executive resources resulting in diminished executive control (Eysenck et al., 2007; Hirsch & Mathews, 2012). As such, it could be expected that, if individuals experience a greater degree of verbal worry about developing dementia, they will correspondingly experience greater difficulty with attention, memory (verbal and visual-spatial), and language, as cognitive resources are reduced. By comparison, associations may not be as reliable when considering visual-perceptual ability, because perceptual attention is separable from top-down, resource-dependent executive control (e.g. Hitch, Allen, & Baddeley, 2020). However, it remains necessary to assess the relationships between dementia worry and equivalent behavioural measures of the MASQ cognitive abilities to draw inference about the processes underlying objective cognitive function.

An alternative explanation for the association between worry in response to memory lapses and subjective cognitive difficulties is that the experience of cognitive difficulties is common to each construct. That is, when an individual is reporting greater concerns about developing dementia because of memory lapses, they are by definition indirectly reporting experiencing memory lapses. Therefore, this aspect of dementia worry, as measured by the DWS (Kessler et al., 2014), is most likely to be associated with the experience of subjective cognitive difficulties as measured by the Multiple Ability Self-Report Questionnaire (Seidenberg et al., 1994). This may also explain why the cognitive subscale of the DWS was associated with cognitive difficulties across the lifespan, and not just in middle-aged and/or older adults, as was the case with dementia worry frequency. We suggest that an individual's thoughts around developing dementia, such as the belief or worry that they are currently developing dementia, should be isolated from the experience of subjective memory lapses. This should help to determine the extent to which it is the worry itself that is causing the subjective experience of cognitive difficulties.

Limitations and future directions

Further research into the effects of dementia worry on subjective cognition is warranted. First, it is not possible to determine whether the presently self-reported

cognitive difficulties correspond to objective measures. For example, subjective attentional deficits associated with anxiety are not always reflected in behavioural cognitive tasks (Clarke & Todd, 2021). Furthermore, the significant relationships between dementia worry and domains of subjective cognition cannot be assumed to be causal in either direction. Older adults who experience more dementia worry may experience more attentional difficulties because of this worry, but equally, more perceived attentional difficulties may cause concern regarding developing dementia. Future research should further explore interactions between dementia worry and domains of cognition using objective measures of cognition and/or longitudinal methods.

Consideration should also be given to factors which may trigger or maintain dementia worry, such as negative aging stereotypes (Molden & Maxfield, 2017), and measure the effect on subjective cognitive difficulty. For example, using an experimental approach, exposure to negative aging stereotypes has been shown to impair behavioural executive control, specifically in older adults reporting moderate and high levels of dementia worry (Fresson et al., 2017). Similarly, while our study accounted for individuals' close personal contact with someone diagnosed with dementia, it may be useful to investigate the extent to which recorded family history of dementia or Alzheimer's disease may influence both dementia worry (e.g. Lee et al., 2021) but also subjective cognitive function. The extent of dementia worry and associations with cognitive abilities in those reporting clinical levels of anxiety and worry should also be investigated. Pathological worry is defined as being uncontrollable and pervasive, to the degree that executive resources cannot be appropriately controlled (e.g. Hirsch & Mathews, 2012). Exploring interactions between levels of worry (clinical or non-clinical) and dementia worry may therefore further clarify the extent to which cognitive processing deficits associated with non-specific forms of pathological worry moderate the relationship between dementia worry and cognitive abilities, or vice-versa.

Longitudinal research has more scope to explore directional relationships amongst stereotype threat, dementia worry, and cognition, as well as longer-term outcomes. For example, this approach could provide evidence regarding the impact of greater dementia worry on objective cognitive impairment and/or dementia (e.g. Mendonça et al., 2016). Accounting for both objective and subjective cognitive performance in these investigations would be useful, given that older adults may report better subjective cognition than they would display objectively (Newson & Kemps, 2006). Ecologically valid objective measures that are more representative of everyday abilities should also be incorporated where possible, as opposed to lab-based tasks only (Salthouse, 2012). Finally, it should also be noted that the present sample comprised almost exclusively white, healthy adult participants who had completed at least secondary/high school education, and a large number were drawn from a university participant pool. Therefore, more diverse samples should be sought in future work using purposive sampling to determine the generalisability of the present findings.

Conclusions

In the present study, we investigated whether dementia worry is associated with adults' subjective cognitive difficulties, and whether any associations are moderated by age. We predicted that associations between dementia worry and subjective cognition would manifest with increasing age because dementia worry holds greater self-relevance. Results showed that age moderated the relationship between overall dementia worry and subjective cognitive difficulties, specifically in the attention domain. Dementia worry was significantly associated with greater self-reported everyday difficulties with attention, but for middle-aged and older adults only, and not for young adults. Furthermore, the effect size was strongest for older adults. Age also moderated the relationship between worry frequency and subjective attentional difficulty. Specifically, frequency of dementia worry was associated with greater difficulties with attention in both middle-aged and older adults. Moreover, regardless of age, adults who reported greater concerns about developing dementia after experiencing memory lapses reported more subjective difficulty across multiple cognitive domains.

The current study therefore highlights a robust relationship between dementia worry and subjective cognitive difficulties across the adult lifespan. Previous studies have typically focused on relationships between dementia worry and subjective cognition within exclusively older adult samples (e.g. Jang et al., 2021; Kinzer & Suhr, 2016; Norman et al., 2020). However, the results of the current study show that it is necessary to further investigate relationships between dementia worry and subjective cognitive abilities across the adult lifespan, as it is

clearly not exclusively older adults who report experiencing dementia worry in some form. Yet, the association between worry frequency and attention may become stronger with age. The results also highlight the necessity to measure the frequency of cognitions and emotions surrounding dementia worry in determining one's subjective evaluation of their own cognitive abilities, to avoid confounding subjective cognitive complaints across dementia worry and cognitive measures. It is now important for future research to continue identifying the causes and effects of dementia worry, while not simply focusing on older age groups. Importantly, greater understanding of dementia worry should aid development of appropriate interventions that could reduce maladaptive and potentially counter-productive worry, and promote proactive, positive health behaviours that can help minimise risk (Hill et al., 2016) and potentially reduce healthcare costs. These could include, for example, active lifestyles, treatment for health-related risks, and dementia screening, where appropriate (Bowen et al., 2019; see also Livingston et al., 2020).

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Data availability statement

The deidentified, raw, and processed data and analyses syntax underlying this study are available on the Open Science Framework (https://osf.io/k9q3n/).

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References

Aberle, I., Rendell, P. G., Rose, N. S., McDaniel, M. A., & Kliegel, M. (2010). The age prospective memory paradox: Young adults may not give their best outside of the lab. *Developmental Psychology*, *46*(6), 1444–1453. https://doi.org/10.1037/a0020718.

Antony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the depression anxiety stress scales in clinical groups and a community sample. *Psychological Assessment*, *10*(2), 176–181. https://doi.org/10.1037/1040-3590.10.2.176

Balsamo, M., Innamorati, M., Van Dam, N. T., Carlucci, L., & Saggino, A. (2015). Measuring anxiety in the elderly: Psychometric properties of the state trait inventory of cognitive and somatic anxiety (STICSA) in an elderly Italian sample. *International Psychogeriatrics*, *27*(6), 999–1008. https://doi.org/10.1017/S1041610214002634

Bar-Haim, Y., Lamy, D., Pergamin, L., Bakermans-Kranenburg, M. J., & Van Ijzendoorn, M. H. (2007). Threat-related attentional bias in anxious and nonanxious individuals: A meta-analytic study. *Psychological Bulletin*, *133*(1), 1–24. https://doi.org/10.1037/0033-2909.133.1.1

Bell, T. R., Hill, N. L., Bhargava, S., & Mogle, J. (2022). Parental dementia and subjective memory impairment in the health and retirement study. *Aging & Mental Health*, *26*(5), 992–1000. https://doi.org/10.1080/13607863.2021.1910790

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society: Series B (Methodological)*, *57*(1), 289–300. https://doi.org/10.1111/j.2517-6161.1995.tb02031.x

Bowen, C. E., Kessler, E. M., & Segler, J. (2019). Dementia worry in middle-aged and older adults in Germany: Sociodemographic, health-related and psychological correlates. *European Journal of Ageing*, *16*(1), 39–52. https://doi.org/10.1007/s10433-018-0462-7

Brown, L. A., Brockmole, J. R., Gow, A. J., & Deary, I. J. (2012). Processing speed and visuospatial executive function predict visual working memory ability in older adults. *Experimental Aging Research*, *38*(1), 1–19. https://doi.org/10.1080/0361073X.2012.636722

Cantegreil-Kallen, I., & Pin, S. (2012). Fear of Alzheimer's disease in the French population: Impact of age and proximity to the disease. *International Psychogeriatrics*, *24*(1), 108–116. https://doi.org/10.1017/S1041610211001529

Carrigan, N., & Barkus, E. (2016). A systematic review of cognitive failures in daily life: Healthy populations. *Neuroscience & Biobehavioral Reviews*, *63*, 29–42. https://doi.org/10.1016/j.neubiorev.2016.01.010

Charles, S. T. (2010). Strength and vulnerability integration: A model of emotional well-being across adulthood. *Psychological Bulletin*, *136*(6), 1068–1091. https://doi.org/10.1037/a0021232

Charles, S. T., & Luong, G. (2013). Emotional experience across adulthood: The theoretical model of strength and vulnerability integration. *Current Directions in Psychological Science*, *22*(6), 443–448. https://doi.org/10.1177/0963721413497013

Cisler, J. M., & Koster, E. H. (2010). Mechanisms of attentional biases towards threat in anxiety disorders: An integrative

review. *Clinical Psychology Review*, *30*(2), 203–216. https://doi.org/10.1016/j.cpr.2009.11.003

Clarke, P. J. F., & Todd, J. (2021). Lessons unlearned: A conceptual review and meta-analysis of the relationship between the Attention Control Scale and Objective Attention Control. *Cognition and Emotion*, *35*(*8*), 1447–1459. http://doi.org/10.1080/02699931.2021.1987861

Cutler, S. J. (2015). Worries about getting Alzheimer's: Who's concerned? *American Journal of Alzheimer's Disease & Other Dementias®*, *30*(6), 591–598. https://doi.org/10.1177/1533317514568889

Cutler, S. J., & Hodgson, L. G. (2001). Correlates of personal concerns about developing Alzheimer's disease among middle-aged persons. *American Journal of Alzheimer's Disease & Other Dementias®*, *16*(6), 335–343. https://doi.org/10.1177/153331750101600604

Deary, I. J., Johnson, W., & Starr, J. M. (2010). Are processing speed tasks biomarkers of cognitive aging? *Psychology and Aging*, *25*(1), 219–228. https://doi.org/10.1037/a0017750

Divers, R., Robinson, A., Miller, L., De Vito, A. N., Pugh, E., & Calamia, M. (2021). Beyond depression: Examining the role of anxiety and anxiety sensitivity on subjective cognition and functioning in older adults. *Aging & Mental Health*, *26*(11), 2300–2306. https://doi.org/10.1080/13607863.2021.1966747

Edwards, M. S., Edwards, E. J., & Lyvers, M. (2017). Cognitive trait anxiety, stress and effort interact to predict inhibitory control. *Cognition and Emotion*, *31*(4), 671–686. https://doi.org/10.1080/02699931.2016.1152232

Eysenck, M. W., & Derakshan, N. (2011). New perspectives in attentional control theory. *Personality and Individual Differences*, *50*(7), 955–960. https://doi.org/10.1016/j.paid.2010.08.019

Eysenck, M. W., Derakshan, N., Santos, R., & Calvo, M. G. (2007). Anxiety and cognitive performance: Attentional control theory. *Emotion*, *7*(2), 336–353. https://doi.org/10.1037/1528-3542.7.2.336

Faudzi, F. N. M., Armitage, C. J., Bryant, C., & Brown, L. J. (2019). A systematic review of the psychometric properties of self-report measures of attitudes to aging. *Research on Aging*, *41*(6), 549–574. https://doi.org/10.1177/0164027518825117

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(*4*), 1149–1160. http://doi.org/10.3758/BRM.41.4.1149

Fernandez-Ballesteros, R. (2011). Positive ageing: Objective, subjective, and combined outcomes. *e-Journal of Applied Psychology*, *7*(1), 22–30. https://doi.org/10.7790/ejap.v7i1.238

French, S. L., Floyd, M., Wilkins, S., & Osato, S. (2012). The fear of Alzheimer's disease scale: A new measure designed to assess anticipatory dementia in older adults. *International Journal of Geriatric Psychiatry*, *27*(5), 521–528. https://doi.org/10.1002/gps.2747

Fresson, M., Dardenne, B., Geurten, M., & Meulemans, T. (2017). The effect of stereotype threat on older people's clinical cognitive outcomes: Investigating the moderating role of dementia worry. *The Clinical Neuropsychologist*, *31*(8), 1306–1328. https://doi.org/10.1080/13854046.2017.1307456

Gale, C. R., Westbury, L. D., Cooper, C., & Dennison, E. M. (2018). Risk factors for incident falls in older men and women: The English longitudinal study of ageing. *BMC Geriatrics*, *18*(1), 1–9. https://doi.org/10.1093/ageing/afx188

Glisky, E. L. (2007). Changes in cognitive function in human aging. In D. R. Riddle, (Ed.), *Brain aging: Models, methods, and mechanisms* (pp. 3–20). CRC Press. https://doi.org/10.1201/9781420005523.

Gloster, A. T., Rhoades, H. M., Novy, D., Klotsche, J., Senior, A., Kunik, M., Wilson, N., & Stanley, M. A. (2008). Psychometric properties of the depression anxiety and stress scale-21 in older primary care patients. *Journal of Affective Disorders*, *110*(3), 248–259. https://doi.org/10.1016/j.jad.2008.01.023

Goodwin, H., Yiend, J., & Hirsch, C. R. (2017). Generalized anxiety disorder, worry and attention to threat: A systematic review. *Clinical Psychology Review*, *54*, 107–122. https://doi.org/10.1016/j.cpr.2017.03.006

Grös, D. F., Antony, M. M., Simms, L. J., & McCabe, R. E. (2007). Psychometric properties of the state-trait inventory for cognitive and somatic anxiety (STICSA): Comparison to the state-trait anxiety inventory (STAI). *Psychological Assessment*, *19*(4), 369–381. https://doi.org/10.1037/1040-3590.19.4.369

Harada, C. N., Love, M. C. N., & Triebel, K. L. (2013). Normal cognitive aging. *Clinics in Geriatric Medicine*, *29*(4), 737–752. https://doi.org/10.1016/j.cger.2013.07.002

Hayes, A. F. (2018). The PROCESS Macro for SPSS and SAS version 3.0 [Computer software]. Retrieved from afhayes.com.

Henry, J. D., & Crawford, J. R. (2005). The short-form version of the depression anxiety stress scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *British Journal of Clinical Psychology*, *44*(2), 227–239. https://doi.org/10.1348/014466505X29657

Hering, A., Phillips, L. H., & Kliegel, M. (2014). Importance effects on age differences in performance in event-based prospective memory. *Gerontology*, *60*(1), 73–78. https://doi.org/10.1159/000355057

Hill, N. L., Mogle, J., Wion, R., Munoz, E., DePasquale, N., Yevchak, A. M., & Parisi, J. M. (2016). Subjective cognitive impairment and affective symptoms: A systematic review. *The Gerontologist*, *56*(6), e109–e127. https://doi.org/10.1093/geront/gnw091

Hirsch, C. R., & Mathews, A. (2012). A cognitive model of pathological worry. *Behaviour Research and Therapy*, *50*(10), 636–646. https://doi.org/10.1016/j.brat.2012.06.007

Hitch, G. J., Allen, R. J., & Baddeley, A. D. (2020). Attention and binding in visual working memory: Two forms of attention and two kinds of buffer storage. *Attention, Perception, & Psychophysics*, *82*(*1*), 280–293. http://doi.org/10.3758/s13414-019-01837-x

Jang, Y., Choi, E., Rhee, M.-K., Yoon, H., Park, N. S., & Chiriboga, D. A. (2021). Older Korean Americans' concern about Alzheimer's disease: The role of immigration-related factors and objective and subjective cognitive status. *Aging & Mental Health*, *25*(5), 807–813. https://doi.org/10.1080/13607863.2020.1720596

Jessen, F., Amariglio, R. E., Buckley, R. F., van der Flier, W. M., Han, Y., Molinuevo, J. L., Rabin, L., Rentz, D. M., Rodriguez-Gomez, O., Saykin, A. J., Sikkes, S. A. M., Smart, C. M., Wolfsgruber, S., & Wagner, M. (2020). The characterisation of subjective cognitive decline. *The Lancet Neurology*, *19*(3), 271–278. https://doi.org/10.1016/S1474-4422(19)30368-0

Kafer, R. A., Rakowskl, W., Lachman, M., & Hickey, T. (1980). Aging opinion survey: A report on instrument development. *The*

International Journal of Aging and Human Development, *11*(4), 319–333. https://doi.org/10.2190/JQF5-XDCV-H1AH-3E1Y

Kessler, E. M., Bowen, C. E., Baer, M., Froelich, L., & Wahl, H. W. (2012). Dementia worry: A psychological examination of an unexplored phenomenon. *European Journal of Ageing*, *9*(4), 275–284. https://doi.org/10.1007/s10433-012-0242-8

Kessler, E. M., Südhof, J. K., & Frölich, L. (2014). Dementia worry" in memory clinic patients not diagnosed with organic mental disorder. *International Psychogeriatrics*, *26*(6), 1049–1051. https://doi.org/10.1017/S1041610214000349

Kinzer, A., & Suhr, J. A. (2016). Dementia worry and its relationship to dementia exposure, psychological factors, and subjective memory concerns. *Applied Neuropsychology: Adult*, *23*(3), 196–204. https://doi.org/10.1080/23279095.2015.1030669

Kosowicz, M., & MacPherson, S. E. (2017). Improving multitasking assessment in healthy older adults using a prop-based version of the breakfast task. *Applied Neuropsychology: Adult*, *24*(3), 252–263. https://doi.org/10.1080/23279095.2015.1136310

Lee, G. J., Do, C., & Suhr, J. A. (2021). Effects of personal dementia exposure on subjective memory concerns and dementia worry. *Aging, Neuropsychology, and Cognition*, *28*(6), 855–870. https://doi.org/10.1080/13825585.2020.1836119

Livingston, G., Huntley, J., Sommerlad, A., Ames, D., Ballard, C., Banerjee, S., Brayne, C., Burns, A., Cohen-Mansfield, J., Cooper, C., Costafreda, S. G., Dias, A., Fox, N., Gitlin, L. N., Howard, R., Kales, H. C., Kivimäki, M., Larson, E. B., Ogunniyi, A., … Mukadam, N. (2020). Dementia prevention, intervention, and care: 2020 report of the lancet commission. *The Lancet*, *396*(10248), 413–446. https://doi.org/10.1016/S0140-6736(20)30367-6

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck depression and anxiety inventories. *Behaviour Research and Therapy*, *33*(3), 335–343. https://doi.org/10.1016/0005-7967(94)00075-U

Lynch, S. M. (2000). Measurement and prediction of aging anxiety. *Research on Aging*, *22*(5), 533–558. https://doi.org/10.1177/0164027500225004

Mather, M., & Knight, M. (2005). Goal-directed memory: The role of cognitive control in older adults' emotional memory. *Psychology and Aging*, *20*(4), 554–570. https://doi.org/10.1037/0882-7974.20.4.554

Maxfield, M., & Greenberg, J. (2020). Anticipated stigma and dementia-related anxiety in middle-aged and older adults. *GeroPsych*, *34*(1), 13–22, https://doi.org/10.1024/1662-9647/a000234.

McDonald, J. H. (2014). *Handbook of biological statistics* (3rd ed.). Sparky House Publishing.

McLean, C. P., & Anderson, E. R. (2009). Brave men and timid women? A review of the gender differences in fear and anxiety. *Clinical Psychology Review*, *29*(6), 496–505. https://doi.org/10.1016/j.cpr.2009.05.003

Mella, N., Vallet, F., Beaudoin, M., Fagot, D., Baeriswyl, M., Ballhausen, N., Métral, G., Sauter, J., Ihle, A., Gabriel, R., Oris, M., Kliegel, M., & Desrichard, O. (2020). Distinct effects of cognitive versus somatic anxiety on cognitive performance in old age: The role of working memory capacity. *Aging & Mental Health*, *24*(4), 604–610. https://doi.org/10.1080/13607863.2018.1548566

Mendonça, M. D., Alves, L., & Bugalho, P. (2016). From subjective cognitive complaints to dementia: Who is at risk?: A systematic review. *American Journal of Alzheimer's Disease & Other Dementias®*, *31*(2), 105–114. https://doi.org/10.1177/1533317515592331

Molden, J., & Maxfield, M. (2017). The impact of aging stereotypes on dementia worry. *European Journal of Ageing*, *14*(1), 29–37. https://doi.org/10.1007/s10433-016-0378-z

Newson, R. S., & Kemps, E. B. (2006). The nature of subjective cognitive complaints of older adults. *The International Journal of Aging and Human Development*, *63*(2), 139–151. https://doi.org/10.2190/1EAP-FE20-PDWY-M6P1

Nicholls, L. A. B., Gallant, A. J., Cogan, N., Rasmussen, S., Young, D., & Williams, L. (2021). Older adults' vaccine hesitancy: Psychosocial factors associated with influenza, pneumococcal, and shingles vaccine uptake. *Vaccine*, *39*(26), 3520–3527. https://doi.org/10.1016/j.vaccine.2021.04.062

Norman, A. L., Woodard, J. L., Calamari, J. E., Gross, E. Z., Pontarelli, N., Socha, J., DeJong, B., & Armstrong, K. (2020). The fear of Alzheimer's disease: Mediating effects of anxiety on subjective memory complaints. *Aging & Mental Health*, *24*(2), 308–314. https://doi.org/10.1080/13607863.2018.1534081

Ong, A. D., Rothstein, J. D., & Uchino, B. N. (2012). Loneliness accentuates age differences in cardiovascular responses to social evaluative threat. *Psychology and Aging*, *27*(1), 190–198. https://doi.org/10.1037/a0025570

Park, D. C., Lautenschlager, G., Hedden, T., Davidson, N. S., Smith, A. D., & Smith, P. K. (2002). Models of visuospatial and verbal memory across the adult life span. *Psychology and Aging*, *17*(2), 299–320. https://doi.org/10.1037/0882-7974.17.2.299

Ree, M. J., French, D., MacLeod, C., & Locke, V. (2008). Distinguishing cognitive and somatic dimensions of state and trait anxiety: Development and validation of the State-Trait Inventory for Cognitive and Somatic Anxiety (STICSA). *Behavioural and Cognitive Psychotherapy*, *36*(3), 313–332. https://doi.org/10.1017/S1352465808004232

Reuter-Lorenz, P. A., & Lustig, C. (2016). Working memory and executive functions in the aging brain. In R. Cabeza, L. Nyberg, & D. C. Park (Eds.), *Cognitive neuroscience of aging: Linking cognitive and cerebral aging* (2nd ed., pp. 235–258). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199372935.003.0010

Salthouse, T. A. (2010). Selective review of cognitive aging. *Journal of the International Neuropsychological Society*, *16*(5), 754–760. https://doi.org/10.1017/S1355617710000706

Salthouse, T. (2012). Consequences of age-related cognitive declines. *Annual Review of Psychology*, *63*(1), 201–226. https://doi.org/10.1146/annurev-psych-120710-100328

Salthouse, T. A. (2014). Correlates of cognitive change. *Journal of Experimental Psychology: General*, *143*(3), 1026–1048. https://doi.org/10.1037/a0034847

Salthouse, T. A. (2019). Trajectories of normal cognitive aging. *Psychology and Aging*, *34*(1), 17–24. https://doi.org/10.1037/pag0000288.

Schnitzspahn, K. M., Kvavilashvili, L., & Altgassen, M. (2020). Redefining the pattern of age-prospective memory-paradox: New insights on age effects in lab-based, naturalistic, and self-assigned tasks. *Psychological Research*, *84*(5), 1370–1386. https://doi.org/10.1007/s00426-018-1140-2

Schoen, C. B., & Holtzer, R. (2017). Differential relationships of somatic and cognitive anxiety with measures of processing speed in older adults. *Aging, Neuropsychology, and*

Cognition, *24*(5), 481–495. https://doi.org/10.1080/13825585.2016.1226247

Scott, S. B., Sliwinski, M. J., & Blanchard-Fields, F. (2013). Age differences in emotional responses to daily stress: The role of timing, severity, and global perceived stress. *Psychology and Aging*, *28*(4), 1076–1087. https://doi.org/10.1037/a0034000

Seidenberg, M., Haltiner, A., Taylor, M. A., Hermann, B. B., & Wyler, A. (1994). Development and validation of a multiple ability self-report questionnaire. *Journal of Clinical and Experimental Neuropsychology*, *16*(1), 093–104. https://doi.org/10.1080/01688639408402620

Shi, R., Sharpe, L., & Abbott, M. (2019). A meta-analysis of the relationship between anxiety and attentional control. *Clinical Psychology Review*, *72*, 101754. http://doi.org/10.1016/j.cpr.2019.101754

Sliwinski, M. J., Freed, S., Scott, S. B., Pasquini, G., & Smyth, J. M. (2021). Does chronic stress moderate age differences in emotional well-being? Testing predictions of strength and vulnerability integration. *The Journals of Gerontology: Series B*, *76*(6), 1104–1113. https://doi.org/10.1093/geronb/gbaa174

Spalding, D. M., MacAngus, K., Moen, M. K., & Nicholls, L. A. B. (2021a). Adult aging moderates the relationship between trait cognitive anxiety and subjective everyday cognitive difficulties. *Frontiers in Psychology*, *12*, Article 747839. https://doi.org/10.3389/fpsyg.2021.747839

Spalding, D. M., Obonsawin, M., Eynon, C., Glass, A., Holton, L., McGibbon, M., McMorrow, C. L., & Nicholls, L. A. B., (2021b). Impacts of trait anxiety on visual working memory, as a function of task demand and situational stress. *Cognition & Emotion*, *35*(1), 30–49. https://doi.org/10.1080/02699931.2020.1803217

Suhr, J. A., & Kinkela, J. H. (2007). Perceived threat of Alzheimer disease (AD): The role of personal experience with AD. *Alzheimer Disease & Associated Disorders*, *21*(3), 225–231. https://doi.org/10.1097/WAD.0b013e31813e6683

Teachman, B. A. (2006). Aging and negative affect: The rise and fall and rise of anxiety and depression symptoms. *Psychology and Aging*, *21*(1), 201–207. https://doi.org/10.1037/0882-7974.21.1.201

Tyndall, A. V., Longman, R. S., Sajobi, T. T., Parboosingh, J. S., Drogos, L. L., Davenport, M. H., Eskes, G. A., Hogan, D. B., Hill, M. D., & Poulin, M. J. (2020). Genetic risk, vascular function, and subjective cognitive complaints predict objective cognitive function in healthy older adults: Results from the brain in motion study. *Frontiers in Integrative Neuroscience*, *14*, Article 571683. https://doi.org/10.3389/fnint.2020.571683

Wells, A. (1995). Meta-cognition and worry: A cognitive model of generalized anxiety disorder. *Behavioural and Cognitive Psychotherapy*, *23*(*3*), 301–320. http://doi.org/10.1017/S1352465800015897

Werner, P., AboJabel, H., & Maxfield, M. (2021). Conceptualization, measurement and correlates of dementia worry: A scoping review. *Archives of Gerontology and Geriatrics*, *92*, Article 104246. https://doi.org/10.1016/j.archger.2020.104246

Wood, B. M., Nicholas, M. K., Blyth, F., Asghari, A., & Gibson, S. (2010). The utility of the short version of the depression anxiety stress scales (DASS-21) in elderly patients with persistent pain: Does age make a difference? *Pain Medicine*, *11*(12), 1780–1790. https://doi.org/10.1111/j.1526-4637.2010.01005.x