Understanding the utility of primary care psychological therapies for risk reduction and therapy outcomes in dementia

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A thesis submitted for the degree of Doctor of Philosophy

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Declaration

I, Georgia Caroline Bell, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signature: Date: 18/09/23

Abstract

Background: Depression and anxiety are associated with dementia risk; however less is known regarding positive mental health. Depression and anxiety are also common in people living with dementia; however the effectiveness of routine primary care psychological therapies for people living with dementia is unknown.

Aims: To investigate the utility of Improving Access to Psychological Therapies (IAPT) services for dementia risk reduction and treatment of depression and anxiety in people living with dementia. Specifically, chapter: 2) synthesise evidence for associations between positive psychological constructs (PPCs) with cognitive function, MCI, and dementia, 3) investigate whether PPCs and cognitive function improve pre-post IAPT therapy, 4) investigate differences in IAPT therapy outcomes between people living with dementia and people without dementia, 5) investigate predictors of IAPT therapy outcomes in people living with dementia.

Chapter methods:

2) Systematic literature review and meta-analysis.

3) 75 participants aged 60+ without dementia attending IAPT. Explored pre-post therapy change in PPCs, cognition, anxiety, and depression (t tests) and associations between them (linear regression).

4 & 5) Used linked national healthcare records to identify ~1,500 people living with dementia receiving IAPT therapy between 2012 to 2019 and investigated therapy outcomes.

Chapter findings:

2) Eudemonic PPCs (purpose/meaning in life) were associated with better cognitive function and reduced risk of dementia.

3) Optimism, memory, and verbal fluency improved over IAPT therapy, but no associations between PPCs and change in cognitive function.

4) Found evidence for IAPT therapies reducing depression/anxiety symptoms in people living with dementia, but poorer outcomes than people without dementia.

5) Predictors of IAPT therapy outcomes in people living with dementia were in-line with those for a general population above and beyond dementia-specific factors.

Conclusions: Eudemonic PPCs may be sensible dementia prevention targets, however more work is needed to understand whether existing services (e.g., IAPT) can promote PPCs in older adults. Further, IAPT may be beneficial for people living with dementia, however adaptations (e.g., more therapy sessions) may be required to improve outcomes.

Impact statement

This thesis has important implications for informing dementia prevention strategies and the post-diagnosis support available for people living with dementia. First, given WHO guidelines recommending multidomain approaches for healthy cognitive ageing and dementia prevention, this work highlights a promising new area to consider – positive mental health. As this research area is in its infancy, the comprehensive systematic review presented in Chapter 2 has important academic implications in providing a synthesised foundation for future research to build upon, such as the work being conducted as part of Dr Amber John's ARUK research fellowship. Moreover, the evidence from this thesis suggests that eudemonic positive psychological constructs (PPCs) (e.g., meaning and purpose in life) may be sensible targets for dementia prevention interventions, especially given their potentially modifiable nature. Whilst little evidence was found in Chapter 3 for the utility of Improving Access to Psychological Therapies (IAPT) services for promoting PPCs in older adults, there is still value in understanding whether existing services could be utilised for dementia prevention and which modifiable risk factors they could address.

Next, this work also has important clinical implications for the treatment of depression and anxiety in people living with dementia. Specifically, the findings from Chapter 4 support the utility of IAPT therapies for reducing symptoms of depression and anxiety in people living with dementia and highlight the underrepresentation of people living with dementia accessing IAPT services. Given the promising evidence, this work has implications for encouraging referrals and challenging assumptions that people living with dementia will not benefit from psychological therapy. This may be especially true given findings from Chapter 5 suggesting that dementia-specific factors (including dementia type and age at dementia diagnosis) were not associated with recovery from depression and anxiety following psychological therapy. Further, Chapter 4 also found that IAPT therapy outcomes in people living with dementia were poorer than people without dementia. Chapter 5 has implications for identifying who with dementia may particularly benefit from psychological therapy, including those who are older, not taking psychotropic medication, have higher work and social functioning, and less severe mental health symptoms. Additionally, these findings may also have implications for informing adaptations to improve

therapy outcomes in people living with dementia, such as offering more therapy sessions and more regular clinical reviews for those with more severe depression.

The work reported in this thesis has been disseminated to a variety of audiences, including academic (publications in peer-reviewed journals, international conference presentations, internal presentations), clinical (presentation to the North and Central East London IAPT Service Improvement and Research Network, publication in Healthcare Counselling and Psychotherapy Journal), people affected by dementia (MODIFY PPI group), and the general public (press releases from media such as the Times, Express, and Daily Mail). The work from Chapter 4 has also been presented at a policy seminar (Dr Amber John's Policy Fellowship) comprising of senior academics, Alzheimer's Society policy officers, people with lived experience of dementia, commissioners, and NHS England leads for IAPT.

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Chapter 1: Introduction

Overview

This chapter provides an overview to the key themes of this thesis – psychological therapies for dementia risk reduction and treatment of depression and anxiety in people living with dementia. First, an overview of dementia and mental health are presented. Second, the motivations and rationale for the empirical work (chapters 2-5) are discussed. Next, the main data source (the MODIFY project) is introduced. Finally, the overarching aim and specific objectives of the thesis are presented.

Dementia

Dementia is an umbrella term that refers to a range of progressive neurological conditions (Alzheimer's Society, 2021), such as Alzheimer's disease (AD), vascular dementia (VaD), and frontotemporal dementia (FTD). Globally, it is estimated that over 55 million people are currently living with dementia (World Health Organization, 2023), with this figure expected to increase to over 150 million cases by 2050 (GBD 2019 Dementia Forecasting Collaborators, 2022). Whilst dementia is more common in older people (aged 65+ years), dementia can also affect people under the age of 65 with young-onset dementia accounting for around 9% of cases (World Health Organization, 2023). Dementia is characterised by decline in brain functioning that includes changes in cognitive ability (e.g., memory difficulties) and behaviour (e.g., loss of empathy) (Alzheimer's Society, 2021), however specific symptoms differ between types of dementia and often between individuals.

Regarding specific types of dementia, the most common is AD which is estimated to account for 60-70% of dementia cases (World Health Organization, 2023) and is characterised by the build-up of amyloid plaques and neurofibrillary tangles that can lead to brain atrophy (Breijyeh and Karaman, 2020). AD is mainly a memory-led dementia, with common symptoms including difficulties with memory, concentration, and communication (Alzheimer's Society, 2021). Rarer forms of AD (atypical AD) in which the early symptoms occur in different parts of the brain include variants such as frontal variant Alzheimer's disease (fvAD) which is associated with behavioural changes and

difficulties with executive function, and posterior cortical atrophy (PCA) which is associated with visuospatial difficulties with spatial awareness and recognition (Shea et al., 2021). Next, the second most common type of dementia is VaD, which is estimated to affect 15% to 30% of people living with dementia with higher prevalence estimates in Asia and developing countries (Wolters and Ikram, 2019). VaD is caused by reduced blood flow to the brain which damages brain cells (Alzheimer's Society, 2021), with stroke being a leading risk factor (Wolters and Ikram, 2019). Whilst early symptoms differ depending on the area of the brain affected, people living with VaD often experience difficulties with executive function and information processing (O'Brien and Thomas, 2015). Finally, while FTD is a rarer form of dementia (2.7% of late-onset dementia cases), it is more common in younger people accounting for 10.2% of young-onset dementia cases (Hogan et al., 2016). FTD is characterised by damage in the frontal or temporal lobes and consists of two variants depending on the area of the brain affected: behavioural variant FTD (bvFTD) and primary progressive aphasia (PPA). Symptoms of FTD often include changes in behaviour or language depending on the variant. Specifically, bvFTD is characterised by changes to behaviour and personality including behavioural disinhibition and loss of empathy (Rascovsky et al., 2011), whereas PPA is characterised by language-based symptoms such as difficulties with comprehension and word retrieval (Gorno-Tempini et al., 2011).

Understandably, dementia has a huge impact on the people affected. In addition to cognitive and behavioural changes, activities of daily living become more affected in people living with dementia as the disease progresses, which in turn can have an impact on quality of life (Giebel et al., 2015; Giebel et al., 2014) and the care support needed (Prizer and Zimmerman, 2018). Further, people living with dementia also commonly experience other physical health comorbidities (e.g., diabetes, hypertension) (Poblador-Plou et al., 2014) which can increase the risk of hospitalisation (Toot et al., 2013) and nursing home admission (Toot et al., 2017). Next, dementia can also negatively impact the carers and loved ones of people living with dementia by contributing to caregiver burden and stress (Sheehan et al., 2021). Dementia caregiver stress has also been associated with other adverse outcomes, including loneliness (Victor et al., 2021), poorer sleep quality (Fonareva and Oken, 2014), poorer

cognitive outcomes (Fonareva and Oken, 2014), mental health problems (Pinquart and Sörensen, 2003), and various biomarkers linked with physical health conditions (e.g., cardiovascular disease, immune dysfunction) (Fonareva and Oken, 2014). Finally, dementia also has a huge societal and economic impact. Globally, dementia is estimated to cost the economy over $1.3 trillion per year (Wimo et al., 2023). This financial impact also contributes to increased pressure on healthcare services. In England, dementia associated costs for hospitals doubled between 2010/11 to 2017/18 (Alzheimer's Research UK, 2020), with the number of emergency hospital admissions increasing and people living with dementia remaining in hospital longer after admission (Torjesen, 2020). Further, the expected demand on community-based social services and care homes in England are projected to substantially increase (95% and 166% respectively between 2015 to 2040) due to the rising number of people living with dementia (Wittenberg et al., 2020). Considering the impact of dementia, it is a key issue for public health, with both dementia prevention and dementia care being important health and care priorities as outlined in the Prime minister's challenge on dementia 2020 (Department of Health, 2015, 2016).

Mental health

Common mental health problems such as depression and anxiety are also major contributors to global health-related burden (GBD Mental Disorders Collaborators, 2022). In the global population, depression and anxiety are estimated to affect 4.4% and 3.6% of people respectively (World Health Organization, 2017) and cost the economy $2.5 trillion each year (The Lancet Global Health, 2020). Whilst there are shared symptoms, depression (e.g., major depressive disorder) is typically characterised by low mood and feelings of worthlessness, whereas anxiety (e.g., generalised anxiety disorder) is characterised by symptoms of excessive worry and restlessness (American Psychiatric Association, 2013). In addition to the symptoms and psychological distress, depression and anxiety can also have other negative impacts on the individual, including associations with lower quality of life (Brenes, 2007; Hohls et al., 2021) and engagement in physical and social activities (De Wit et al., 2010).

When conceptualising mental health, it is important to consider more than just the presence or absence of mental health problems. As such, this thesis distinguishes between negative mental health (e.g., depression, anxiety) and positive mental health (e.g., psychological wellbeing) as separate but related concepts. In contrast to negative mental health, positive mental health refers to positive emotional health and functioning. Specifically, it has been proposed that wellbeing is achieved from having a balance or equilibrium between the psychological, social, and physical challenges an individual faces and the resources the individual has to deal with them (Dodge et al., 2012). Within the research area of wellbeing, the literature distinguishes between hedonic and eudemonic approaches. Broadly speaking, hedonic wellbeing is characterised by the pursuit and experience of pleasure (e.g., positive affect) and positive evaluations (e.g., life satisfaction), whereas eudemonic wellbeing refers to the pursuit and experience of meaning and personal growth (e.g., purpose and meaning in life) (Ryff et al., 2021). In this sense, positive mental health is more than the absence of negative mental health and instead also involves the presence of various positive psychological constructs (PPCs).

Drawing from positive psychology, there are several notable theories that have proposed PPCs that contribute to wellbeing. First, Ryff's six-factor model of psychological wellbeing (Ryff, 1989a; 1989b) was conceptualised as a multidimensional approach to wellbeing beyond happiness and life satisfaction that encompasses both scientific and philosophical perspectives. This model proposes that positive psychological functioning comprises of self-acceptance, personal growth, purpose in life, environmental mastery, autonomy, and positive relations with others. Next, Peterson and Seligman (2004) designed the Character Strengths and Virtues handbook as a classification system for positive character traits comparable to that provided by the Diagnostic and Statistical Manual of Mental Disorders (American Psychiatric Association, 1994) for negative mental health. In this, 24 measurable character strengths were identified and grouped into 6 key virtues (courage, justice, humanity, temperance, wisdom and knowledge, transcendence). Finally, Seligman (2011) developed the PERMA model as an alternative to authentic happiness theory (pleasure, engagement, meaning) (Seligman, 2002). Building on this, the PERMA model instead proposes that wellbeing can be achieved through

positive emotions, engagement, positive relationships, meaning in life, and accomplishment, all of which are required for an individual to flourish (Seligman, 2011).

Understandably, it is important to maintain positive mental health and psychological wellbeing across the lifespan. In older adults specifically, promoting PPCs may be particularly relevant for helping people to manage the challenges associated with ageing. Several notable theories, including Erikson's theory of psychosocial development (Erikson, 1994) and terror management theory (Greenberg et al., 1986), have emphasised the importance of PPCs such as self-esteem, life satisfaction, and meaning in life in older adulthood. Broadly speaking, these theories argue that positive life evaluations and sense of meaning can be beneficial for protecting against negative mental health (e.g., depression) and anxiety around mortality. Similarly, it has also been suggested that positive health-related decisions may be motivated by the pursuit of eudemonic PPCs (e.g., meaning, self-esteem) (Goldenberg and Arndt, 2008). In addition to psychical health, positive mental health can also be important when facing threats to cognitive health. For example, evidence suggests that promoting PPCs such as self-esteem and meaning in life through nostalgic reminiscence can be particularly beneficial for coping with and processing a diagnosis of dementia (Cheston and Christopher, 2019). Overall, it may be that promoting PPCs in older people may be important for coping with existential threat in later life, including death anxiety, physical illness, or dementia.

Understanding the utility of psychological therapies for dementia risk reduction and treatment of depression and anxiety in people living with dementia

Taken together, the topic of mental health and dementia is important for two reasons. First, there is an association between earlier mental health and later dementia. Second, mental health problems (e.g., depression and anxiety) are common in people living with dementia. This thesis will focus on both of these topics and consider mental health (both positive and negative) across dementia (from risk of developing dementia to living with dementia) and the role of psychological therapies offered in primary care psychological therapy services.

Given that psychological therapies have a good evidence base for treating common mental health problems (National Institute for Health and Care Excellence, 2011a), they may have potential utility for reducing dementia risk (through treating negative mental health problems and promoting positive mental health prior to dementia) and treating depression and anxiety in people living with dementia.

Dementia risk

The first element this thesis examines is the association between positive mental health with dementia risk and whether psychological therapies can promote positive mental health in older adults.

There is accumulating evidence for an association between common mental health problems (e.g., depression and anxiety) and dementia. The Lancet Commission's 2020 report identified depression in later life as one of 12 potentially modifiable risk factors for dementia (Livingston et al., 2020). Additionally, there is growing evidence for the association between anxiety and risk of dementia (Santabárbara et al., 2020). Given that depression and anxiety can be prodromes of dementia, it is also worth noting that these associations may not be causal. Beyond depression and anxiety, research has also found an association between psychological distress (including negative affect, pessimism, and hopelessness) and increased risk of dementia (Sutin et al., 2018a). At present, much of the research in this area has focused on negative mental health, however less is known about positive mental health and wellbeing. Given the importance of dementia prevention, understanding possible risk and protective factors is essential. As there has been extensive research investigating associations between negative mental health and dementia risk, this thesis will focus on the role of PPCs that contribute to positive mental health.

There has been growing interest in the protective associations between elements of wellbeing and health outcomes (Park et al., 2016), including protective effects regarding cardiovascular disease (Boehm and Kubzansky, 2012), stroke (Kim et al., 2011), and mortality (Boyle et al., 2009). In relation to cognitive health, this research area is very much in its infancy. Previous research exploring psychological wellbeing has generally found mixed results

for the individual constructs (Nakanishi et al., 2019; Sutin et al., 2018b). One study used the National Survey of Health and Development 1946 birth cohort and found that, of the PPCs included in Ryff's psychological wellbeing scale, only higher personal growth and lower self-acceptance at age 52 were significantly associated with better global cognitive function 17 years later (Nakanishi et al., 2019). Similarly, in another study investigating associations between psychological wellbeing and risk of dementia 6-8 years later using data from the Health and Retirement Study, significant associations were found for purpose in life only, with mixed findings for positive affect and no associations found for life satisfaction, optimism, and mastery (Sutin et al., 2018b). These findings highlight the need for constructs of positive mental health and wellbeing to be investigated individually. Considering the potential implications for healthy cognitive aging and dementia prevention, it is important to understand whether PPCs that contribute to positive mental health are protective in their association with risk of dementia above and beyond the absence of negative mental health. At present there is limited research on this topic, and of the existing literature, study designs differ and results are mixed. Therefore, it is difficult to draw clear conclusions without the use of a systematic approach to synthesise findings. In Chapter 2, I present a systematic review and meta-analysis investigating associations between PPCs with cognitive function, mild cognitive impairment, and dementia risk.

Next, given that there is currently no cure for dementia, understanding and improving prevention strategies is critical. With growing evidence for a range of potentially modifiable risk factors (Livingston et al., 2020), it is important to identify effective interventions that could help reduce risk. In relation to negative mental health, previous research has suggested that improvements in symptoms of depression and anxiety over the course of primary care psychological therapies in older adults is associated with reduced risk (12% and 17% respectively) of all-cause dementia up to eight years later (John et al., 2022; Stott et al., 2023). From an economic perspective, it is important to understand whether existing resources such as primary care psychological therapy services could be utilised for dementia prevention. Given the growing interest in positive mental health and risk of dementia, it is possible that psychological therapies could also be beneficial for dementia prevention by

promoting PPCs that contribute to positive mental health. In Chapter 3, I present work investigating whether psychological therapies are associated with change in PPCs and whether PPCs are associated with positive change in cognition over psychological therapy.

Treatment of depression and anxiety in people living with dementia

The second element this thesis examines is the treatment of depression and anxiety in people living with dementia using psychological therapies.

Depression and anxiety are common in people living with dementia, with estimates suggesting that 38-41% of people with mild or moderate dementia also experience depression and anxiety (Leung et al., 2021). Not only are depression and anxiety highly prevalent in people living with dementia, but when left untreated they have been associated with numerous adverse outcomes, such as faster cognitive decline (Rapp et al., 2011), lower quality of life (Beerens et al., 2013), and earlier institutionalisation (Dorenlot et al., 2005). As such, it is vital that appropriate and effective treatment options are available for people living with dementia.

In a general adult population, recommended treatment options for depression and anxiety include psychotropic medications (e.g., antidepressants) and psychological therapies (National Institute for Health and Care Excellence, 2011b, 2022). Psychological therapies cover a range of approaches, from low intensity interventions such as guided self-help to high intensity interventions such as cognitive behavioural therapy (CBT). In the UK, psychological therapies can be accessed through primary care psychological therapy services and specialist secondary care services. This thesis will focus on psychological therapies offered in primary care psychological therapy services, specifically in Improving Access to Psychological Therapies (IAPT) services (National Collaborating Centre for Mental Health, 2021). These services have recently announced that they will be changing their name to NHS Talking Therapies for Anxiety and Depression, however for consistency this thesis will continue to refer to these services as IAPT. IAPT services offer a range of evidence-based psychological treatments for common mental health problems and are freely available on the NHS via GP referral, self-referral, or referral from secondary services. Beyond offering evidence-based treatments, a key feature of IAPT is

that outcomes are routinely monitored at each session using standardised measures including the Patient Health Questionnaire 9-item (PHQ-9) (Kroenke et al., 2001), the Generalised Anxiety Disorder Scale 7-item (GAD-7) (Spitzer et al., 2006), and anxiety disorder specific measures (ADSM) for specific anxiety disorders (e.g., Social Phobia Inventory, Health Anxiety Inventory). These form part of the minimum dataset that all IAPT services have been required to collect since 2012. As IAPT are outcome focussed, this allows not only for the monitoring of individual patients but also ensuring that services are meeting the 50% recovery target set out by NHS England (NHS Digital, 2019). IAPT therapy outcomes defined by NHS digital include reliable improvement (reduction in depression and/or anxiety that exceeds the error of measurement), reliable recovery (reduction in depression/anxiety that exceeds the error of measurement and moves below the clinical cut-off for 'caseness') and reliable deterioration (increase in depression and/or anxiety that exceeds the error of measurement) (NHS Digital, 2019) and are commonly used in research using IAPT data (e.g., John et al., 2022; Saunders et al., 2021; Stott et al., 2023).

In people living with dementia specifically, current NICE guidelines recommend considering psychological therapies for the treatment of mild to moderate depression and anxiety and that psychotropic medication should not be routinely offered (National Institute for Health and Care Excellence, 2018). Whilst the evidence for the effectiveness of psychotropic medication (e.g., antidepressants) is mixed (Dudas et al., 2018), current evidence from randomised control trials (RCTs) for the use of psychological therapies with people living with dementia is more promising (Orgeta et al., 2022). Findings from the most recent Cochrane review found psychological therapies can be beneficial for reducing symptoms of depression in people living with dementia, with larger effects found for CBT-based therapies compared to treatment as usual in people living with dementia who also met clinical criteria for depression (Orgeta et al., 2022). However, no evidence was found for CBT-based therapies reducing symptoms of anxiety in people living with dementia. It should be noted that in addition to (and sometimes in conjunction with) CBT, many other types of psychotherapies have been used with people living with dementia to help reduce negative mental health symptoms (e.g., depression) (Cheston, 2022), including meaning-based therapies (Sukhawathanakul et al., 2021), problem-

solving interventions (Shoesmith et al., 2022; Sukhawathanakul et al., 2021), and group psychotherapy (Cheston and Ivanecka, 2017). The Alzheimer's Society's recent report 'Left to cope alone' emphasises the need for appropriate and accessible support post dementia diagnosis from primary care psychological therapy services such as IAPT (Alzheimer's Society, 2022). Whilst there is supporting evidence from RCTs, the effectiveness of psychological therapies provided within adult primary care psychological therapy services for treating depression and anxiety in people living with dementia is currently unknown. Given that people living with dementia may be seen in primary care psychological therapy settings, it is particularly important to understand their utility for improving symptoms of depression and anxiety in people living with dementia. In Chapter 4, I investigate primary care psychological therapy outcomes in people living with dementia.

Next, given the variability within dementia, it is also important to understand who with dementia may particularly benefit from primary care psychological therapies. For example, it may be that age of dementia onset is associated with psychological therapy outcomes given that people with young-onset dementia are more likely to experience behavioural and psychological symptoms than people with late-onset dementia (Altomari et al., 2022) and that research has suggested that older adults have better therapy outcomes than working age adults (Saunders et al., 2021). Further, there may also be differences in psychological therapy outcomes between types of dementia. Considering different symptomology associated with different types of dementia, it may be that people with memory-dementias (e.g., Alzheimer's disease) may have difficulties remembering and implementing therapeutic strategies. On the other hand, it is also possible that behavioural symptoms (e.g., apathy, behavioural disinhibition, mental inflexibility) and lack of insight into the condition commonly experienced in behavioural variant frontotemporal dementia (Barker et al., 2022; Rascovsky et al., 2011) may effect ability to engage with psychological therapy and lead to worse therapy outcomes. Finally, in a general population, various clinical and therapy factors have been identified to be associated with poorer psychological therapy outcomes, including higher baseline symptom severity (Buckman et al., 2021a; Saunders et al., 2020), longer duration of symptoms prior to treatment (Buckman et al., 2021a), psychotropic medication use

(Buckman et al., 2021a), fewer treatment sessions (Clark et al., 2018; Saunders et al., 2020), and longer waiting times (Clark et al., 2018). It is likely that these factors may also be important for people living with dementia, however at present no research has specifically investigated this. Understanding which factors are associated with better psychological therapy outcomes in people living with dementia is critical to better inform the optimal choice of treatment. In Chapter 5, I investigate dementia-specific and non-dementia specific factors associated with psychological therapy outcomes in people living with dementia.

MODIFY Project

This thesis utilises data from the MODIFY project, funded by the Alzheimer's Society (MODIFY AS-PG-18-013). The original overarching aim of the MODIFY project is to explore the use of psychological therapy for dementia risk reduction. This project has two arms (MODIFY feasibility study, MODIFY grant dataset), described below. Work arising from the MODIFY project (including the work presented in this thesis) was conducted in collaboration with a patient and public involvement group including people affected by dementia from the Alzheimer's Society. For this thesis, the MODIFY monitor group met twice yearly and were involved in all aspects of the research, including conceptualisation, study design, interpretation of findings, and co-creating dissemination plans.

MODIFY feasibility study

The first arm of the MODIFY project aimed to investigate whether modifiable dementia risk factors change over the course of psychological therapies offered in IAPT. For this feasibility study, people aged 60+ without identified dementia at baseline were recruited from three IAPT sites in London (Camden and Islington, Homerton, North East London Foundation Trust). This study had a recruitment target of 165 participants. Various measures of dementia risk factors (e.g., sleep, loneliness, alcohol consumption, PPCs) and cognitive ability (e.g., memory, verbal fluency, attention) were administered through telephone assessments with participants at 3 timepoints: baseline (prior to starting therapy), 3 months, and 6 months. Additional questionnaires and a step and movement counter were also sent to participants after each assessment. I was

one of two research assistants collecting data for this study and data from this work are used in Chapter 3 of this thesis.

MODIFY grant dataset

The second arm aimed to create a unique dataset that would allow us to identify who in IAPT had a diagnosis of dementia. These data comprise of national healthcare records that were linked using a linkage key provided by NHS Digital. These data were used for Chapter 4 and 5 of this thesis and include:

- **IAPT dataset (National Collaborating Centre for Mental Health, 2021):** Routinely collected data from every patient seen in IAPT services across all 211 clinical commissioning group areas in England between 2012 and 2019. This includes demographic (e.g., gender, age, ethnicity), therapy (e.g., referral and assessment dates, treatment information at each appointment), and outcome (e.g., improvement, recovery, deterioration) information for individual patients.
- **Hospital Episode Statistics (HES) dataset (NHS Digital, 2021a):** Admitted Patient Care and Outpatient datasets from all NHS hospitals across England up to 2020. This includes demographic (e.g., gender, age, ethnicity), geographical (e.g., residential area, area treatment was received), administrative (e.g., dates of admission and discharge), and clinical (e.g., diagnoses, treatments, operations) information for individual patients.
- **Mental Health Services dataset (NHS Digital, 2021b):** Previously known as the Mental Health Minimum Dataset (MHMDS) and the Mental Health and Learning Disability Dataset (MHLDDS). This includes data up to 2019 from secondary care services (e.g., provided in hospitals, outpatient clinics, in the community) for mental illness, learning disability, autism, and other neurodevelopmental conditions.
- **HES-ONS Mortality dataset (NHS Digital, 2020):** Linked information from HES and Office of National Statistics (ONS) mortality data. This includes cause, date, and place of death (both in and out of hospital). Data were available up to 2020.

Research aims

The overarching aim of this thesis is to investigate the benefits of psychological therapies offered in IAPT services for dementia risk reduction and treatment of depression and anxiety in people living with dementia. This thesis consists of two arms: positive mental health and dementia risk (Chapters 2 & 3) and IAPT for the treatment of negative mental health in people living with dementia (Chapters 4 & 5). The specific chapter aims are outlined below.

For the first arm, Chapter 2 aims to synthesise the evidence for associations between PPCs with cognitive function, mild cognitive impairment (MCI), and dementia in older adults. This chapter includes an exploratory systematic literature review using a comprehensive list of search terms for PPCs, outcomes (cognitive function, MCI, dementia), and age-related terms. Where two or more studies reported on the same PPC and outcome, these were pooled in the form of a meta-analysis. Next, Chapter 3 uses data from the MODIFY feasibility study and investigates whether psychological therapies offered in IAPT can promote PPCs in older people without identified dementia. Specifically, this chapter aims to understand whether IAPT therapies are associated with change in PPCs and whether PPCs are associated with change in domains of cognitive function over the course of therapy. For this study, data for 75 participants were available and included people aged 60+ years without dementia recruited from IAPT services in London. Participants completed a range of questionnaires via telephone at three timepoints (baseline, 3 months, 6 months), including measures for PPCs (optimism, gratitude, self-compassion, meaning in life) and cognitive domains (immediate and delayed memory, verbal and semantic fluency, sustained and selective attention, global cognition). Routinely collected IAPT data were also available for each participant, including pre and post depression and anxiety scores. Paired t tests were used to explore pre-post therapy change in PPCs and domains of cognitive function, and linear regression models were used to explore associations between change in PPCs (with significant pre-post therapy change) with change in domains of cognitive function (with significant pre-post therapy change) over psychological therapy.

For the second arm, Chapters 4 and 5 use national healthcare record data from the MODIFY grant dataset to investigate whether psychological therapies offered in IAPT may be useful for treating mental health problems in people

living with dementia and who with dementia may be benefitting. In this dataset, information were available for around 1,500 people living with dementia who completed a course of psychological treatment (defined as 2 or more therapy sessions (National Collaborating Centre for Mental Health, 2021)) in IAPT between 2012 to 2019. Specifically, Chapter 4 aims to investigate differences in IAPT therapy outcomes between people living with dementia and a propensity score matched control sample without identified dementia. Paired t tests were used to explore change in depression and anxiety scores over psychological therapy in people living with dementia and logistic regression models were used to explore differences in routine IAPT outcome measures (reliable improvement, reliable recovery, reliable deterioration) between people living with dementia and people without dementia. Finally, Chapter 5 aims to understand which factors may predict positive change in negative mental health in people living with dementia over the course of psychological therapy. This chapter investigates both dementia-specific (e.g., dementia type, age at dementia diagnosis) and non-dementia specific factors (e.g., sociodemographic and clinical factors) associated with better IAPT therapy outcomes in people living with dementia. To explore dementia type, a subsample was identified including 214 people with AD, 150 VaD, 65 atypical AD, and 50 FTD. Logistic regression models were used to explore associations between dementia-specific and non-dementia specific factors with IAPT therapy outcomes.

Chapter 2: Positive psychological constructs and dementia risk reduction – literature review

This chapter includes research from two studies that have been published in *Ageing Research Reviews*:

Bell, G., Singham, T., Saunders, R., John, A., & Stott, J. (2022). Positive psychological constructs and association with reduced risk of mild cognitive impairment and dementia in older adults: a systematic review and meta-analysis. *Ageing Research Reviews*, 101594. https://doi.org/10.1016/j.arr.2022.101594

Bell, G., Singham, T., Saunders, R., Buckman, J. E., Charlesworth, G., Richards, M., John, A., & Stott, J. (2022). Positive psychological constructs and cognitive function: a systematic review and meta-analysis. *Ageing Research Reviews*, 101745. https://doi.org/10.1016/j.arr.2022.101745

Abstract

Background: Despite accumulating evidence for the association between negative mental health (depression, anxiety) and risk of cognitive decline, mild cognitive impairment (MCI), and dementia, less is known about the possible protective effects of positive mental health and wellbeing.

Aims: To synthesise evidence regarding associations between positive psychological constructs (PPCs) and a) cognitive function and b) risk of MCI and dementia.

Methods: Literature searches were conducted in Medline, PsycINFO, and Scopus. Papers were included if they reported on at least one PPC and cognitive function, MCI, or dementia in people aged 50+ without identified dementia at baseline. In total, 37 studies were identified for cognitive function outcomes and 8 were identified for MCI or dementia. All included studies are described narratively. Where two or more studies reported on the same PPC and outcome, these were pooled in the form of a random effects meta-analysis.

Results: *Cognitive function:* Significant cross-sectional associations were found for meaning in life, purpose in life, and positive affect with various domains of cognitive function, however no evidence was found for an association between life satisfaction and cognitive state. The only longitudinal meta-analysis possible

found no evidence for an association between positive affect and memory. *MCI and dementia:* Purpose and meaning in life were significantly associated with a reduced risk of MCI and dementia, however no evidence was found for positive affect.

Conclusions: Mixed findings for different PPCs highlight the importance of investigating the factors that contribute to cognitive health individually. Current evidence suggests that eudemonic constructs may be more important than hedonic constructs in their association with cognitive function and risk of dementia. However, due to this research area being in its infancy, more research is needed to further explore the possible protective effects of individual PPCs. Understanding which factors may be protective could have important implications for informing interventions to promote healthy cognitive ageing and dementia prevention.

Introduction

With global estimates suggesting that over 55 million people are currently living with dementia (World Health Organization, 2023), research investigating strategies for dementia prevention are of high importance. The Lancet Commission's most recent report identified 12 potentially modifiable risk factors that account for around 40% of dementia cases and proposed actions for dementia prevention based on these (Livingston et al., 2020). Of these factors, depression in later life was found to be associated with increased risk of dementia incidence, although this relationship may be bidirectional. Globally, estimates suggest that 28% of older adults experience depression (Hu et al., 2022). As such, it is important to understand how common mental health problems are associated with cognitive function and risk of dementia. Previous research has provided evidence for an association between common negative mental health problems (depression, anxiety) and risk of both cognitive decline (John et al., 2019b) and dementia (da Silva et al., 2013). Additionally, it has also been suggested that experiencing symptoms of depression and anxiety across the life course is associated with poorer cognitive function that can be detected as early as age 50 (John et al., 2019a). In addition to common mental health problems, research has also suggested that other elements of negative mental

health that contribute to psychological distress, such as negative affect, pessimism, and hopelessness, are also associated with an increased risk of cognitive impairment and dementia (Sutin et al., 2018a). Despite the growing evidence for negative mental health, less is known about the possible protective effects of positive mental health on cognitive function and dementia risk.

Positive mental health and psychological wellbeing are more than the absence of mental health problems (e.g., depression or anxiety) and psychological distress. As discussed in Chapter 1, they also involve the presence of positive psychological constructs (PPCs). Within the field of positive psychology, there have been several influential theories that have aimed to identify factors that contribute to psychological wellbeing. First, Ryff's (1989a; 1989b) six-factor model proposes that self-acceptance, personal growth, purpose in life, environmental mastery, autonomy, and positive relations with others are the key factors that contribute to psychological wellbeing. Next, the Character Strengths and Virtues handbook was designed by Peterson and Seligman (2004) as a classification system for positive character strengths. In this, 24 character strengths were identified and grouped into 6 key virtues (courage, justice, humanity, temperance, wisdom and knowledge, transcendence). Finally, Seligman's (2011) PERMA model argues that wellbeing can be achieved from positive emotions, engagement, positive relationships, meaning in life, and accomplishments.

In relation to cognitive health, previous research has found mixed results for associations between PPCs with cognitive function (Nakanishi et al., 2019) and dementia (Sutin et al., 2018b), thus highlighting the importance of investigating these factors individually rather than using a combined measure of wellbeing. To date, there have been no systematic reviews collating the associations between PPCs and different aspects of cognition or risk of MCI and dementia. Understanding which PPCs may be protective could have important implications for informing interventions for dementia prevention. Further, understanding associations between PPCs and pre-clinical decline in different cognitive domains could have important implications for promoting healthy cognitive aging more generally, through the preventative benefits of early intervention prior to clinical cognitive impairment. Therefore, the aim of this chapter is to synthesise evidence from the current literature regarding associations between

positive psychological constructs (PPCs) with cognitive function, mild cognitive impairment (MCI), and dementia in adults aged 50 and over without cognitive impairment at baseline.

Methods

This review was registered on PROSPERO (https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42020224669) and has been reported in accordance with PRISMA guidelines (Page et al., 2021).

Search strategy

Literature searches were conducted in Medline, PsycINFO, and Scopus from inception until March 2021. Search terms for positive psychological constructs were based on the theories of wellbeing described in the introduction (Peterson and Seligman, 2004; Ryff, 1989b; Seligman, 2011) and developed through consultations with experts in the field. Terms that were not psychological constructs (e.g., positive relations with others, knowledge) and those that were too broad and could not be contextualised (e.g., interest, elevation) were removed. Search terms for cognitive function, MCI, and dementia were based on those used in a recent systematic review (Desai et al., 2020). Finally, a third concept of age-related terms were also used. These were based on the strategy suggested by ISSG Search Filter Resource for Medline (ISSG Search Filter Resource, 2006) with additional relevant terms added (e.g., midlife, later life, retire) and adapted for use in other databases. Relevant subject headings for each concept were also applied for searches in Medline and PsycINFO. Searches were re-run in Medline prior to final analyses to identify any additional papers for inclusion (October 2021 for MCI/dementia outcomes, February 2022 for cognitive outcomes). The complete list of search terms are presented in Table 1.

Table 1: List of search terms

Positive psychological constructs	Cognition, MCI, Dementia	Age filter
"positive psycholog*"; "well-being"; "self-acceptance"; "purpose in life"; courage; bravery; valo?r; authenticity; honesty; love; kindness; generosity; nurturance; compassion; temperance; forgiveness; mercy; humility; modesty; prudence; "self-regulation"; "self-control"; transcendence; gratitude; hope; optimism; "future-mindedness"; "future orientation"; humo?r; playfulness; spirituality; religiousness; faith; "positive emotion*"; engagement; (meaning* adj3 life); accomplishment*; "positive affect"; "life satisfaction"; "personal growth"; "environmental mastery"; perseverance; industriousness; vitality; zest; enthusiasm; vigo?r; justice; loyalty; fairness; humanity; "social intelligence"; "emotional intelligence"; "personal intelligence"; "appreciation of beauty"; "appreciation of excellence"; awe; wonder; wisdom; creativity; originality; ingenuity; curiosity; "novelty-seeking"; "openness to experience"; "open-mindedness"; "critical thinking"	memory; dement*; alzheimer*; "cognition"; "Mild Cognitive Impairment"; "cognitive function*"; "cognitive impairment*"; "cognitive decline"; "cognitive deficit*"; "cognitive loss*"; "cognitive abilit*"; "cognitive status"; "cognitive change"; "cognitive performance"; "cognitive dysfunction*"	aged; aging; ageing; elder*; ((old or retired) adj2 (people* or patient* or inpatient* or in-patient* or outpatient* or out-patient* or client* or person* or individual* or wom?n or man or men or age)); older*; geriatr*; gerontolog*; senior*; senescen*; retiree*; sexagenarian*; septuagenarian*; octagenarian*; nonagenarian*; centenarian*; supercentenarian*; veteran*; midlife; "mid-life"; (late* adj2 life); retire*

Inclusion criteria

The inclusion criteria consisted of quantitative studies that were published in English in peer-reviewed journals. No restrictions regarding date of publication were used. As this is an emerging area, an exploratory and inclusive approach was adopted for designing the inclusion criteria and identifying relevant papers. Papers were included if they reported on at least one PPC (as defined above) and at least one objective measure of cognitive function (including global cognition, memory, or executive function) or a binary outcome measure of MCI

or dementia. The inclusion criteria for the sample included participants without identified cognitive impairment at baseline and a mean age of 50 or older at the point that the outcome measure was collected. Additionally, both cross-sectional and longitudinal designs were included. Qualitative studies, individual case studies, and literature reviews were excluded.

Screening procedure

Following the removal of duplicates, all papers were screened in accordance with the inclusion criteria by the primary reviewer. For this, a 3-stage process was used: title, abstract, full-text. A second independent reviewer screened 10% of studies at each stage and inter-rater reliability was calculated. Disagreements between reviewers were discussed and resolved through consensus meetings prior to commencing the next screening stage.

Data extraction

Data were extracted using a standardised form in Excel, including author name(s), year of publication, sample size, mean age of sample, demographic information of sample, country, length of follow up, type of PPC, measures used for predictor and outcome, covariates, and effect sizes. Effect sizes were extracted from samples without identified cognitive impairment, where this was not specified this was assumed. For cognitive outcome studies, cross-sectional results (both baseline and follow up) were also extracted from longitudinal studies where possible.

Risk of bias (quality) assessment

Longitudinal studies were assessed for risk of bias using the Newcastle-Ottowa Quality Assessment scale (Wells et al., 2014). MCI and dementia studies were scored out of 9, with scores of 7-9 representing ‘low risk’, 4-6 ‘medium risk’, and 3 or below ‘high risk’ (Table 2). Longitudinal cognitive outcome studies were scored out of 8 and considered low (7-8), medium (4-6), or high (<4) risk of bias (Table 3). Cross-sectional cognitive outcome studies were assessed using the Joanna Briggs Institute Checklist (Joanna Briggs Institute, 2017), with scores out of 7 representing low (6-7), medium (3-5), or high (<3) risk (Table 4).

Table 2: Risk of bias assessment for MCI and dementia studies (k = 11)

	Boyle 2010	Korthauer 2018	Sutin 2020	Gawronski 2016	Rawtaer 2017	Zhou 2020	Sutin 2018	Sutin 2021 (HRS)	Sutin 2021 (ELSA)	Sutin 2021 (TILDA)	Sutin 2021 (NHATS)
SELECTION **Representativeness of the exposed cohort**											
Representative of the average in the community □	**1**		**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Selected group of users		**0**									
No description											
Selection of the non-exposed											
Drawn from the same community as the exposed cohort □	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Drawn from a different source											
No description											
Ascertainment of exposure											
Secure record OR structured interview □											
Written self-report	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
No description											
Demonstration that outcome of interest was not present at start											
Yes □	**1**	**1**	**1**	**1**	**1**	**1**	**1**				
No								**0**	**0**	**0**	**0**
COMPARIBILITY **Comparability of cohorts on the basis of the design or analysis**											
Study controls for age and gender □	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Study controls for any additional factor (education, depression) □	**½**	**½**	**½**	**1**	**1**	**½**	**1**	**1**	**1**	**1**	**1**
OUTCOME											

Assessment of outcome											
Independent blind assessment OR record linkage □	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Self-report											
No description											
Was the follow up long enough for outcomes to occur?											
Yes □	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
No											
Adequacy of follow up of cohorts											
Complete follow up OR subjects lost to follow up and description provided of those lost □	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
No description of those lost											
No statement											
TOTAL	**7.5**	**6.5**	**7.5**	**8**	**8**	**7.5**	**8**	**7**	**7**	**7**	**7**

Table 3: Risk of bias assessment for longitudinal cognitive function studies (k = 20)

	Boyle 2010	Castro-Schilo 2019	Wilson 2013	Zhang 2021	Danhauer 2013	Ihle 2021	Bishop 2011	Sol 2020	Windsor 2015	Oh 2020	Shin 2021	Nystrom 2019	Nakanishi 2019	Berk 2017	Dewitte 2020	Gerstorf 2007	Kim 2019	Hittner 2020	Lewis 2021	Allerhand 2014
SELECTION																				
Representativeness of the exposed cohort																				
Representative of the average in the community □	**1**	**1**	**1**	**1**		**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Selected group of users					**0**															
No description																				
Selection of the non-exposed	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**	**NA**
Ascertainment of exposure																				
Secure record OR structured interview □																				
Written self-report	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
No description																				
Demonstration that outcome of interest was not present at start																				
Yes □	**1**		**1**	**1**	**1**		**1**	**1**				**1**		**1**						**1**
No		**0**				**0**			**0**	**0**	**0**		**0**		**0**	**0**	**0**	**0**	**0**	
COMPARABILITY																				
Comparability of cohorts on the basis of the design or analysis																				
Study controls for age and gender □	**1**	**NA**	**1**	**1**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**½**	**1**	**1**	**1**	**1**
Study controls for education and depression □	**½**	**NA**	**½**	**½**	**½**	**½**	**0**	**1**	**½**	**½**	**1**	**0**	**1**	**1**	**½**	**0**	**1**	**1**	**1**	**1**

OUTCOME **Assessment of outcome**																				
Independent blind assessment OR record linkage □	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Self-report																				
No description																				
Was the follow up long enough for outcomes to occur?																				
Yes □	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
No																				
Adequacy of follow up of cohorts																				
Complete follow up OR subjects lost to follow up and description provided of those lost □	**1**	**1**	**1**	**1**		**1**	**1**	**1**	**1**			**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
No description of those lost or No statement					**0**					**0**	**0**									
Total	**6.5**	**4**	**6.5**	**6.5**	**4.5**	**5.5**	**5**	**7**	**5.5**	**4.5**	**5**	**6**	**6**	**7**	**5.5**	**4.5**	**6**	**6**	**6**	**7**

Table 4: Risk of bias assessment for cross-sectional cognitive function studies (k = 17)

	Waldman-Levi 2020	Sharma 2017	Lewis 2017	Koenig 2004	Hill 2005	Jones 2003	Bishop 2012	Saad 2019	Requena 2009	Fung 2013	Aftab 2019	West 1984	Zahodne 2018	Wettstein 2015	Sutin 2021a	Sutin 2021b	Tani 2022
Were the criteria for inclusion in the sample clearly defined?	1	1	0	0	1	0	1	1	0	1	1	0	1	1	0	1	1
Were the study subjects and the setting described in detail?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Was the exposure measured in a valid and reliable way?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Were objective, standard criteria used for measurement of the condition?	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Were confounding factors identified?	NA	NA	1	1	NA	NA	NA	1	NA	1	NA	NA	1	NA	1	1	1
Were strategies to deal with confounding factors stated?	NA	NA	1	1	NA	NA	NA	1	NA	1	NA	NA	1	NA	1	1	1
Were the outcomes measured in a valid and reliable way?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Was appropriate statistical analysis used?	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Total	**5**	**5**	**6**	**6**	**7**	**4**	**5**	**7**	**4**	**7**	**5**	**4**	**7**	**5**	**6**	**7**	**7**

Statistical analysis and data synthesis

Findings from all studies have been reported as a narrative synthesis. Where at least two studies reported on the same PPC and outcome (e.g., binary measure of dementia or same cognitive domain), data was pooled in the form of a meta-analysis. Random effects meta-analyses were conducted in R using the *metafor* package (Viechtbauer, 2010). Relevant effect sizes (cognition: correlation, standardised beta; MCI/dementia: hazard ratios, odds ratios) were extracted from the included papers. All analyses were run using effect sizes from fully adjusted models. For MCI/dementia, 95% confidence intervals were calculated for each outcome. For cognitive function, analyses using beta coefficients were conducted using adjusted effect sizes and standard error and analyses using correlation coefficients transformed r to fisher's z then back to r. Heterogeneity of effect sizes across studies was assessed using the I^2 statistic and interpreted as either high (75%), moderate (50%), or low (25%) (Higgins et al., 2003). Meta-analytic data is presented in forest plots. Some studies were not pooled as the models used were not comparable. Additionally, where repeated samples occurred (i.e., drawn from the same data source), the study with the largest sample was used in the analysis. Due to the small number of studies in each analysis (<10) (Sterne et al., 2011) and the substantial heterogeneity present in some analyses (Terrin et al., 2003), publication bias was not assessed. Results for cognitive outcomes and MCI/dementia outcomes are presented separately. For cognitive outcomes, meta-regression of Survey of Health, Ageing and Retirement in Europe (SHARE) vs non-SHARE samples were conducted to explore heterogeneity in the meaning in life analyses.

Selection process

Initially, 31,914 studies were identified through database searches. After the removal of duplicates, 19,951 unique studies were screened against the inclusion criteria. First, papers were screened by title (reviewer agreement 97.3%). Next, 201 papers were screened by abstract (reviewer agreement 90%). At this stage, 4 papers were excluded as abstracts and full-texts were unable to be retrieved. Finally, 103 studies were read in full and assessed for eligibility (reviewer agreement 80%). The full selection process is presented in Figure 1.

Cognitive function studies

In total, 32 studies were identified for inclusion. Re-running searches prior to the final analysis identified another 5 eligible papers. Overall, 37 studies met criteria for final inclusion.

MCI and dementia studies

In total, 7 studies were eligible for inclusion. Re-running searches prior to the final analysis identified one additional paper (Sutin et al., 2021a). This paper included both a review and new analyses using data from four different cohorts. For the purpose of this review, results from the new analyses were extracted and treated as unique studies. Overall, 8 papers (11 unique studies) met the criteria for final inclusion.

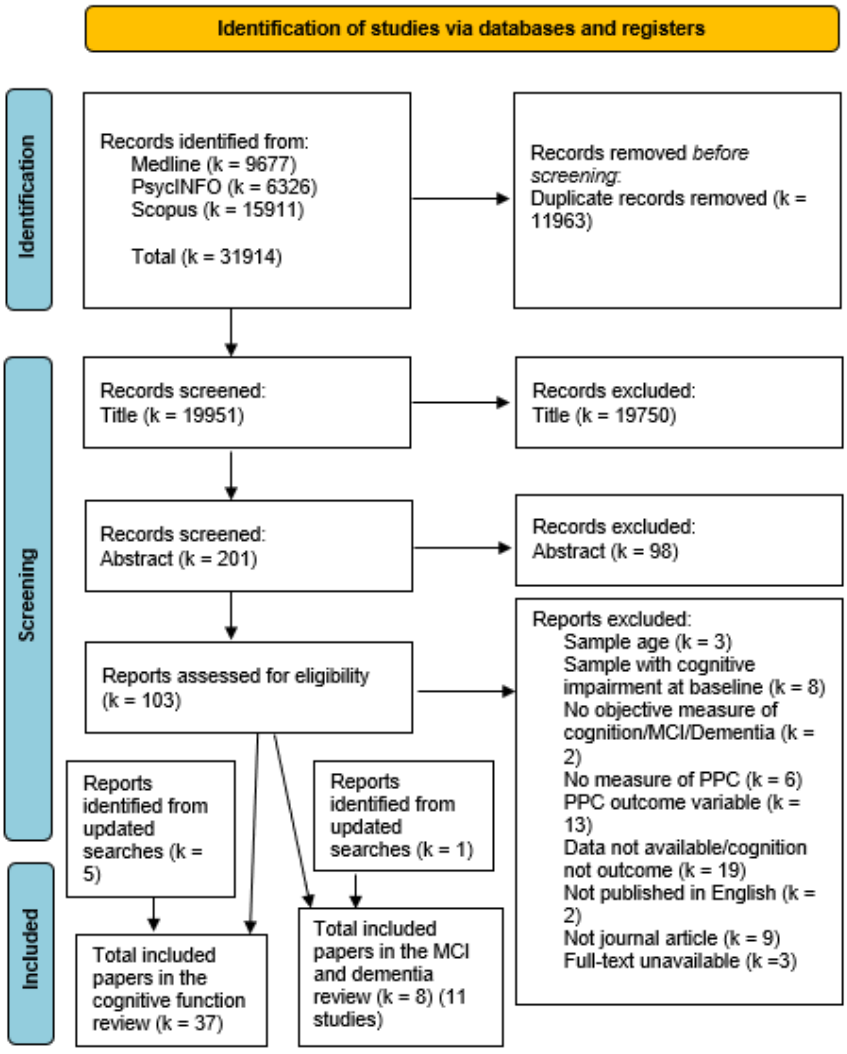

Figure 1: PRISMA flow diagram

Results: Cognitive function

Study characteristics (*k* = 37)

Study characteristics are reported in Table 5. In total, 37 studies were included in this review. Of these, 20 studies used longitudinal designs and 17 were cross-sectional. Cross-sectional findings were also reported in 8 of the longitudinal studies. All samples had a mean age of 50+ at baseline, although some papers included participants aged <50 years (Dewitte et al., 2020; Hittner et al., 2020; Lewis et al., 2017). Next, 20 studies specified that participants with dementia were excluded from their samples, 16 did not specify, and one study that examined multiple cohorts across different countries excluded participants with dementia in some samples but were unable to specify in others (Sutin et al., 2021c). The majority of the studies were conducted in North America (*k* = 21), or Europe (*k* = 10), with several conducted in Asia (k = 5). The PPCs investigated in studies included positive affect (k = 12), purpose in life (k = 11), life satisfaction (k = 8), positive wellbeing (k = 5), meaning in life (k = 2), all others (religiosity, emotional intelligence, creative thinking, self-control, industriousness, gratitude, hope, autonomy, environmental mastery, personal growth, self-acceptance, optimism) were included in one study only. Cognitive outcomes included cognitive state (k = 20), memory (k =20), executive function (k = 6), verbal fluency (k = 4), and processing speed (k =7). Quality assessment scores ranged from 4-7 for both cross-sectional and longitudinal studies, meaning studies were at medium-low risk of bias. As such, no studies were excluded from analyses based on the quality assessment ratings.

Table 5: Study characteristics for cognitive function studies

Study	Data source	Country	Baseline sample size	Mean age (range)	Sex (% female)	Predictor (measure)	Outcome (measure)	Main findings	Risk of bias
Cross-sectional									
Aftab (2019)	SAGE	USA	638	80.1 (61+)	46.1%	Meaning in life (Presence and Search subscales from MLQ)	Cognitive state (TICS-m)	Significant positive correlation between presence and cognition and negative correlation between search and cognition	Medium
Bishop (2012)	GCS	USA	137	99.7 (98+)	78.83%	Positive affect (BABS), Life satisfaction (LSI-A)	Cognitive state (SPMSQ)	Significant correlation between positive affect and cognition, but not between life satisfaction and cognition	Medium
Fung (2013)	N/A	Hong Kong	380	70.4 (60-97)	50.3%	Purpose in life (Chinese version of Purpose in life scale)	Cognitive state (MMSE)	Significant association between purpose and cognition	Low
Hill (2005)	MAAS	Netherlands	119	72.3 (65-82)	49.6%	Positive affect (PANAS)	Memory (VVLT)	Significant association between	Low

								positive affect and recall but not recognition	
Jones (2003)	N/A	USA	129	75.4 (65-89)	65.9%	Life satisfaction (PGC), Positive affect (PANAS)	Cognitive state (CERAD)	Significant correlation between both life satisfaction and positive affect with cognition	Medium
Koenig (2004)	N/A	USA	838	64.3 (50+)	53.1%	Religiosity (Hoge's 10-item scale)	Global cognitive function (MMSE)	Significant association between self-rated religiousness and cognition, non-significant association for intrinsic religiosity	Low
Lewis (2017)	MIDUS	USA	3,489	56.4 (32-84)	55%	Purpose in life (Ryff's subscale)	Cognitive state, Episodic memory, Executive function (BTACT, SGST)	Significant association between purpose and all cognitive outcomes	Low
Requena (2009)	N/A	Spain	340	71.6 (60-85)	91.2%	Life satisfaction (SWLS)	Memory (RBMT)	Significant negative correlation between life	Medium

								satisfaction and memory	
Saad (2019)	N/A	Israel	151	79 (60+)	63.6%	Emotional intelligence (AVEI)	Cognitive state (MoCA)	Significant association between emotional intelligence and cognition	Low
Sharma (2017)	N/A	India	58	(50-64)	56.9%	Creative thinking (TTCT)	Executive function (Stroop test), Memory (subtest of PGIMS)	Significant correlation between creativity and executive function, but not working memory	Medium
Sutin (2021a)	HRS, MIDUS, WLSG, WLSS, NCDS, TILDA, ELSI, SHARE	32 countries	>140,000 (See paper for details)	See paper for details. Note, not reported for samples excluding dementia	See paper for details. Note, not available for samples excluding dementia	Purpose in life (Ryff's subscale), Meaning in life (single item from CASP-19)	Memory (word list recall), Verbal fluency (animal naming)	Significant association between meaning and verbal fluency in all cohorts except SHARE Israel and with episodic memory in all cohorts except SHARE Israel and SHARE Malta, significant association between	Low

								purpose and episodic memory in all cohorts and with verbal fluency in all cohorts except Wisconsin Longitudinal Study sibling sample	
Sutin (2021b)	HRS	USA	2,516	69.3 (65+)	60%	Self-control (4 items), Industriousness (4 items)	Cognitive state (word learning and recall, logical memory, counting backwards, letter cancellation, SDMT, constructional praxis, animal fluency, Number series)	Significant association between industriousness and cognition, non-significant association between self-control and cognition	Low
Tani (2022)	NEIGE	Japan	478	(65-84)	51.5%	Gratitude (2 items from GQ-6)	Cognitive state (Japanese version of MMSE)	Significant association between gratitude and cognition	Low

Waldman-Levi (2020)	N/A	USA	39	74.9 (70+)	48.7%	Hope (IHS)	Cognitive state (MoCA)	Significant negative correlation between hope and cognition	Medium
West (1984)	N/A	Not specified	67	79.1 (65-90)	100%	Life satisfaction (LSI-A)	Memory (Unrelated/related free recall, digit span, related numbers)	Significant correlation between life satisfaction and related numbers task only	Medium
Wettstein (2015)	N/A	Germany	387	82.5 (75-94)	49.9%	Life satisfaction (SWLS), Positive affect (PANAS)	Processing speed (counting backwards), working memory (digit span backwards), reasoning (number series), semantic fluency (animal naming), abstraction (similarities)	Results stratified by sensory impairment: no significant association between life satisfaction and any cognitive outcome. Significant association between positive affect and processing speed only in both visually-impaired and hearing-impaired groups, and positive affect	Medium

								and semantic fluency only in sensory unimpaired group	
Zahodne (2018)	WHICAP	USA	548	74.6 (65+)	62.6%	Life satisfaction, Meaning/Purpose, Positive affect (Surveys from NIH toolbox)	Episodic memory, Working memory, Executive function, Verbal fluency, Processing speed (Neuropsychological battery)	Significant association between life satisfaction and episodic memory only, positive affect and processing speed only, and meaning/purpose with visuospatial and processing speed only	Low
Longitudinal									
Allerhand (2014)	ELSA	England	10,985	65 (50-90)	54.8%	Positive wellbeing (CASP-19)	Cognitive state, Executive function (animal naming), Memory (word list), Processing speed (letter cancellation)	Significant association between positive wellbeing and all cognitive outcomes	Low

Berk (2017)	MAAS	Netherlands	258	61 (40-82)	54%	Positive affect (PANAS)	Memory (VVLT), Executive function (CST), Processing speed (LDST)	Non-significant associations between positive affect and all cognitive outcome	Low
Bishop (2011)	GCS	USA	136	Not specified	Not specified	Positive affect (BABS)	Cognitive state (SPMSQ)	Non-significant association between positive affect and cognition	Medium
Boyle (2010)	RMAP	USA	698	80.4	74.9%	Purpose in life (Ryff's subscale)	Cognitive state (battery of 19 tests), Episodic memory (Logical memory story A, East Boston Story, Word list memory/recall/ recognition), Semantic memory (BNT, Verbal fluency, Reading test), Working memory (Digit span forwards/backwards, Digit ordering),	Significant association between purpose and all cognitive outcomes except visuospatial ability	Medium

							Perceptual speed (SDMT, Number comparison, Stroop test), Visuospatial ability (JLO, SPM)		
Castro-Schilo (2019)	SALSA	USA	1,789	70.6 (60+)	58.4%	Positive affect (4 positive items from CES-D)	Cognitive state (3MS), Verbal memory (SEVLT)	Significant association between baseline positive affect with cognition and memory but not rate of change, significant association between rate of change in positive affect with rate of change in cognition and memory	Medium
Danhauer (2013)	Co-STAR	USA and Canada	1,479	67.1 (65+)	100%	Positive affect (PANAS)	Cognitive state (3SME), Verbal knowledge (PMA vocabulary), Verbal fluency	Significant association between positive affect and verbal fluency measures only	Medium

							(letter and category fluency), Figural memory (BVRT), Verbal memory (CVLT, recall), Working memory (Digits forwards and backwards), Spatial ability (Card rotations), Fine motor speed (Finger tapping)		
Dewitte (2020)	MIDUS	USA	3,633	56.4 (32-84)	55.4%	Purpose in life (Ryff subscale), Positive affect (6 items)	Memory (word recall task from BTACT)	Significant cross-sectional and longitudinal correlations between purpose and memory, non-significant cross-lagged association. Significant correlation between positive affect	Medium

								and memory for follow up cross-sectional only	
Gerstorf (2007)	BASE	Germany	516	84.9 (70-103)	50%	Psychological wellbeing (PGC)	Perceptual speed (Digit letter, identical pictures)	Significant longitudinal association between psychological wellbeing and perceptual speed, non-significant cross-sectional correlation	Medium
Hittner (2020)	MIDUS	USA	991	55.5 (34-83)	54.5%	Positive affect (PANAS, ABS-GWB)	Memory (BTACT)	Significant association between both measures of positive affect with follow up memory and change, significant cross-sectional correlation between PANAS and memory at follow up but not baseline	Medium
Ihle (2021)	VLV	Switzerland	1,040	74.5 (64-96)	49.2%	Life satisfaction (SWLS)	Executive function (TMT part A)	Non-significant association between life	Medium

								satisfaction and change in executive function	
Kim (2019)	HRS	USA	11,525	72.6 (50+)	57.3%	Purpose in life (Ryff's subscale)	Cognitive state (recall, mental status tasks)	Significant association between purpose and cognition	Medium
Lewis (2021)	HRS	USA	4,599	74.3 (65-104)	56.8%	Purpose in life (Ryff's subscale)	Word recall, Mental status (TICS)	Significant association between purpose and baseline word recall and mental status but not longitudinal change	Medium
Nakanishi (2019)	NSHD	England, Scotland, Wales	703	52	100%	Autonomy, Environmental mastery, Personal growth, Purpose in life, Self-acceptance (42-item Ryff scales), Positive affect (WEMW),	Cognitive state (ACE-III)	Significant associations only found for higher personal growth and lower self-acceptance	Medium

						Life satisfaction (SWLS)			
Nystrom (2019)	BPCS	Sweden	586	70.2 (60-95)	55.3%	Subjective wellbeing (3 items)	Memory (Sentence recall, Category-cued recall, Face recognition, Word recall, Activity recall)	Non-significant association between subjective wellbeing and objective memory	Medium
Oh (2020)	HRS	USA	4,457	66.7 (50+)	50%	Optimism (LOT-R)	Memory (word recall), Mental status (serial 7's, counting backwards, orientation)	Significant cross-sectional and longitudinal association between optimism and both memory and mental status	Medium
Shin (2021)	HRS	USA	12,856	73.2 (50+)	57.7%	Purpose in life (Ryff's subscale)	Cognitive state, Fluid intelligence (word recall, serial subtraction, counting backwards), Crystallised intelligence (object	Significant association between purpose and all cognitive outcomes	Medium

							naming, orientation)		
Sol (2020)	NHATS	USA	9,411	76.2 (65+)	57.3%	Psychological wellbeing (5 items from Ryff's scale)	Memory (10-item list learning recall task)	Significant association between psychological wellbeing and baseline memory but not rate of change	Low
Wilson (2013)	RMAP	USA	759	80.3 (65+)	74.3%	Purpose in life (Ryff's subscale)	Cognitive state (2 Story tasks, Word list memory/recall/ recognition, BNT, Verbal fluency, Word recognition test, Digit span forwards/backwards, Digit ordering, SDMT, Number comparison, Stroop test, JLO, SPM)	Significant association between purpose and cognition	Medium
Windsor (2015)	ALSA	Australia	1,475	77.1 (70+)	50%	Purpose in life (Ryff's subscale)	Processing speed (DSS), Memory (immediate	Significant association between purpose and memory	Medium

							recall from BNT)	intercept and processing speed intercept and slope but not memory slope	
Zhang (2021)	CLHLS	China	9,487	81.2 (61-112)	48.1%	Psychological wellbeing (7 items)	Cognitive state (MMSE)	Significant association between psychological wellbeing and cognition	Medium

GCS = Georgia Centenarian Study; WHICAP = Washington Heights-Inwood Columbia Aging Project; SLAS = Singapore Longitudinal Ageing Study; VLV = Vivre-Leben-Vivere survey; SAGE = Successful Aging Evaluation; MAAS = Maastricht Aging Study; MIDUS = Midlife Development in the United States; Co-STAR = Cognition in the Study of Tamoxifen and Raloxifene; BPCS = Betula Prospective Cohort Study; BASE = Berlin Aging Study; HRS = Health and Retirement Study; ELSA = English Longitudinal Study of Ageing; RMAP = Rush Memory and Aging Project; NSHD = National Survey of Health and Development 1946; ALSA = Australian Longitudinal Study of Ageing; NEIGE = Neuron to Environmental Impact across Generations study; NHATS = National Health and Aging Trends Study; SALSA = Sacramento Area Latino Study on Aging; WLSG = Wisconsin Longitudinal Study Graduate sample; WLSS = Wisconsin Longitudinal Study Sibling sample; NCDS = National Child Development Study; TILDA = The Irish LongituDinal study; ELSI = Brazilian Longitudinal Study of Aging; SHARE = Survey of Health, Ageing and Retirement in Europe; CLHLS = Chinese Longitudinal Health Longevity Survey; BABS = Bradburn Affect Balance Scale; LSI-A = Life Satisfaction Index-A; SWLS = Satisfaction with Life Scale; PANAS = Positive and Negative Affect Schedule; AVEI = Audio Visual test of Emotional Intelligence; MLQ = Meaning in Life Questionnaire; PGC = Philadelphia Geriatric Center's Morale Scale-revised; CASP-19 = Control, Autonomy, Self-realisation and Pleasure Scale; ABS-GWB = Affect Balance Scale-General Well-being Schedule; WEMW = Warwick-Edinburgh Mental Wellbeing; LOT-R = Revised Life Orientation Test; GQ-6 = Gratitude Questionnaire Six-item Form; CES-D = Center for Epidemiologic Studies Depression Scale; TTCT = Torrance Test of Creative Thinking; IHS = Integrative Hope Scale; SPMSQ = Short Portable Mental Status Questionnaire; NIH = National Institutes of Health; PGIMS = Post Graduate Institute Memory Scale; MoCA = Montreal Cognitive Assessment; TMT = Trail Making Test; TICS = Telephone Interview for Cognitive Status; CERAD = Consortium to Establish a Registry for Alzheimer's Disease; VVLT = Visual Verbal Learning Test; CST = Concept Shifting Test; LDST = Letter Digit Substitution Test; MMSE = Mini Mental State Examination; BTACT = Brief Test of Adult Cognition by Telephone; PMA = Primary Mental Abilities; BVRT = Benton Visual Retention Test; CVLT = Modified California Verbal Learning Test; RBMT = Rivermead Behavioural Memory Test; SGST = Stop and Go Switch Task; SDMT = Symbol Digit Modalities Test; JLO = Judgement of Line Orientation; SPM = Standard Progressive Matrices; ACE-III = Addenbrooke's Cognitive Examination; DSS = Digit Symbol Substitution subscale; BNT = Boston Naming Task; 3MS = Modified Mini-Mental State Examination; SEVLT = Spanish and English Verbal Learning Test.

Life satisfaction

In total, eight studies investigated life satisfaction (Bishop et al., 2012; Ihle et al., 2021; Jones et al., 2003; Nakanishi et al., 2019; Requena et al., 2009; West et al., 1984; Wettstein et al., 2015; Zahodne et al., 2018).

Cross-sectional (*k* = 6)

Mixed results were observed from cross-sectional associations between life satisfaction and cognitive function. One study found a significant correlation between life satisfaction and cognitive state (Jones et al., 2003), whereas another found no significant correlation (Bishop et al., 2012). Studies testing the association between life satisfaction and specific cognitive domains generally found non-significant results (Wettstein et al., 2015; Zahodne et al., 2018) with the exception of a significant correlation with memory in two studies (Requena et al., 2009; Zahodne et al., 2018). However, mixed findings for memory were found in another study, suggesting that life satisfaction was positively correlated with the related numbers task but not the digit span or recall tasks (West et al., 1984). Findings from Requena et al. (2009) and Zahodne et al. (2018) were not pooled in the form of a meta-analysis as one used a binary measure of life satisfaction and the other used a continuous measure.

There was no evidence for a significant association between life satisfaction and cognitive state in meta-analysis (r = .17, 95% CI [-0.05, 0.38], p = .13, I^2 = 70.28%) (Figure 2).

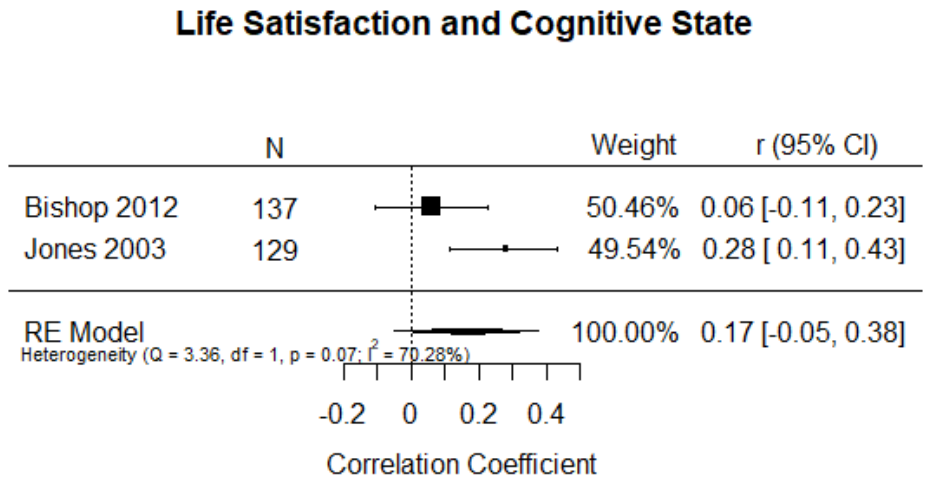

Figure 2: Life satisfaction and cognitive state (cross-sectional)

Longitudinal (*k* = 2)

No evidence was found for longitudinal associations between life satisfaction and later cognitive state (Nakanishi et al., 2019) or change in executive function (Ihle et al., 2021).

Positive affect

In total, twelve studies investigated positive affect (Berk et al., 2017; Bishop et al., 2011; Bishop et al., 2012; Castro-Schilo et al., 2019; Danhauer et al., 2013; Dewitte et al., 2020; Hill et al., 2005; Hittner et al., 2020; Jones et al., 2003; Nakanishi et al., 2019; Wettstein et al., 2015; Zahodne et al., 2018).

Cross-sectional (*k* = 7)

Findings revealed significant correlations between positive affect and cognitive state (Bishop et al., 2012; Jones et al., 2003). However, associations between positive affect and specific cognitive domains were generally non-significant (Zahodne et al., 2018), with the exception of processing speed (Wettstein et al., 2015; Zahodne et al., 2018) and memory where one study found a significant correlation with memory recall but not recognition (Hill et al., 2005) and two studies found a significant correlation between follow up positive affect and memory performance but not for baseline measures (Dewitte et al., 2020; Hittner et al., 2020).

Results from two meta-analyses of cross-sectional studies revealed that positive affect was significantly associated with cognitive function (r = .25, 95% CI [0.14, 0.36], p < .001, I^2 = 0.00%) (Figure 3) and memory (r = .05, 95% CI [0.02, 0.08], p < .001, I^2 = 0.00%) (Figure 4). Note, due to repeated samples (MAAS and MIDUS), Hill et al. (2005) and Hittner et al. (2020) were excluded from the memory analysis.

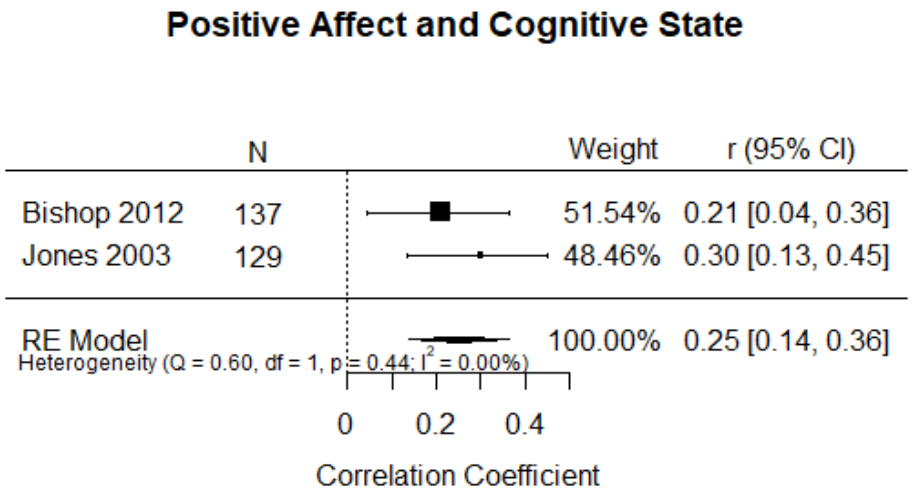

Figure 3: Positive affect and cognitive state (cross-sectional)

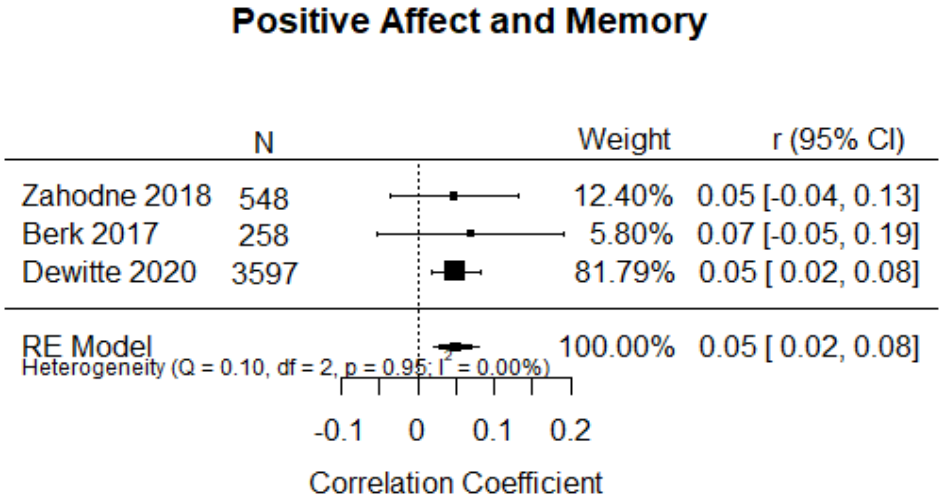

Figure 4: Positive affect and memory (cross-sectional)

Longitudinal (*k* = 7)

Findings generally revealed non-significant associations between positive affect and cognitive state (Bishop et al., 2011; Nakanishi et al., 2019). One study (Castro-Schilo et al., 2019) found that baseline positive affect was significantly associated with cognitive function and verbal memory three years later but not with rate of change, whereas rate of change in positive affect was significantly associated with rate of change in both cognitive outcomes. Studies that explored specific cognitive domains have also found little evidence for an association (Berk et al., 2017; Danhauer et al., 2013), with the exception of

letter and category fluency (Danhauer et al., 2013) and mixed findings for memory, with one study finding significant associations for both measures of positive affect (Hittner et al., 2020) and three studies finding no significant association (Berk et al., 2017; Danhauer et al., 2013; Dewitte et al., 2020).

Meta-analytic results for longitudinal studies found no evidence for an association between positive affect and memory (r = .12, 95% CI [-0.22, 0.44], p = .48), with substantial heterogeneity observed in this model (I^2 = 99.23%) (Figure 5). Note, due to repeated samples (MIDUS), Hittner et al. (2020) was excluded from this analysis.

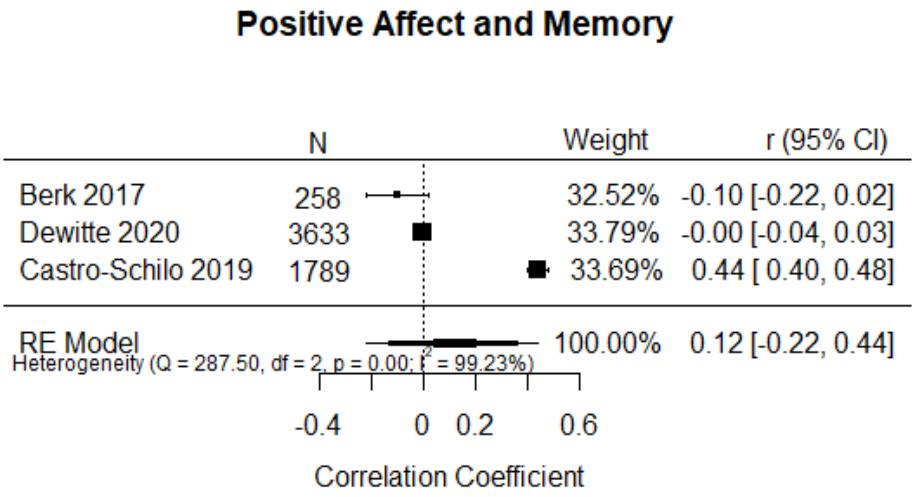

Figure 5: Positive affect and memory (longitudinal)

Meaning in life

In total, two studies (including analyses of 33 cohorts) investigated meaning in life (Aftab et al., 2019; Sutin et al., 2021c).

Cross-sectional (*k* = 2)

Aftab et al. (2019) found cognitive state was positively correlated with 'presence of meaning in life' and negatively correlated with 'search for meaning in life'. Sutin et al. (2021c) found significant associations with verbal fluency in all cohorts (total *n* = 24) except SHARE Israel, and with episodic memory in all cohorts (total *n* = 32) except SHARE Israel and SHARE Malta.

Meta-analytic results revealed significant associations between meaning in life and verbal fluency (b = 0.09, 95% CI [0.07, 0.11], p < .001) (Figure 6) and

memory (b = 0.10 95% CI [0.08, 0.12], p < .001) (Figure 7). However, significant heterogeneity was observed in both models (verbal fluency: I^2 = 89.24%; memory: I^2 = 92.06%). Where possible, all effect sizes for these analyses were taken from supplementary analyses that excluded participants with dementia (Sutin et al., 2021c), although demographic information was not provided for these subsamples meaning data were not available to conduct meta-regression for these factors. Instead, meta-regressions exploring differences in findings between SHARE and non-SHARE cohorts (NCDS, TILDA, ELSI) were conducted as Sutin et al. (2021c) identified this to be a potential source of heterogeneity in their full sample analyses. Results from these meta-regressions were non-significant for both memory (b = 0.05, 95% CI [-0.01, 0.11], p = .08) and verbal fluency (b = 0.05, 95% CI [-0.01, 0.10], p = .08). Due to substantial heterogeneity in both models, funnel plots were not used to assess publication bias (Terrin et al., 2003).

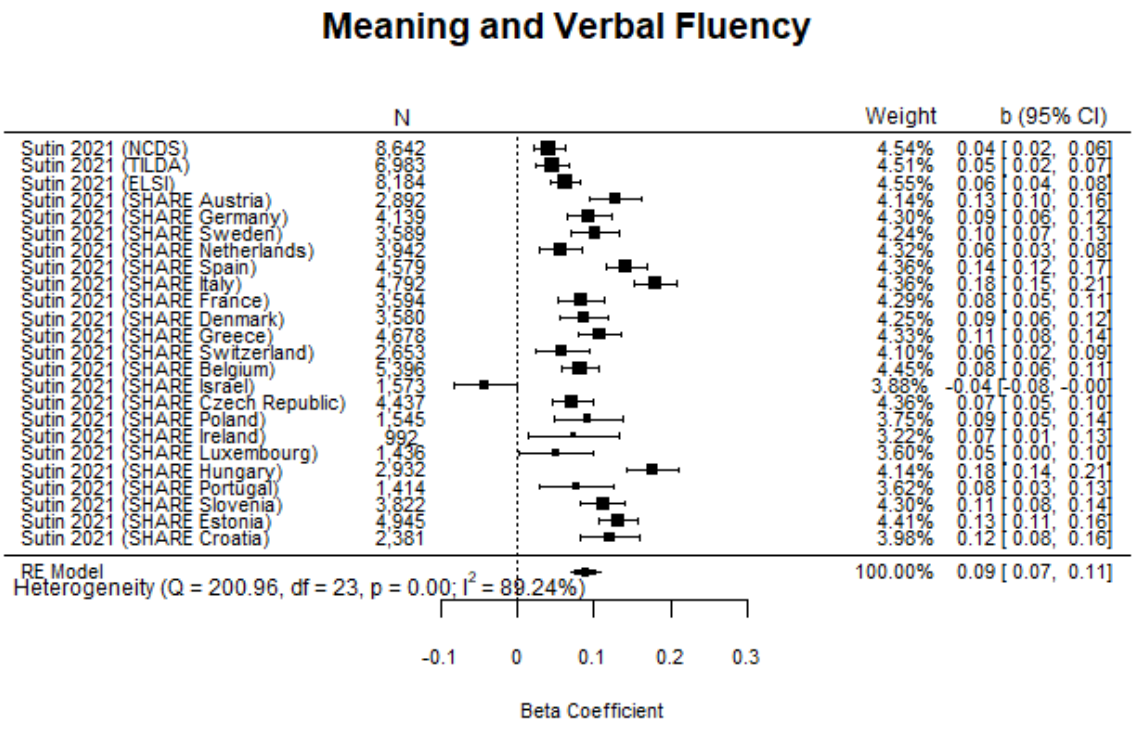

Figure 6: Meaning in life and verbal fluency (cross-sectional)

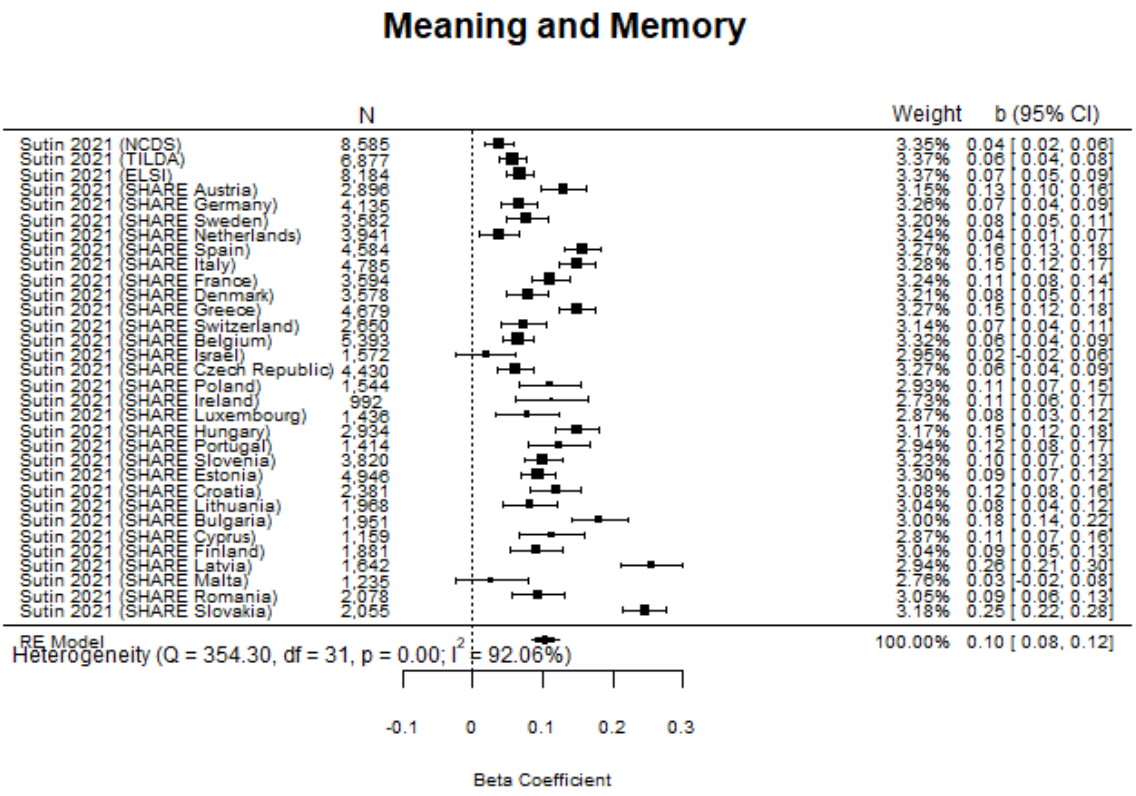

Figure 7: Meaning in life and memory (cross-sectional)

Purpose in life

In total, eleven studies investigated purpose in life (Boyle et al., 2010; Dewitte et al., 2020; Fung and Lam, 2013; Kim et al., 2019; Lewis and Hill, 2021; Lewis et al., 2017; Nakanishi et al., 2019; Shin et al., 2021; Sutin et al., 2021c; Wilson et al., 2013; Windsor et al., 2015).

Cross-sectional (*k* = 7)

Findings suggested that higher purpose in life was positively associated with cognitive state (Boyle et al., 2010; Fung and Lam, 2013; Lewis et al., 2017), memory (Boyle et al., 2010; Dewitte et al., 2020; Lewis and Hill, 2021; Lewis et al., 2017; Sutin et al., 2021c; Windsor et al., 2015), processing speed (Boyle et al., 2010; Windsor et al., 2015), and executive function (Lewis et al., 2017). Additionally, Sutin et al. (2021c) also found significant associations between purpose and verbal fluency in all cohorts except the Wisconsin Longitudinal Study sibling sample.

Results from meta-analyses revealed significant associations between purpose in life and memory (r = .13, 95% CI [0.08, 0.18], p < .001) (Figure 8) and verbal fluency (b = 0.07, 95% CI [0.05, 0.08], p < .001, I^2 = 0.00%) (Figure 9), although

substantial heterogeneity was observed in the memory model (I^2 = 89.64%). Due to repeated samples (MIDUS) in the memory analysis, Lewis (2017) and Sutin (2021) were excluded. This meta-analysis includes both correlational and beta effect sizes (Peterson and Brown, 2005).

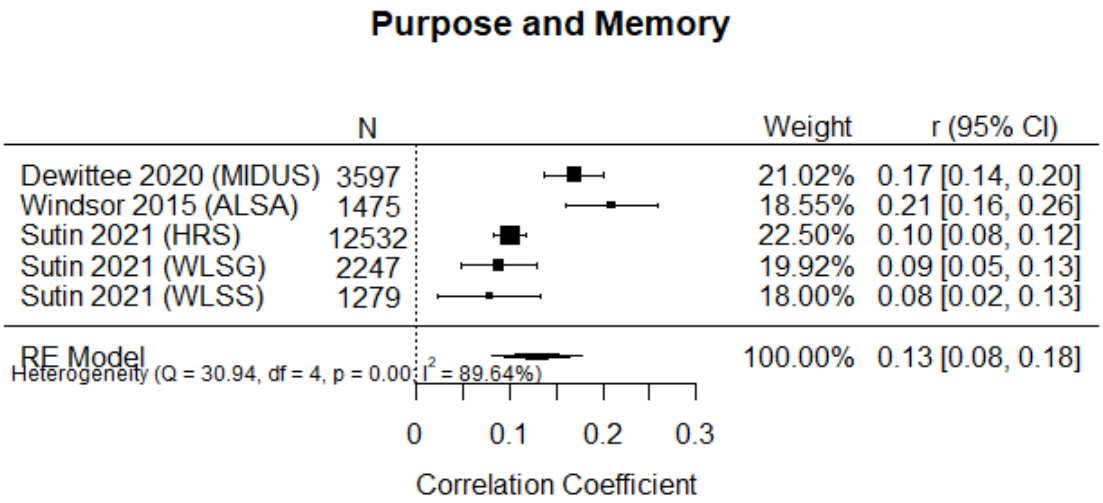

Figure 8: Purpose in life and memory (cross-sectional)

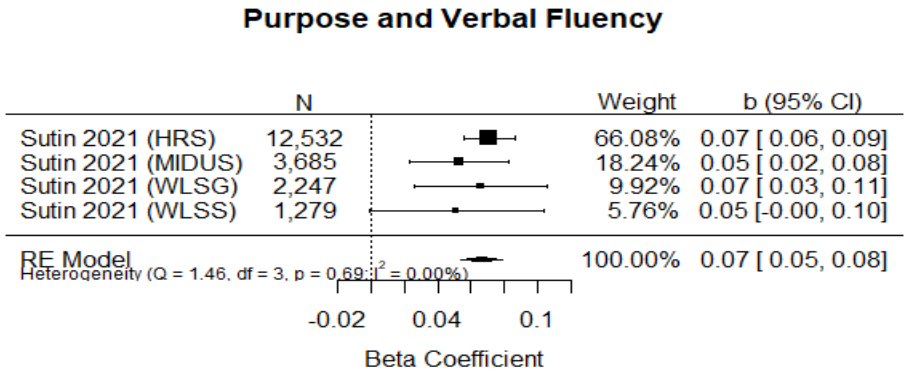

Figure 9: Purpose in life and verbal fluency (cross-sectional)

Longitudinal (*k* = 8)

In general, there was evidence for an association between purpose in life and cognitive state (Boyle et al., 2010; Kim et al., 2019; Shin et al., 2021; Wilson et al., 2013). However, one study (Nakanishi et al., 2019) found that the association between midlife purpose in life and later cognitive function became non-significant after controlling for childhood cognitive ability. Studies investigating specific cognitive domains found significant positive associations between purpose in life and processing speed (Boyle et al., 2010; Windsor et

al., 2015), but mixed results for memory with one study finding significant associations with memory change (episodic, semantic, working) (Boyle et al., 2010) and two studies finding no significant association (Lewis and Hill, 2021; Windsor et al., 2015). Further, one study (Dewitte et al., 2020) found positive correlations between purpose in life and memory, although cross-lagged results were only significant when positive affect, negative affect, and self-related health were removed as covariates.

Wellbeing

In total, five studies investigated various types of positive wellbeing (Allerhand et al., 2014; Gerstorf et al., 2007; Nystrom et al., 2019; Sol et al., 2020; Zhang et al., 2021).

Longitudinal (*k* = 5)

Allerhand et al. (2014) investigated multiple cognitive domains and found significant positive associations between wellbeing (control, autonomy, self-realisation, pleasure) and all cognitive outcomes (cognitive state, executive function, memory, processing speed). Zhang et al. (2021) found that wellbeing (optimism, conscientiousness, neuroticism, loneliness, personal control, self-esteem, happiness) was significantly associated with slower decline in cognitive state. Gerstorf et al. (2007) found that wellbeing (non-agitation, aging satisfaction, life satisfaction) was significantly associated with change in perceptual speed, but not baseline level. Finally, Sol et al. (2020) used items from Ryff's psychological wellbeing scale and found a significant association with baseline memory but not rate of memory decline, whereas Nystrom et al. (2019) found no significant cross-sectional or cross-lagged association between subjective wellbeing (life satisfaction, happiness, enjoyment of life) and memory. Due to differences in the measures and definitions of wellbeing used, these studies were not pooled in the form of a meta-analysis.

Other PPCs

Nine studies investigated other PPCs (Koenig et al., 2004; Nakanishi et al., 2019; Oh et al., 2020; Saad et al., 2019; Sharma and Babu, 2017; Sutin et al., 2021b; Tani et al., 2022; Waldman-Levi et al., 2020; Zahodne et al., 2018).

Cross-sectional (*k* = 7)

One study explored multiple cognitive domains and found significant positive correlations between a combined measure of meaning and purpose in life with visuospatial function and working memory only (Zahodne et al., 2018). Another study investigated facets of conscientiousness and found that industriousness was significantly associated with better cognitive state independent of the other facets, whereas self-control was non-significant (Sutin et al., 2021b). Other individual studies found significant positive associations for emotional intelligence (Saad et al., 2019), hope (Waldman-Levi et al., 2020), and gratitude (Tani et al., 2022) with cognitive state, although no significant association was found for intrinsic religiosity (Koenig et al., 2004). Finally, findings from Sharma and Babu (2017) suggested that creative thinking was significantly correlated with executive function but not with working memory.

Longitudinal (*k* = 2)

Nakanishi et al. (2019) found that higher personal growth and lower self-acceptance in midlife were significantly associated with better cognitive state at age 69, however no significant association was found for autonomy or environmental mastery. Oh et al. (2020) found a significant association between optimism and both memory and mental status.

Results: Mild cognitive impairment and dementia

Study characteristics (*k* = 8, 11 studies)

Study characteristics are reported in Table 6. From the eight papers (11 studies) included, all were longitudinal and used data from the following datasets: Health and Retirement Study (*k* = 3), Singapore Longitudinal Ageing Study (*k* = 1), Chinese Longitudinal Healthy Longevity Survey (*k* = 1), Rush Memory and Aging Project (*k* = 1), Women's Health and Initiative Memory Study (*k* = 1), Survey of Health, Ageing and Retirement in Europe (*k* = 1), English Longitudinal Study of Aging (*k* = 1), The Irish LongituDinal study on Ageing k*n* = 1), and National Health Trends and Aging Study (*k* = 1). All samples had a mean age of 60+ and included 62,520 unique participants. One paper excluded participants with dementia at baseline and the first follow up (Boyle et al., 2010),

six papers excluded any cognitive impairment at baseline (Gawronski et al., 2016; Korthauer et al., 2018; Rawtaer et al., 2017; Sutin et al., 2020; Sutin et al., 2018b; Zhou et al., 2020), and one paper (4 studies) did not explicitly specify (Sutin et al., 2021a). Studies were conducted in USA (*k* = 6), Singapore (*k* = 1), China (*k* = 1), England (*k* = 1), Ireland (*k* = 1), and one multinational study covering 14 countries (Denmark, Sweden, Czech Republic, Poland, Austria, Belgium, France, Germany, Switzerland, the Netherlands, Greece, Italy, Spain, Israel). One study reported on multiple PPCs (life satisfaction, positive affect, purpose in life, optimism, perceived mastery), three studies reported on meaning in life, and one study reported on the following individual PPCs: life satisfaction, positive affect, purpose in life, optimism, purpose/meaning in life, psychological wellbeing. Outcomes reported included dementia (*k* = 5), MCI (*k* = 2), dementia-MCI combined (*k* = 1), and cognitive impairment (*k* = 3). Quality assessment scores ranged between 6.5-8, with most studies being rated as having low risk of bias (*k* = 10).

Table 6: Study characteristics for MCI and dementia studies

Study	Data source	Country	Sample size	Mean age	Sex (% female)	PPC assessed	PPC measure	Outcome assessed	Outcome measure	Covariates	Follow up length	Risk of bias
Boyle 2010	Rush MAP	USA	698	80.4	74.9	Purpose in life	10-item Ryff's PWB subscale	MCI	Clinical diagnosis	Age, Sex, Education	1-7 years	Low
Gawronski 2016	HRS	USA	4,624	75	57	Optimism	LOT-R	Incident cognitive impairment	TICSm/ 16-item IQCODE	Age, Sex, Race/ ethnicity, Marital status, Education, Wealth, Smoking, Exercise, Alcohol, Heart disease, Hypertension, Diabetes, BMI	4 years	Low
Korthauer 2018	WHISCA	USA	2,137	73.9	100	Positive affect	PANAS	MCI Probable dementia	3MS, neuropsychiatric evaluation	Age, Race, Education, Randomisation arm, Marital Status, Smoking Status, Alcohol consumption, Exercise, BMI, Blood pressure, Antidepressant use, Hypertension, CVD/stroke/TIA, Diabetes, High cholesterol	1-20 years	Medium

Rawtaer 2017	SLAS	Singapore	1,601	64.9	64.5	Life satisfaction	4-item Life Satisfaction Scale	MCI-Dementia	CDR	Age, Gender, Education, Smoking, Alcohol, Dyslipidemia, Hypertension, Diabetes, Obesity, History of stroke/heart disease, APOE allele status, Depression, Physical activities, Social activities, Productive activities, Living alone, Loneliness, Marital status	8 years	Low
Sutin 2018b	HRS	USA	10,099	67.03	60	Life satisfaction Optimism Mastery Positive affect 2006 Positive affect 2008 Purpose in life	SWLS LOT-R 5-item scale 6-items scale 13-items scale 7-item Ryff's PWB subscale	Dementia incidence	TICSm	Age, Sex, Race, Ethnicity, Education, Depressive symptoms, History of a mental disorder	6-8 years	Low
Sutin 2020	SHARE	14 European countries	22,514	63.88	55.7	Meaning in life	Single question (4-point scale)	Incident cognitive impairment	Memory recall and animal naming	Age, Sex, Education, Marital status	3-9 years	Low
Sutin 2021a	HRS	USA	11,520	67.85	59.7	Purpose in life	7-item Ryff's PWB subscale	Dementia incidence	TICSm	Age, Gender, Race/ethnicity, Education,	10-12 years	Low

										Diabetes, Hypertension, Smoking, Obesity, Depression, Physical activity		
Sutin 2021a	ELSA	England	7,781	64.10	55.1	Meaning in life	Single question (4-point scale)	Dementia incidence	Clinical diagnosis IQCODE	Age, Gender, Race/ethnicity, Education, Diabetes, Hypertension, Smoking, Obesity, Depression, Physical activity	16 years	Low
Sutin 2021a	TILDA	Ireland	4,917	61.88	55.9	Meaning in life	Single question (4-point scale)	Dementia incidence	MMSE	Age, Gender, Race/ethnicity, Education, Diabetes, Hypertension, Smoking, Obesity, Depression, Physical activity	6 years	Low
Sutin 2021a	NHATS	USA	4,354	76.84	59.2	Purpose/ meaning in life	Single question (3-point scale)	Dementia incidence	3 tasks (word recall, orientation, clock drawing) Clinical diagnosis AD8	Age, Gender, Race/ethnicity, Education, Diabetes, Hypertension, Smoking, Obesity, Depression, Physical activity	8 years	Low

Zhou 2020	CLHLS	China	6,998	80.97	51.2	Psychological wellbeing	4 positive items and 3 negative items	Cognitive impairment	Chinese revised version of MMSE	Age, Gender, Education, Baseline cognitive function, Working status, Diabetes, CVD, Activities of daily living disability, BMI, Smoking, Alcohol, Exercise	3 years	Low

MCI = Mild cognitive impairment; BMI = Body mass index; CVD = Cardiovascular disease; TIA = Transient ischaemic attack; SWLS = Satisfaction with life scale; LOT-R = Life Orientation Test; PANAS = Positive and Negative Affect Schedule; TICSm = modified Telephone Interview for Cognitive Status; CDR = Clinical Dementia Rating Scale; 3MS = Modified Mini-Mental State Examination; IQCODE = Informant Questionnaire on Cognitive Decline in Elderly; MMSE = Mini-Mental State Examination; AD8 = AD8 Dementia Screening interview; HRS = Health and Retirement Study; SLAS = Singapore Longitudinal Ageing Study; Rush MAP = Rush Memory and Aging Project; WHISCA = Women's Health Initiative Memory Study (cognition and affect); SHARE = Survey of Health, Ageing and Retirement in Europe; CLHLS = Chinese Longitudinal Health Longevity Survey; ELSA = English Longitudinal Study of Aging; TILDA = The Irish LongituDinal study on Ageing; NHATS = National Health Trends and Aging Study.

Positive affect

Two studies, including 3 distinct samples, reported on the association between positive affect and risk of dementia. Korthauer et al. (2018) found that there was a significant association between negative affect and risk of MCI and dementia, however no significant association was found for positive affect for either outcome. Sutin et al. (2018b) reported results for two separate subsamples. One sample (*N* = 5390) completed a 6-item scale in 2006 and the other (*N* = 4709) completed a 13-item scale in 2008. Findings from this paper revealed that the association between positive affect and risk of developing dementia was significant in the 2008 sample only. Pooling these results in the form of a meta-analysis found that positive affect was not significantly associated with future risk of dementia (HR = 0.94, 95% CI [0.76, 1.15], p = .54, I^2 = 58.23%) (Figure 10). The test for heterogeneity was non-significant (p = .09).

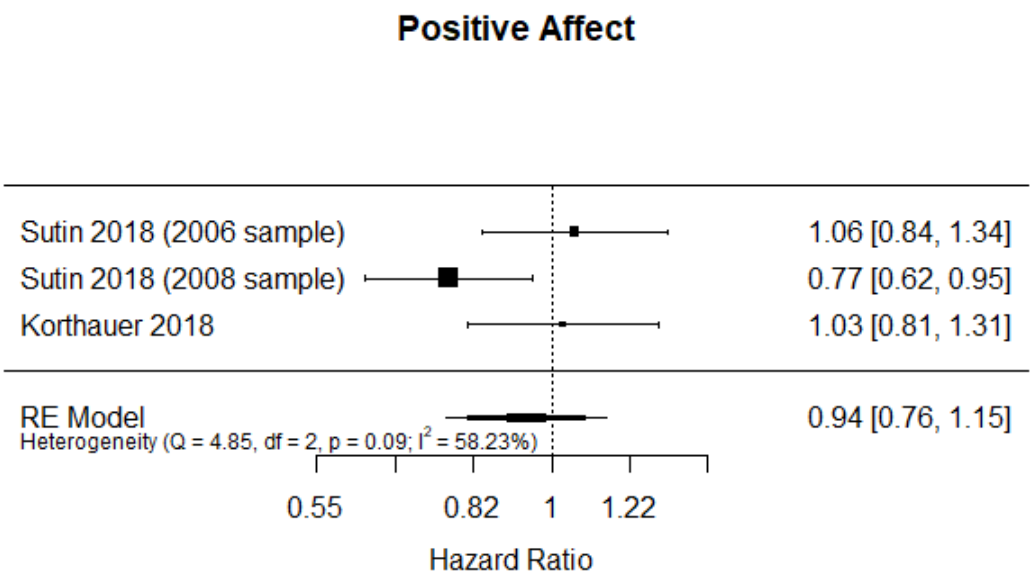

Figure 10: Positive affect and risk of dementia

Purpose and meaning in life

Three studies (including data from six different samples) reported on purpose or meaning in life (Boyle et al., 2010; Sutin et al., 2021a; Sutin et al., 2020). Note, data for purpose in life from Sutin et al. (2018b) have not been included in the analyses in this section as Sutin et al. (2021a) provided updated findings using the same data source (HRS). Further, whilst Boyle et al. (2010) investigated both dementia and MCI as outcomes, only results for MCI were included in

these analyses as participants with MCI at baseline were present in the dementia analysis. The included studies revealed that purpose/meaning in life was significantly associated with reduced risk of cognitive impairment (Sutin et al., 2020), MCI (Boyle et al., 2010), and dementia (Sutin et al., 2021a). Findings from Boyle et al. (2010) revealed that baseline purpose in life was significantly associated with reduced risk of MCI and remained significant in a sensitivity analysis accounting for persistent MCI (present at 2 or more examinations). Next, Sutin et al. (2020) explored the association between meaning in life and cognitive impairment in a sample of over 22,000 participants across 14 different countries. Findings from this study revealed that lower meaning in life was associated with greater risk of cognitive impairment. This result remained consistent across sensitivity analyses (excluding participants under age 65, excluding participants who developed impairment within 5 years, controlling for income) and separate analyses of each European region. Finally, Sutin et al. (2021a) found significant associations between purpose/meaning in life and dementia incidence across separate analyses of 4 different cohorts (HRS, ELSA, TILDA, NHATS). These results remained consistent when also controlling for known clinical and behavioural risk factors for dementia (depression, obesity, diabetes, hypertension, smoking, physical inactivity).

Meta-analytic results revealed that purpose in life was significantly associated with a reduced risk of MCI-dementia (HR = 0.82, 95% CI [0.77, 0.86], $p < .001$, $I^2 = 0.00\%$) (Figure 11) and meaning in life was significantly associated with a reduced risk of cognitive impairment-dementia (HR = 0.81, 95% CI [0.76, 0.85], $p < .001$, $I^2 = 0.00\%$) (Figure 12). Next, meta-analyses were conducted to explore combined effects of purpose/meaning in life. Results revealed significant associations between purpose/meaning with reduced risk of all outcomes combined (cognitive impairment, MCI, dementia) (HR = 0.81, 95% CI [0.78, 0.84], $p < .001$, $I^2 = 0.00\%$) (Figure 13) and dementia outcomes specifically (HR = 0.81, 95% CI [0.78, 0.85], $p < .001$, $I^2 = 0.00\%$) (Figure 14). No significant heterogeneity was found in any of the models.

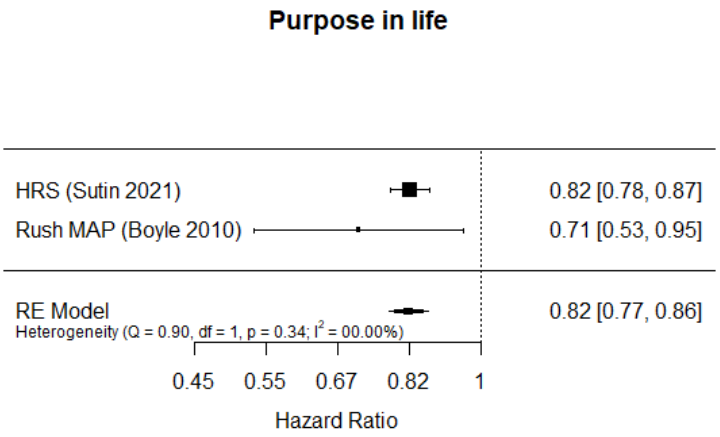

Figure 11: Purpose in life and risk of MCI/dementia

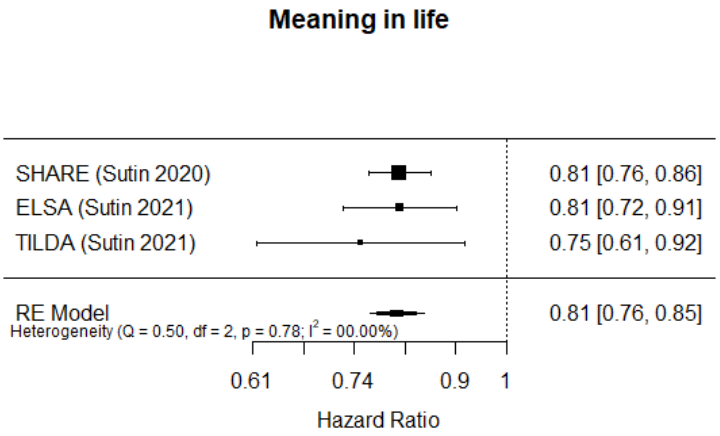

Figure 12: Meaning in life and risk of cognitive impairment/dementia

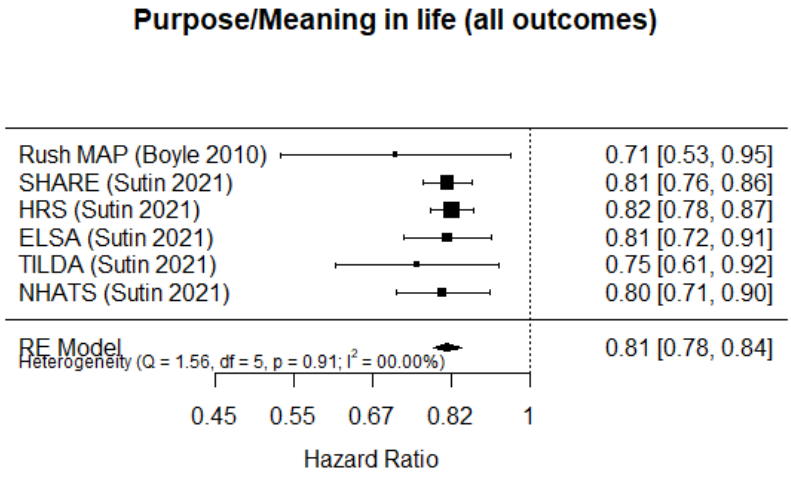

Figure 13: Purpose/Meaning in life and risk of MCI/dementia

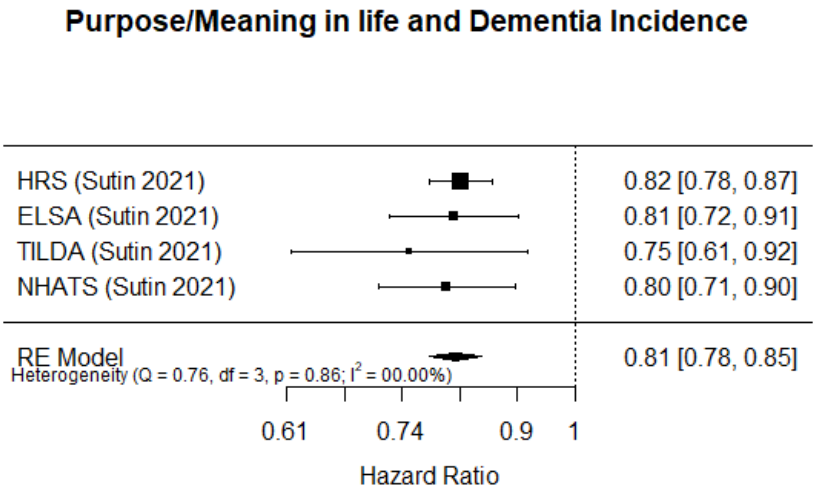

Figure 14: Purpose/Meaning in life and risk of dementia

Life satisfaction

Two studies reported on life satisfaction, however due to differences in measures used (continuous vs. binary) it was decided that it was not appropriate to pool these results in the form of a meta-analysis. Sutin et al. (2018b) found a significant association between life satisfaction and risk of dementia, however this effect was no longer significant when controlling for depressive symptoms. Rawtaer et al. (2017) controlled for depression and found a significant association between being 'very satisfied with life' and a reduced risk of developing MCI-dementia.

Optimism

Two studies investigated optimism, however as both used data from the Health and Retirement Study these were not combined in a meta-analysis. Sutin et al. (2018b) found no significant association between optimism and dementia incidence (defined as ≤ 6 out of 27 on TICSm). Gawronski et al. (2016) found that optimism was significantly associated with a reduced likelihood of developing cognitive impairment (defined as ≤ 10 out of 35 on TICSm). This effect persisted across models, including when adjusting for symptoms of depression and anxiety and when excluding participants with outcome scores within 1 standard deviation of the threshold used to indicate cognitive impairment.

Other PPCs

Due to insufficient number of studies for the remaining PPCs identified, results have been described narratively only. First, Sutin et al. (2018b) found no significant association between perceived mastery and risk of dementia incidence. Next, Zhou et al. (2020) used data from the Chinese Longitudinal Health Longevity Survey to explore the association between psychological wellbeing and cognitive impairment. In this study, the measure of psychological wellbeing was comprised of 4 positive items (optimism, conscientiousness, sense of personal control, and positive feelings about aging) and 3 negative items (neuroticism, loneliness, and perceived loss of self-worth). Results suggested that higher psychological wellbeing was significantly associated with reduced odds of cognitive impairment.

Discussion

This review aimed to synthesise evidence regarding associations between PPCs with cognitive function, MCI, and dementia. Findings for cognitive function and MCI/dementia are summarised below. The general discussion largely focuses on findings for MCI/dementia; however strengths, limitations, and implications are presented for the review as a whole.

Summary of findings

Cognitive function

Cross-sectional meta-analytic findings revealed significant associations for positive affect (with cognitive state and memory), purpose in life (with memory and verbal fluency), and meaning in life (with memory and verbal fluency). No significant cross-sectional association was found between life satisfaction and cognitive state. The only meta-analysis using longitudinal findings found no significant association between positive affect and memory. Findings from the narrative review suggested promising evidence for purpose in life with various cognitive domains, although evidence for longitudinal associations with memory was mixed. Mixed results were also observed for positive affect, particularly between cross-sectional and longitudinal evidence. Similarly, mixed findings were also reported for positive wellbeing studies, although it is worth noting that due to different wellbeing definitions these studies were not directly comparable.

Next, little evidence was found for associations between life satisfaction and any cognitive domain, with the exception of some significant cross-sectional findings for memory. Finally, findings from individual studies highlighted PPCs such as hope, personal growth, optimism, emotional intelligence, and creative thinking may be of potential interest for further investigation. Despite some significant findings from meta-analyses, these results should be interpreted with caution due to small effect sizes and some broad confidence intervals indicating uncertainty regarding the actual size of the effect.

MCI and dementia

Meta-analytic results revealed that higher purpose and meaning in life were significantly associated with a reduced risk of all clinical cognitive impairment outcomes, however results for positive affect were non-significant. Moreover, findings for purpose/meaning in life remained stable across analyses, suggesting that higher purpose/meaning is associated with a reduced rate of clinically significant cognitive impairment by nearly 20%. Whilst these results should be interpreted with caution due to the small number of studies, findings for purpose/meaning in life are consistent with those from another meta-analysis (Sutin et al., 2021a). Sutin et al. (2021a) found promising evidence for the association between combined purpose/meaning in life and risk of dementia using data from four unique cohorts, however there were limitations in that it included one sample with cognitive impairment at baseline. The present review builds on this work by exploring the effects of purpose and meaning in life individually and their combined effect on risk of dementia in a sample without identified cognitive impairment at baseline.

General discussion

Overall, the present findings provide promising evidence for the possible protective effects of purpose and meaning in life, whereas constructs such as positive affect and life satisfaction may be less important for maintaining cognitive health. It is possible that differences between eudemonic and hedonic approaches to wellbeing may lend some explanations for the different findings for these PPCs. As discussed in Chapter 1, the literature distinguishes between hedonic wellbeing characterised by the pursuit and experience of pleasure (e.g., positive affect) and positive evaluations (e.g., life satisfaction) and eudemonic

wellbeing characterised by the pursuit and experience of meaning and personal growth (e.g., purpose and meaning in life) (Ryff et al., 2021). In this sense, it may be that eudemonic wellbeing plays a more important role in protecting against cognitive decline and dementia than hedonic wellbeing. One possible explanation for this may be that individuals with higher eudemonic wellbeing may be more likely to engage in other protective behaviours and activities. For example, previous research has found associations between purpose/meaning in life and other protective factors, such as social connectedness (Stavrova and Luhmann, 2016) and physical activity (Yemiscigil and Vlaev, 2021). Similarly, it is also possible that eudemonic wellbeing may be associated with fewer risk factors for cognitive decline and dementia (e.g., depression), although many studies adjusted for depression suggesting the effect may be independent of this. Taken together, it may be that individuals with higher eudemonic wellbeing may be more likely to have healthier lifestyles with an additive protective effect and in turn increase resilience regarding possible risk factors. There are several possible pathways the protective effects of purpose and meaning in life could be operating through (causal, reverse causality, prodromal). If this effect is causal, then there are several possible mechanisms that could be proposed, including neurobiological, behavioural, or a mixture of both. For example, previous research has suggested that purpose in life may be associated with faster recovery to baseline cortisol levels after experiencing stress (Fogelman and Canli, 2015). As there is growing evidence for an association between higher cortisol levels and risk of dementia (Ouanes and Popp, 2019), there may be a protective neurobiological effect of purpose in life through its association with response to and recovery from stressful events. More research is needed to better understand the mechanisms and pathways for these protective effects.

With regards to positive affect, there are several possible explanations for the difference between cross-sectional and longitudinal findings from cognitive function studies. Previous research has suggested that higher positive affect on the day of memory task administration is associated with better performance (Brose et al., 2014), thus it may be that positive affect may have some protective effect on later cognitive function if it is maintained. Alternatively, it may be that these differences in findings reflect reverse causality. For example, it is possible that significant cross-sectional results suggest that poor memory

leads to poorer positive affect, whereas the measure of positive affect precedes the measure of memory in longitudinal studies the effect is not found. However, no significant associations were found from longitudinal studies that explored this association (Bishop et al., 2011; Hittner et al., 2020). Another explanation may be due to the inclusion of studies with the largest sample as it appears that the overall cross-sectional association between positive affect and memory may be being driven by the inclusion of Dewitte et al. (2020) (*n* = 3,633). For the dementia outcome studies, differences in findings for positive affect may be attributed to the measures used. In Sutin et al. (2018b) both measures included positive emotions only, however a significant association was only found for the 2008 sample that used a measure including a wider range of positive emotions. Korthauer et al. (2018) explored both positive and negative affect and only found significant effects for negative affect. It may be that the absence of negative affect may be more protective than the presence of positive affect.

From the narrative synthesis for MCI/dementia outcome studies, the mixed results observed for optimism and life satisfaction may also reflect the importance of considering how these PPCs relate to negative psychological factors. Arguably, as constructs that contribute to positive and negative mental health are related, it is important to consider both in parallel. For optimism, whilst both studies used versions of the Life Orientation Test from the Health and Retirement Study, the definitions used varied across studies. For example, Sutin et al. (2018b) used the 3 positive items only, whereas Gawronski et al. (2016) combined both positive and negative (reversed scored) items as a composite. In this respect, aside from exploring different cognitive outcomes, the findings were not comparable as the predictors measured fundamentally different concepts of optimism – one regards optimism independently from pessimism and the other defines optimism in terms of presence of optimism and absence of pessimism. It is important to make this distinction as previous research that has investigated the association between optimism/pessimism as independent but related factors and physical health outcomes found a significant association for the presence of optimism but a stronger effect for the absence of pessimism (Scheier et al., 2021). This may also lend some explanation as to why significant results were found by Gawronski et al. (2016) but not by Sutin et al. (2018b). Similarly, Sutin et al. (2018b) found that the

association between life satisfaction and risk of dementia was no longer significant after controlling for depressive symptoms. The authors suggested that anhedonia (inability to feel pleasure) experienced in depression may lend some explanation and that the association between life satisfaction and dementia risk is not independent of negative emotions. However, Rawtaer et al. (2017) found a significant association even when controlling for depression. Instead, the mixed findings for life satisfaction may relate to the measures used. Whilst both studies used shorter scales (4-5 items), one treated life satisfaction as a continuous variable and the other used binary coding. It is possible that treating life satisfaction as a categorical variable may increase the risk of a false positive result (Altman and Royston, 2006).

Strengths and limitations

This is the first review to synthesise evidence regarding associations between an extensive list of PPCs with cognitive function, MCI, and dementia. As such, it provides a valuable foundation for future research to build upon by identifying promising areas and those that have been under researched. However, as this is an emerging research area, there are also several notable limitations. First, due to the broad nature of the topic, there was some difficulty contextualising and optimising the search terms. As a result, whilst a comprehensive list of PPC search terms were used, there are several others that were not covered (e.g., interest, elevation). Next, many of the PPC terms included have not yet been explored in the literature. Moreover, at present there are few studies reporting on the same individual PPC and often definitions and measures used differed across studies. For example, whilst two studies reported on associations between life satisfaction and risk of dementia, the measures used were not directly comparable. Thus, it was not appropriate to statistically synthesise evidence for some PPCs. Similarly for cognitive function outcomes, current longitudinal studies reporting on the same PPC were either not directly comparable or used participants from the same population. Where repeated samples occurred, this review included the study with the largest sample in the meta-analysis. As such, it is possible that findings were inadvertently biased towards a ‘significant’ effect since significance becomes more likely the larger the sample size. Additionally, most analyses used cross-sectional designs and were unable to explore associations with pre-clinical cognitive decline. Next,

regarding outcome measures, it is important to acknowledge that MCI and dementia are separate clinical diagnoses. However, due to the small number of studies identified for these outcomes and the early stages of the research area, these outcomes were combined in some analyses which may affect the interpretation of these findings. Moreover, for studies reporting on dementia specifically, the measures used were not consistent. Whilst it is common practice in meta-analyses looking at dementia as an outcome (Peters et al., 2019; Sutin et al., 2021a), the meta-analytic results reported in this review should be interpreted with caution. With clinical diagnosis of dementia being the gold standard, combining these with outcome measures using cut-off scores (e.g., TICSm, MMSE) may present some uncertainty to the validity of these findings, particularly when the cut-offs used are not dissimilar to those used by other studies to indicate pre-clinical cognitive impairment. For example, Gawronski et al. (2016) used a cut-off score of ≤ 10 out of 35 on TICSm to indicate cognitive impairment, whereas Sutin et al. (2018b) used ≤ 6 out of 27 to indicate dementia. Despite this, it should be noted that no significant heterogeneity was observed in any meta-analysis exploring MCI and dementia as outcomes.

Implications and future directions

Understanding the possible protective effects of individual PPCs could have important implications for developing and refining early interventions for dementia preventions and promoting healthy cognitive aging. In line with the present findings, purpose and meaning in life may be sensible targets for intervention. For example, it is possible that interventions aiming to increase eudemonic PPCs, such as meaning-centred therapies (Vos and Vitali, 2018; Wong, 2010), may also be beneficial for healthy cognitive aging. However, at present there is little evidence to support this. Moreover, WHO guidelines highlight that multi-domain approaches to risk reduction interventions for cognitive decline and dementia are likely to be the most beneficial (World Health Organization, 2019). Given the potentially modifiable nature of PPCs, these could prove to be a useful target area for prevention interventions to explore.

Findings from this review also have implications for informing future research. To better understand the possible protective effects of individual PPCs, more

high-quality longitudinal studies are needed, particularly around PPCs associated with eudemonic wellbeing. For example, causal inference methods (e.g., Mendelian randomisation) may be particularly valuable. Further, as PPCs may be modifiable protective factors, future research should explore whether these can be promoted through adaptations to existing psychological interventions. For example, there is evidence that behavioural interventions can be beneficial for psychological wellbeing (Weiss et al., 2016). Thus, future research could also explore the effectiveness of these interventions for reducing risk of dementia. Finally, as previously mentioned, it is important to consider the relationship between positive mental health and negative mental health when investigating PPCs. Thus, research should continue to explore the associations between both positive and negative elements of mental health and how this relates to cognitive function and risk of MCI and dementia.

Conclusions

This chapter used an exploratory approach to identify associations between PPCs and cognitive function, MCI, and dementia. Findings provide a comprehensive and synthesised foundation on which to further explore this research area. The mixed findings for different PPCs highlight the importance of investigating factors that contribute to positive mental health and wellbeing individually. Moreover, the present evidence suggests that eudemonic wellbeing may play a more important role in cognitive health than hedonic wellbeing. This is a promising area for future research which may have important implications for informing interventions to promote healthy cognitive aging and dementia prevention. Specifically, evidence for the possibly protective effects of purpose and meaning in life suggest that these may be sensible targets for interventions.

Chapter 3: The utility of IAPT for promoting psychological constructs in older adults

Abstract

Background: Previous evidence from Chapter 2 has suggested that positive psychological constructs (PPCs) such as purpose and meaning in life may be beneficial for dementia prevention and healthy cognitive ageing. Given the implications of the current evidence, it is important to understand whether existing primary care psychological therapy services such as Improving Access to Psychological Therapies (IAPT) can also improve positive mental health and healthy cognitive ageing in older adults.

Aims: To investigate whether PPCs and domains of cognitive function change over the course of primary care psychological therapy in adults aged 60+. To investigate change in PPCs and cognitive function over therapy and associations between them.

Methods: 75 participants aged 60+ without dementia at baseline were recruited from three IAPT sites in London. Measures for PPCs (optimism, meaning in life, self-compassion, gratitude) and cognitive function (memory, verbal fluency, attention, global cognition) were administered via telephone at three timepoints (baseline, 3 months, 6 months). Paired t tests were used to explore pre(baseline)-post(6months) therapy change and linear regression models were used to explore associations between PPCs and change in cognitive function.

Results: Significant pre-post therapy change in PPCs was found for optimism only (Pre: M = 11.09, SD = 4.86; Post: M = 12.29, SD = 4.77; $t(74) = -3.24$, p = .002, d = .25). For cognitive domains, significant pre-post therapy change was found for immediate word recall (Pre: M = 9.82, SD = 3.00; Post: M = 11.16, SD = 3.35; $t(72) = -4.95$, p <.001, d = .42), delayed word recall (Pre: M = 9.24, SD = 3.10; Post: M = 10.89, SD = 3.38; $t(69) = -5.71$, p<.001, d = .51), immediate logical memory (Pre: M = 14.68, SD = 3.58; Post: M = 16.07, SD = 3.17; $t(74) = -3.35$, p = .001, d = .41), delayed logical memory (Pre: M = 13.39, SD = 3.59; Post: M = 15.24, SD = 3.42; $t(71) = -5.02$, p <.001, d =.53), and verbal fluency (Pre: M = 44.33, SD = 12.34; Post: M = 47.85, SD = 12.74; $t(72) = -3.43$, p = .001, d = .28). However, no evidence was found for any association between

baseline PPCs or change in optimism with change in domains of cognitive function.

Conclusions: Psychological therapies offered in primary care services may have additional benefits beyond treating depression and anxiety for older adults. However, more research is needed to understand the mechanisms for changes in cognitive function and PPCs over psychological therapy.

Introduction

Understanding and identifying modifiable factors associated with increased risk of dementia is vital for informing dementia prevention strategies and promoting healthy cognitive ageing. At present, much of the research in this area has focused on identifying potentially modifiable risk factors for dementia, such as the Lancet Commission's 2020 report which identified 12 risk factors that could be targets for dementia prevention strategies both at a policy and individual level (Livingston et al., 2020). Of these, depression in later life was identified as one potentially modifiable risk factor and there is also accumulating evidence for an association between experiencing affective symptoms and pre-clinical cognitive decline (John et al., 2019b). Despite this growing body of research, less is known about potentially modifiable protective factors, specifically the possible protective effects of positive mental health on cognitive health. As discussed in Chapter 2, positive mental health and wellbeing is more than the absence of negative mental health. Instead, it also requires the presence of various positive psychological constructs (PPCs), such as positive emotions, meaning, and purpose in life (Ryff, 1989a; Ryff, 1989b; Seligman, 2011). These PPCs can be categorised in terms of hedonic (e.g., pleasure and positive affect) and eudemonic (e.g., meaning and personal growth) perspectives of wellbeing (Ryff et al., 2021). Chapter 2 synthesised the current evidence for associations between individual PPCs that contribute to positive mental health with cognitive function, mild cognitive impairment, and dementia (Bell et al., 2022b; Bell et al., 2022c). Findings suggested that eudemonic PPCs (e.g., purpose/meaning in life) were associated with better cognitive function and reduced risk of dementia, whereas mixed evidence was found for hedonic PPCs (e.g., positive affect, life satisfaction).

Whilst in its infancy, research in this area has provided some promising early evidence that could have important implications for dementia prevention strategies. It is possible that promoting PPCs in older adults could be beneficial for healthy cognitive ageing. Recent evidence has suggested that treating depression and anxiety through psychological therapies offered in Improving Access to Psychological Therapies services (IAPT) is associated with reduced incidence of dementia diagnosis (John et al., 2022; Stott et al., 2023). IAPT offers evidence-based psychological therapies for common mental health problems (depression, anxiety) and is freely available on the NHS in England (National Collaborating Centre for Mental Health, 2021). Given the importance of dementia risk reduction interventions, it is important to understand whether existing services may have additional benefits, such as whether primary care psychological therapies can also improve positive mental health and wellbeing in older adults and how this is associated with cognitive health over time.

This chapter aims to:

1) Investigate whether PPCs (optimism, gratitude, self-compassion, meaning in life) and domains of cognitive function (memory, verbal fluency, attention, global cognition) improve over the course of primary care psychological therapy in older adults without identified dementia
2) Investigate associations between PPCs and change in cognitive function over the course of psychological therapy

Methods

MODIFY feasibility study

This study uses data from the MODIFY feasibility study. The MODIFY feasibility study aims to investigate the feasibility of measuring a range of key dementia risk factors and whether they change over the course of psychological therapies for depression and anxiety offered in IAPT services. Participants (*N* = 165) were recruited from three IAPT services in London (Camden and Islington, Homerton, North East London Foundation Trust). The eligibility criteria included 1) aged 60 and over, 2) attending IAPT services for psychological therapy, 3) have capacity to consent, 4) no language barriers, 5) no identified dementia at baseline, and 6) no self-reported uncorrected visual impairment that would prevent them from

taking part. Various measures of modifiable dementia risk factors (e.g., sleep, loneliness, alcohol consumption) and cognitive ability (e.g., memory, verbal fluency, attention) were administered through telephone assessments with participants at three time points: baseline prior to starting therapy (T1), 3 months (T2), and 6 months (T3). Additional questionnaires and a step counter were also sent to participants after each assessment. Therapy outcome data (e.g., PHQ and GAD scores for the first and last session) were provided by IAPT services for each participant. At the time of writing, data collection is still ongoing for the MODIFY feasibility study, with an anticipated end date of September 2023.

Participants

For this study, participants (*N* = 75) were included if they had received at least 2 therapy sessions (definition used nationally for course of treatment (National Collaborating Centre for Mental Health, 2021)), were not still receiving therapy, and had completed the baseline MODIFY assessment and at least one other follow-up assessment (either 3 or 6 months). No exclusions were made based on the presenting problem, type of therapy received, or level of intensity of treatment (high, low, mixed).

Measures

Sociodemographic and therapy variables

Sociodemographic information was collected during the baseline assessment (T1) and included age, gender (male, female), ethnicity (consistent with ONS ethnicity categories), and highest level of educational qualification obtained (coded as no qualification, secondary, post-secondary, vocational, undergraduate, post-graduate, doctorate). Routinely collected IAPT data were also obtained for each participant, including pre- and post-therapy measures for depression (measured using the Patient Health Questionnaire 9-item; PHQ-9) (Kroenke et al., 2001) and anxiety (measured using the Generalized Anxiety Disorder Scale 7-item; GAD-7) (Spitzer et al., 2006), the number of therapy sessions attended, and level of treatment intensity.

Positive psychological constructs

This study investigates four constructs that contribute to positive mental health and wellbeing: optimism, self-compassion, gratitude, and meaning in life. These PPCs were chosen as they are relatively under-researched (Bell et al., 2022b; Bell et al., 2022c) and align with eudemonic perspectives of wellbeing (Vittersø, 2016). Given the current evidence from Chapter 2, it appears that eudemonic PPCs may be sensible targets for interventions that could also be beneficial for cognitive health. Measures for all PPCs were collected at each assessment. Optimism was measured using the revised Life Orientation Test (LOT-R) (Scheier et al., 1994), with scores ranging from 0-24 and higher scores reflecting higher optimism. Self-compassion was measured using Neff's Self-Compassion Scale short form (Raes et al., 2011), including subscales for self-kindness, self-judgement, common humanity, isolation, mindfulness, and over-identification (2 items each using a 5-point scale). Subscale scores were determined by calculating the mean of the subscale item responses and the overall self-compassion score was calculated as the total mean score across all subscales. For the purpose of this study, only overall self-compassion, self-kindness, common humanity, and mindfulness scores were used, with higher scores reflecting higher PPCs. Gratitude was measured using the Gratitude Questionnaire six-item form (GQ-6) (McCullough et al., 2002), with scores ranging from 6-42 and higher scores reflecting greater gratitude. Meaning in life was measured using a 5-point single item ("To what extent do you feel your life to be meaningful?") taken from WHOQOL-BREF (The Whoqol Group, 1998), with higher scores reflecting greater meaning in life. Previous research has suggested that single item measures of meaning in life have good validity and reliability (Atroszko et al., 2015).

Cognitive function

Measures of cognitive function were collected at each assessment. Global cognition was assessed using the Montreal Cognitive Assessment (MoCA) Blind. This is a revised version of the MoCA without the visual items, which previous research has suggested has good specificity (Wittich et al., 2010), and includes tasks for memory, attention, language, abstraction, and orientation. Immediate and delayed memory were measured with the Rey Auditory Verbal

Learning Test (RAVLT) (Schmidt, 1996) and the Logical Memory Story A subtest from the Wechsler Memory Scale revised (Wechsler, 1987). The RAVLT is a word learning task (scored out of 15) and the logical memory test involves recalling details about a story (scored out of 25). Sustained and selective attention were measured using the elevator counting and elevator counting with distraction subtests from the Test of Everyday Attention (TEA) (Robertson et al., 1996). These tasks involved 7 rounds of counting tones and 10 rounds of counting tones whilst ignoring higher pitched tones. Verbal and semantic fluency were assessed using FAS and animal naming tasks (Tombaugh et al., 1999). Participants were asked to name as many animals or words beginning with F/A/S as they could in 60 seconds. All the above measures were chosen as they could be administered remotely (via telephone).

Statistical analysis

Pre-post therapy change (T1-T3) in PPCs and domains of cognitive function were explored using paired t tests. For this, the comparisons between baseline and 6-month scores were used to maximise the follow up period. Due to multiple comparisons, Bonferroni corrections were used to determine significance (adjusted $\alpha = .003$). Next, to maximise power, unadjusted linear regression models were used to explore associations between PPCs with change in domains of cognitive function (T1-T3). For these models, only cognitive domains with significant pre-post therapy change were explored. Where significant pre-post therapy change in PPCs (T1-T3) were identified, these were included as predictors, otherwise baseline PPC measures were used. Finally, given that the primary aim of psychological therapies is to reduce symptoms of depression and anxiety, supplementary linear regression analyses were conducted to explore whether change in PPCs or cognitive function were associated with change in depression and anxiety scores. For these, change scores for depression and anxiety were calculated using PHQ9 and GAD7 scores from the first and last therapy sessions. As in the primary models, only cognitive domains and PPCs with significant change were included, otherwise baseline PPCs were used.

Results

Sample characteristics

Baseline sample characteristics are presented in Table 7. The majority of participants identified as female (65.33%), white ethnicity (89.33%), and had a mean age of 65.65 years (*SD* = 5.74). For therapy variables, most participants received low intensity IAPT treatments (72.00%) and had a mean number of therapy sessions of 8.33 (*SD* = 4.63). Of the factors presented in Table 7, complete data were available on all key sociodemographic and therapy variables. However, for measures of PPCs or cognitive function, 34 participants (45.33%) had missing data on one or more baseline measure, compared with 35 (46.67%) at the 3 month follow up and 39 (52.00%) at the 6 month follow up. Comparisons of baseline variables between participants with complete (n = 19, 25.33%) and missing (n = 56, 74.67%) data revealed significant differences in semantic fluency, verbal fluency, and immediate logical memory only (Appendix A).

Table 7: Baseline sample characteristics

Baseline characteristic	**N (%)**
Sex	
Female	49 (65.33)
Male	26 (34.67)
Ethnicity	
White	67 (89.33)
Black	4 (5.33)
Asian	1 (1.33)
Mixed	1 (1.33)
Other	2 (2.67)
Education	
No qualification	6 (8.00)
Secondary education	12 (16.00)
Post-secondary education	12 (16.00)
Vocational qualification	15 (20.00)
Undergraduate degree	17 (22.67)
Post-graduate degree	12 (16.00)
Doctorate	1 (1.33)
Treatment intensity	
Low (Step 2)	54 (72.00)
High (Step 3)	17 (22.67)
Mixed (Step 2 & 3)	4 (5.34)
	Mean (SD)
Age	65.65 (5.74)

Optimism	11.09 (4.86)
Gratitude	30.36 (6.49)
Self-compassion	2.75 (0.67)
Meaning in life	2.90 (0.90)
Global cognition	19.20 (1.91)
Semantic fluency	21.41 (6.52)
Verbal fluency	43.68 (12.79)
Logical memory immediate	14.68 (3.58)
Logical memory delayed	13.33 (3.61)
Word recall immediate	9.84 (3.00)
Word recall delayed	9.21 (3.07)
Sustained attention	6.59 (0.86)
Selective attention	7.22 (2.98)
GAD7	12.91 (4.76)
PHQ9	14.15 (6.10)
Number of sessions	8.33 (4.63)

Change in PPCs and cognitive domains

Paired t tests with Bonferroni correction revealed significant pre-post therapy change for optimism only (Pre: *M* = 11.09, *SD* = 4.86; Post: *M* = 12.29, *SD* = 4.77; *t*(74) = -3.24, *p* = .002, *d* = .25), suggesting that optimism improved over psychological therapy. No significant difference was found for self-compassion (Pre: *M* = 2.75, *SD* = .67; Post: *M* = 2.84, *SD* = .60; *t*(71) = -1.93, *p* = .06), gratitude (Pre: *M* = 30.41, *SD* = 6.52; Post: *M* = 31.36, *SD* = 4.76; *t*(73) = -1.51, *p* = .14), or meaning in life (Pre: *M* = 2.92, *SD* = .94; Post: *M* = 2.98, *SD* = 1.00; *t*(47) = -.52, *p* = .61). Further, no significant pre-post change was found for any of the self-compassion subscales: self-kindness (Pre: *M* = 2.80, *SD* = .88; Post: *M* = 3.02, *SD* = .74; *t*(73) = -2.58, *p* = .01), mindfulness (Pre: *M* = 3.37, *SD* = .98; Post: *M* = 3.07, *SD* = 1.00; *t*(74) = 2.34, *p* = .02), or common humanity (Pre: *M* = 3.09, *SD* = .82; Post: *M* = 3.26, *SD* = .90; *t*(74) = -1.75, *p* = .08).

For domains of cognitive function, significant pre-post therapy improvements were found for immediate word recall (Pre: *M* = 9.82, *SD* = 3.00; Post: *M* = 11.16, *SD* = 3.35; *t*(72) = -4.95, *p* <.001, *d* = .42), delayed word recall (Pre: *M* = 9.24, *SD* = 3.10; Post: *M* = 10.89, *SD* = 3.38; *t*(69) = -5.71, *p*<.001, *d* = .51), immediate logical memory (Pre: *M* = 14.68, *SD* = 3.58; Post: *M* = 16.07, *SD* = 3.17; *t*(74) = -3.35, *p* = .001, *d* = .41), delayed logical memory (Pre: *M* = 13.39, *SD* = 3.59; Post: *M* = 15.24, *SD* = 3.42; *t*(71) = -5.02, *p* <.001, *d* =.53), and

verbal fluency (Pre: *M* = 44.33, *SD* = 12.34; Post: *M* = 47.85, *SD* = 12.74; *t*(72) = -3.43, *p* = .001, *d* = .28). No significant difference was found for sustained attention (Pre: *M* = 6.59, *SD* = .86; Post: *M* = 6.78, *SD* = .56; *t*(72) = -2.28, *p* = .03), global cognition (Pre: *M* = 19.34, *SD* = 1.88; Post: *M* = 19.70, *SD* = 2.17; *t*(55) = -1.19, *p* = .24), semantic fluency (Pre: *M* = 21.47, *SD* = 6.55; Post: *M* = 21.85, *SD* = 6.35; *t*(73) = -0.63, *p* =.53), or selective attention (Pre: *M* = 7.58, *SD* = 2.68; Post: *M* = 7.75, *SD* = 2.47; *t*(59) = -0.73, *p* =.47).

Associations between PPCs and change in domains of cognitive function

Unadjusted linear regression models found no significant associations between change in optimism with change in any cognitive domain (Table 8). Additionally, no significant associations were found between baseline scores for individual PPCs and change in any cognitive domain.

Table 8: Associations between PPCs and change in cognitive function

Unadjusted models	**Verbal fluency**			**Immediate logical memory**			**Delayed logical memory**			**Immediate word recall**			**Delayed word recall**		
	b	**se**	**p**	**b**	**se**	**p**	**b**	**se**	**p**	**b**	**se**	**p**	**b**	**se**	**p**
Optimism change (T1-T3)	-.01	.32	.98	-.04	.13	.74	.10	.11	.37	-.08	.08	.33	-.13	.09	.16
Optimism (T1)	.02	.22	.93	.04	.09	.64	-.02	.08	.76	.03	.06	.61	-.002	.06	.97
Self-compassion (T1)	.45	1.60	.78	.47	.64	.47	-.05	.62	.94	.43	.42	.31	-.004	.47	.99
Gratitude (T1)	-.20	.16	.23	.02	.06	.78	.08	.06	.16	-.02	.04	.66	-.06	.04	.21
Meaning in life (T1)	-.31	1.33	.82	.41	.51	.42	-.10	.45	.82	-.31	.29	.30	-.63	.34	.07
Self-kindness (T1)	-.24	1.20	.84	-.33	.48	.49	.12	.45	.80	.41	.32	.20	-.26	.33	.44
Mindfulness (T1)	.76	1.05	.47	.13	.43	.77	.25	.38	.52	.53	.27	.06	.20	.30	.51
Common humanity (T1)	.72	1.26	.57	-.10	.51	.85	-.19	.46	.68	-.14	.33	.67	-.64	.34	.07

Supplementary analyses

Supplementary analyses were conducted to explore associations between baseline PPCs, change in optimism, and change in domains of cognitive function with change in depression and anxiety over the course of psychological therapy. Significant pre-post therapy change was found for scores of depression (Pre: *M* = 14.15, *SD* = 6.10; Post: *M* = 7.20, *SD* = 5.16; *t*(74) = 9.96, *p* <.001, *d* = 1.23) and anxiety (Pre: *M* = 12.91, *SD* = 4.76; Post: *M* = 6.00, *SD* = 4.51; *t*(74) = 10.67, *p* <.001, *d* = 1.49). Findings from univariate linear regression models found no associations between baseline PPCs or change in optimism with change in depression or anxiety, with the exception that higher baseline mindfulness scores were associated with greater improvement in depression scores (b = -1.52, se = .70, p = .03) (Table 9). Additionally, no significant associations were found between change in domains of cognitive function with change in depression or anxiety.

Table 9: Associations between PPCs and cognitive function with change in depression and anxiety

Unadjusted models	**Depression (PHQ9) change**			**Anxiety (GAD7) change**		
	b	**se**	**p**	**b**	**se**	**p**
Optimism change	-.18	.22	.42	-.32	.20	.11
Optimism (baseline)	.12	.14	.43	.10	.13	.47
Self-compassion (baseline)	.18	1.10	.87	.63	1.00	.53
Gratitude (baseline)	.002	.11	.99	-.07	.10	.48
Meaning in life (baseline)	1.53	.89	.09	.22	.79	.79
Self-kindness (baseline)	-.21	.81	.80	.39	.74	.60
Mindfulness (baseline)	**-1.53**	**.70**	**.03**	-1.23	.66	.06
Common humanity (baseline)	-.67	.85	.43	-.55	.79	.49
Verbal fluency change	-.03	.08	.73	-.01	.07	.87
Immediate logical memory change	.07	.20	.74	.05	.18	.80
Delayed logical memory change	-.08	.23	.73	-.12	.21	.57
Immediate word recall change	-.13	.31	.69	-.31	.28	.28
Delayed word recall change	.17	.31	.59	.007	.29	.98

Discussion

These findings suggest that optimism improves over the course of psychological therapy, however no evidence was found for gratitude, self-compassion, or meaning in life. For cognitive function, results revealed significant pre-post therapy change in memory (immediate and delayed) and verbal fluency. No associations were found between baseline PPCs or change in optimism with change in domains of cognitive function. Additionally, there was little evidence that baseline PPCs or change in cognitive function were associated with change in depression or anxiety, with the exception that higher baseline mindfulness was associated with greater reduction in depression over the course of psychological therapy.

Of the PPCs investigated, optimism was the only one that significantly changed over the course of IAPT therapy. As LOT-R includes items for both optimism and pessimism, it is important to acknowledge that this change could reflect an increase in optimism, a reduction in pessimism, or both. Given evidence that optimism and pessimism are independent but related factors (Scheier et al., 2021) and associations between pessimism and depression (Strunk et al., 2006), it is possible that this change may be explained by reductions in pessimism through improvements in negative mental health. However, no association was found between change in optimism and change in negative mental health, which potentially mitigates against this. More work is needed to better understand the mechanism for this change. Next, considering many interventions offered in IAPT use a CBT approach (National Collaborating Centre for Mental Health, 2021), the therapeutic techniques used will often address self-criticisms and self-judgements that are commonly experienced in depression and anxiety (Werner et al., 2019). As such, it is surprising that there was no evidence for change in self-compassion and self-kindness given that psychological therapies will likely encourage these PPCs. One possible explanation may be that whilst self-judgements may change over therapy, it may take longer for improvements in self-kindness and self-compassion through continued practice of therapeutic strategies. Similarly, it is also possible that PPCs like meaning in life and gratitude may change over a longer period of time due to lifestyle changes. For example, it may be that treating anxiety or depression may not immediately improve meaning in life (hence no significant

change over therapy), but improvement in symptoms may result in lifestyle changes (e.g., getting a new job, more social and physical activities) which may in turn improve meaning in life and gratitude. Whilst this would not be captured in the present study, it should be tested in future research with longer follow up data available.

In relation to associations between PPCs and cognitive function, the present findings are inconsistent with evidence from the systematic review presented in Chapter 2 (Bell et al., 2022b). Chapter 2 highlighted associations between eudemonic constructs and cognitive function, however the present study did not find similar evidence regarding under researched (optimism, gratitude, self-compassion) eudemonic-related PPCs. Arguably, this may reflect that some eudemonic PPCs are more important for healthy cognitive aging than others, although no evidence was found for meaning in life either, for which there was promising evidence from the review. However, it is also worth noting that the present study included a sample of older people with clinical depression or anxiety, rather than a general population sample as in Chapter 2, which may also explain differences in findings. Given associations between depression and anxiety with cognitive decline (John et al., 2019b) and associations between positive mental health and better cognitive function (Bell et al., 2022b), there are likely interplaying mechanisms in this sample. For example, it may be that participants with higher PPCs at baseline had better cognitive function and improvements in negative mental health reduced risk of cognitive decline, yet neither were associated with improvements in cognitive function. More research is needed to better understand the interplay between positive and negative mental health and cognitive function in older adults.

Strengths and limitations

This is the first study to test whether individual PPCs that contribute to positive mental health improve over the course of psychological therapy in a primary care setting. Additionally, this study investigates relatively under researched PPCs, contributing to the development of the wider research area. However, some methodological limitations should be noted. First, whilst Bonferroni corrections were used to control for type I error when investigating pre-post therapy change in PPCs and cognitive function, it is possible that this may have increased the risk of type II error. Additionally, given the small sample size and

missing data, this study may not be fully powered to observe effects. Next, it is possible that the change in cognitive function observed may be accounted for by other variables that may change over the course of psychological therapy, such as physical activity (Carvalho et al., 2014) and loneliness (Boss et al., 2015). Further, an alternative explanation for these findings could be due to practice effects resulting from using repeated cognitive measures. Due to the relatively short time frame between assessments (3 months), it is possible that not only did participants know what to expect in follow up assessments, but also started to learn some of the cognitive tasks (especially when recalling the word lists or story). As such, these results should be interpreted with caution as the change observed may only reflect improvements in cognitive test scores resulting from practice effects rather than genuine improvement in cognitive function. Another possible limitation relates to the selective nature of the sample. Previous research has suggested that those who access IAPT are more likely to be younger, female, white ethnicity, and have higher education and no disability (Sharland et al., 2023). Not only are older people underserviced in IAPT services, but recruitment methods for this study varied between IAPT sites, with one site recruiting specifically from a research register (people who indicated that they would be happy to be contacted regarding potential research opportunities) and the other two sites asking all new patients that met the participant criteria. As such, the present sample is unlikely to be representative of people aged 60+ with depression or anxiety and instead reflects a subsample - those who attended IAPT and were happy to take part in research. Finally, it is also possible that difficulties arising from conducting measures over the phone (e.g., stable signal, audio quality) may have contributed to noise in these data. Specifically for the cognitive measures, variable audio quality may have interfered with tasks such as word recall and elevator counting that relied on clear audio.

Implications and future directions

Given present findings that certain domains of cognitive function may improve over the course of psychological therapies offered in IAPT, this research could have implications for the utility of these services for promoting healthy cognitive ageing in older adults. However, due to uncertainty regarding whether these changes reflect improvement in cognitive function or in test scores and no

associations found between PPCs, depression, or anxiety with change in cognitive function, the mechanisms for this change need further investigation. Nonetheless, this research does suggest the primary care psychological therapies could have additional benefits for older people beyond treating common mental health problems. Understanding this is particularly important given the underrepresentation of older people accessing IAPT services (Sharland et al., 2023) and could have important implications for encouraging referrals. More research is needed to 1) understand which PPCs are important for healthy cognitive ageing, 2) understand the mechanisms behind the change in PPCs and cognitive function, and 3) understand whether psychological therapies can be utilised to promote these changes. Specifically, longer follow up periods are needed in future research exploring change in PPCs such as meaning in life.

Conclusions

Overall, it appears that psychological therapies offered in IAPT may be beneficial for improving cognitive function in older adults. However, at present the mechanisms underlying this change are unclear. More longitudinal research is needed to better understand the utility of existing primary care psychological therapy services for promoting psychological wellbeing and healthy cognitive ageing in older adults.

Chapter 4: Psychological therapies in IAPT for treatment of depression and anxiety in people living with dementia

This chapter includes research that has been published in *eClinicalMedicine*:

Bell, G., El Baou, C., Saunders, R., Buckman, J. E., Charlesworth, G., Richards, M., … & Stott, J. (2022). Effectiveness of primary care psychological therapy services for the treatment of depression and anxiety in people living with dementia: Evidence from national healthcare records in England. *Eclinicalmedicine*, *52*, 101692. https://doi.org/10.1016/j.eclinm.2022.101692

Abstract

Background: Depression and anxiety are common in people living with dementia. Psychological therapies offered in primary care mental health services, such as Improving Access to Psychological Therapies (IAPT), are often recommended for treating depression and anxiety in people living with dementia, however it is currently unknown how effective these are.

Aims: This study aims to investigate whether depressive and anxiety symptoms in people living with dementia improve over the course of psychological therapy offered in IAPT and how this compares to people without dementia.

Methods: National routinely collected data from IAPT services across England linked with hospital and mental health services records were used to identify people living with dementia (N = 1,549) who attended IAPT services between 2012 to 2019. Logistic regression and linear regression models were used to explore differences in psychological therapy outcomes in people living with dementia compared to a propensity score matched control sample without dementia. Outcome measures included pre-post therapy change in symptoms of depression (PHQ-9) and anxiety (GAD-7) and therapy outcomes (reliable improvement, recovery, deterioration).

Results: Findings suggest that symptoms of depression ($t(1548) = 31.05$, $p < .001$) and anxiety ($t(1548) = 30.31$, $p < .001$) improved in people living with dementia over the course of psychological therapy with large effect sizes (depression: d = -0.83; anxiety: d = -0.80). However, people living with dementia were less likely to reliably improve (OR = .75, 95% CI [.63,.88], p <.001) or recover (OR = .75, 95% CI [.64,.88], p = .001), and more likely to deteriorate

(OR = 1.35, 95% CI [1.03,1.78], p = .029) than a matched control sample without dementia.

Conclusions: Psychological therapies offered in primary care mental health services may be beneficial for reducing symptoms of depression and anxiety in people living with dementia, however at present psychological therapies are not as effective for people living with dementia as for people without dementia. Understanding the evidence has important implications for encouraging referrals and informing service adaptations. More research is needed to understand how access to and outcomes of psychological therapies can be improved in people living with dementia.

Introduction

Common mental health problems, such as depression and anxiety, are major contributors to global health-related burden (GBD Mental Disorders Collaborators, 2022), making them key issues for public health. Globally, anxiety and depression are estimated to affect 3.6% and 4.4% of the population respectively (World Health Organization, 2017) and estimated to cost the economy $2.5 trillion each year (The Lancet Global Health, 2020). Depression and anxiety are more common in people living with dementia, with prevalence estimates of 38-41% for both depression and anxiety in people with mild to moderate dementia (Leung et al., 2021). In addition to the subjective psychological distress experienced, anxiety and depression in people living with dementia have been associated with numerous adverse outcomes, such as lower quality of life (Beerens et al., 2013), faster cognitive decline (Rapp et al., 2011), and earlier institutionalisation (Dorenlot et al., 2005). Psychological therapies offered in primary care mental health services are a recommended first line treatment for depression and anxiety in the UK (National Institute for Health and Care Excellence, 2011a), including for people living with dementia (National Institute for Health and Care Excellence, 2018), and are often preferred 3-to-1 by patients over pharmacological interventions (McHugh et al., 2013). In people living with dementia specifically, non-pharmacological interventions appear to be more effective in reducing depressive symptoms than antidepressant medication (Watt et al., 2021). Previous reviews of

randomised control trials (RCTs) have generally found positive evidence for the effectiveness of psychological therapies for reducing symptoms of depression, anxiety, and psychological distress in people living with dementia (Noone et al., 2019; Orgeta et al., 2022; Robinson and Moghaddam, 2022). Despite this, there are only a small number of studies addressing the efficacy of psychological therapies for people living with dementia and at present no study has examined psychological therapy outcomes in an existing primary care setting anywhere in the world. From 159 studies identified through literature searches (search terms: (anxi* OR depress*) AND (therap* OR interven*) AND (demen* OR Alzheimer*) AND ((primar* NEAR care*) OR routine* OR (service* NEAR (mental OR psycholog*)))) conducted in Pubmed (from inception to June 2022), no relevant studies using a naturalistic setting were identified. Moreover, given that there may be systematic differences between people living with dementia who take part in research studies and those who receive clinical care, it is unclear how representative these outcomes are for people living with dementia in routine clinical practice (Cooper et al., 2014). Understanding this is critical for informing service design, development, and implementation. As such, in line with MRC guidance for evaluating complex interventions (Skivington et al., 2021), this study uses a naturalistic design to examine psychological therapy outcomes in a nationally provided primary care psychological therapy service. Improving Access to Psychological Therapies (IAPT) services are freely available across England via the National Health Service (NHS) and offer a variety of evidence-based psychological therapies for common mental health problems delivered by trained professionals (National Collaborating Centre for Mental Health, 2021), with the NHS mental health implementation plan requiring IAPT to accept and meet the needs of people living with dementia (NHS, 2019).

This chapter aims to:

1) Examine the effectiveness of psychological therapies offered in IAPT for reducing symptoms of depression and anxiety in people living with dementia.
2) Contextualise these findings within previously published RCT work identified through a recent systematic review.

3) Investigate whether the degree of improvement in therapy outcomes in people living with dementia differs to a matched control sample without identified dementia.

Methods

Data

This chapter utilises data from the MODIFY grant dataset (as described in Chapter 1). This consists of routinely collected data from IAPT services across all 211 clinical commissioning group areas in England between 2012 to 2019 (National Collaborating Centre for Mental Health, 2021) linked with national healthcare data from Hospital Episode Statistics (HES) (NHS Digital, 2021a), Mental Health Services Dataset (MHSDS) (NHS Digital, 2021b), and HES-ONS mortality data (NHS Digital, 2020). These data were linked using a linkage key provided by NHS Digital. The MODIFY grant dataset includes information for demographic (e.g., gender, age, ethnicity), psychological therapy (e.g., referral and assessment dates, treatment outcomes), and other healthcare (e.g., inpatient and outpatient records, diagnosis and treatment, cause and place of death) variables for individual participants across England.

Participants

Participants included people who received psychological therapy in IAPT between 2012 to 2019 and have a record in IAPT linked with a record in HES/MHSDS to identify dementia. To the available sample, a standard set of exclusion criteria used in previous studies using IAPT data (Saunders et al., 2021; Saunders et al., 2020) were applied: 1) did not complete a course of treatment (defined as two or more psychological therapy sessions (National Collaborating Centre for Mental Health, 2021)), 2) did not meet the clinical cut-off for ‘caseness’ for depression (10+ on PHQ-9) or generalised anxiety disorder (8+ on GAD-7) (National Collaborating Centre for Mental Health, 2021), 3) had a primary diagnosis outside of the IAPT treatment protocol and for which there is no evidence-based psychological therapy offered in IAPT (e.g., severe mental illness such as schizophrenia and bipolar disorder, alcohol dependency, bereavement) (National Collaborating Centre for Mental Health, 2021), 4) were still in IAPT treatment (identified using endcode variable which

indicates that treatment has ended), 5) were missing data for baseline or follow-up measures on the Patient Health Questionnaire 9-item (PHQ-9) or Generalized Anxiety Disorder Scale 7-item (GAD-7). As pre-post therapy PHQ-9 and GAD-7 data are routinely completed for approximately 99% of IAPT patients, exclusion based on missing data resulted in very few participants being excluded (*N* = 3,133) (Clark, 2018).

For this study specifically, participants who received a dementia diagnosis during or after IAPT treatment were also excluded. Where participants had more than one episode of IAPT treatment between 2012-2019, only data for the first course of treatment were used. Out of a total 2,515,402 patients who received IAPT treatment during the time period of data collection, 1,945,323 patients were identified as eligible and included in analyses, of whom 1,549 (0.08%) had a diagnosis of dementia prior to attending IAPT.

Measures

Demographic and therapy measures

Self-reported demographic information was available from routinely collected IAPT data, including gender, age at referral, ethnicity (consistent with ONS codes), index of multiple deprivation (IMD) decile (1 represents the most deprived 10% of geographical areas in England and 10 represents the least deprived 10%) (Ministry of Housing Communities & Local Government, 2019), and employment status (employed vs unemployed). Psychological therapy and health information were available from IAPT data, including number of therapy sessions attended, date of first and last therapy sessions, and self-reported measures of whether patients were prescribed/taking psychotropic medication and whether they had a long-term health condition (LTC). Additionally, waiting times between referral to assessment and assessment to treatment were calculated from appointment dates.

Clinical measures

Depression and anxiety measures were taken from IAPT data (NHS Digital, 2019). Depression was assessed using the Patient Health Questionnaire 9-item (PHQ-9) (Kroenke et al., 2001) with a ‘caseness’ threshold score of ≥10. Anxiety was assessed using the Generalized Anxiety Disorder Scale 7-item

(GAD-7) (Spitzer et al., 2006) with a 'caseness' threshold score of ≥8. For specific anxiety disorders (e.g., social phobia, panic disorder), 'anxiety disorder specific measures' (ADSMs) were used (see Appendix B for caseness thresholds). Caseness refers to the level of symptoms likely to be sufficient to meet diagnostic criteria for the specific mental health disorder. All-cause dementia status was identified using ICD-10 dementia codes from HES and MHSDS data (World Health Organization, 1993).

Outcome measures

Primary outcomes were based on nationally determined outcome metrics used in IAPT (NHS Digital, 2019):

- *Reliable improvement:* a reduction in depression (≥6 points on PHQ-9) or anxiety (≥4 points on GAD-7; see Appendix B for ADSM cut-offs) symptoms from first to last treatment session that exceeds the error of measurement on the corresponding symptom scale
- *Reliable recovery:* a reduction in depression/anxiety that exceeds the measurement error (reliable improvement) and ending treatment below the clinical threshold for 'caseness' (as defined above) on both the depression and anxiety scales
- *Deterioration:* an increase in pre-post therapy scores for depression or anxiety beyond the error of measurement using the same change thresholds as reliable improvement

Secondary outcomes included continuous measures of pre-post therapy change on measures of depression (PHQ-9), generalised anxiety (GAD-7), and work and social functioning (Work and Social Adjustment Scale; WSAS) (Mundt et al., 2002).

Statistical analysis

All analyses were conducted using STATA 17 (StataCorp, 2021).

Main analyses

First, comparisons of baseline characteristics between the dementia and control (without dementia) groups were conducted using independent t-tests and chi-square tests. Missing data for categorical variables were dummy coded to retain

a larger sample. Due to a small number of extreme values, waiting time variables were winsorized at the top 99% to reduce the influence of outliers. Additional t-tests and chi-square tests were also conducted to compare outcome measures between groups. Next, to understand the representativeness of people living with dementia accessing IAPT, the percentage of people living with dementia in the sample were calculated across a) all age groups and b) in those aged 65 and over. To approximate representation, an analysis was conducted using national dementia prevalence figures for mild to moderate dementia in older adults (Wittenberg et al., 2019), the prevalence of depression and anxiety in mild to moderate dementia (Leung et al., 2021), and the prevalence of depression in a general older population (Zenebe et al., 2021).

For aim 1, paired t-tests were used to investigate pre-post differences in PHQ-9 and GAD-7 scores for the dementia group. To address aim 2, given the lack of a control group of people living with dementia not receiving IAPT therapy in the MODIFY grant dataset, comparison groups were identified from a recent systematic review that investigated the effectiveness of psychosocial interventions for depression or anxiety in people living with dementia using evidence from RCTs (Noone et al., 2019). This review was chosen as it specifically included studies using participants who met clinical criteria for depression or anxiety. Studies from the review were selected where appropriate data were available for pre- and post- intervention measures of either anxiety or depression for the treatment and control group. These findings were used to contextualise the current findings by calculating standardised mean difference.

For aim 3, logistic regression models were conducted to explore the association between dementia and primary outcomes and linear regression models were used to explore the secondary outcomes. These models were first run using the full sample, then again using a propensity score (PS) matched sample. People living with dementia were matched with control participants without dementia on all variables listed in Table 10 (except number of sessions) using *psmatch2* (Leuven and Sianesi, 2003) (see Appendix C for PS matching model) with the caliper set at 0.001. The caliper was set in line with previous research using PS matching with IAPT data (Saunders et al., 2021). Where a control was identified as an appropriate match for more than one participant in the dementia sample,

matching with replacement was applied. These were weighted and used in the analysis. No control was matched to more than 2 participants from the dementia sample (maximum weight = 2). Finally, as outcomes may differ between IAPT services, multilevel logistic regression (primary outcomes) and multilevel mixed-effects linear regression (secondary outcomes) models with random intercepts were used to explore clustering effects by Clinical Commissioning Group (CCG) (see Appendix D for CCG categories).

Sensitivity analyses

First, due to the overrepresentation of people living with dementia diagnosed with dementia before the age of 65 in this sample, sensitivity analyses were conducted with specific dementia diagnosis age groups (<65 only, 65+ only). Next, subgroup analyses were conducted to explore associations between dementia and psychological therapy outcomes across treatment intensity: low intensity only (e.g., guided self-help, computerised cognitive behavioural therapy), high intensity only (e.g., CBT, interpersonal psychotherapy), and mixed intensity (patients who were either stepped up or stepped down during the episode of treatment) (National Collaborating Centre for Mental Health, 2021). For each sensitivity analysis, the PS matching algorithm was rerun.

Results

Sample characteristics

Comparisons of participants with complete data and missing data on key variables are presented in Appendix E. Baseline sample characteristics (demographic and therapy variables) for people living with dementia and the control group without identified dementia are presented in Table 10 and psychological therapy outcomes (primary and secondary) are presented in Table 11. Prior to PS matching, people living with dementia were older at referral, had fewer therapy sessions, and had lower baseline scores on GAD-7 but not PHQ-9. There were also significant differences between groups for gender, ethnicity, employment status, LTC case, psychotropic medication, IMD decile, and appointment year. No significant differences in waiting times (referral to assessment, assessment to treatment) between group were

identified. After PS matching, there were no significant differences in baseline characteristics between groups (Table 10).

Table 10: Comparison of sample characteristics

		Before PS matching			**After PS matching**		
		Dementia (n = 1,549)	**Control (n = 1,943,774)**		**Dementia (n = 1,351)**	**Control (n = 1,329)**	
		N (%)	**N (%)**	**p-value**	**N (%)**	**N (%)**	**p-value**
Gender	Male	656 (42.35%)	638,827 (32.87%)	<.001	577 (42.71%)	548 (41.23%)	.74
	Female	889 (57.39%)	1,298,144 (66.78%)		771 (57.07%)	778 (58.54%)	
	Missing / preferred not to answer	4 (0.03%)	6,803 (0.35%)		3 (0.22%)	3 (0.23%)	
Ethnicity (ONS)	White	1,231 (79.47%)	1,592,990 (81.95%)	<.001	1,082 (80.09%)	1,070 (80.51%)	.98
	Mixed	16 (1.03%)	37,581 (1.93%)		15 (1.11%)	15 (1.13%)	
	Asian	69 (4.45%)	82,892 (4.26%)		56 (4.15%)	52 (3.91%)	
	Black	55 (3.55%)	48,121 (2.48%)		37 (2.74%)	42 (3.16%)	
	Other	22 (1.42%)	20,958 (1.08%)		20 (1.48%)	17 (1.28%)	
	Missing / preferred not to answer	156 (10.07%)	161,232 (8.29%)		141 (10.44%)	133 (10.01%)	
Employment status	Employed	1,016 (65.59%)	1,423,631 (73.24%)	<.001	897 (66.40%)	905 (68.10%)	.12
	Unemployed	397 (25.63%)	404,671 (20.82%)		362 (26.79%)	316 (23.78%)	
	Missing / preferred not to answer	136 (8.78%)	115,472 (5.94%)		92 (6.81%)	108 (8.13%)	
LTC Case	No	393 (25.37%)	1,087,647 (55.96%)	<.001	353 (26.13%)	363 (27.31%)	.54
	Yes	771 (49.77%)	446,768 (22.98%)		692 (51.22%)	687 (51.69%)	
	Missing	385 (24.85%)	409,359 (21.06%)		306 (22.65%)	279 (20.99%)	
Psychotropic medication	Prescribed (not taking)	39 (2.52%)	92,403 (4.75%)	<.001	38 (2.81%)	35 (2.63%)	.52
	Prescribed (taking)	826 (53.32%)	916,808 (47.17%)		754 (55.81%)	734 (55.23%)	
	Not prescribed	427 (27.57%)	755,864 (38.89%)		383 (28.35%)	361 (27.16%)	
	Missing / preferred not to answer	257 (16.59%)	178,699 (9.19%)		176 (13.03%)	199 (14.97%)	

Index of Multiple Deprivation (IMD) Decile	1	231 (14.91%)	208,662 (10.73%)	<.001	196 (14.51%)	202 (15.20%)	.89
	2	183 (11.81%)	209,808 (10.79%)		148 (10.95%)	150 (11.29%)	
	3	184 (11.88%)	208,714 (10.74%)		155 (11.47%)	153 (11.51%)	
	4	154 (9.94%)	205,407 (10.57%)		123 (9.10%)	125 (9.41%)	
	5	153 (9.88%)	193,805 (9.97%)		139 (10.29%)	132 (9.93%)	
	6	152 (9.81%)	185,660 (9.55%)		139 (10.29%)	137 (10.31%)	
	7	124 (8.01%)	177,192 (9.12%)		112 (8.29%)	114 (8.58%)	
	8	120 (7.75%)	171,647 (8.83%)		114 (8.44%)	126 (9.48%)	
	9	104 (6.71%)	165,031 (8.49%)		95 (7.03%)	79 (5.94%)	
	10	95 (6.13%)	153,640 (7.90%)		91 (6.74%)	85 (6.40%)	
	Missing	49 (3.16%)	64,208 (3.30%)		39 (2.89%)	26 (1.96%)	
Year of first appointment	2012	19 (1.23%)	60,387 (3.10%)	<.001	15 (1.11%)	12 (0.90%)	.99
	2013	75 (4.84%)	218,483 (11.24%)		66 (4.89%)	64 (4.82%)	
	2014	163 (10.52%)	290,669 (14.95%)		144 (10.66%)	140 (10.53%)	
	2015	278 (17.95%)	336,423 (17.31%)		227 (16.80%)	226 (17.01%)	
	2016	315 (20.34%)	338,177 (17.40%)		273 (20.21%)	263 (19.79%)	
	2017	310 (20.01%)	319,400 (16.43%)		274 (20.28%)	286 (21.52%)	
	2018	317 (20.46%)	314,087 (16.16%)		284 (21.02%)	272 (20.47%)	
	2019	72 (4.65%)	66,148 (3.40%)		68 (5.03%)	66 (4.97%)	
		Mean (SD)	**Mean (SD)**	**p-value**	**Mean (SD)**	**Mean (SD)**	**p-value**
Age at referral		65.92 (16.19)	40.31 (14.71)	<.001	65.33 (15.76)	65.45 (15.21)	.84
Baseline PHQ-9		15.56 (5.78)	15.72 (5.62)	.26	15.74 (5.80)	15.71 (5.85)	.90
Baseline GAD-7		12.97 (5.11)	14.28 (4.45)	<.001	13.13 (5.07)	13.26 (4.94)	.52
Waiting time: referral to assessment (weeks)		3.26 (4.20)	3.24 (4.28)	.83	3.39 (4.30)	3.29 (4.44)	.54
Waiting time: assessment to treatment (weeks)		6.89 (7.35)	6.68 (7.11)	.26	6.98 (7.37)	6.89 (7.33)	.76
Number of sessions*		5.53 (3.98)	6.51 (4.577)	<.001	5.87 (4.00)	6.43 (4.30)	<.001

Independent t-tests were used for continuous variables and chi-square tests were used for categorical variables

*Note, number of sessions was not included in the PS matching algorithm

Table 11: Comparison of therapy outcomes

Before PS matching					
	Dementia		**Control**		
Primary outcomes	**Total N**	**N (%)**	**Total N**	**N (%)**	**p**
Reliable improvement	1,544	951 (61.59%)	1,936,805	1,364,952 (70.47%)	<.001
Reliable recovery	1,375	536 (38.98%)	1,690,479	756,604 (44.76%)	<.001
Reliable deterioration	1,543	153 (9.92%)	1,927,859	124,240 (6.44%)	<.001
Secondary outcomes	**Total N**	**M (SD)**	**Total N**	**M (SD)**	**p**
PHQ-9 Change	1,549	5.24 (6.64)	1,943,774	6.35 (6.56)	<.001
GAD-7 Change	1,549	4.39 (5.70)	1,943,774	5.85 (5.91)	<.001
WSAS Change	1,113	3.90 (9.63)	1,296,047	6.00 (9.60)	<.001
After PS matching					
	Dementia		**Control**		
Primary outcomes	**Total N**	**N (%)**	**Total N**	**N (%)**	**p**
Reliable improvement	1,348	853 (63.28%)	1,326	923 (69.61%)	.001
Reliable recovery	1,197	482 (40.27%)	1,169	550 (47.05%)	.001
Deterioration	1,347	131 (9.73%)	1,322	98 (7.41%)	.03
Secondary outcomes	**Total N**	**M (SD)**	**Total N**	**M (SD)**	**p**
PHQ-9 Change	1,351	5.48 (6.73)	1,329	6.60 (6.64)	<.001
GAD-7 Change	1,351	4.58 (5.79)	1,329	5.48 (6.07)	<.001
WSAS Change	993	4.27 (9.74)	988	5.70 (9.40)	<.001

Independent t-tests were used for continuous outcomes and chi-square tests were used for categorical outcomes

Proportion of people living with dementia in IAPT

In this study, people living with dementia made up 0.08% of the full sample and 0.74% of participants aged 65 and over. To calculate representativeness, the difference between the observed proportion of people living with dementia aged 65+ who received psychological therapy in IAPT and the expected proportion of people living with dementia aged 65+ who may be eligible for such therapy were compared. The lower bound estimate of expected access (1.14%) was calculated using national dementia prevalence estimates for mild to moderate dementia (3%) (Wittenberg et al., 2019) and the prevalence estimates of depression and anxiety in mild to moderate dementia (38%) (Leung et al., 2021). Given that depression and anxiety are more common in people living with dementia, this is likely to be an underestimate. To calculate the upper bound estimate of expected access (6.69%), depression prevalence in a

general older population (17%) (Zenebe et al., 2021) was also accounted for. These estimates suggest that the number of people living with dementia aged 65+ in IAPT is between 1.5 and 9 times lower than the expected need for psychological therapy services in this population.

Note, this estimate assumes that all people living with mild to moderate dementia are suitable for psychological therapies offered in IAPT and that undiagnosed dementia is not present in the control sample. Moreover, the observed proportion of people living with dementia in the sample is likely not that much lower than what would be expected in practice when also taking into consideration IAPT access targets (15-25% of prevalent cases) (Independent Mental Health Taskforce, 2016; National Collaborating Centre for Mental Health, 2021) and the lower IAPT access rates of older people generally (6.4% in 2015 when the target is 12%) (Department of Health, 2011; NHS Digital, 2016).

Improvement in psychological therapy outcomes in people living with dementia

Results from paired t-test revealed significant pre-post therapy changes in both PHQ-9 (pre: M = 15.56, SD = 5.78; post: M = 10.32, SD = 6.83) and GAD7 (pre: M = 12.97, SD = 5.11; post: M = 8.58, SD = 5.87) scores in people living with dementia, indicating that symptoms of depression ($t(1548) = 31.05$, $p < .001$) and generalised anxiety ($t(1548) = 30.31$, $p < .001$) improve over the course of IAPT therapy. This constituted a large effect size for decreases in symptoms of both depression (d = -0.83) and anxiety (d = -0.80). For context, findings from RCTs examining non-pharmacological interventions for people living with dementia with clinical depression or anxiety from Noone et al. (2019) are presented in Table 12. Two comparison studies were identified for anxiety measures (Intervention d = -0.13 and -1.42; Control d = -0.26 and -0.08) and five comparison studies were identified for depression with effect sizes ranging from -0.24 to -0.60 for intervention and 0.04 to -0.40 for control groups respectively.

Table 12: Contextualising change in therapy outcomes in people living with dementia with previously published studies

Study	Group	Depression measure	d	95% CI	Follow up
MODIFY	IAPT	PHQ9	-0.83	-0.90, -.75	
Stanley et al. (2013)	Control	GDS	-0.23	-0.94, 0.47	3 months
	Peaceful Mind Program		-0.24	-1.01, 0.53	
Guétin et al. (2009)	Control	GDS	0.04	-0.67, 0.76	4 weeks
	Music therapy		-0.59	-1.32, 0.15	
Cheng et al. (2012)	Control	GDS	0.04	-0.76, 0.84	3 months
	Tai Chi		-0.60	-1.42, 0.22	
Bailey et al. (2017)	Control	GDS	-0.23	-0.78, 0.33	6 weeks
	QAR-Depression		-0.56	-1.12, -0.01	
Williams and Tappen (2008)	Control	CSDD	-0.40	-1.21, 0.41	16 weeks
	Exercise training		-0.43	-1.13, 0.27	
Study	**Group**	**Anxiety measure**	**d**	**95% CI**	**Follow up**
MODIFY	IAPT	GAD7	-0.80	-0.87, -0.72	
Stanley et al. (2013)	Control	GAI	-0.26	-0.97, 0.44	3 months
	Peaceful Mind Program		-0.13	-0.90, 0.64	
Guétin et al. (2009)	Control	Hamilton Scale	-0.08	-0.79, 0.64	4 weeks
	Music therapy		-1.42	-2.22, -0.62	

Differences in psychological therapy outcomes between people living with dementia and a matched control group without dementia

Of the 1,368 people living with dementia with complete data available for all continuous variables used in the matching algorithm, 17 were unable to be matched. The final matched sample consisted of 1,351 people living with dementia and 1,329 match controls without identified dementia. Primary and secondary outcomes are presented in Table 13. For primary outcomes, there was evidence to suggest that people living with dementia had lower likelihood of reliable improvement (OR = .75, 95% CI [.63, .88], $p < .001$) and recovery (OR = .75, 95% CI [.64, .88], $p = .001$), and higher likelihood of deterioration (OR = 1.35, 95% CI [1.03, 1.78], $p = .03$) of symptoms of depression and anxiety compared to a PS matched control sample without identified dementia. Results remained consistent when controlling for all key variables used in the matching

algorithm and number of sessions attended, with the exception of deterioration which became non-significant (p = .06). For secondary outcomes, having dementia was significantly associated with less change in depression (b = -1.14, se = .26, p < .001), generalised anxiety (b = -.92, se = .23, p < .001), and general functioning (WSAS) (b = -1.38, se = .43, p = .001), than having no identified dementia. Findings from multilevel models did not differ dramatically from the single-level models, with intraclass correlations coefficients suggesting that differences between CCGs accounted for less than 1% of the variation in both primary and secondary outcomes (Table 14).

Table 13: Primary and secondary outcomes

Primary outcomes	**Reliable improvement**				**Reliable recovery**				**Reliable Deterioration**			
	N	OR	95% CI	p	N	OR	95% CI	p	N	OR	95% CI	p
Full sample (unadjusted)	1,938,349	.67	.61, .74	<.001	1,691,854	.79	.71, .88	<.001	1,929,402	1.60	1.35, 1.89	<.001
PS matched (unadjusted)	2,696	.75	.63, .88	<.001	2,383	.75	.64, .88	.001	2,691	1.35	1.03, 1.78	.03
PS matched (adjusted)*	2,696	.78	.66, .93	.004	2,378	.79	.66, .94	.01	2,685	1.31	.99, 1.75	.06
Secondary outcomes	**PHQ-9 Change**				**GAD-7 Change**				**WSAS Change**			
	N	b	se	p	N	b	se	p	N	b	se	p
Full sample (unadjusted)	1,945,323	-1.11	.17	<.001	1,945,323	-1.46	.15	<.001	1,297,160	-2.10	.29	<.001
PS matched (unadjusted)	2,702	-1.14	.26	<.001	2,702	-.92	.23	<.001	2,000	-1.38	.43	.001
PS matched (adjusted)*	2,702	-.93	.23	<.001	2,702	-.65	.20	.001	2,000	-1.34	.42	.002

Logistic regression models were used for primary outcomes and linear regression models were used for secondary outcomes

* Adjusted for all matched variables (gender, ethnicity, employment status, LTC case, psychotropic medication, IMD decile, year of first appointment, age at referral, baseline PHQ-9, baseline GAD-7, waiting times referral to assessment, waiting time assessment to treatment) and number of IAPT sessions attended

Table 14: Multilevel models

PRIMARY	Reliable improvement					Reliable recovery					Deterioration				
	N	**OR**	**95% CI**	**p**	**ICC**	**N**	**OR**	**95% CI**	**p**	**ICC**	**N**	**OR**	**95% CI**	**p**	**ICC**
PS matched (unadjusted)	2,539	.77	.65, .91	.002	.008	2,246	.73	.62, .86	<.001	.002	2,534	1.38	1.04, 1.83	.02	.004
PS matched (adjusted)	2,539	.81	.68, .97	.02	.01	2,242	.78	.65, .93	.01	.005	2,529	1.38	1.03, 1.85	.03	.002
SECONDARY	**PHQ-9 Change**					**GAD-7 Change**					**WSAS total Change**				
	N	**b**	**se**	**P**	**ICC**	**N**	**b**	**se**	**p**	**ICC**	**N**	**B**	**se**	**p**	**ICC**
PS matched (unadjusted)	2,544	-1.12	.27	<.001	.004	2,544	-.87	.24	<.001	.004	1,945	-1.38	.43	.001	<.001
PS matched (adjusted)	2,544	-.94	.24	<.001	.005	2,544	-.59	.20	.004	.007	1,945	-1.34	.43	.002	<.001

Sensitivity analyses

Age at dementia diagnosis

People diagnosed with dementia before the age of 65 (PLWD<65) accounted for 44.16% of the dementia sample. There were differences in reliable improvement (64% vs 58%) and reliable recovery (46% vs 31%) outcomes between people diagnosed with dementia aged 65+ (PLWD65+) and PLWD<65, but not for reliable deterioration or secondary outcomes (Table 15). Matching algorithms were rerun for this sensitivity analysis. All 611 PLWD<65 with complete data on matched variables were able to be matched. Of the 757 PLWD65+ with complete data on matched variables, 21 were unable to be matched. Sensitivity analyses exploring differences in outcomes between people living with dementia (PLWD<65 only/PLWD65+ years only) and matched controls without identified dementia were in line with main models for both groups (Table 16), except for deterioration which was significant in the PLWD65+ subsample but not PLWD<65 and WSAS change which was no longer significant in any model except the adjusted PLWD65+ model.

Table 15: Comparison of therapy outcomes between dementia diagnosis age groups (65+ vs >65 years)

	Diagnosis 65+		Diagnosis <65		
Primary outcomes	**Total N**	**N (%)**	**Total N**	**N (%)**	**p**
Reliable improvement	864	554 (64.12%)	680	397 (58.38%)	.02
Reliable recovery	744	341 (45.83%)	631	195 (30.90%)	<.001
Deterioration	864	76 (8.80%)	679	77 (11.34%)	.10
Secondary outcomes	**Total N**	**M (SD)**	**Total N**	**M (SD)**	**p**
PHQ-9 Change	865	5.37 (6.24)	684	5.07 (4.54)	.38
GAD-7 Change	865	4.43 (5.45)	684	4.33 (6.00)	.74
WSAS Change	573	3.41 (8.32)	540	4.41 (10.83)	.08

Treatment intensity

Logistic (primary outcomes) and linear (secondary outcomes) were used to explore therapy outcomes by treatment intensity subsample (High intensity only, Low intensity only, Mixed). Results are presented in Table 17. The PS matching algorithm was rerun on each subsample. No significant results were found in the mixed intensity group. Findings for ‘HI only’ and ‘LI only’ groups were largely in line with the main models, with the exception of reliable deterioration which

was non-significant in the HI only groups and WSAS change which was non-significant in the LI only group.

Table 16: Sensitivity analysis - dementia diagnosis age groups (PLWD<65/PLWD65+)

Therapy outcomes for PLWD<65												
Primary outcomes	**Reliable improvement**				**Reliable recovery**				**Reliable Deterioration**			
	N	OR	95% CI	p	N	OR	95% CI	p	N	OR	95% CI	p
PS matched (unadjusted)	1,216	.75	.59, .95	.02	1,126	.73	.58, .94	.01	1,210	1.27	.86, 1.87	.22
PS matched (adjusted)*	1,216	.75	.58, .96	.02	1,126	.74	.57, .96	.02	1,210	1.31	.87, 1.99	.20
Secondary outcomes	**PHQ-9 Change**				**GAD-7 Change**				**WSAS Change**			
	N	B	se	p	N	B	se	p	N	B	se	p
PS matched (unadjusted)	1,222	-1.09	.39	.01	1,222	-.77	.35	.03	965	-1.11	.71	.12
PS matched (adjusted)*	1,222	-1.09	.36	.003	1,222	-.69	.31	.03	965	-1.19	.71	.09
Therapy outcomes for PLWD65+												
Primary outcomes	**Reliable improvement**				**Reliable recovery**				**Reliable Deterioration**			
	N	OR	95% CI	p	N	OR	95% CI	p	N	OR	95% CI	p
PS matched (unadjusted)	1,469	.63	.50, .79	<.001	1,236	.68	.54, .85	.001	1,466	1.78	1.18, 2.68	.01
PS matched (adjusted)*	1,469	.63	.50, .80	<.001	1,228	.69	.54, .87	.002	1,449	1.92	1.25, 2.96	.003
Secondary outcomes	**PHQ-9 Change**				**GAD-7 Change**				**WSAS Change**			
	N	B	se	p	N	B	se	p	N	B	se	p
PS matched (unadjusted)	1,472	-1.44	.34	<.001	1,472	-1.29	.29	<.001	1,057	-.91	.51	.08
PS matched (adjusted)*	1,472	-1.52	.29	<.001	1,472	-1.01	.25	<.001	1,057	-1.04	.52	.05

* Adjusted for all matched variables (gender, ethnicity, employment status, LTC case, psychotropic medication, IMD decile, year of first appointment, age at referral, baseline PHQ-9, baseline GAD-7, waiting times referral to assessment, waiting time assessment to treatment) and number of IAPT sessions attended

Table 17: Sensitivity analysis - Treatment intensity

Primary outcomes	**Reliable improvement**				**Reliable recovery**				**Reliable Deterioration**			
	N	OR	95% CI	p	N	OR	95% CI	p	N	OR	95% CI	p
LI only (unadjusted)	766	.62	.45, .84	.002	638	.66	.49, .91	.01	765	2.02	1.17, 3.49	.01
HI only (unadjusted)	998	.70	.53, .91	.01	916	.64	.49, .83	.001	997	1.17	.74, 1.87	.50
Mixed intensity (unadjusted)	285	.73	.44, 1.22	.23	260	.81	.50, 1.31	.39	284	1.62	.68, 3.87	.28
LI only (adjusted)*	766	.60	.43, .84	.003	638	.67	.47, .94	.02	760	2.17	1.20, 3.95	.01
HI only (adjusted)*	992	.68	.51, .91	.01	916	.63	.47, .83	.001	977	1.31	.79, 2.19	.30
Mixed intensity (adjusted)*	283	.74	.41, 1.36	.34	259	.86	.50, 1.48	.58	246	1.61	.57, 4.54	.37
Secondary outcomes	**PHQ-9 Change**				**GAD-7 Change**				**WSAS Change**			
	N	b	se	p	N	b	se	p	N	b	se	p
LI only (unadjusted)	768	-1.28	.46	.01	768	-.96	.42	.02	679	-1.18	.72	.10
HI only (unadjusted)	1,000	-1.53	.43	<.001	1,000	-1.16	.37	.002	864	-1.72	.66	.01
Mixed intensity (unadjusted)	286	-1.53	.84	.07	286	-.13	.71	.85	267	-.87	1.28	.50
LI only (adjusted)*	768	-1.49	.41	<.001	768	-.88	.35	.01	679	-1.07	.71	.13
HI only (adjusted)*	1,000	-1.59	.39	<.001	1,000	-1.06	.33	.001	864	-1.74	.67	.01
Mixed intensity (adjusted)*	286	-.98	.75	.20	286	-.03	.63	.96	267	-1.58	1.24	.21

* Adjusted for all matched variables (gender, ethnicity, employment status, LTC case, psychotropic medication, IMD decile, year of first appointment, age at referral, baseline PHQ-9, baseline GAD-7, waiting time referral to assessment, waiting time assessment to treatment) and number of IAPT sessions attended

Discussion

For those accessing psychological therapies offered in IAPT between 2012 to 2019, findings suggest that symptoms of depression and anxiety in people living with dementia significantly change over the course of IAPT therapy with large effect sizes. However, people living with dementia are less likely to reliably improve or recover than people without dementia. While psychological therapy outcomes appear to be worse in people living with dementia than a matched sample without dementia, the difference pre- and post-therapy in people living with dementia does appear to be clinically meaningful (Bauer-Staeb et al., 2021). Further, the large effect sizes were in line with and in many cases larger than findings from RCT evidence reviewed in a recent meta-analysis (Noone et al., 2019), suggesting that psychological therapies offered in routine clinical care settings may be effective in reducing symptoms of depression and anxiety in people living with dementia. Moreover, it appears that around 62% of people living with dementia reliably improve and 40% reliably recover following IAPT therapy, with reliable recovery rates lower due to the more stringent requirement to move from caseness to non-caseness on measures. The present findings should be interpreted in the context of a somewhat selective sample given estimates that people living with dementia may be underserviced in IAPT by 1.5-9 fold and this sample had an overrepresentation (44.16%) of people living with dementia diagnosed before age 65 (young-onset accounts for ~9% of dementia cases) (World Health Organization, 2023). Given that older people in general are underrepresented in IAPT (Sharland et al., 2023), it appears that this may also apply to people living with dementia. However, subdividing results by dementia diagnosis age groups (<65 vs 65+) did not drastically alter the findings. Further, given previous findings that older adults are more likely to improve and recover following psychological therapy than working-age adults (Saunders et al., 2021), it is also notable that prior to PS matching the control sample had a mean age 25 years younger than the dementia sample, yet results remained consistent before and after PS matching.

Whilst causality cannot be established due to the study design, this work does provide initial evidence that psychological therapies offered in IAPT could be an effective treatment for depression and anxiety in people living with dementia.

However, adaptations tailored to the individual may be required to make outcomes more comparable to people without dementia. A recent review identified several adaptations that may be beneficial when delivering psychological therapies with people living with dementia, including simplifying language, using memory aids, and involving family members or carers (Robinson and Moghaddam, 2022). As data were derived from a natural therapy setting, it is possible that some adaptations were made for people living with dementia during their psychological therapy. However, data regarding this were unavailable. Next, previous research has suggested that motivation to change is a significant predictor of IAPT therapy outcomes (Verbist et al., 2021). Whilst apathy can be present in depression and anxiety, it is also highly prevalent in dementia (Leung et al., 2021). It may be that people living with dementia are more likely to have lower motivation to change and adhere to therapeutic strategies, lending some explanation as to why psychological therapy outcomes are worse in people living with dementia. Relatedly, one possible explanation as to why therapy outcomes are worse in people living with dementia yet many do improve and recover may relate to the amount of support they receive outside of therapy. Previous research has suggested that social support is associated with better psychological therapy outcomes in a general population (Buckman et al., 2021b). Moreover, previous research of interviews with IAPT clinicians suggested that involving family members and carers in the therapy process can be beneficial for people living with dementia (Baker et al., 2022). It may be that people living with dementia who live with a spouse or carer are more likely to receive support and encouragement to attend sessions and implement strategies learned in therapy than those who live independently. More research is needed to understand which factors may be associated with better psychological therapy outcomes within people living with dementia specifically.

Strengths and limitations

This is the first study to examine IAPT outcomes for people living with dementia, and to date, the largest ever study to examine psychological therapy outcomes in a national sample of people living with dementia using routinely collected data from a natural setting. However, there are also several notable limitations. First, this study is unable to infer causal relationships between receiving

psychological therapy and depression and anxiety symptoms improvement in people living with dementia. Whilst the PHQ-9 has been validated for use with people living with dementia (Hancock and Larner, 2009), the GAD-7 has not. Another limitation is that it was not possible to account for all variables that may be associated with psychological therapy outcomes in IAPT (e.g., social support (Buckman et al., 2021b)). Further, whilst controlling for LTCs, multimorbidity was not taken into account as the binary measure used does not specify the number of conditions present. Not only is multimorbidity more common in people living with dementia (Tonelli et al., 2017), but there may also have been systematic differences in the types of LTCs between samples that may in part explain the difference in outcomes. Next, due to the stepped-care model used in IAPT, it was not possible to reliably investigate type of psychological therapy as patients often receive a range of evidence-based treatments within an episode of care. Moreover, whilst CBT-related therapies can be offered to all patients in IAPT, other types of therapies are only offered to patients with specific mental health diagnoses (e.g., interpersonal therapy for people with depression, EMDR for people with PTSD) (National Collaborating Centre for Mental Health, 2021). Instead, this study investigated associations between dementia and psychological therapy outcomes across treatment intensity as this is a more important distinction in IAPT and more inclusive across mental health diagnoses, however this also means that the present findings are unable to contribute evidence for specific types of psychological interventions. Similarly, whilst a minimum of two therapy sessions is the definition used by IAPT for a course of treatment (National Collaborating Centre for Mental Health, 2021), this is not consistent with NICE recommendations for treating depression in a general adult population across a variety of psychological interventions (National Institute for Health and Care Excellence, 2022). Further, it was not possible to account for any possible adaptations made during psychological therapy for people living with dementia as these data were unavailable. As such, it is unclear if any adaptations were offered to the people living with dementia in this sample or what sort of adaptations were implemented as this is likely to vary depending on the service and clinician.

Another limitation may relate to how the dementia sample was identified. In this study people living with dementia were identified based on linked records, thus

some people living with dementia (those without linked records) attending IAPT may have been missed. However, as it is likely that the proportion of people living with dementia with a linked IAPT/HES records is higher than in people without dementia, this study may reflect a bias towards a higher level of representation of people living with dementia than is actually the case. Further, using HES data meant relying on formal dementia diagnosis to identify people living with dementia. As not all participants will have been assessed for dementia, this study could not capture suspected but undiagnosed dementia or cases not recorded in HES. Thus, it is not possible to guarantee that the control sample was free from dementia or cognitive impairment. Using matched samples may have made it more likely that people living with dementia were matched with people with undiagnosed dementia; however, if this were the case an underestimation of the effect would be expected. Similarly, it is possible that for those who did have dementia assessments and were presenting with mild symptoms, some services may have diagnosed mild cognitive impairment rather than dementia. However, previous research has suggested that routinely collected UK health records have good validity estimates for dementia diagnoses (McGuinness et al., 2019). Another limitation is that it was not possible to account for the severity of dementia at the time of IAPT treatment. It is likely that the people living with dementia treated in IAPT were presenting with milder symptoms and those with more severe symptoms were referred on to other specialist services, however data were not available to explore this. As such, the large effect sizes found for change in depression and anxiety may only reflect improvement in people with mild dementia. Finally, whilst a large sample of people living with dementia receiving psychological therapy was identified, this is a smaller proportion than would be expected. Due to the selective sample, these treatment effect sizes are likely to be an overestimate and may differ if people living with dementia were better represented in IAPT.

Implications and future directions

Understanding whether primary care psychological therapy services, such as IAPT, are effective in reducing symptoms of depression and anxiety in people living with dementia has important implications for public health. These results support the treatment of anxiety and depression in people living with dementia within primary care psychological therapy services. Understanding this is critical

given the high prevalence of anxiety and depression in people living with dementia (Leung et al., 2021), associated adverse outcomes (Beerens et al., 2013; Dorenlot et al., 2005; Rapp et al., 2011), and lack of strong evidence for the efficacy of alternative treatment options such as antidepressants (Dudas et al., 2018). Moreover, older people are currently under-represented in services such as IAPT (Clark, 2018), with previous research suggesting that general practitioners are often reluctant to refer older people to IAPT services due to views about appropriateness and preferences for alternative treatments (Collins and Corna, 2018). Additionally, this study also highlights that people living with dementia may be underserviced in IAPT by 1.5 to 9 times the expected need for these services in this population. As such, improving access to these services is essential. Given the promising evidence for the benefits of psychological therapy for people living with dementia, the present findings may have implications for referrals as building this evidence-base is crucial for encouraging referrals of people living with dementia into primary care psychological therapy services. Whilst this study evaluates psychological outcomes for a selective group of people living with dementia with depression or anxiety (i.e., those who access IAPT) and are unlikely to be representative of people living with dementia with depression and anxiety who do not attend psychological therapy services, these findings are still important for understanding whether IAPT can be beneficial. For example, if outcomes are poor in this sample, they are unlikely to be better in a more representative sample of people living with dementia. Next, this research also highlights the need to identify appropriate adaptations that could be beneficial for improving psychological therapy outcomes for people living with dementia and ensuring that clinicians have adequate training for working with people living with dementia and implementing these adaptations. Currently, dementia-specific training is not routinely offered to clinicians in IAPT, with clinicians reporting feeling unsupported in working with people living with dementia (Baker et al., 2022). Therefore, services should consider implementing strategies to help staff feel more confident supporting people living with dementia. Finally, it is important to acknowledge that there is a lot of variation in dementia, thus psychological therapies may not suit everyone. As such, the appropriateness of services should be determined prior to referral and a range of interventions

should be available to suit different preferences and levels of cognitive impairment.

To better understand psychological therapy outcomes in people living with dementia, more research is needed to explore which factors (e.g., sociodemographic, dementia type, therapy variables) are associated with better psychological therapy outcomes. Understanding who with dementia may be more likely to benefit from psychological therapy can help encourage referrals and inform clinician training and service adaptations. Similarly, future research should also explore differences in pathways into (e.g., referral, waiting times) and through (e.g., number of sessions, treatment type) psychological therapy between people living with dementia and people without dementia to identify potential barriers to accessing and engaging with primary care psychological therapy services.

Conclusions

Psychological therapies offered in IAPT services may be beneficial for reducing symptoms of depression and anxiety in people living with dementia; however, people living with dementia are less likely to experience improvement in symptoms or recover from depression and anxiety than people without dementia. Given current public health recommendations, research exploring psychological therapy outcomes in people living with dementia using data from natural settings is crucial for understanding whether these services are effective. Greater insight into why there is a difference in therapy outcomes between people living with dementia and people without dementia could help inform adaptations in services to improve these outcomes for people living with dementia.

Chapter 5: Predictors of IAPT therapy outcomes in people living with dementia

This chapter includes research that has been submitted to the British Journal of Psychiatry and is undergoing revision after peer review.

Abstract

Background: Primary care psychological therapy services, such as Improving Access to Psychological Therapies (IAPT), can be effective in reducing symptoms of depression and anxiety in people living with dementia and are recommended by national guidelines in the UK. However, it is currently unknown which factors are associated with better psychological therapy outcomes in people living with dementia.

Aims: Investigate whether dementia-specific and non-dementia specific factors are associated with psychological therapy outcomes in people living with dementia.

Methods: National linked healthcare records (MODIFY grant dataset) were used to identify 1,522 people living with dementia who attended IAPT services across England. Logistic regression models were conducted to explore associations between dementia-specific (dementia type, age at dementia diagnosis, time between dementia diagnosis and IAPT therapy) and non-dementia specific sociodemographic and clinical (age, gender, IMD decile, employment status, baseline depression, baseline anxiety, baseline work and social functioning, psychotropic medication use, long term health conditions, number of sessions, IAPT waiting time) factors with psychological therapy outcomes (reliable recovery, deterioration, dropout) on widely used measures of depression (PHQ-9) and anxiety (GAD-7).

Results: No evidence was found for associations between dementia type and psychological therapy outcomes, except for people with frontotemporal dementia had higher likelihood of deterioration in symptoms of depression or anxiety than people with vascular dementia (OR = 2.98, 95% CI [1.08, 8.22], p = .03) and people with Alzheimer's disease (OR = 2.95, 95% CI [1.15, 7.55], p = .03). Age at dementia diagnosis (<65 vs 65+) did not predict any therapy outcomes after controlling for sociodemographic and clinical factors. For non-dementia specific factors, greater depression severity (recovery: OR = .95, 95%

CI [.92, .98], p < .001; deterioration: OR = 1.73, 95% CI [1.04, 2.90], p = .04), anxiety severity (deterioration: OR = .89, 95% CI [.84, .94], p < .001; dropout: OR = 1.06, 95% CI [1.02, 1.11], p = .01), lower work and social functioning (recovery: OR = .98, 95% CI [.96 .99], p = .002; dropout: OR = 1.03, 95% CI [1.01, 1.05], p = .01), psychotropic medication use (recovery: OR = .67, 95% CI [.51, .90], p = .01; deterioration: OR = 1.73, 95% CI [1.04, 2.90], p = .04), being working age (recovery: OR = 2.03, 95% CI [1.10, 3.73], p = .02), and fewer therapy sessions (recovery: OR = 1.12, 95% CI [1.09, 1.16], p < .001) were all associated with worse psychological therapy outcomes in people living with dementia.

Conclusions: Dementia type was generally not associated with psychological therapy outcomes. Associations between clinical variables and therapy outcomes in people living with dementia were in line with those identified for a general population. These findings have implications for identifying people with dementia who may particularly benefit from psychological therapy services. Additional support and adaptations (e.g., more therapy sessions, more regular clinical reviews) may be required to improve psychological therapy outcomes in people living with dementia, particularly in those who are younger and have more severe depression.

Introduction

Depression and anxiety are common in people living with dementia (Leung et al., 2021) and have been associated with numerous adverse outcomes, such as earlier institutionalisation (Dorenlot et al., 2005), lower quality of life (Beerens et al., 2013), and faster cognitive decline (Rapp et al., 2011). A recent Cochrane review of randomised control trials has suggested that psychological therapies may be helpful in reducing symptoms of depression in people living with dementia (Orgeta et al., 2022). In line with NICE guidelines (National Institute for Health and Care Excellence, 2018), depression and anxiety in people living with dementia are routinely treated with psychological therapies offered in primary care psychological therapy services, such as Improving Access to Psychological Therapies (IAPT). Findings from Chapter 4 provide supporting evidence for the utility of IAPT services for reducing symptoms of depression

and anxiety in people living with dementia, although at present psychological therapy outcomes in people living with dementia are not as good as for people without dementia (Bell et al., 2022a). Moreover, there is significant variability in psychological therapy outcomes within people living with dementia and less is known about who, within a dementia population, might be more likely to benefit from psychological therapy. Understanding this is critical in informing treatment decision making and identifying the optimal choice of treatment.

Dementia is an umbrella term that covers a range of neurological conditions (Alzheimer's Society, 2021), thus it is not appropriate to take a ‘one-size-fits-all' approach to care and treatment. In relation to treating depression and anxiety in people living with dementia, it is possible that different symptomology associated with different types of dementia could be an important factor when considering psychological therapy outcomes, particularly in the earlier stages when psychological therapy may be more relevant. Specifically, it may be that different neurological symptoms may differentially affect ability to engage with psychological treatment protocols. For example, people living with dementia with memory-led symptoms, such as in Alzheimer's disease (AD), may experience difficulties with remembering and implementing therapeutic strategies leading to poorer psychological therapy outcomes. However, it may also be easier for patients and clinicians to compensate for memory difficulties using adaptations (e.g., memory aids, involving family members in the therapy process) (Robinson and Moghaddam, 2022) than behavioural symptoms (e.g., loss of motivation, mental inflexibility, loss of empathy) characteristic of behavioural variant frontotemporal dementia (BvFTD) (Rascovsky et al., 2011). Additionally, previous research has suggested that people with BvFTD are less likely to engage with services and to have insight into their difficulties (Barker et al., 2022), which may affect psychological therapy outcomes. Since memory difficulties have been a main focus for adapted psychological therapies for people living with dementia (Robinson and Moghaddam, 2022) given the high prevalence of AD (World Health Organization, 2023) and that non-memory led dementias are commonly misunderstood, it may be that psychological therapy is less optimally adapted and less effective for people with atypical forms of AD with non-memory cognitive symptoms (e.g., frontal variant AD, posterior cortical atrophy).

Next, it is also important to recognise differences between young-onset (aged <65 years) and late-onset dementia (aged 65+ years). People with young-onset dementia are more likely to experience behavioural and psychological symptoms (Altomari et al., 2022), present with non-memory based first cognitive symptoms (Barnes et al., 2015), have rarer forms of dementia (Shea et al., 2021), and have a greater awareness of the disease (Baptista et al., 2019) than people with late-onset dementia. Considering these differences and previous findings that older adults have better psychological therapy outcomes than working age adults (Saunders et al., 2021), it is possible that people with late-onset dementia may have better psychological therapy outcomes than people with young-onset dementia.

Finally, in relation to non-dementia specific factors, previous research has identified various sociodemographic, clinical and therapy variables that have been associated with psychological therapy outcomes for common mental health problems (e.g., depression, anxiety) in a general population. Some examples associated with poorer psychological therapy outcomes include higher baseline symptom severity (Buckman et al., 2021a; Saunders et al., 2020; Stochl et al., 2021), longer duration of symptoms prior to treatment (Buckman et al., 2021a), greater baseline impairment in work and social functioning (Delgadillo et al., 2016; Stochl et al., 2021), lack of social support (Buckman et al., 2021b), psychotropic medication use (Buckman et al., 2021a), fewer treatment sessions (Clark et al., 2018; Saunders et al., 2020), longer waiting times (Clark et al., 2018), younger age (Saunders et al., 2021), and unemployment (Buckman et al., 2022). Such factors may also be important in dementia, although at present no research has investigated this in people living with dementia specifically. Understanding which factors are associated with better psychological therapy outcomes in people living with dementia could have important implications for informing service adaptation and improving therapy outcomes in this population. Consequently, this study will be the first to:

1. Investigate whether dementia specific factors (including dementia type and age at dementia diagnosis) are associated with psychological therapy outcomes

2. Investigate whether non-dementia specific factors (sociodemographic, clinical and therapy variables) are associated with psychological therapy outcomes in people living with dementia

Methods

Participants

This study utilises the MODIFY grant dataset (as previously described in Chapter 1). This includes IAPT data (National Collaborating Centre for Mental Health, 2021) linked with Hospital Episode Statistics (HES) data (NHS Digital, 2021a), the Mental Health Services Dataset (MHSDS) (NHS Digital, 2021b), and HES-ONS mortality data (NHS Digital, 2020). Anonymised data and linkage key were provided by NHS Digital. A sample of people living with dementia who attended IAPT between 2012 to 2019 were identified using exclusion criteria consistent with Chapter 4 (Bell et al., 2022a) and previous research using IAPT data (Saunders et al., 2021). Where participants entered psychological treatment on more than one occasion during this period, only data from their first IAPT treatment were used. Participants were included if they received a course of psychological treatment (defined as at least two sessions) (National Collaborating Centre for Mental Health, 2021), had a primary mental health diagnosis that is treated in IAPT (National Collaborating Centre for Mental Health, 2021), were not still receiving treatment, had complete pre-post data for the Patient Health Questionnaire 9-item (PHQ-9) (Kroenke et al., 2001) and the Generalized Anxiety Disorder Scale 7-item (GAD-7) (Spitzer et al., 2006), met the clinical cut-off for caseness for depression (10+ on PHQ-9) or anxiety (8+ on GAD-7, or scoring above ‘caseness’ on any Anxiety Disorder Specific Measure (ADSM); see Appendix B for ADSMs cut-offs) (National Collaborating Centre for Mental Health, 2021), and received a dementia diagnosis prior to attending IAPT (those diagnosed during or after therapy were excluded). The full sample comprised of 1,522 people living with dementia (regardless of dementia diagnosis type) to maximise power when examining non-dementia specific factors (see Table 18 for sample characteristics).

Dementia type subsample

This subsample was used to investigate the association between dementia specific factors and psychological therapy outcomes. To facilitate examination of differences between dementia types, participants with non-specific dementia diagnoses were excluded to create this subsample. Dementia type was determined based on ICD-10 codes (World Health Organization, 1993). To define the dementia type subsample, participants with only one diagnosis type for the Alzheimer's disease (AD), vascular dementia (VaD) and frontotemporal dementia (FTD) groups were used (excluding any cases where there was more than one diagnosis recorded at different time points) (see Chapter 1 for overview of these dementia types). For the atypical AD group, there were no participants in the full sample that had a diagnosis of atypical AD only. Instead, to define this group, participants who were diagnosed with atypical dementia with any combination of AD or 'dementia not otherwise specified' were used. The final subsample included 479 people living with dementia, of whom 214 had a diagnosis of AD, 150 had VaD, 65 had atypical AD, and 50 had FTD (see Table 19 for subsample characteristics). Comparisons of those included and excluded from this subsample are presented in Appendix F.

Table 18: Full sample characteristics

Characteristic		**Full sample (N = 1,522) N (%)**
Gender	Male	647 (42.51)
	Female	871 (57.23)
	Missing/Prefer not to say	4 (0.26)
Ethnicity	White	1,209 (79.43)
	Mixed	15 (0.99)
	Asian	68 (4.47)
	Black	54 (3.55)
	Other	22 (1.45)
	Missing/Prefer not to say	154 (10.12)
Employment status	Unemployed	420 (27.60)
	Employed	167 (10.97)
	Retired	800 (52.56)
	Missing/Prefer not to say	135 (8.87)
LTC case	Yes	760 (49.93)
	No	385 (25.30)
	Missing/Prefer not to say	377 (24.77)
Psychotropic medication	Taking	814 (53.48)
	Not taking	454 (29.83)
	Missing	254 (16.69)
Age at dementia diagnosis	<65	675 (44.35)
	65+	847 (55.65)
Age at referral (categorical)	<65	610 (40.08)
	65+	912 (59.92)
		Mean (SD)
Age at referral		65.93 (16.12)
IMD decile		4.76 (2.81)
Baseline depression severity (PHQ-9)		15.70 (5.67)
Baseline anxiety severity (GAD-7)		13.11 (4.95)
Baseline work and social functioning (WSAS)		16.91 (9.72)
Waiting time (weeks)		10.37 (8.57)
Dementia diagnosis to treatment (weeks)		102.03 (135.94)
Number of sessions		5.53 (3.98)

Table 19: Dementia type subsample characteristics

Characteristic		**AD (N = 214) N (%)**	**VaD (N = 150) N (%)**	**FTD (N = 50) N (%)**	**Atypical AD (N = 65) N (%)**
Gender	Male	85 (39.72)	69 (46.00)	31 (62.00)	29 (44.62)
	Female	129 (60.28)	81 (54.00)	19(38.00)	36 (55.38)
Ethnicity	White	166 (77.57)	127 (84.67)	42 (84.00)	49 (75.38)
	Mixed	4 (1.87)	1 (0.67)	1(2.00)	1 (1.54)
	Asian	6 (2.80)	6 (4.00)	0 (0.00)	4 (6.15)
	Black	5 (2.34)	5 (3.33)	0 (0.00)	3 (4.62)
	Other	5 (2.34)	1 (0.67)	0 (0.00)	0 (0.00)
	Missing/Prefer not to say	28 (13.08)	10 (6.67)	7 (14.00)	8 (12.31)
Employment status	Unemployed	49 (22.90)	29 (19.33)	27 (54.00)	7 (10.77)
	Employed	27 (12.62)	8 (5.33)	7 (14.00)	3 (4.62)
	Retired	124 (57.94)	103 (68.67)	12 (24.00)	52 (80.00)
	Missing/Prefer not to say	14 (6.54)	10 (6.67)	4 (8.00)	3 (4.62)
LTC case	Yes	91 (42.52)	85 (56.67)	23 (46.00)	35 (53.85)
	No	68 (31.78)	27 (18.00)	16 (32.00)	15 (23.08)
	Missing/Prefer not to say	55 (25.70)	38 (25.33)	11 (22.00)	15 (23.08)
Psychotropic medication	Taking	114 (53.27)	79 (52.67)	33 (66.00)	38 (58.46)
	Not taking	75 (35.05)	42 (28.00)	15 (30.00)	19 (29.23)
	Missing	25 (11.68)	29 (19.33)	2 (4.00)	8 (12.31)
Age at dementia diagnosis	<65	92 (42.99)	51 (34.00)	38 (76.00)	9 (13.85)
	65+	122 (57.01)	99 (66.00)	12 (24.00)	56 (86.15)
		Mean (SD)	**Mean (SD)**	**Mean (SD)**	**Mean (SD)**
Age at referral		66.19 (16.40)	69.93 (14.74)	56.60 (12.83)	73.69 (11.24)
IMD decile		5.25 (2.82)	4.57 (2.84)	4.98 (2.88)	5.54 (2.80)
Baseline depression severity (PHQ-9)		15.91 (6.00)	15.42 (5.54)	17.88 (4.91)	14.46 (5.88)
Baseline anxiety severity (GAD-7)		13.61 (4.92)	12.49 (5.23)	13.70 (4.70)	12.45 (4.54)
Baseline work and social functioning (WSAS)		16.74 (9.57)	16.35 (8.79)	19.60 (9.40)	13.60 (8.18)

Waiting time (weeks)	11.91 (9.68)	9.89 (7.85)	10.35 (9.43)	10.64 (8.53)
Dementia diagnosis to treatment (weeks)	170.22 (283.82)	96.64 (89.67)	95.27 (67.45)	69.29 (71.66)
Number of sessions	5.93 (4.32)	4.99 (2.97)	6.82 (4.80)	5.17 (3.09)

Measures

Sociodemographic factors

Sociodemographic information was available from IAPT and HES data, including gender, ethnicity, employment status, index of multiple deprivation (IMD) decile, and age at referral to IAPT. Ethnicity was categorised using ONS-ethnicity groups. IMD decile was treated as a continuous variable with lower scores representing more deprived geographical areas in England. Given previous findings regarding age and therapy outcomes (Saunders et al., 2021), age was explored as a categorical variable (<65 years vs 65+ years).

Clinical and therapy factors

Clinical and therapy variables associated with psychological therapy outcomes in a general population identified in previous research (Buckman et al., 2021a; Clark et al., 2018; Delgadillo et al., 2016; Saunders et al., 2020; Stochl et al., 2021) were available in IAPT data. Routinely collected IAPT data included pre-post therapy measures for depression (PHQ-9) and anxiety (GAD-7 or ADSM), baseline measure of work and social functioning (Work and Social Adjustment Scale; WSAS) with higher scores reflecting greater functional impairment (Mundt et al., 2002), whether the patient was taking any psychotropic medication (e.g., anti-depressants, anxiolytic), the number of therapy sessions attended, and whether a long-term health condition (LTC) was present. Waiting time between referral and treatment was calculated from the dates provided in IAPT records and winsorized at the top 99% due to a small number of extreme values.

Dementia factors

Dementia diagnosis and type were taken from ICD-10 codes (World Health Organization, 1993) recorded in HES and MHSDS data. Previous research has suggested that this approach has good validity (McGuinness et al., 2019). Whilst it was not possible to ascertain age at dementia onset, information regarding age at the time of first dementia record was available. This was dichotomised as ‘under 65 years old’ (young onset) and ‘aged 65 years and over’ (late onset) and treated as an approximate estimate of age of onset. Time between dementia diagnosis and starting treatment was calculated using dates

available from IAPT, HES, and MHSDS data and represents the number of weeks between these dates.

Outcome measures

As per Chapter 4 (Bell et al., 2022a), primary and secondary outcome measures were based on IAPT definitions routinely used in IAPT services (NHS Digital, 2019). Primary outcomes included reliable recovery (reduction in depression or anxiety symptoms beyond the error of measurement on PHQ-9, GAD-7, or ADSM and ending treatment below the clinical caseness threshold on both depression and anxiety measures), reliable deterioration (increase in depression or anxiety symptoms beyond the error of measurement), and dropout (did not complete course of therapy). Secondary outcomes included reliable improvement (reduction in depression or anxiety symptoms beyond the error of measurement), and pre-post therapy change in PHQ-9 and GAD-7 scores. See Appendix B for scale cut-offs.

Statistical analysis

All analyses were conducted using STATA 17 (StataCorp, 2021). First, using the dementia type subsample, associations between dementia-specific factors (dementia type, age at dementia diagnosis, time between dementia diagnosis and IAPT therapy) and psychological therapy outcomes were explored. Logistic regression models were used for primary outcomes (reliable recovery, reliable deterioration, dropout) and reliable improvement, and linear regression models were used for the other secondary outcomes (PHQ-9 change, GAD-7 change). Standardised beta coefficients are reported for linear regression models. Complete data were available for all dementia-specific factors.

Next, using the full sample, associations between non-dementia specific factors with psychological therapy outcomes were explored. Specifically, sociodemographic (age, gender, IMD decile, employment status), clinical and therapy (baseline depression, baseline anxiety, baseline work and social functioning, psychotropic medication use, LTC, number of sessions, IAPT waiting time) factors were explored alongside significant dementia-specific factors from the previous model (age at dementia diagnosis). Ethnicity was not included in these models due to the small number of participants (10.45%) identifying as non-white ethnicities. Variables were first explored using

univariate logistic regression models. Those with significant associations were used in the subsequent analyses. For these, multiple logistic regression models were conducted for primary outcomes and reliable improvement, and multiple linear regression models were used for the other secondary outcomes. To maximise sample size, missing data on all categorical variables were dummy coded and used in analyses. Comparisons of participants with complete vs missing data on at least one key variable (full sample) were performed using independent t-tests and chi-square tests (Appendix G). Finally, a sensitivity analysis exploring individual WSAS items (excluding the 'ability to work' item was conducted for primary outcomes only.

Results

Dementia-specific factors and psychological therapy outcomes

Primary outcomes

The association between dementia-specific factors and primary psychological therapy outcomes are presented in Table 20. There was no evidence to suggest that dementia type was associated with psychological therapy outcomes, with the exception that people with FTD had a higher likelihood of deterioration in symptoms of depression or anxiety following therapy than people with VaD (OR = 2.98, 95% CI [1.08, 8.22], p = .03) and people with AD (OR = 2.95, 95% CI [1.15, 7.55], p = .03). Age at dementia diagnosis was associated with all psychological therapy outcomes, suggesting that being diagnosed with dementia at age 65 or older vs. 64 or below is associated with higher likelihood of recovery (OR = 2.98, 95% CI [2.02, 4.39], p <.001), and lower likelihood of reliable deterioration (OR = .35, 95% CI [.17, .73], p = .01) and dropout (OR = .49, 95% CI [.31, .79], p = .003) following psychological therapy. No significant relationships were found for time between dementia diagnosis and treatment.

Secondary outcomes

Findings for secondary outcomes are presented in Table 21. No associations were found between dementia-specific factors and change in depression. Age at dementia diagnosis was significantly associated with pre-post therapy

change in symptoms of anxiety (B = .11, se = .52, p - .02) and higher odds of reliable improvement (OR = 1.87, 95% CI [1.28, 2.74], p = .001).

Table 20: Association between dementia-specific factors and primary psychological therapy outcomes

	Reliable Recovery			Reliable deterioration			Dropout		
	OR	**95% CI**	**p**	**OR**	**95% CI**	**p**	**OR**	**95% CI**	**p**
AD (REF) vs VaD	1.27	.83, 1.93	.27	.99	.41, 2.37	.98	.91	.53, 1.57	.74
AD (REF) vs FTD	.94	.51, 1.76	.85	**2.95**	**1.15, 7.55**	**.03**	1.12	.54, 2.33	.76
AD (REF) vs Atyp	1.19	.68, 2.07	.55	.75	.21, 2.71	.66	.83	.38, 1.83	.65
VaD (REF) vs FTD	.74	.39, 1.42	.37	**2.98**	**1.08, 8.22**	**.03**	1.23	.56, 2.66	.61
VaD (REF) vs Atyp	.94	.52, 1.68	.83	.76	.20, 2.90	.69	.91	.40, 2.09	.83
Atyp (REF) vs FTD	.79	.38, 1.67	.54	3.94	.99, 15.70	.05	1.34	.51, 3.53	.55
Age at dementia diagnosis (<65 [REF] vs 65+)	**2.98**	**2.02, 4.39**	**<.001**	.35	.17, .73	.01	**.49**	**.31, .79**	**.003**
Dementia diagnosis to IAPT treatment	.99	.99, .99	.05	1.00	.99, 1.00	.55	**1.00**	**1.00, 1.00**	**.02**

Table 21: Association between dementia-specific factors and secondary psychological therapy outcomes

	PHQ-9 change			GAD-7 change			Reliable improvement		
	B	**se**	**p**	**B**	**se**	**p**	**OR**	**95% CI**	**p**
AD (REF) vs VaD	-.02	.69	.74	-.01	.60	.84	.81	.52, 1.25	.34
AD (REF) vs FTD	-.01	1.08	.84	-.08	.92	.19	.69	.37, 1.29	.24
AD (REF) vs Atyp	-.05	.94	.36	.03	.77	.58	1.04	.58, 1.88	.90
VaD (REF) vs FTD	.001	1.08	.99	-.08	.96	.25	.85	.44, 1.62	.62
VaD (REF) vs Atyp	-.05	.94	.51	.05	.79	.49	1.28	.69, 2.38	.43
Atyp (REF) vs FTD	.04	1.34	.64	-.15	1.05	.12	.66	.31, 1.42	.29
Age at dementia diagnosis (<65 [REF] vs 65+)	.08	.62	.08	**.11**	**.52**	**.02**	**1.87**	**1.28, 2.74**	**.001**
Dementia diagnosis to IAPT treatment	-.02	.001	.67	-.02	.001	.61	.99	.99, 1.00	.06

Non-dementia specific factors and psychological therapy outcomes

The following analyses were performed with the full sample and included significant non-dementia specific factors (gender, IMD decile, age at referral, psychotropic medication use, baseline depression severity, baseline anxiety severity, baseline work and social functioning, number of therapy sessions) from the univariate models (Appendix H) and age at dementia diagnosis.

Primary outcomes

Findings for primary psychological therapy outcomes are presented in Table 22. When controlling for all other variables in the model, no evidence for an association was found for gender, IMD decile, or age at dementia diagnosis with any psychological therapy outcome. Age at referral was associated with reliable recovery (OR = 2.03, 95% CI [1.10, 3.73], p =.02), suggesting that older people living with dementia (65+) were more likely to recover from symptoms of depression and anxiety than working age people living with dementia (<65). Taking psychotropic medication was associated with lower likelihood of reliable recovery (OR = .67, 95% CI [.51, .90], p = .01) and higher likelihood of reliable deterioration (OR = 1.73, 95% CI [1.04, 2.90], p = .04). Higher baseline depression severity was associated with lower likelihood of reliable recovery (OR = .95, 95% CI [.92, .98], p = <.001) and deterioration (OR = .94, 95% CI [.89, .98], p = .01). Higher baseline anxiety severity was associated with higher likelihood of dropout (OR = 1.06, 95% CI [1.02, 1.11], p = 01) and lower likelihood of deterioration (OR = .89, 95% CI [.84, .94], p <.001). Greater impairment in baseline work and social functioning was associated with lower likelihood of reliable recovery (OR = .98, 95% CI [.96, .99], p = .002) and higher likelihood of dropout (OR = 1.03, 95% CI [1.01, 1.05], p = .01). Receiving more therapy sessions was associated with higher likelihood of reliable recovery (OR = 1.12, 95% CI [1.09, 1.16], p <.001).

Secondary outcomes

Findings for secondary psychological therapy outcomes are presented in Table 23. No associations were found for IMD decile or age at dementia diagnosis. Being female was associated with higher likelihood of reliable improvement only (OR = 1.32, 95% CI [1.01, 1.71], p = .04). Baseline depression severity was associated with change in depression (B = .50, se = .04, p < .001) and anxiety

(B = -.09, se = .03, p = .01). Baseline anxiety severity was associated with change in anxiety (B = .52, se = .04, p < .001) and reliable improvement (OR = 1.06, 95% CI [1.03, 1.09], p < .001). Finally, age at referral (PHQ-9 change: B = .18, se = .89, p = .01; GAD-7 change: B = .19, se = .76, p = .003; reliable improvement: OR = 2.11, 95% CI [1.10, 4.04], p = .02), psychotropic medication use (PHQ-9 change: B = -.08, se = .42, p = .01; GAD-7 change: B = -.07, se = .35, p = .03; reliable improvement: OR = .62, 95% CI [.46, .84], p = .002), baseline work and social functioning (PHQ-9 change: B = -.12, se = .02, p < .001; GAD-7 change: B = -.09, se = .02, p = .002; reliable improvement: OR = .98, 95% CI [.96, .99], p = .002), and number of therapy sessions (PHQ-9 change: B = .19, se = .05, p < .001; GAD-7 change: B = .17, se = .04, p < .001; reliable improvement: OR = 1.10, 95% CI [1.06, 1.14], p < .001) were associated with all secondary outcomes.

Table 22: Association between non-dementia specific factors and primary psychological therapy outcomes (adjusted model)

	Reliable Recovery (N = 1,079)			Reliable deterioration (N = 1,079)			Dropout (N = 912)		
	OR	**95% CI**	**p**	**OR**	**95% CI**	**p**	**OR**	**95% CI**	**P**
Gender (Male REF)	1.09	.84, 1.41	.53	.90	.58, 1.40	.64	1.08	.78, 1.49	.64
IMD Decile	1.01	.97, 1.06	.61	.98	.91, 1.07	.71	.95	.90, 1.01	.12
Age at referral (<65 [REF] vs 65+)	**2.03**	**1.10, 3.73**	**.02**	1.06	.42, 2.70	.90	.55	.26, 1.18	.12
Psychotropic medication (Not taking REF)	**.67**	**.51, .90**	**.01**	**1.73**	**1.04, 2.90**	**.04**	1.14	.80, 1.64	.47
Baseline depression severity (PHQ-9)	**.95**	**.92, .98**	**<.001**	**.94**	**.89, .98**	**.01**	1.00	.96, 1.03	.79
Baseline anxiety severity (GAD-7)	.99	.96, 1.03	.67	**.89**	**.84, .94**	**<.001**	**1.06**	**1.02, 1.11**	**.01**
Baseline work and social functioning (WSAS)	**.98**	**.96, .99**	**.002**	1.01	.98, 1.04	.49	**1.03**	**1.01, 1.05**	**.01**
Number of sessions	**1.12**	**1.09, 1.16**	**<.001**	.98	.93, .104	.51	**.76**	**.71, .81**	**<.001**
Age at dementia diagnosis (<65 [REF] vs 65+)	.76	.41, 1.40	.38	.53	.21, 1.37	.19	1.08	.50, 2.33	.85

Table 23: Association between non-dementia specific factors and secondary psychological therapy outcomes

	PHQ-9 change (N = 1,080)			GAD-7 change (N = 1,080)			Reliable improvement (N = 1,079)		
	B	**se**	**p**	**B**	**se**	**p**	**OR**	**95% CI**	**p**
Gender	.04	.38	.16	.04	.32	.13	**1.32**	**1.01, 1.71**	**.04**
IMD Decile	.01	.07	.78	.01	.06	.61	1.04	.99, 1.09	.12
Age at referral (<65 vs 65+)	**.18**	**.89**	**.01**	**.19**	**.76**	**.003**	**2.11**	**1.10, 4.04**	**.02**
Psychotropic medication	**-.08**	**.42**	**.01**	**-.07**	**.35**	**.03**	**.62**	**.46, .84**	**.002**
Baseline depression severity (PHQ9)	**.50**	**.04**	**<.001**	**-.09**	**.03**	**.01**	1.02	.99, 1.04	.21
Baseline anxiety severity (GAD7)	-.04	.05	.21	**.52**	**.04**	**<.001**	**1.06**	**1.03, 1.09**	**<.001**
Baseline functioning (WSAS)	**-.12**	**.02**	**<.001**	**-.09**	**.02**	**.002**	**.98**	**.96, .99**	**.002**
Number of sessions	**.19**	**.05**	**<.001**	**.17**	**.04**	**<.001**	**1.10**	**1.06, 1.14**	**<.001**
Age at dementia diagnosis (<65 vs 65+)	-.06	.90	.36	-.07	.76	.31	.70	.36, 1.35	.29

Sensitivity analysis

Given the majority of participants in the full sample were either unemployed (27.60%) or retired (52.56%), a sensitivity analysis was conducted to explore individual WSAS items excluding item 1 (‘ability to work’). Results are presented in Table 24. Greater functional impairment in home management was associated with lower likelihood of dropout (OR = .92, 95% CI [.85, .99], p = .03), whereas greater impairment in social leisure activities was associated with higher likelihood of dropout (OR = 1.09, 95% CI [1.00, 1.18], p = .05). Greater impairment in forming and maintaining close relationships was associated with lower likelihood of reliable recovery (OR = .94, 95% CI [.89, 1.00], p =.04). No significant associations were found for private leisure activities.

Table 24: Sensitivity analysis using individual WSAS items (adjusted model)

	Reliable Recovery (N = 1,100)			Reliable deterioration (N = 1,100)			Dropout (N = 929)		
	OR	**95% CI**	**p**	**OR**	**95% CI**	**p**	**OR**	**95% CI**	**P**
Gender (Male REF)	1.08	.83, 1.40	.58	.96	.62, 1.49	.86	1.07	.78, 1.47	.69
IMD Decile	1.00	.95, 1.05	.96	1.00	.92, 1.08	.95	.96	.90, 1.02	.17
Age at referral (<65 [REF] vs 65+)	**2.11**	**1.14, 3.91**	**.02**	1.06	.41, 2.72	.90	.53	.25, 1.14	.10
Psychotropic medication (Not taking REF)	**.69**	**.52, .91**	**.01**	**1.76**	**1.06, 2.91**	**.03**	1.14	.80, 1.63	.47
Baseline depression severity (PHQ-9)	**.95**	**.92, .98**	**<.001**	**.93**	**.89, .98**	**.01**	1.00	.96, 1.03	.81
Baseline anxiety severity (GAD-7)	.99	.96, 1.03	.74	**.88**	**.84, .93**	**<.001**	**1.06**	**1.02, 1.10**	**.004**
WSAS Item 2: Home management	1.04	.98, 1.11	.16	.94	.85, 1.04	.20	**.92**	**.85, .99**	**.03**
WSAS Item 3: Social leisure activities	.97	.91, 1.03	.31	1.07	.97, 1.19	.18	**1.09**	**1.00, 1.18**	**.05**
WSAS Item 4: Private leisure activities	.94	.89, 1.01	.08	1.03	.93, 1.15	.56	1.07	.99, 1.16	.09
WSAS Item 5: Close relationships	**.94**	**.89, 1.00**	**.04**	1.04	.95, 1.14	.42	1.00	.93, 1.07	.96
Number of sessions	**1.12**	**1.08, 1.16**	**<.001**	.98	.92, 1.04	.43	**.76**	**.71, .81**	**<.001**
Age at dementia diagnosis (<65 [REF] vs 65+)	.76	.41, 1.40	.38	.54	.21, 1.41	.21	1.03	.47, 2.24	.94

Discussion

This is the first study to investigate factors associated with psychological therapy outcomes for depression and anxiety in people living with dementia. Results suggested that dementia type was not associated with psychological therapy outcomes, with the exception that people living with FTD had nearly 3 times higher odds of symptom (depression, anxiety) deterioration than people with VaD or AD. However, large confidence intervals suggest lack of estimate precision and that these findings should be interpreted with caution. Age at dementia diagnosis was found to be associated with reliable recovery and dropout, suggesting that people diagnosed with dementia aged 65+ had better psychological therapy outcomes following therapy and less likely to dropout than people diagnosed before age 65. However, age at dementia diagnosis was no longer significant when controlling for non-dementia specific factors in the multivariate models. Findings for non-dementia specific factors revealed that baseline symptom severity (depression, anxiety), baseline work and social functioning, psychotropic medication use, age at referral to IAPT, and number of sessions were associated with psychological therapy outcomes in people living with dementia.

With previous findings from Chapter 4 suggesting that psychological therapies offered in IAPT can be beneficial for reducing symptoms of depression and anxiety in people living with dementia (Bell et al., 2022a), understanding who with dementia may benefit is particularly valuable. For the most part, dementia type was not found to be associated with psychological therapy outcomes. However, it is possible that there may be differences associated with FTD that may increase the likelihood of mental health symptom deterioration, particularly given the directions and significance values for reliable deterioration between FTD and other types of dementia. It may be that larger samples may also detect differences between FTD and atypical AD, although this is speculative given the large confidence intervals observed. One possible explanation for the preliminary findings for FTD may be that people with FTD experience faster rates of decline in cognition and general functioning compared to people with other types of dementia (Rascovsky et al., 2005), thus these findings may be a reflection of general deterioration beyond symptoms of depression and anxiety. Similarly, another explanation may relate to differences between FTD variants -

behavioural variant FTD (bvFTD) and primary progressive aphasia (PPA) (described in Chapter 1). Arguably, different types of therapy adaptations may be required to accommodate differences in variant symptomology. As previously mentioned, many psychological therapy adaptations are currently better suited to support memory-led (e.g., AD) or language-based (e.g., PPA) symptoms (Robinson and Moghaddam, 2022), thus psychological therapy may be less optimally adapted to accommodate behavioural symptoms characteristic of bvFTD (Rascovsky et al., 2011). Whilst information regarding FTD variant and therapy adaptations were unavailable, it is possible that if the FTD subsample largely consisted of people with bvFTD this may lend some explanation for differences in therapy outcomes. Next, in light of the findings for age at dementia diagnosis, it appears that the initial associations observed are likely better explained by other characteristics. For example, people with young-onset dementia generally have a greater awareness of the disease (Baptista et al., 2019) and this has been associated with more affective and neuropsychiatric symptoms (Baptista et al., 2021; van Vliet et al., 2013b). As such, associations between age at dementia diagnosis and psychological therapy outcomes may instead be explained by differences in psychological symptom profiles. Further, given previous findings that older adults have better psychological therapy outcomes than working age adults (Saunders et al., 2021), it may be that these results are better explained by differences between age profiles than dementia-onset profiles as suggested by significant results for age at referral.

In relation to previous research investigating non-dementia specific factors, it appears that many factors associated with psychological therapy outcomes in a general population are also important for people living with dementia. The present findings that psychotropic medication use, greater impairment in work and social functioning, and fewer therapy sessions are associated with poorer psychological therapy outcomes in people living with dementia are consistent with previous research (Buckman et al., 2021a; Clark et al., 2018; Delgadillo et al., 2016; Saunders et al., 2020; Stochl et al., 2021). Regarding baseline symptom severity, results suggest that higher baseline depression scores are associated with lower odds of recovery and deterioration, and higher baseline anxiety scores are associated with lower odds of deterioration and higher odds

of dropout. The directions of these associations are likely due to how these outcomes are defined, as higher baseline symptoms scores have less room for deterioration, more room for improvement, and require larger change to cross the ‘caseness’ threshold for recovery. Considering these findings as a whole, results suggest that factors associated with psychological therapy outcomes in a general population are also relevant for people living with dementia over and above dementia specific factors. Thus, when assessing eligibility for psychological therapy, referrers should consider these key factors regardless of having a dementia diagnosis.

Strengths and limitations

This study is the first to explore factors associated with psychological therapy outcomes in a sample of people living with dementia specifically. Moreover, this study uses national healthcare data which provides a unique insight into outcomes for people living with dementia in routinely provided clinical care. Limitations of this study primarily relate to defining dementia-related factors. Whilst dementia diagnoses in hospital records are mostly reliable (Brown et al., 2016; McGuinness et al., 2019; Sommerlad et al., 2018), determining the type of dementia can present difficulties (Mendez et al., 2007). Due to some people with dementia receiving multiple different dementia diagnoses, this study focused on people living with dementia with only one dementia type recorded (albeit possibly recorded several times). This is likely to be more accurate, however resulted in smaller selective subsamples which increased the possibility of type 2 error. Next, people with young-onset dementia typically experience a longer delay between symptoms onset and diagnosis than people with late-onset dementia (van Vliet et al., 2013a). This presents two issues. First, people living with dementia diagnosed before age 65 may have had more advanced dementia than those diagnosed later, which could account for their poorer outcomes. This is also perhaps suggested by the fact that age at dementia diagnosis was no longer associated with psychological therapy outcomes (e.g., recovery) when controlling for non-dementia specific factors including a measure of functioning (WSAS). Secondly, whilst confident that people living with dementia diagnosed before age 65 in the sample reflect young-onset dementia, it is possible that some people diagnosed with dementia aged 65 and over were presenting with symptoms prior to age 65.

Another limitation of this study relates to the representativeness of the sample. People with young-onset dementia account for 9% of dementia cases (World Health Organization, 2023), yet accounted for 44% of the full sample in this study, which is likely due to the underrepresentation of older adults generally in IAPT (Sharland et al., 2023). Additionally, as in Chapter 4 (Bell et al., 2022a), the proportion of people living with dementia attending IAPT is likely much lower than the need for these services in this population. Thus, the present findings should be interpreted in the context of this selective sample. Other limitations of this study include being unable to account for any adaptations that may have been made during IAPT therapy for people living with dementia or for the degree of severity of dementia as these data were unavailable. Additionally, whilst the PHQ-9 has been validated for use with people living with dementia (Hancock and Larner, 2009), it has not been examined in specific dementia subtypes. Further, the GAD-7 and WSAS have not been validated for use in a dementia population generally. As such, it is not clear whether the measure of work and social functioning reflects difficulties due to mood or dementia. This may be particularly relevant for people with behavioural dementia symptoms (e.g., behavioural variant FTD) where there may be more overlap between dementia-related and mental health-related symptoms. As such, it is important to acknowledge this limitation when interpreting the findings for FTD in this chapter. Finally, the possible non-dementia specific factors to investigate were limited by the dataset. As such, this study focused on clinical and therapy factors that are routinely measured in IAPT. However, it is important to acknowledge that there are various other factors identified in the literature that have not been considered for people living with dementia specifically (e.g., motivation to change (Verbist et al., 2021), social support (Buckman et al., 2021b)). Future research should continue to explore which factors are associated with better psychological therapy outcomes in people living with dementia.

Implications and future directions

Given general practitioners can be reluctant to refer older adults generally to psychological therapy services (Collins and Corna, 2018), research in this area has important implications for encouraging referrals of people living with dementia into these services. First, this research has implications for

challenging assumptions that people living with dementia will not benefit from psychological therapy by highlighting that sociodemographic and clinical factors may be more important in predicting treatment prognosis. Specifically, these findings suggest that eligibility of people living with dementia for primary care psychological therapy services such as IAPT should be assessed beyond dementia-specific factors. Of particular importance is that when individual items of the work and social functioning scale were explored, only greater impairment in forming and maintaining close relationships was consistently associated with poorer psychological therapy outcomes in people living with dementia. Given that general functional impairment is likely to be greater in people living with dementia than people without dementia, it is potentially important to focus on this aspect of functioning rather than others when assessing suitability for psychological therapy. Moreover, it is also a potential area for therapy targets as difficulties with close relationships may be an area that could be addressed within psychological therapy. Next, this research also has implications for identifying people living with dementia who may require more support and adaptations during the therapy process. For example, people living with dementia attending psychological therapy with more severe symptoms of depression and greater impairment in work and social functioning seem to do worse and may be candidates for higher intensity therapy, more regular clinical reviews, and additional therapy sessions to mitigate risks of poor therapy outcomes.

Future research should explore barriers and facilitators to accessing psychological therapies for people living with dementia and whether pathways (e.g., referral, waiting times) into therapy differ to people without dementia. Further, given the present results for number of therapy sessions and baseline symptom severity, future research could also explore trajectories to understand when people living with dementia are benefitting from psychological therapy. Finally, future research could also investigate whether treating depression and anxiety in people living with dementia reduces the likelihood of other associated adverse events, such as whether reliable recovery in people living with dementia is associated with later institutionalisation or slower cognitive decline.

Conclusions

This study suggests that factors associated with therapy outcomes in a general population (baseline depression and anxiety, work and social functioning, psychotropic medication use, and number of therapy sessions) are also relevant for people living with dementia over and above dementia-specific factors. When assessing eligibility for psychological therapy, referrers should consider these factors regardless of dementia diagnosis. This research has important implications for encouraging referrals of people living with dementia into primary care psychological therapy services such as IAPT and identifying who may particularly benefit from psychological therapy.

Chapter 6: Discussion

This chapter will summarise the main findings of this thesis, present key implications, highlight overall strengths and limitations, and propose directions for future research.

Summary

Using data from the MODIFY project, this thesis aimed to investigate the utility of primary care psychological therapies offered in Improving Access to Psychological Therapies (IAPT) services for dementia risk reduction and treatment of depression and anxiety in people living with dementia. First, Chapter 2 reviewed and synthesised the current literature regarding associations between positive psychological constructs (PPCs) with cognitive function, MCI, and dementia. Meta-analytic findings revealed evidence for associations between eudemonic PPCs (purpose and meaning in life) with various domains of cognitive function and reduced risk of dementia, however little evidence was found for hedonic constructs such as positive affect or life satisfaction. Following this, Chapter 3 investigated whether PPCs improved over the course of psychological therapies offered in IAPT in people aged 60+ without dementia. Findings suggested that optimism, memory, and verbal fluency improved over the course of psychological therapy, however, no association was found between baseline PPCs or change in optimism with change in domains of cognitive function. Further, there was no evidence to suggest that baseline PPCs or change in domains of cognitive function were associated with change in depression or anxiety over psychological therapy, with the exception of mindfulness which was associated with greater change in depression scores. Next, Chapter 4 used linked national healthcare records to investigate the effectiveness of IAPT services for reducing symptoms of depression and anxiety in people living with dementia. Results revealed large effect sizes for pre-post symptom change in depression and anxiety in people living with dementia, however people living with dementia were less likely to reliably improve or recover than a matched control sample without dementia. Finally, Chapter 5 investigated dementia-specific and non-dementia specific factors associated with primary care psychological therapy outcomes in people living with dementia. There was some evidence to suggest that people with

frontotemporal dementia (FTD) had poorer psychological therapy outcomes than people with Alzheimer's or vascular dementia. Beyond dementia-specific factors, greater severity in symptoms of depression and anxiety, poorer work and social functioning, psychotropic medication use, being working age (<65 years), and fewer therapy sessions were all independently associated with poorer psychological therapy outcomes in people living with dementia.

Positive mental health and dementia risk

Whilst there has been a greater focus on negative mental health and risk of dementia, there has been growing interest in the possible protective effects of positive mental health. The work presented in Chapter 2 highlights that eudemonic PPCs may be important for healthy cognitive ageing. As previously discussed in Chapter 2, it is possible that people with higher eudemonic wellbeing may be more likely to have healthier lifestyles and engage in other protective behaviours, such as social and physical activities (Stavrova and Luhmann, 2016; Yemiscigil and Vlaev, 2021). In this sense, there may be an accumulative protective effect associated with eudemonic wellbeing. Although, it is also possible that this mechanism may be bidirectional, with previous research also suggesting that engagement in other protective behaviours (e.g., physical activity) is associated with later eudemonic wellbeing (e.g., purpose in life) (Yemiscigil and Vlaev, 2021). More work is needed to understand the protective mechanisms, particularly work exploring causality using methods such as mendelian randomisation. Nonetheless, it appears that improving positive mental health could be an important target for dementia prevention strategies. Regarding possible interventions to promote positive mental health and specifically eudemonic PPCs, there are several existing psychological interventions including meaning-centred therapy (Vos and Vitali, 2018; Wong, 2010) and compassion-focused therapy (Craig et al., 2020; Gilbert, 2009). At present, these are not routinely offered in primary care services and it is unknown whether these therapies could be effective interventions for dementia prevention. Thus, it is also important to understand whether routinely offered psychological therapies for depression and anxiety (e.g., CBT, counselling) may also be beneficial for promoting positive mental health. Findings from Chapter 3 suggested that optimism improved over the course of IAPT therapy, however no

evidence was found for other eudemonic PPCs (gratitude, meaning in life, self-compassion). Given the potential bidirectional associations with other healthier behaviours, it is possible that psychological therapies may still be beneficial for improving these PPCs, although it may take longer before improvements are observed. Further, it is also possible that psychological therapy may be beneficial for promoting other eudemonic PPCs that were not investigated in Chapter 3 (e.g., purpose in life, personal growth). More research is needed to understand the utility of primary care psychological therapy services for promoting positive mental health and dementia prevention.

In relation to modifiable risk factors for dementia (Livingston et al., 2020), there is evidence that treating depression through psychological therapies offered in IAPT is associated with reduced risk of dementia (John et al., 2022). Given the potentially modifiable nature of PPCs, understanding which PPCs may be protective has important implications for informing dementia prevention strategies. Due to the economic costs of both mental health and dementia (The Lancet Global Health, 2020; World Health Organization, 2023), it is important to understand whether existing services (e.g., IAPT) may have additional benefits, especially considering WHO guidelines recommending multidomain interventions for healthy cognitive aging and dementia prevention (World Health Organization, 2019). Despite Chapter 3 finding limited evidence for the utility of IAPT for promoting eudemonic PPCs in older people over a 6-month period, it is possible that psychological therapy may still have benefits for improving PPCs over a longer timeframe. Thus, more research is needed to understand which PPCs may change over psychological therapy using a wider range of PPC measures and longer follow up to allow for detection of longer-term change.

Primary care psychological therapy for people living with dementia

Building on previous findings from RCTs (Noone et al., 2019; Orgeta et al., 2022; Robinson and Moghaddam, 2022), the evidence provided in this thesis supports the use of psychological therapies offered in routine clinical care (IAPT) for reducing symptoms of depression and anxiety in people living with dementia. Findings from a recent Cochrane review suggested that CBT-based therapies can be beneficial for reducing symptoms of depression in people

living with dementia but the benefits for anxiety were unclear (Orgeta et al., 2022). In comparison, Chapter 4 suggests that symptoms of both depression and anxiety improve over the course of psychological therapies offered in IAPT in people living with dementia. Whilst IAPT offer a range of evidence-based treatments, CBT-based approaches are commonly offered for most presenting problems (National Collaborating Centre for Mental Health, 2021), thus it is likely that many people in the sample received CBT-based therapy. As such, this work may contribute to the evidence base for the effectiveness of CBT-based therapies for reducing symptoms of depression and anxiety in people living with dementia. Whilst encouraging, this work also found that people living with dementia had poorer therapy outcomes than people without dementia. Given the variation in dementia, it is important to understand who is benefiting from psychological therapy. Chapter 5 found that predictors of psychological therapy outcomes in people living with dementia were largely in line with those identified for a general population (Buckman et al., 2021a; Saunders et al., 2021; Saunders et al., 2020; Stochl et al., 2021) above and beyond dementia-specific factors. Thus, it appears that clinical factors (e.g., depression/anxiety severity, psychotropic medication use, work and social functioning, number of therapy sessions) may be more important for predicting whether people living with dementia will benefit from psychological therapy than type of dementia or age at dementia diagnosis. However, it is also worth noting that while the work and social functioning measure is intended to assess impairment in functioning resulting from mental health symptoms, it is possible that this measure could also be a proxy for changes in functioning due to dementia. As such, it may be that dementia severity is important for psychological therapy outcomes, although it was not possible to investigate this as data regarding severity were not available. However, it is likely that the people living with dementia seen in IAPT were presenting with mild dementia symptoms.

This work has important clinical implications for the treatment of depression and anxiety in people living with dementia. Ensuring appropriate and timely post-diagnostic support is crucial for supporting people to live well with dementia. However, at present, mental health needs are not being met for many people living with dementia (Alzheimer's Society, 2022). With depression and anxiety being highly prevalent in people living with dementia (Leung et al., 2021) and

mixed evidence for the efficacy of pharmacological interventions such as antidepressants (Dudas et al., 2018), understanding the utility of primary care psychological therapy services is critical for informing treatment options and meeting the mental health needs of people living with dementia. The empirical work presented in Chapter 4 suggests that psychological therapies routinely offered in IAPT can be effective in reducing symptoms of depression and anxiety in people living with dementia. Whilst promising, there was also evidence that psychological therapy outcomes for people living with dementia are poorer than in people without dementia. This highlights the need to identify potential adaptations to improve therapy outcomes for people living with dementia. For example, considering findings from Chapter 5, it may be that offering more therapy sessions for people living with dementia (especially for those with more severe depression) may be a sensible adaptation to improve therapy outcomes. However, it is also worth acknowledging the difficulties of implementing changes in IAPT services that arise from service inflexibility, increased clinician workload, and limited resources (Baker et al., 2022).

Next, there is an underrepresentation of older adults generally in IAPT (Sharland et al., 2023), yet evidence suggests that older adults have better psychological therapy outcomes than working aged adults (Saunders et al., 2021). As such, it is important to consider how barriers to access (e.g., referrer attitudes and self-stigma (Collins and Corna, 2018; Mackenzie and Pankratz, 2022)) contributing to this underrepresentation could be addressed. In relation to people living with dementia specifically, Chapter 4 highlights that this population (particularly older people living with dementia) are underserviced in IAPT compared to the expected need. It is likely that barriers to access to IAPT for people living with dementia are similar to those faced by older people generally, although may be exacerbated due to a dementia diagnosis. For example, these barriers can occur at the patient (e.g., self-stigma regarding mental health service use in older adults (Mackenzie and Pankratz, 2022)), referrer (e.g., GP attitudes around referring older people into IAPT generally (Collins and Corna, 2018)), clinician (e.g., inadequate support and training for working with people living with dementia (Baker et al., 2022)), and service (e.g., target and outcome focus resulting in exclusion based on a dementia diagnosis (Baker et al., 2022)) level. Chapter 5 has implications for identifying who with

dementia may be more likely to benefit from psychological therapy. Specifically, this work suggests that suitability for these services should not be based solely on the presence of a dementia diagnosis, but instead should be assessed considering factors that are also relevant for a general population (e.g., depression symptom severity, work and social functioning). Thus, this work could have important implications for challenging assumptions that people living with dementia will not benefit from primary care psychological therapy services and encouraging the referral of people living with dementia into these services.

Finally, considering findings that IAPT outcomes are worse in people living with dementia compared to people without dementia and that people living with dementia may be under-serviced in IAPT compared to the expected need for these services, this thesis provides valuable insight into understanding the suitability of IAPT services for people living with dementia. Given the encouraging findings from Chapter 4 that IAPT can be beneficial for people living with dementia as many do show symptom improvement, it would appear that IAPT services have potential. However, in addition to addressing barriers to access, person-centred therapy adaptations and more training and support for staff to work with people living with dementia are likely required to ensure that these services can appropriately meet the needs of people living with dementia. Thus, more work is needed to understand how IAPT (both access and outcomes) could be improved for people living with dementia and how they can be utilised in dementia care pathways.

Strengths and limitations

The work in this thesis is the first to explore the utility of psychological therapies offered in IAPT for promoting positive mental health in older adults and the treatment of negative mental health in people living with dementia. Chapter 2 synthesises a relatively under researched topic of PPCs that contribute to positive mental health and their association with cognitive function and risk of dementia. This work provides important foundations for the research area to build upon. Next, using an exploratory approach, Chapter 3 is the first study to investigate changes in and associations between PPCs, cognitive function, and depression and anxiety over the course of routine psychological therapy in older

adults. Key strengths of Chapter 4 and 5 are that they investigate a large national sample of people living with dementia in the context of an existing clinical setting (IAPT). This provides a unique insight into the outcomes of people living with dementia in routine clinical care.

However, there are also several notable limitations that should be taken into consideration when interpreting findings. First, given the nature of PPCs and the emerging research area exploring positive mental health and cognition, there were difficulties conceptualising PPCs. Whilst Chapter 2 used a relatively comprehensive list of PPC search terms informed by the literature, it was not possible to explore every PPC that contributes to positive mental health (e.g., interest, elevation). Another limitation relating to the emerging nature of this research area is that many of the studies identified in the systematic review were not directly comparable due to differences in how PPCs were measured and the statistical models used. As a result, it was not possible to pool all of the existing evidence in the form of a meta-analysis. Next, given the time frame for setting up the MODIFY feasibility study (used in Chapter 3), the PPC measures included had to be decided prior to the completion of the systematic reviews presented in Chapter 2. Ideally, it would have been preferable to investigate the utility of IAPT for promoting PPCs with evidence for an association with cognitive function and dementia risk. Although, with evidence for associations between wellbeing and various positive health outcomes (Park et al., 2016), it is arguably still valuable to understand whether IAPT can promote positive mental health in older people, regardless of whether this is also associated with change in cognitive function. Further, as discussed in Chapter 3, it is likely that the use of repeated measures and the short time frame between follow ups (3months) may have increased the risk of practice effects with the cognitive measures. Additionally, given the study design, it is not possible to explore causality for the observed change in cognitive measures. As such, these methodological limitations should be taken into consideration when interpreting findings.

Next, as suggested in Chapter 4, people living with dementia are underserviced in primary care psychological therapy services. Thus, findings from Chapters 4 and 5 should be interpreted in the context of a somewhat selective sample, although perhaps less selective than the RCT samples evaluated in Orgeta et al. (2022). Still, it is likely that smaller effect sizes for pre-post therapy change

would have been observed in Chapter 4 with a more representative sample. Additionally, it also appears that there may be an over-representation of people with young onset dementia in IAPT, although this finding is not unexpected given that older people are underrepresented in IAPT generally (Sharland et al., 2023). People with young onset dementia generally have a greater awareness of the disease (Baptista et al., 2019) and experience more affective and psychological symptoms (Altomari et al., 2022; Baptista et al., 2021) than people with late onset dementia. Given evidence that greater baseline severity in depression and anxiety are associated with poorer therapy outcomes (Chapter 5) and significant differences in reliable improvement and recovery rates between dementia diagnosis age groups (Chapter 4), it is possible that the over-representation of people with young onset dementia in the sample may have contributed to poorer psychological therapy outcomes compared to people without dementia than is actually the case in a more representative sample. However, sensitivity analyses in Chapter 4 suggested that results remained consistent with the main models when both diagnosis age groups were explored separately.

There are also potential limitations regarding how dementia samples were defined. In the MODIFY grant dataset, people living with dementia were identified through ICD-10 dementia diagnosis codes (World Health Organization, 1993) recorded in hospital records. Previous research has suggested that these are reliable (Brown et al., 2016; McGuinness et al., 2019; Sommerlad et al., 2018), however relying on recorded dementia diagnoses meant that it was not possible to guarantee that the control sample in Chapter 4 did not include people with undiagnosed dementia and thus the difference between groups may have been underestimated. Similarly, the true sample size of people living with dementia attending IAPT may have been larger which also presents limitations for estimating under-representation. Next, both Chapter 4 and 5 included age at dementia diagnosis variables, however there are possible limitations relating to the timing of dementia diagnosis. Whilst confident that individuals diagnosed with dementia before age 65 represent young-onset, it is possible that those diagnosed aged 65+ may also include people with young-onset, especially given that people with young-onset dementia tend to face

longer delays before diagnosis than people with late onset dementia (van Vliet et al., 2013a).

Another possible limitation relates to difficulties with accurately diagnosing type of dementia. Specifically in Chapter 5, it was apparent that many people living with dementia were diagnosed with different types of dementia at different timepoints. Consequently, sample sizes for the dementia type subsamples were smaller due to excluding participants with multiple different dementia type diagnoses. As such, these findings should be interpreted with caution as, not only is this subsample derived from a selective sample, but there may also have been systematic differences between participants included and excluded from the subsample (as suggested by comparisons presented in Appendix F). Additionally, there is no guarantee that the dementia diagnoses for the participants included in this subsample were accurate.

Lastly, due to using secondary data from national healthcare records, it was not possible to account for some potentially relevant variables. For example, whilst it is likely that people living with dementia seen in IAPT were presenting with milder dementia symptoms and thus outcomes and predictors may only reflect people with mild dementia, no data were available regarding severity of dementia. As such, it was not possible to examine the utility of psychological therapies offered in IAPT across the stages of dementia progression. Similarly, it is likely that some adaptations were made for some people living with dementia in the sample during IAPT therapy, however it was not possible to account for whether adaptations were made or the types of adaptations made for people living with dementia as no data were available. Additionally, it is unknown whether the topic of dementia was addressed within therapy sessions. This is particularly important to acknowledge considering previous research has suggested that clinicians often feel unsupported working with people living with dementia and may require additional training (Baker et al., 2022). As dementia-related topics (e.g., coming to terms with a dementia diagnosis or coping with symptoms) may contribute to psychological distress in people living with dementia, it is possible that this may also lend some explanation for differences in therapy outcomes between people with and without dementia if these were not adequately addressed. Next, using linked IAPT data meant it was not possible to compare psychological therapy outcomes to a control group of

people living with dementia not receiving therapy making it difficult to know what the natural progression of depression/anxiety symptoms would have been. Instead, this was approximated using RCT control group effect sizes, however this also has limitations including different depression/anxiety measures used between studies and not being able to match samples. Finally, there are also potential limitations to using IAPT data regarding how data are collected and the outcome measures used. It is important to acknowledge that the threshold for 'caseness' used in IAPT does not necessarily indicate a diagnosis of depression or anxiety and instead reflects the severity of symptoms. As such, findings relating to reliable recovery should be interpreted in this context and are unlikely to be comparable to RCT evidence that uses standardised diagnostic interviews (Scott, 2021). Moreover, there have also been criticisms regarding the suitability of administering the PHQ9 and GAD7 weekly given problems that arise from using repeated measures (Scott, 2018). Further, the lack of independent blind assessments with outcome monitoring could introduce the possibility that clinicians may be motivated to show bias towards symptom improvement. This may be especially true in people living with dementia who may also require additional support when completing the assessments. As such, the appropriateness of IAPT outcome monitoring in people living with dementia specifically may be called into question given the above points and that some measures used have not been validated in this population.

Directions for future research

Informed by the findings from this thesis, two key directions for future research are proposed. First, as demonstrated by Chapter 2, research investigating associations between positive mental health and wellbeing with risk of dementia is very much in its infancy, with many potentially important PPCs not yet explored in the literature. Given the potential implications for informing dementia prevention strategies, more work is needed to better understand which PPCs may be protective in their association with dementia risk and more longitudinal studies are needed to better understand associations with pre-clinical decline. Moreover, with promising evidence for the association between purpose and meaning in life and reduced risk of dementia, future research should also explore the possible mechanisms for this association. As one potential

mechanism may be that people with higher purpose/meaning may be more likely to engage it other protective behaviours (e.g., physical activity, social activities), it is possible that there may be an accumulative protective effect. In this sense, it is possible that psychological therapies may be useful for promoting positive mental health in older adults by encouraging lifestyle changes that lead to purpose and meaning in life. However, more longitudinal work is needed to explore this.

The second direction for future research relates to Chapters 4 and 5. This thesis provides evidence that primary care psychological therapies can be beneficial for reducing symptoms of depression and anxiety in people living with dementia. Whilst this is encouraging, more work is needed to understand who and how people living with dementia are benefiting and whether outcomes can be improved. One possible avenue would be to explore trajectories of symptoms of depression and anxiety over the course of psychological therapy to understand when people living with dementia are benefitting and how many sessions may be required for reliable improvement and recovery. Further, identifying characteristics associated with different symptom trajectories could have important implications for informing optimal treatment. Next, given potential barriers to referral and access into psychological therapy for people living with dementia, there is great value in understanding the pathways into and through primary care psychological therapy services for people living with dementia. Understanding how people living with dementia are being referred to IAPT and what happens to them once referred is important for identifying target areas to improve access. Finally, given that depression and anxiety have been associated with numerous adverse outcomes in people living with dementia (Beerens et al., 2013; Dorenlot et al., 2005; Rapp et al., 2011), research could also explore whether successful psychological therapy is associated with reduced risk of these outcomes.

Conclusions

In conclusion, this thesis examines the utility of IAPT services for dementia risk reduction and treatment of depression and anxiety in people living with dementia. First, findings suggest that eudemonic PPCs, such as purpose and

meaning in life, may be valuable targets for healthy cognitive aging and dementia prevention interventions. However, more work is needed to understand whether existing services such as IAPT may have additional benefits for promoting positive mental health in older adults. Second, this thesis also found evidence to support the utility of psychological therapies offered in IAPT for reducing symptoms of depression and anxiety in people living with dementia, although more work is needed to understand how therapy outcomes can be improved in people living with dementia. Further, predictors of psychological therapy outcomes in people living with dementia were found to be consistent with those identified for a general population above and beyond type of dementia and age at dementia diagnosis. Overall, this work has important implications for informing dementia prevention strategies through promoting positive mental health in older adults, improving the post-diagnosis mental health support available for people living with dementia, and understanding the utility that primary care psychological therapy services such as IAPT could have for both.

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Appendices

Appendix A: Comparisons of participants with complete and missing data (Chapter 3)

Baseline characteristic		**Comple data (N = 19)**	**Missing data (N = 56)**	
		N (%)	**N (%)**	**p**
Sex	Female	14 (73.68)	35 (62.50)	.38
	Male	5 (26.32)	21 (37.50)	
Ethnicity	White	18 (94.74)	49 (87.50)	.60
	Black	0 (0.00)	4 (7.14)	
	Asian	0 (0.00)	1 (1.79)	
	Mixed	0 (0.00)	1 (1.79)	
	Other	1 (5.26)	1 (1.79)	
Education	No qualification	1 (5.26)	5 (8.93)	.25
	Secondary education	1 (5.26)	11 (19.64)	
	Post-secondary education	1 (5.26)	11 (19.64)	
	Vocational qualification	6 (31.58)	9 (16.07)	
	Undergraduate degree	5 (26.32)	12 (21.43)	
	Post-graduate degree	5 (26.32)	7 (12.50)	
	Doctorate	0 (0.00)	1 (1.79)	
Treatment intensity	Low (Step 2)	11 (57.89)	43 (76.79)	.42
	High (Step 3)	7 (36,84)	10 (17.86)	
	Mixed (Step 2 & 3)	1 (5.26)	3 (5.36)	
		Mean (SD)	**Mean (SD)**	**p**
Age		66.26 (6.24)	65.45 (5.60)	.60
Optimism		11.00 (5.37)	11.13 (4.73)	.92
Gratitude		32.00 (7.13)	29.80 (6.23)	.21
Self-compassion		2.71 (0.62)	2.76 (0.68)	.77
Meaning in life		2.95 (1.13)	2.88 (0.78)	.78
Global cognition		19.53 (1.78)	19.05 (1.97)	.37
Semantic fluency		24.26 (4.81)	20.45 (6.78)	.03
Verbal fluency		53.42 (12.76)	40.38 (11.09)	<.001
Logical memory immediate		16.37 (3.06)	14.11 (3.59)	.02
Logical memory delayed		14.42 (3.06)	12.94 (3.73)	.12
Word recall immediate		10.00 (2.92)	9.79 (3.03)	.79
Word recall delayed		9.68 (2.85)	9.04 (3.16)	.44
Sustained attention		6.63 (0.60)	6.57 (0.94)	.80
Selective attention		8.16 (2.09)	6.85 (3.21)	.11
GAD7		13.68 (4.36)	12.64 (4.90)	.41
PHQ9		13.32 (5.85)	14.43 (6.21)	.50
Number of sessions		9.11 (5.22)	8.07 (4.43)	.40

Appendix B: Symptom scale cut-offs (Chapters 4 and 5)

(NHS Digital, 2019)

Symptom Scale	**Caseness**	**Change (improvement /deterioration)**
Patient Health Questionnaire	≥10	6
Generalised Anxiety Disorder Scale	≥8	4
Agoraphobia Morbidity Inventory	≥2.3	0.73
Social Phobia Inventory	≥19	10
Panic Disorder Severity Scale	≥8	>5
Impact of Events Scale (PTSD)	33	9
Obsessive Compulsive Inventory	≥40	32
Health Anxiety Inventory	≥18	4

Appendix C: Propensity score matching model (Chapter 4)

		Coefficient	se	95% CI	p
Gender	Female	-.33	.06	-.44, -.22	<.001
	Missing	-1.20	.59	-2.35, -.05	.04
Ethnicity	Mixed	.43	.26	-.09, .94	.10
	Asian	.53	.14	.26, .81	<.001
	Black	.64	.16	.33, .96	<.001
	Other	.67	.23	.22, 1.11	.004
	Missing	.20	.10	.01, .39	.04
IMD decile	2	-.28	.11	-.49, -.06	.01
	3	-.27	.11	-.48, -.60	.01
	4	-.51	.12	-.74, -.28	<.001
	5	-.41	.11	-.63, -.19	<.001
	6	-.40	.11	-.62, -.18	<.001
	7	-.65	.12	-.88, -.41	<.001
	8	-.61	.12	-.84, -.37	<.001
	9	-.76	.13	-1.01, -.51	<.001
	10	-.79	.13	-1.04, -.53	<.001
	Missing	-.28	.18	-.63, .07	.12
LTC case	Yes	.61	.07	.48, .74	<.001
	Missing	.41	.08	.24, .57	<.001
Appointment year	2013	.10	.29	-.46, .66	.73
	2014	.50	.27	-.03, 1.04	.07
	2015	.85	.27	.32, 1.37	.002
	2016	1.05	.27	.53, 1.57	<.001
	2017	1.05	.27	.53, 1.57	<.001
	2018	1.07	.27	.55, 1.59	<.001
	2019	1.15	.29	.59, 1.72	<.001
Psychotropic medication	Prescribed (taking)	.47	.17	.14, .80	.01
	Not prescribed	.18	.17	-.16, .52	.29
	Missing	.74	.18	.37, 1.10	<.001
Employment status	Unemployed	.85	.07	.71, .99	<.001
	Missing	.38	.12	.14, .61	.002
Age at referral		.12	.002	.11, .12	<.001
Baseline PHQ-9		.02	.01	.01, .04	<.001
Baseline GAD-7		-.04	.01	-.05, -.03	<.001
Waiting time 1		.02	.01	.003, .03	.02
Waiting time 2		.01	.003	.0001, .01	.05

Appendix D: Clinical commissioning group categories (Chapter 4)

	Category	Clinical commissioning groups (CCG)
1	NHS England South (South West)	NHS Bristol CCG , NHS Kernow CCG, NHS North Somerset CCG, NHS Somerset CCG, NHS South Gloucestershire CCG, NHS Northern, Eastern and Western Devon CCG, NHS South Devon and Torbay CCG
2	NHS England South (South East)	NHS Ashford CCG, NHS Brighton and Hove CCG, NHS Canterbury and Coastal CCG, NHS Eastbourne, Hailsham and Seaford CCG, NHS Coastal West Sussex CCG, NHS Crawley CCG, NHS Dartford, Gravesham and Swanley CCG, NHS East Surrey CCG, NHS Guildford and Waverley CCG, NHS Hastings & Rother CCG, NHS Medway CCG, NHS Horsham and Mid Sussex CCG, NHS North West Surrey CCG, NHS South Kent Coast CCG, NHS Surrey Heath CCG, NHS Swale CCG, NHS Thanet CCG, NHS Surrey Downs CCG, NHS West Kent CCG, NHS High Weald Lewes Havens CCG
3	NHS England South (South Central)	NHS Bracknell and Ascot CCG, NHS Chiltern CCG, NHS Newbury and District CCG, NHS North & West Reading CCG, NHS Oxfordshire CCG, NHS Slough CCG, NHS South Reading CCG, NHS Aylesbury Vale CCG, NHS Windsor, Ascot and Maidenhead CCG, NHS Wokingham CCG, NHS Bath and North East Somerset CCG, NHS Gloucestershire CCG, NHS Swindon CCG, NHS Wiltshire CCG
4	NHS England South (Wessex)	NHS North Hampshire CCG, NHS Fareham and Gosport CCG, NHS Isle of Wight CCG, NHS Portsmouth CCG, NHS South Eastern Hampshire CCG, NHS Southampton CCG, NHS West Hampshire CCG, NHS Dorset CCG, NHS North East Hampshire and Farnham CCG
5	NHS England London	NHS Barking and Dagenham CCG, NHS Barnet CCG, NHS Bexley CCG, NHS Brent CCG, NHS Bromley CCG, NHS Camden CCG, NHS City and Hackney CCG, NHS Croydon CCG, NHS Ealing CCG, NHS Enfield CCG, NHS Hounslow CCG, NHS Greenwich CCG, NHS Hammersmith and Fulham CCG, NHS Haringey CCG, NHS Harrow CCG, NHS Havering CCG, NHS Hillingdon CCG, NHS Islington CCG, NHS Kingston CCG, NHS Lambeth CCG, NHS Lewisham CCG, NHS Newham CCG, NHS Redbridge CCG, NHS Richmond CCG, NHS Southwark CCG, NHS Merton CCG, NHS Sutton CCG, NHS Tower Hamlets CCG, NHS Waltham Forest CCG, NHS Wandsworth CCG, NHS West London (Kensington and Chelsea, Queen's Park and Paddington) CCG, NHS Central London (Westminster) CCG
6	NHS England Midlands and East (West Midlands)	NHS Birmingham South and Central CCG, NHS Coventry and Rugby CCG, NHS Dudley CCG, NHS Herefordshire CCG, NHS Warwickshire North CCG, NHS Redditch and Bromsgrove CCG, NHS Sandwell and West Birmingham CCG, NHS Solihull CCG, NHS South Warwickshire CCG, NHS South Worcestershire CCG, NHS Walsall CCG, NHS Wolverhampton CCG, NHS Wyre Forest CCGNHS Birmingham Crosscity CCG
7	NHS England Midlands and East (North Midlands)	NHS Erewash CCG, NHS Hardwick CCG, NHS Mansfield and Ashfield CCG, NHS Newark & Sherwood CCG, NHS North Derbyshire CCG, NHS Nottingham City CCG, NHS Nottingham North and East CCG, NHS Nottingham West CCG, NHS Rushcliffe CCG, NHS Southern Derbyshire CCG, NHS Cannock Chase CCG, NHS East Staffordshire CCG, NHS North Staffordshire CCG, NHS Shropshire CCG, NHS South

		East Staffordshire and Seisdon Peninsula CCG, NHS Stafford and Surrounds CCG, NHS Stoke on Trent CCG, NHS Telford and Wrekin CCG
8	NHS England Midlands and East (East)	NHS Cambridgeshire and Peterborough CCG, NHS Ipswich and East Suffolk CCG, NHS Great Yarmouth & Waveney CCG, NHS Mid Essex CCG, NHS North East Essex CCG, NHS North Norfolk CCG, NHS Norwich CCG, NHS South Norfolk CCG, NHS Thurrock CCG, NHS West Essex CCG, NHS West Norfolk CCG, NHS West Suffolk CCG, NHS Basildon and Brentwood CCG, NHS Castle Point and Rochford CCG, NHS Southend CCG
9	NHS England Midlands and East (Central Midlands)	NHS Lincolnshire East CCG, NHS Corby CCG, NHS East Leicestershire and Rutland CCG, NHS Leicester City CCG, NHS Lincolnshire West CCG, NHS Milton Keynes CCG, NHS Nene CCG, NHS South West Lincolnshire CCG, NHS West Leicestershire CCG, NHS Bedfordshire CCG, NHS East and North Hertfordshire CCG, NHS Herts Valleys CCG, NHS Luton CCG, NHS South Lincolnshire CCG
10	NHS England North (Lancashire and South Cumbria)	NHS Blackburn with Darwen CCG, NHS Blackpool CCG, NHS Chorley and South Ribble CCG, NHS East Lancashire CCG, NHS Greater Preston CCG, NHS Lancashire North CCG, NHS West Lancashire CCG, NHS Fylde & Wyre CCG
11	NHS England North (Cumbria and North East)	NHS Darlington CCG, NHS Durham Dales, Easington and Sedgefield CCG, NHS Gateshead CCG, NHS Newcastle North and East CCG, NHS Newcastle West CCG, NHS North Durham CCG, NHS Hartlepool and Stockton-on-Tees CCG, NHS Northumberland CCG, NHS South Tees CCG, NHS South Tyneside CCG, NHS Sunderland CCG, NHS Cumbria CCG, NHS North Tyneside CCG
12	NHS England North (Greater Manchester)	NHS Bolton CCG, NHS Bury CCG, NHS Central Manchester CCG, NHS Oldham CCG, NHS Heywood, Middleton & Rochdale CCG, NHS Salford CCG, NHS North Manchester CCG, NHS South Manchester CCG, NHS
13	NHS England North (Yorkshire and Humber)	NHS Airedale, Wharfedale and Craven CCG, NHS Barnsley CCG, NHS Bassetlaw CCG, NHS Bradford Districts CCG, NHS Calderdale CCG, NHS Leeds North CCG, NHS Bradford City CCG, NHS Doncaster CCG, NHS East Riding of Yorkshire CCG, NHS Greater Huddersfield CCG, NHS Leeds West CCG, NHS Hambleton, Richmondshire and Whitby CCG, NHS Harrogate and Rural District CCG, NHS Hull CCG, NHS Leeds South and East CCG, NHS North East Lincolnshire CCG, NHS North Kirklees CCG, NHS North Lincolnshire CCG, NHS Rotherham CCG, NHS Scarborough and Ryedale CCG, NHS Sheffield CCG, NHS Vale of York CCG, NHS Wakefield CCG
14	NHS England North (Cheshire and Merseyside)	NHS Eastern Cheshire CCG, NHS Halton CCG, NHS Knowsley CCG, NHS South Cheshire CCG, NHS South Sefton CCG, NHS Southport and Formby CCG, NHS St Helens CCG, NHS Vale Royal CCG, NHS Warrington CCG, NHS West Cheshire CCG, NHS Wirral CCG, NHS Liverpool CCG

Appendix E: Comparison of participants with complete and missing data (Chapter 4)

		Dementia group (N = 1,549)			Control group (N = 1,943,774)		
		Complete data (N = 885)	**Missing data (N = 664)**		**Complete data (N = 1,212,484)**	**Missing data (N = 731,290)**	
		N (%)	**N (%)**	**p**	**N (%)**	**N (%)**	**p**
Gender	Male	389 (43.95)	267 (40.21)	.17	396, 726 (32.72)	242,101 (33.11)	<.001
	Female	496 (56.05)	393 (59.19)		815, 758 (67.28)	482,386 (65.96)	
Ethnicity	White	796 (89.94)	435 (65.51)	.01	1,088,587 (89.78)	504,403 (68.97)	<.001
	Mixed	7 (0.79)	9 (1.36)		25,123 (2.07)	12,458 (1.70)	
	Asian	42 (4.75)	27 (4.07)		53,032 (4.37)	29,860 (4.08)	
	Black	24 (2.71)	31 (4.67)		32,441 (2.68)	15,680 (2.14)	
	Other	16 (1.81)	6 (0.90)		13,301 (1.10)	7,657 (1.05)	
IMD decile	1	102 (11.53)	129 (19.43)	<.001	121,014 (9.98)	87,648 (11.99)	<.001
	2	89 (10.06)	94 (14.16)		131,516 (10.85)	78,292 (10.71)	
	3	117 (13.22)	67 (10.09)		134,056 (11.06)	74,658 (10.21)	
	4	87 (9.83)	67 (10.09)		135,077 (11.14)	70,330 (9.62)	
	5	101 (11.41)	52 (7.83)		126,497 (10.43)	67,308 (9.20)	
	6	93 (10.51)	59 (8.89)		121,828 (10.05)	63,832 (8.73)	
	7	73 (8.25)	51 (7.68)		117,078 (9.66)	60,114 (8.22)	
	8	81 (9.15)	39 (5.87)		113,107 (9.33)	58,540 (8.01)	
	9	74 (8.36)	30 (4.52)		110,020 (9.07)	55,011 (7.52)	
	10	68 (7.68)	27 (4.07)		102,291 (8.44)	51,349 (7.02)	
LTC case	No	299 (33.79)	94 (14.60)	.98	856,692 (70.66)	230,955 (31.58)	<.001
	Yes	586 (66.21)	185 (27.86)		355,792 (29.34)	90,976 (12.44)	
Appointment year	2012	11 (1.24)	8 (1.20)	<.001	24,269 (2.00)	36,118 (4.94)	<.001
	2013	32 (3.62)	43 (6.48)		107,508 (8.87)	110,975 (15.18)	
	2014	68 (7.68)	95 (14.31)		150,087 (12.38)	140,582 (19.22)	
	2015	130 (14.69)	148 (22.29)		196,629 (16.22)	139,794 (19.12)	
	2016	170 (19.21)	145 (21.84)		226,149 (18.65)	112,028 (15.32)	
	2017	192 (21.69)	118 (17.77)		227,165 (18.74)	92,235 (12.61)	

	2018	224 (25.31)	93 (14.01)		231,212 (19.07)	82,875 (11.33)	
	2019	58 (6.55)	14 (2.11)		49,465 (4.08)	16,683 (2.28)	
Psychotropic medication	Prescribed (not taking)	25 (2.82)	14 (2.11)	.03	61,822 (5.10)	30,581 (4.18)	<.001
	Prescribed (taking)	587 (66.33)	239 (35.99)		622,014 (51.30)	294,794 (40.31)	
	Not prescribed	273 (30.85)	154 (23.19)		528,648 (43.60)	227,216 (31.07)	
Employment status	Employed	644 (72.77)	241 (36.30)	.35	959,793 (79.16)	463,838 (63.43)	<.001
	Unemployed	372 (42.03)	156 (23.49)		252,691 (20.84)	151,980 (20.78)	
		Mean (SD)	**Mean (SD)**	**p**	**Mean (SD)**	**Mean (SD)**	**p**
Age at referral		64.46 (15.76)	67.85 (16.57)	<.001	40.21 (14.76)	40.48 (14.62)	<.001
Baseline PHQ-9		16.15 (5.85)	14.78 (5.60)	<.001	15.67 (5.60)	15.81 (5.65)	<.001
Baseline GAD-7		13.46 (5.04)	12.31 (5.13)	<.001	14.29 (4.42)	14.27 (4.50)	<.001
Waiting time 1		3.07 (3.66)	3.51 (4.83)	.04	2.86 (3.65)	3.85 (5.10)	<.001
Waiting time 2		7.82 (7.46)	5.22 (6.85)	<.001	6.86 (7.01)	6.29 (7.30)	<.001
Number of sessions		6.18 (4.10)	4.67 (3.66)	<.001	6.84 (4.65)	5.95 (4.37)	<.001

Independent t-tests were used for continuous outcomes and chi-square tests were used for categorical outcomes

Appendix F: Comparison of participants included and excluded in dementia type subsample (Chapter 5)

Characteristic		**Included (N = 479) N (%)**	**Excluded (N = 1,043) N (%)**	**p**
Gender	Male	214 (44.68)	433 (41.51)	.22
	Female	265 (55.32)	606 (58.10)	
	Missing/Prefer not to say	0 (0.00)	4 (0.38)	
Ethnicity	White	384 (80.17)	825 (79.10)	.33
	Mixed	7 (1.46)	8 (0.77)	
	Asian	16 (3.34)	52 (4.99)	
	Black	13 (2.71)	41 (3.93)	
	Other	6 (1.25)	16 (1.53)	
	Missing/Prefer not to say	53 (11.06)	101 (9.68)	
Employment status	Unemployed	112 (23.38)	308 (29.53)	<.001
	Employed	45 (9.39)	122 (11.70)	
	Retired	291 (60.75)	509 (48.80)	
	Missing/Prefer not to say	31 (6.47)	104 (9.97)	
LTC case	Yes	234 (48.85)	526 (50.43)	.80
	No	126 (26.30)	259 (24.83)	
	Missing/Prefer not to say	119 (24.84)	258 (24.74)	
Psychotropic medication	Taking	264 (55.11)	550 (52.73)	.06
	Not taking	151 (31.52)	303 (29.05)	
	Missing/Prefer not to say	64 (13.36)	190 (18.22)	
Age at dementia diagnosis	<65	190 (39.67)	485 (46.50)	.01
	65+	289 (60.33)	558 (53.50)	
		Mean (SD)	**Mean (SD)**	**P**
Age at referral		67.38 (15.98)	65.26 (16.35)	.02
IMD decile		5.05 (2.84)	4.62 (2.79)	.01
Baseline depression severity (PHQ-9)		15.76 (5.78)	15.67 (5.62)	.76
Baseline anxiety severity (GAD-7)		13.11 (4.97)	13.11 (4.94)	.98
Baseline functioning (WSAS)		16.56 (9.23)	17.09 (9.95)	.40
Waiting time (weeks)		10.97 (9.00)	10.09 (8.36)	.08
Dementia diagnosis to treatment (weeks)		125.66 (203.07)	91.18 (87.65)	<.001
Number of sessions		5.63 (3.88)	5.49 (4.03)	.53

Independent t-tests were used for continuous variables and chi-square tests were used for categorical variables

Appendix G: Comparison of participants with complete and missing data (full sample) (Chapter 5)

Characteristic		**Complete data (N = 728) N (%)**	**Missing data (N = 794) N (%)**	**p**
Gender	Male	325 (44.64)	322 (40.55)	.13
	Female	403 (55.36)	468 (58.94)	
Ethnicity	White	657 (90.25)	552 (69.52)	.01
	Mixed	4 (0.55)	11 (1.39)	
	Asian	36 (4.95)	32 (4.03)	
	Black	18 (2.47)	36 (4.53)	
	Other	13 (1.79)	9 (1.13)	
Employment status	Unemployed	226 (31.04)	194 (24.43)	.23
	Employed	96 (13.19)	71 (8.94)	
	Retired	406 (55.77)	394 (49.62)	
LTC case	Yes	475 (65.25)	285 (35.89)	.29
	No	253 (34.75)	132 (16.62)	
Psychotropic medication	Taking	494 (67.86)	320 (40.30)	.002
	Not taking	234 (32.14)	220 (27.71)	
Age at dementia diagnosis	<65	358 (49.18)	317 (39.92)	<.001
	65+	370 (50.82)	477 (60.08)	
		Mean (SD)	**Mean (SD)**	**p**
Age at referral		64.15 (15.46)	67.57 (16.55)	<.001
IMD decile		5.16 (2.84)	4.36 (2.74)	<.001
Baseline depression severity (PHQ-9)		16.43 (5.71)	15.03 (5.55)	<.001
Baseline anxiety severity (GAD-7)		13.70 (4.91)	12.56 (4.92)	<.001
Baseline functioning (WSAS)		17.41 (9.36)	15.92 (10.32)	.02
Waiting time (weeks)		10.81 (8.07)	9.85 (9.12)	.04
Dementia diagnosis to treatment (weeks)		109.21 (146.55)	95.45 (125.16)	.05
Number of sessions		6.24 (4.20)	4.88 (3.66)	<.001

Independent t-tests were used for continuous variables and chi-square tests were used for categorical variables

Appendix H: Association between non-dementia specific factors and primary psychological therapy outcomes (unadjusted model) (Chapter 5)

	Reliable improvement				Reliable Recovery				Reliable deterioration				Dropout			
	N	**OR**	**95% CI**	**p**	**N**	**OR**	**95% CI**	**p**	**N**	**OR**	**95% CI**	**p**	**N**	**OR**	**95% CI**	**p**
Gender (Male REF)	1,522	1.32	1.08, 1.63	.01	1,522	1.22	.99, 1.50	.06	1,518	.88	.62, 1.27	.51	1,148	1.07	.83, 1.39	.60
IMD Decile	1,473	1.09	1.05, 1.13	<.001	1,473	1.08	1.04, 1.12	<.001	1,473	1.00	.93, 1.06	.89	1,120	.91	.87, .95	<.001
Age at referral (<65 [REF] vs 65+)	1,522	1.43	1.16, 1.77	.001	1,522	2.09	1.68, 2.59	<.001	1,522	.71	.50, 1.02	.07	1,148	.60	.46, .78	<.001
Employment status: employed (REF) vs unemployed	1,522	.83	.58, 1.20	.33	1,522	.60	.42, .88	.01	1,522	1.16	.64, 2.11	.63	1,148	1.27	.82, 1.97	.28
Employment status: employed (REF) vs retired	1,522	1.24	.88, 1.75	.21	1,522	1.34	.95, 1.88	.09	1,522	.79	.45, 1.41	.43	1,148	.70	.46, 1.06	.09
LTC Case (No LTC REF)	1,522	1.03	.80, 1.33	.82	1,522	.87	.68, 1.12	.28	1,522	.97	.63, 1.48	.88	1,148	.96	.70, 1.32	.80
Psychotropic medication (Not taking REF)	1,522	.74	.58, .94	.02	1,522	.65	.52, .82	<.001	1,522	1.28	.83, 1.96	.26	1,148	1.33	.98, 1.80	.06
Baseline depression severity (PHQ-9)	1,522	1.02	1.00, 1.04	.04	1,522	.93	.91, .95	<.001	1,522	.94	.91, .97	<.001	1,148	1.04	1.02, 1.07	.001
Baseline anxiety severity (GAD-7)	1,522	1.04	1.02, 1.06	<.001	1,522	.94	.92, .96	<.001	1,522	.91	.88, .94	<.001	1,148	1.05	1.02, 1.08	.001

Baseline work and social functioning (WSAS)	1,098	.98	.97, .99	.01	1,098	.96	.95, .97	<.001	1,098	.99	.97, 1.01	.42	925	1.03	1.02, 1.05	<.001
WSAS Item 1: Ability to work	1,103	1.02	.97, 1.06	.47	1,103	.99	.95, 1.03	.57	1,103	1.01	.94, 1.08	.88	930	1.01	.96, 1.06	.78
WSAS Item 2: Home management	1,125	.97	.93, 1.02	.25	1,125	.94	.90, .98	.004	1,125	.95	.88, 1.03	.21	947	1.02	.96, 1.07	.54
WSAS Item 3: Social leisure activities	1,123	.97	.92, 1.01	.12	1,123	.89	.85, .93	<.001	1,123	1.00	.93, 1.08	.99	945	1.09	1.04, 1.15	.001
WSAS Item 4: Private leisure activities	1,125	.96	.92, 1.00	.05	1,125	.88	.84, .92	<.001	1,125	.99	.92, 1.06	.76	947	1.11	1.05, 1.17	<.001
WSAS Item 5: Close relationships	1,128	.94	.90, .99	.01	1,128	.88	.85, .93	<.001	1,128	.99	.92, 1.07	.84	950	1.06	1.01, 1.12	.03
Waiting time	1,345	1.01	1.00, 1.02	.17	1,345	1.00	.99, 1.02	.55	1,345	1.00	.98, 1.02	.97	1,044	.99	.98, 1.01	.35
Number of sessions	1,522	1.11	1.08, 1.15	<.001	1,522	1.08	1.05, 1.11	<.001	1,522	.99	.94, 1.04	.61	1,148	.81	.77, .85	<.001
Age at dementia diagnosis (<65 [ref] vs 65+)	1,522	1.31	1.07, 1.61	.01	1,522	1.92	1.56, 2.37	<.001	1,522	.71	.49, 1.01	.06	1,148	.63	.48, .81	<.001

Logistic regression models were used