The Relationship Between Subjective Cognitive Decline and Cognitive Leisure Activities in Older Adults: A Mixed Methods Study

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Declaration

I, Emine Akbayrak, confirm that the Thesis is my own work. I am aware of the University's Guidance on the Use of Unfair Means (http://www.sheffield.ac.uk/ssid/unfair-means). This work has not previously been presented for an award at this, or any other, university.

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Abstract

Background: Subjective cognitive decline (SCD), defined as self-perceived worsening in cognitive abilities in the absence of objective impairment, is recognised as an early marker of dementia and is associated with poorer mental health and reduced quality of life, making it a critical target for early intervention. Cognitive leisure activity (CLA), such as reading, enhances cognitive functioning and mental wellbeing, offering a low-cost, accessible approach to brain health. However, evidence on the relationship between SCD and CLA remains limited and inconsistent, with gaps concerning non-memory cognitive domains and experiential factors shaping engagement. Thus, this research aimed to examine the SCD–CLA relationship and factors influencing CLA participation among older adults.

Method: This PhD comprised a systematic review and empirical research using a sequential explanatory mixed methods design. The review informed the empirical investigation. The quantitative phase involved a cross-sectional survey of 255 community-dwelling older adults in the United Kingdom, assessing SCD concerns, CLA engagement, and sociodemographic characteristics. Correlation and regression analyses were conducted. The qualitative phase included semi-structured interviews with 20 older adults with SCD, analysed using thematic analysis. Quantitative and qualitative findings were integrated through a joint display approach.

Results: Quantitative analyses showed that higher SCD concerns were associated with lower CLA engagement, and that specific activity types were linked to distinct cognitive domains. Qualitative findings illustrated multidomain cognitive difficulties, accompanied by emotional and social challenges. Integrated findings indicated a bidirectional relationship between SCD and CLA: while cognitive concerns could motivate engagement in CLA for maintaining cognitive health, SCD-related emotional distress and reduced confidence constrained participation. CLA did not statistically moderate the age–SCD association, yet participants emphasised perceived emotional and cognitive benefits.

Conclusion: Fostering activity engagement in older adults with SCD requires addressing emotional, social, and contextual barriers while providing guidance, accessibility, and support to maintain cognitive and psychosocial wellbeing.

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List of Abbreviations

AD	Alzheimer's Disease
CLA	Cognitive Leisure Activity
CLAS	Cognitive Leisure Activity Scale
CR	Cognitive Reserve
GP	General Practitioner
GRAMMS	Good Reporting of a Mixed Methods Study
MCI	Mild Cognitive Impairment
MMAT	McGill Mixed Methods Appraisal
NIA-AA	National Institute on Ageing and Alzheimer's Association
NOS	Newcastle-Ottawa Scale
OR	Odds Ratio
PIS	Participant Information Sheet
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PROSPERO	Prospective Register of Systematic Reviews
SCD	Subjective Cognitive Decline
SCD-I	Subjective Cognitive Decline Initiative
SCD-Q	Subjective Cognitive Decline Questionnaire
SMD	Subjective Memory Decline
SPSS	Statistical Package for the Social Sciences
SRQR	Standards for Reporting Qualitative Research
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
SWiM	Synthesis Without Meta-Analysis
UK	United Kingdom

Thesis Overview

This thesis is written in the style of a monograph, as required by the School of Medicine and Population Health at the University of Sheffield, UK. It is organised into traditional chapters that include individual studies, some of which have been published or are yet to be published. The structure of the thesis aims to offer a thorough examination of subjective cognitive decline (SCD) and engagement in cognitive leisure activities (CLA) among older adults. The research integrates a systematic review, quantitative and qualitative empirical studies, and mixed methods analyses to fully address the research questions.

Chapter 1 (Background to the Research): This chapter introduces the core concepts of SCD and CLA engagement. SCD serves as an early sign of possible cognitive impairment and is linked with a higher risk of future objective cognitive decline, poorer mental health, and reduced quality of life. On the other hand, CLA is considered a modifiable factor that could help reduce these negative outcomes. The chapter outlines the rationale, objectives, and research questions of the thesis, emphasising the importance of understanding how SCD relates to CLA engagement in older adults.

Chapter 2 (Systematic Review): This chapter presents a published systematic review that summarises existing evidence regarding the relationship between SCD and CLA engagement. The review found inconsistent results, primarily due to the varied ways SCD was measured, often using only one or two memory-related items, and the inconsistent measurement of CLA, which typically focused on frequency rather than the range or type of activities. There was limited qualitative or mixed methods evidence explaining why and how SCD might affect CLA engagement. These findings highlighted key conceptual and methodological gaps that guided the later empirical research.

Chapter 3 (Methods): This chapter outlines the pragmatic sequential explanatory mixed methods design used in the research. It explains why this approach was chosen to fully answer the research questions and to capture both the quantitative patterns and qualitative experiences related to CLA engagement. The quantitative part of the research involved a cross-sectional survey of 255 older adults. It assessed SCD across three domains, including memory, executive function, and language, and CLA engagement across 16 types of activities along with their frequency. It also collected sociodemographic information such as age, gender, education level, and marital status. Correlation and regression analyses were used to explore the relationships

between these variables. The qualitative part included semi-structured interviews with 20 older adults with SCD who had different levels of CLA engagement. These interviews were analysed using thematic analysis. Findings from both phases were combined using a joint display to provide a detailed understanding of the relationship between SCD and CLA engagement.

Chapter 4 (Quantitative Findings): This chapter presents survey-based analyses that investigate the connections between general and specific types of SCD and engagement in CLA, including how often and in what variety these activities are undertaken. It also explores whether engagement in CLA moderates the association between age and SCD and examines how different types of CLA relate to specific concerns about SCD. These results are presented in relation to existing literature, with detailed discussion and interpretation provided in Chapter 8.

Chapter 5 (Qualitative Findings on Participants' Experiences of Subjective Cognitive Decline): This chapter outlines participants' characteristics and explores their experiences of SCD through three main themes: (1) lived experience of SCD, (2) negative impacts of SCD, and (3) coping strategies for SCD. These themes cover emotional, social, and behavioural aspects of SCD and offer a foundation for understanding processes that influence CLA engagement in Chapter 6. While some discussion of existing literature is included, a detailed synthesis of findings is provided in Chapter 8.

Chapter 6 (Qualitative Findings on Motivations and Barriers to Cognitive Activity Participation): This chapter examines influences that shape CLA engagement among older adults who experience SCD. Three main themes emerged: (1) motivations for CLA engagement, (2) barriers to CLA engagement, and (3) strategies to support CLA engagement. These themes offer a thorough understanding of how individual and environmental factors work together to affect participation. These results are presented in relation to existing literature, with detailed discussion and interpretation provided in Chapter 8.

Chapter 7 (Integration of Findings): This chapter combines quantitative and qualitative data using a joint display and narrative synthesis to examine how findings align, complement each other, or differ across the research questions. This provides a comprehensive view of the relationship between SCD and CLA engagement.

Chapter 8 (Discussion and Conclusion): This chapter interprets the combined quantitative and qualitative findings within the context of existing research, outlines theoretical and practical contributions, discusses the strengths and limitations of the research, considers implications for policy and practice, and suggests directions for future research.

CHAPTER 1- Background to the Research

1.1 Introduction

The population of older people is increasing rapidly around the world and maintaining cognitive and mental health has become a major concern for public health. Cognitive impairments, such as dementia, cause a lot of stress and strain on individuals, their families, and healthcare systems. Since there are no cures available, it's vital to detect people who might be at risk early on. Subjective cognitive decline (SCD) refers to when someone feels their memory or cognitive abilities is getting worse, without objective cognitive impairment. This is considered as a possible early sign of cognitive impairment, and it is associated with poorer mental well-being. Cognitive leisure activity (CLA), on the other hand, represents one of the most effective modifiable lifestyle factors shown to support cognitive and mental health in later life (Yates *et al.*, 2016). This research examined the relationship between SCD and CLA engagement among older adults. This chapter provides the background on SCD and CLA, investigates the current evidence of the relationship between these concepts, and outlines the rationale, research questions, and objectives of this PhD.

1.2 Ageing and Cognitive Health

1.2.1 Demographic trends: Global and national context

During the twenty-first century, population ageing has become one of the most significant demographic shifts in the world. According to the World Health Organisation (WHO, 2025a), the proportion of the global population aged 60 years and over is projected to nearly double from 12% in 2015 to 22% by 2050, with the number of older adults rising from 1 billion in 2020 to 2.1 billion. The number of people over the age of 60 will triple by 2050 to reach approximately 426 million, with one in six people over the age of 60 by 2030 (WHO, 2025a). A similar trend is evident in the United Kingdom (UK). According to the 2022-based National Population Projections (Office for National Statistics, 2025) the number of people at state pension age is (currently 66 years in the UK) expected to increase by 1.7 million between 2022 and 2032, rising from 12 to 13.7 million. The population aged 85 years and over is also projected to almost double from 1.7 million in 2022 to 3.3 million by 2047, reflecting both increasing life expectancy and the ageing of the post-war and 1960s baby boom cohorts. As the population grows older, the occurrence of cognitive health issues, such as dementia, is likely to rise, creating major challenges for people, their families, and the healthcare system.

1.2.2 Cognitive health in ageing

As the population of older adults increases, understanding age-related changes in cognition becomes increasingly important. While some of these changes are considered part of normal ageing, others may signal early objective cognitive impairment or the onset of age-related disorders (Salthouse, 2019). The concept of crystallised and fluid intelligence is commonly used to explain patterns of cognitive change across the lifespan. These frameworks clarify how certain cognitive abilities remain stable or even improve with age, while others gradually decline due to neurobiological changes (Harada, Natelson Love and Triebel, 2013). Crystallised intelligence refers to the accumulation of knowledge, skills, and experiences acquired over the lifespan. It is common to see skills such as vocabulary, general knowledge, and reading comprehension remain stable or even improve until around the sixth decade of life before plateauing in later years (Christensen, 2001; Harada, Natelson Love and Triebel, 2013). A fluid intelligence, on the other hand, is characterised by the ability to solve problems, reasoning, and process new information independently of previous experience. These abilities, including processing speed, memory, and executive function, tend to peak in early adulthood and then gradually decline across the adult lifespan (Harada, Natelson Love and Triebel, 2013; Kirk, 2024).

Cognitive ability can be categorised into distinct domains, each reflecting specific aspects of mental functioning. In the present research, three domains, including memory, executive function, and language, were examined in detail, as they are critical for daily functioning and are known to show differential patterns of age-related change (Harada, Natelson Love and Triebel, 2013; Kirk, 2024).

Memory comprises declarative (explicit) and nondeclarative (implicit) types. There are two categories of declarative memory: semantic memory (knowledge of facts and language) and episodic memory (memory of personal events), the former declining gradually with age, whereas the latter remains relatively stable with respect to age (Harada, Natelson Love and Triebel, 2013; Kirk, 2024). The ability to retain non-declarative memory, such as procedural memory for motor and cognitive abilities, lasts throughout our lives, for example, the ability to tie a shoelace or ride a bicycle (Harada, Natelson Love and Triebel, 2013; Kirk, 2024). The working memory reflects the ability to temporarily store and manipulate information, which declines with age and is considered a complex attentional task (Kirk, 2024). Overall, older adults retain a great deal of their factual and procedural knowledge; however, it becomes

increasingly difficult for them to retrieve newly acquired or context-specific information. The effects of this situation can be observed in everyday tasks such as mentally calculating a restaurant tip or following multi-step instructions.

A person's executive function refers to their ability to plan, solve problems, be mentally flexible, process working memories, and plan responses. All of these skills are essential to a person's independent functioning on a daily basis (Harada, Natelson Love and Triebel, 2013; Kirk, 2024). There is a tendency for cognitive abilities, such as reasoning with unfamiliar material, response inhibition, and updating working memory, to decline with age, specifically after the fifth or sixth decade of life. Some executive functions, like mental flexibility and reasoning about familiar material, are relatively preserved (Harada, Natelson Love and Triebel, 2013; Kirk, 2024). Practical examples include making a shopping list, multitasking while cooking, or stopping an automatic action to do something new.

Language is largely preserved with normal ageing, with vocabulary often remaining stable or even improving over the lifespan (Harada, Natelson Love and Triebel, 2013; Kirk, 2024). Some aspects, such as verbal fluency, may decline, and individuals may occasionally experience tip-of-the-tongue moments (temporary difficulty retrieving familiar words), but these changes largely reflect slower processing speed rather than true language impairment. Auditory comprehension in noisy environments can also decline, typically due to age-related hearing loss rather than language deficits (Harada, Natelson Love and Triebel, 2013; Kirk, 2024). Generally, older adults maintain the ability to understand and use language effectively in daily life, such as engaging in conversations and reading.

Although cognitive abilities exhibit age-related alterations, these changes develop progressively over time rather than abruptly, and the pattern of change differs among individuals (Christensen, 2001). These gradual changes are considered a normal part of ageing, and none of them show a *"falling off the cliff"* effect at any particular age (Kirk, 2024). A sudden or marked decline in cognitive abilities may signal the beginning of cognitive impairments, such as dementia. Distinguishing normal age-related cognitive changes from early signs of impairment provides a basis for discussing the prevalence and impact of it in the following section.

1.2.3 Dementia prevalence and impact

The gradual decline of cognitive function is part of normal ageing; however, a subset of older adults may experience more pronounced impairments, potentially resulting in clinical conditions over time. Dementia is characterised by progressive declines in two or more cognitive domains, such as memory, language, executive and visuospatial abilities, personality, and behaviour (Weller and Budson, 2018). As a result, it is difficult to perform both basic and instrumental activities of daily living (Weller and Budson, 2018). Globally, around 57 million people are living with dementia, with nearly 10 million new cases diagnosed each year (WHO, 2025b). Alzheimer's disease (AD) is the most common form, accounting for 60–70% of all dementia cases (WHO, 2025b). Dementia also poses a major economic and social burden, costing the global economy an estimated US$ 1.3 trillion in 2019, about half of which is attributed to informal care provided by family members and friends (WHO, 2025b).

The National Institute on Ageing and Alzheimer's Association (NIA-AA) recently updated their framework for classifying AD along a clinical continuum (Jack *et al.*, 2024; see Figure 1.1). According to this model, there are six stages, beginning with the presence of asymptomatic biomarkers (Stages 0–1), progressing to the presence of mild detectable cognitive changes without functional losses (Stage 2), and finally leading to progressive cognitive and functional decline leading to dementia (Stages 3–6). In particular, Stage 2, defined as subtle or subjective cognitive changes that are associated with a preserved level of daily functioning, represents a transitional stage prior to measurable impairment, which is conceptually in accordance with the notion of perceived cognitive decline. In this framework, perceived cognitive decline is viewed as an early sign along the Alzheimer's continuum (Jack *et al.*, 2018). However, subjective cognitive complaints are common in older adults, may arise in the absence of measurable objective impairment (Kiene, Hildebrandt and Roheger, 2025) and are shaped by non-neurodegenerative influences such as psychological well-being, lifestyle, and perceptions of everyday cognitive functioning, highlighting the need for careful interpretation in both clinical and research contexts (Jack *et al.*, 2018).

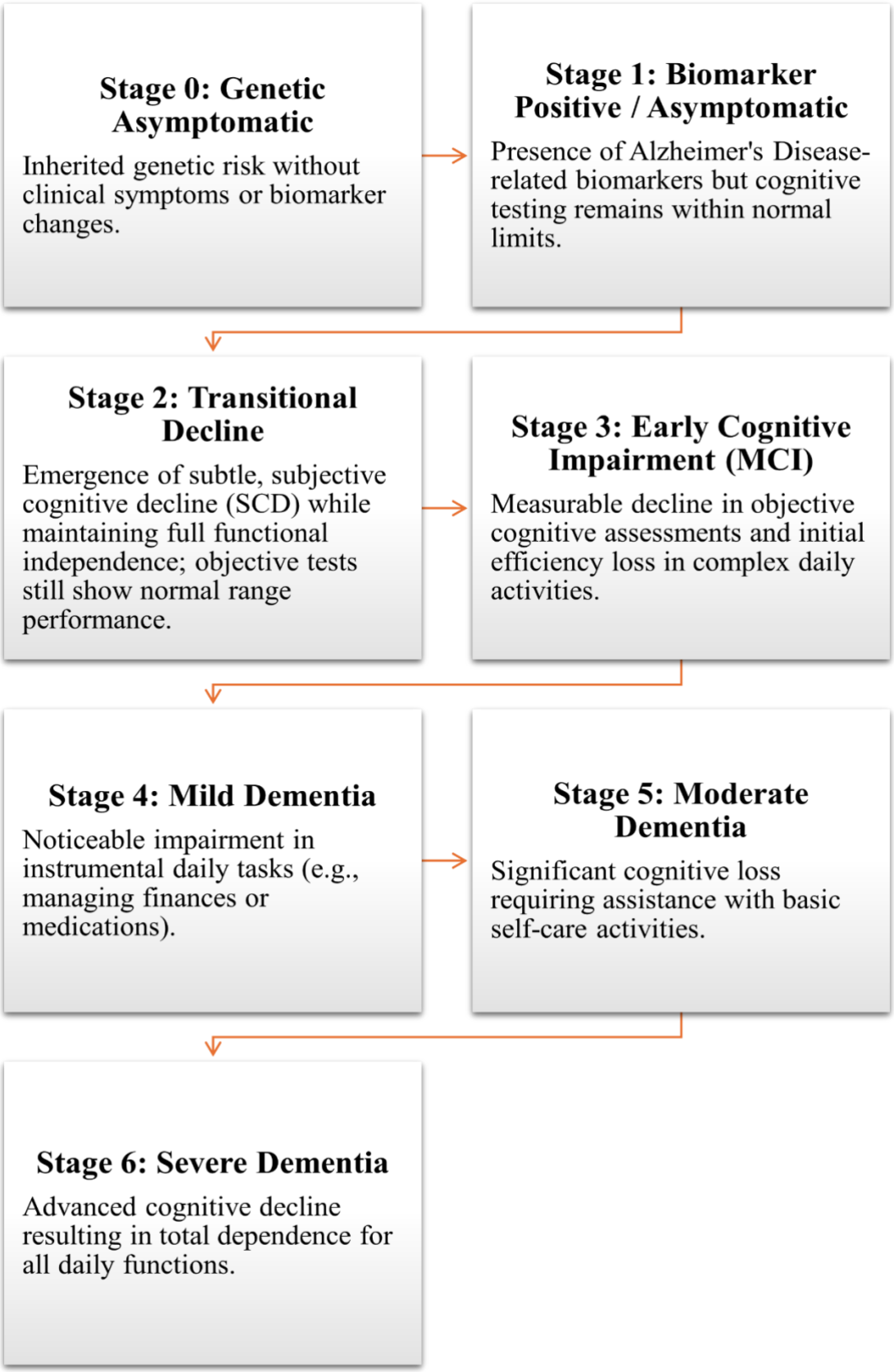

Figure 1.1 Clinical staging of the Alzheimer's disease continuum according to the NIA-AA framework. *Adapted from* (Jack *et al.*, 2024).

1.3 Subjective Cognitive Decline

In the early 1980s, Reisberg and colleagues introduced the concept of subjective cognitive decline (SCD) within the Global Deterioration Scale, where it was defined as subjective memory complaints occurring in the context of intact objective cognitive functioning (Reisberg et al., 1982, as cited in Rabin, Smart and Amariglio, 2017) . This stage is theorised to precede mild cognitive impairment (MCI) by many years and to signify the earliest clinically apparent phase of cognitive alterations associated with AD (Reisberg, 1986, as cited in Rabin, Smart and Amariglio, 2017). It was not until 2005 that the concept of SCD began to reemerge, accompanied by significant heterogeneity in terms of terminology, assessment strategies, and study settings (Rabin, Smart and Amariglio, 2017). A consequence of this variability was the need for conceptual clarity and methodological standardisation, which led the Subjective Cognitive Decline Initiative (SCD-I) in 2014 to develop a consensus-based framework (Jessen *et al.*, 2014). Within this consensus-based framework, SCD is defined as a self-reported decline in cognitive capacity over time compared to a previously normal level of functioning in the absence of objective cognitive impairment (Jessen *et al.*, 2014).

SCD is a broad condition that can progress in different ways over time due to various underlying causes (See Figure 1.2).

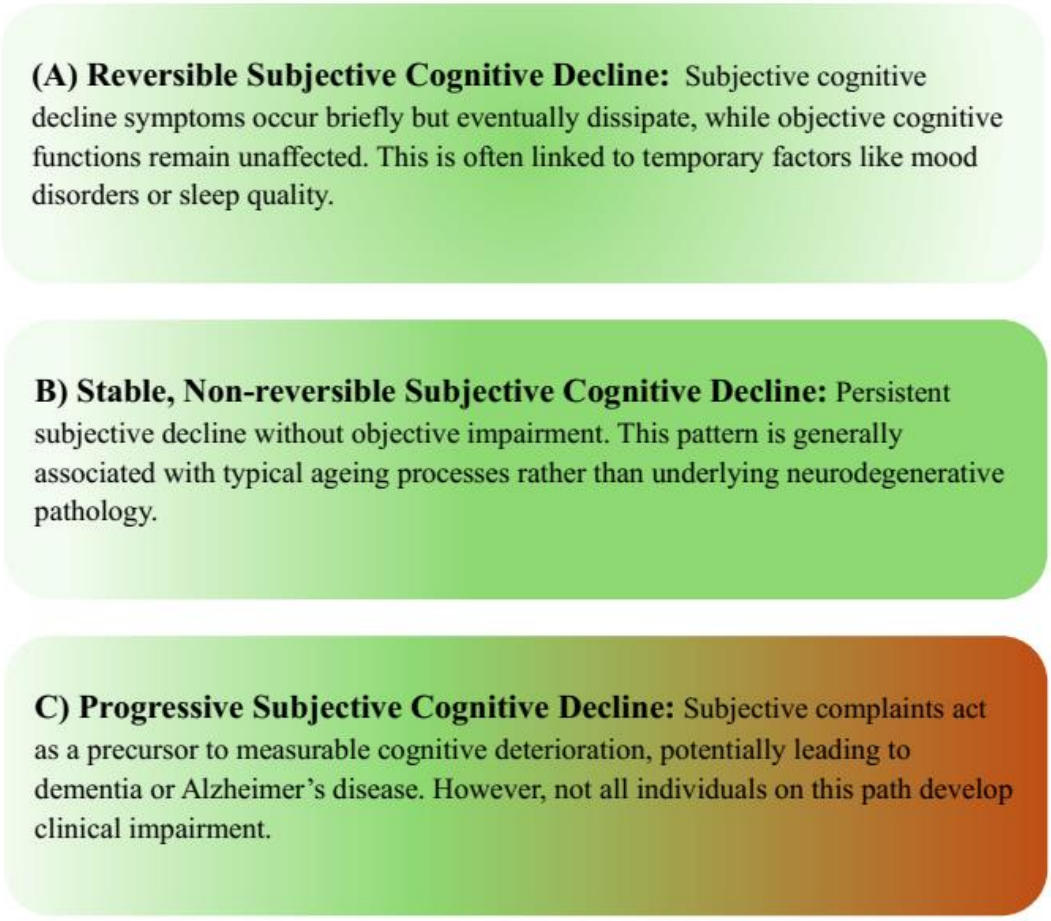

Figure 1. 2. Schematic representation of trajectories of SCD and objective cognitive function over time. ***Note.*** The gradient illustrates the transition from no cognitive decline (white) to subjective symptoms (green) and objective impairment (red). *Adapted from* (Jessen *et al.*, 2020).

SCD can manifest across multiple cognitive domains, including memory, attention, executive functions, language, and visuospatial abilities. Memory is generally the first and most commonly affected domain, though other domains, such as attention, executive function, language, and motor abilities, can also be impacted (Jessen *et al.*, 2020). A population-based cohort study in Germany reported the highest prevalence of domain-specific SCD for memory (65.9%), followed by attention (54.6%), motor abilities (52.9%), executive function (39.7%), and language (31.5%), with age consistently associated with SCD across domains (Schütz *et al.*, 2020). Another recent study investigating neuropsychological performance among older adults with SCD found subtle deficits in episodic memory (delayed recall), executive functions (inhibitory control), and language (comprehension) compared to a matched healthy control group (López-Higes *et al.*, 2025). It has been demonstrated through a systematic review of longitudinal studies and cross-sectional studies that the association between SCD and cognitive performance is strongest for global cognition and memory (Zhou *et al.*, 2025). Differences in

executive function, language, and attention were less consistent (Zhou *et al.*, 2025). In support of this argument, a 14-year longitudinal study conducted in England found that both subjective memory complaints and concentration complaints were associated with worse objective cognitive function, indicating that focusing on memory alone may overlook important deficits in attention and concentration (Begum *et al.*, 2014). Together, these findings underscore the importance of considering multiple cognitive domains rather than limiting assessment to memory alone (Jessen *et al.*, 2020).

1.3.1 Prevalence of subjective cognitive decline in an ageing population

SCD is fairly common among older adults, with prevalence estimates varying across populations and settings. Epidemiological studies have reported SCD prevalence ranging from 10% to 88%, increasing with age, from about 20% in those ≤65 years to up to 88% in those ≥85 years (Si, Xing and Han, 2020). In a systematic review of studies conducted in China, the prevalence of SCD among adults aged 60 and above was reported as 46.4% (Xue *et al.*, 2023). In a community-based sample in Greece, 28% of cognitively unimpaired individuals aged 65 and older without psychiatric conditions reported experiencing SCD (Vlachos *et al.*, 2019), while in a German sample of primary care patients aged 75 and above, the prevalence was 54% (Roehr *et al.*, 2019). A recent international study that pooled individual data from 16 cohorts across 15 countries, involving 39,387 older adults over the age of 60 who were cognitively healthy, found that approximately 25% of older adults experience SCD (Röhr *et al.*, 2020). Similarly, studies in memory clinic settings report prevalence estimates ranging from 18% to 55% (Bhome *et al.*, 2018). Specifically, in the UK, a large primary care cohort study including adults aged 65–99 years between 2009 and 2018 reported that 4.3% of participants newly developed concerns about their memory during the study period, and the proportion of individuals reporting memory concerns remained relatively stable over the decade (Hallam *et al.*, 2022). This research provides a useful indicative perspective on subjective cognitive issues among older UK adults (Hallam *et al.*, 2022). Nevertheless, evidence on SCD prevalence in the UK remains limited, with few studies addressing this topic.

1.3.2 Methodological challenges in subjective cognitive decline research

A primary factor contributing to the significant variations in reported SCD prevalence is the challenge of obtaining consistent measurements. SCD is a reflection of an individual's impression of cognitive changes, and it is difficult to capture these early, subtle alterations

(Ibnidris *et al.*, 2022). Measurement consistency is compromised by the fact that many studies simply utilise a single yes/no question about memory and refer to different time periods (some ask about changes over the previous five years, while others use much longer durations) (Rabin *et al.*, 2015; Ibnidris *et al.*, 2022). Many instruments have incomplete reliability checks; for example, some report internal consistency (Cronbach's α) but others do not (Ibnidris *et al.*, 2022). An analysis of 19 research revealed 34 distinct SCD questionnaires, the majority of which were used only once (75%) and varied in terms of the number of questions, response styles, and domains covered (Rabin *et al.*, 2015). More recently, Rabin et al. (2023) demonstrated that such inconsistencies extend beyond content to include variation in response scales (ranging from dichotomous to 7-point Likert formats), time references, and question types (e.g., ability-based vs. change-based items), all of which compromise comparability across studies. To improve SCD measurement, Rabin et al. (2023) recommended that tools should include questions on multiple cognitive areas, including memory, language, and executive function, use standardised response formats, capture the timing and progression of changes, and remain brief and practical to complete (Rabin *et al.*, 2023). They also showed that items covering these domains are the most reliable and informative in capturing perceived cognitive decline (Rabin *et al.*, 2023).

1.3.3 Subjective cognitive decline as an early sign of cognitive impairment

Many studies have examined the risk of future objective cognitive impairment among individuals with SCD. Pike et al. (2022) found that people with SCD were almost twice as likely to develop dementia and roughly 70% more likely to develop MCI than people without SCD; in terms of odds, SCD was linked to a 2.5-fold increased risk of dementia and a 1.8-fold increased risk of MCI. Similarly, Mitchell et al. (2014) reported that older adults experiencing subjective memory complaints face approximately twice the risk of developing dementia compared to those without such complaints. Neuroimaging studies have further elucidated structural and functional brain disparities in individuals with SCD relative to healthy controls, thereby reinforcing the hypothesis that SCD may indicate initial neuropathological changes (Parker *et al.*, 2022). Specifically, a UK primary care cohort study of older adults reported that, within three years of an initial documented memory concern, nearly half of the individuals (45.5%) were subsequently diagnosed with dementia, highlighting the increased future risk linked to SCD in this population (Hallam *et al.*, 2022). Collectively, these findings underscore that SCD may serve as a clinically significant early marker of cognitive decline, emphasising

the significance of monitoring subjective cognitive complaints to identify individuals at increased risk of progressing to MCI or dementia.

Jessen et al. (2020) also introduced the concept of 'SCD-plus', a set of features that have been associated with an increased risk of future objective cognitive decline:

- *Memory-specific decline:* Subjective decline in memory, regardless of other cognitive domains.
- *Recent onset:* SCD starting within the past 5 years is linked to higher future risk.
- *Age ≥ 60:* Onset of SCD at age 60 or older is associated with increased risk of future cognitive decline.
- *Concerns/worries:* Expressing worries about cognitive decline indicates higher risk.
- *Observer confirmation:* Reports of cognitive decline by someone close to the individual increase the likelihood of future objective decline.

In addition, they also proposed two further features: consistent SCD over time, where repeated reports of subjective decline indicate higher risk than short-term complaints, and seeking medical help because of SCD, which is associated with increased risk compared with individuals with SCD who do not seek help (Jessen *et al.*, 2020). Together, these features facilitate the identification of individuals with SCD who are at an increased risk of progressing to MCI or dementia. Supporting this, a recent longitudinal systematic review analysed 37 studies investigating predictors of cognitive decline in individuals with SCD and reported an average conversion rate of 19.8% to any form of cognitive deterioration, including 7.3% progressing to all-cause dementia and 4.9% to AD (Li *et al.*, 2023). Five SCD-plus features, including older age at onset, consistent SCD, self- and informant-reported SCD, expressed worries, and memory clinic recruitment, were among the significant risk factors for future objective cognitive decline (Li *et al.*, 2023).

1.3.4 Subjective cognitive decline and psychological symptoms

While SCD reflects self-perceived cognitive decline, evidence suggests that it is not solely linked to objective cognitive impairment. Some studies have shown that SCD is frequently linked to psychological factors such as anxiety, depression, and stress (Hill *et al.*, 2016; Zhou *et al.*, 2025). In line with this, a longitudinal study of cognitively healthy older adults revealed that individuals experiencing higher levels of perceived stress were more prone to report memory complaints over time, suggesting that stress may play a role in the persistence of

subjective cognitive concerns in later life (Bell *et al.*, 2021). Similarly, a recent systematic review of 167 ageing studies found that SCD was commonly linked to depressive symptoms across both cross-sectional and longitudinal research, although the causal relationship between them remains uncertain (Zhou *et al.*, 2025). Furthermore, 58 studies examining subjective cognitive impairment and affective symptoms were reviewed and found consistent cross-sectional associations with depression and anxiety (Hill *et al.*, 2016). However, longitudinal findings suggest that subjective cognitive impairment may be bidirectionally related to depressive symptoms (Hill *et al.*, 2016).

Beyond these associations, heightened anxiety and worry appear to exacerbate subjective cognitive complaints and may increase the risk of future objective cognitive decline. According to a meta-analysis, individuals with SCD who expressed concerns over their cognitive decline were at 56% greater risk of future cognitive decline, indicating the prognostic significance of concern (Li *et al.*, 2023). Consistently, it has been found that the level of dementia-related worry in older adults is associated with a lower level of subjective overall cognition and executive function (Divers *et al.*, 2022). Notably, some studies suggest that SCD may reflect affective or subclinical psychological issues rather than early cognitive impairment. The presence of memory complaints was associated with anxiety symptoms among middle-aged individuals, but not with the performance of objective memory or attention (Quek *et al.*, 2022), and in a clinic-based sample of adults aged 60–95, SCD was linked to depressive symptoms but not objective cognitive performance after adjusting for demographics (Zlatar *et al.*, 2018). Overall, these findings indicate that psychological factors can play a central role in SCD and may influence both subjective perception and future risk of objective cognitive decline.

1.3.5 Subjective cognitive decline and sociodemographic factors

Sociodemographic characteristics, including age, gender, marital status, and educational attainment, have been examined in relation to SCD, as these factors may influence both the perception of cognitive changes and the likelihood of reporting SCD in older adults. SCD is consistently associated with older age, with multiple studies identifying age as a stable risk factor for both the presence and severity of SCD complaints (Jessen *et al.*, 2020; Schütz *et al.*, 2020; Wen *et al.*, 2021; Hallam *et al.*, 2022). Marital status influences SCD, with single, divorced, or widowed individuals generally reporting higher levels of SCD complaints compared with married participants (Weng *et al.*, 2020; Wen *et al.*, 2021; Ma *et al.*, 2024). However, one study found that living with a spouse was also associated with increased

cognitive concerns (Roh, Dan and Kim, 2021), suggesting that this relationship may be influenced by factors such as relationship dynamics or support needs rather than marital status alone. For example, individuals experiencing cognitive concerns may be more likely to live with someone for support, which complicates interpretation of the direction of this association. Sex differences have also been observed in SCD, with females generally reporting higher levels of subjective cognitive complaints than males (Roh, Dan and Kim, 2021; Borelli *et al.*, 2022; Carter *et al.*, 2023; Ma *et al.*, 2024). The association between education and SCD is somewhat inconsistent, with some studies reporting lower SCD prevalence among individuals with higher educational attainment (Weng *et al.*, 2020; Roh, Dan and Kim, 2021; Lin *et al.*, 2022; Mondini *et al.*, 2022), while others suggest that more educated individuals may report more subjective cognitive complaints (Rabin, Smart and Amariglio, 2017; Carter *et al.*, 2023). Taken together, SCD appears to be more frequently reported among older adults, females, and individuals who are single, divorced, or widowed, while higher education mostly seems protective, with some studies (Lin *et al.*, 2022; Mondini *et al.*, 2022; Carter *et al.*, 2023) reporting a mixed pattern.

1.3.6 Subjective cognitive decline and other related factors

SCD is also associated with other psychosocial factors, including personality traits, social isolation that can shape individuals' experiences and interpretations of cognitive changes. In terms of personality, a recent systematic review found that higher SCD in older adults was frequently linked to higher neuroticism and lower conscientiousness, with no consistent associations for openness, extraversion, or agreeableness (Koller *et al.*, 2019). Similarly, Reynolds et al. (2022) found that SCD was associated with lower conscientiousness and lower emotional stability, as well as higher loneliness. It is also possible to identify individuals with SCD who are at a greater risk of developing objective cognitive impairments such as MCI and AD based on their personality traits (Bessi *et al.*, 2018). The importance of loneliness and social isolation appears to go beyond personality: older adults with more subjective cognitive complaints reported higher levels of loneliness and stress, while those with fewer complaints reported lower levels of loneliness (Pecchinenda *et al.*, 2024). Social isolation was further highlighted as a key psychosocial risk factor, alongside depression, with similar prevalence of SCD observed in women and men (Schliep *et al.*, 2022). Finally, SCD has been constantly associated with reduced quality of life, both in systematic review (Hill *et al.*, 2017) and large population-based studies, such as a nationwide survey in Korea showing that individuals with

SCD (n = 37,614) had higher rates of depression and lower quality of life scores compared with those without SCD (Lee and Ho Chung, 2022).

In summary, these results suggest that SCD may act as an early sign of future cognitive challenges and is closely connected to various psychological and social factors, such as mental health, demographic features, and personality traits. While the reasons behind SCD are probably complex and differ from person to person, the evidence consistently shows that it can have a negative impact on the daily lives of older adults, lowering their quality of life and general sense of well-being. These findings highlight the need for careful assessment and focused attention in both clinical and research settings. Due to its wide-ranging effects, efforts to understand and reduce SCD concerns should focus on risk factors that can be changed, with the goal of maintaining cognitive health and overall well-being.

1.4 Cognitive Leisure Activity

Leisure activity is broadly defined as the pursuit of a range of tasks and activities outside of work-related responsibilities, encompassing both passive and active engagements (Fallahpour *et al.*, 2016). Despite decades of research, however, there remains considerable diversity in conceptualisations and no universally accepted definition of leisure activities in the literature (Fallahpour *et al.*, 2016). Within this broader framework, cognitive leisure activity (CLA) is defined by its ability to encourage cognitive processes. Based on a synthesis of previous studies (Wilson *et al.*, 2003, 2005; Stern and Munn, 2010), activities are regarded as cognitively stimulating if they meet two conditions: (1) seeking or processing information plays a central role in the activity, and (2) they require little physical effort or social interaction, which makes them suitable for a wide range of people. Examples of such activities include reading books or newspapers, keeping a journal, playing boardgames, and attending concerts, all of which have been widely used in cognitive ageing research (Wilson *et al.*, 2003, 2005). This definition and operationalisation of CLA is adopted throughout this thesis to ensure conceptual clarity and consistency across the systematic review, quantitative, and qualitative research phases. Although several lifestyle factors, including physical and social activity, have been linked to cognitive health in later life, the present thesis focuses specifically on CLA due to its direct engagement of cognitive processes and its potential relevance to early SCD concerns.

1.4.1 Cognitive leisure activity engagement as a modifiable protective factor

Recent epidemiological studies highlight daily lifestyle-related activities as promising approaches to maintain cognitive function (Fallahpour *et al.*, 2016). Among these, CLA emerges as a feasible and effective approach that may safeguard against age-related cognitive deterioration and diminish the likelihood of cognitive impairment. Even though lifestyle factors cannot reverse cognitive decline, identifying protective influences can provide substantial benefits, including increased independence, reduced social and economic burdens, and an enhanced quality of life (Stern and Munn, 2010). For example, delaying the onset of AD even briefly can substantially reduce annual incidence and associated healthcare costs (Stern and Munn, 2010). Similarly, recent estimates suggest that up to 40% of dementia cases may be preventable through the modification of life-course risk factors (De Looze *et al.*, 2023).

A substantial body of evidence suggests that engaging in CLA may delay or buffer cognitive impairment (Wilson *et al.*, 2012; Park *et al.*, 2014; Mao, Xie and Lu, 2023) and is associated with a lower risk of such decline, highlighting its potential role as a modifiable lifestyle factor (Yates *et al.*, 2016). This protective effect has been attributed to Cognitive Reserve theory, which posits that mentally stimulating activities strengthen neural networks and enhance the brain's ability to maintain function despite age-related and pathological changes (Stern, 2002, 2009). Within this framework, CLA contributes to reserve by repeatedly engaging cognitive processes, supporting neural efficiency, flexibility, and compensatory mechanisms (Stern, 2002, 2009). Moreover, such activities may facilitate the formation and reinforcement of new neural connections, thereby promoting neuroplasticity (Marzola *et al.*, 2023).

Beyond direct cognitive benefits, engagement in these activities can also reduce stress and depressive symptoms, fostering psychological well-being that indirectly contributes to cognitive health (Kim *et al.*, 2022). Regular participation in cognitively stimulating leisure activities has further been linked to lower levels of stress, depression, and anxiety, supporting both cognitive and emotional well-being (Poelke *et al.*, 2016; Song *et al.*, 2025). Overall, evidence indicates that CLA engagement contributes to both cognitive vitality and emotional stability in later life, highlighting its potential as an accessible and cost-effective approach to promoting healthy cognitive ageing.

However, despite encouraging evidence, findings on the protective effects of CLA are not universally consistent. Numerous longitudinal and epidemiological research indicate weak or

non-significant correlations when controlling for variables such as education, socioeconomic background, or baseline cognitive capacity (Salthouse, 2006; Hindle, Martyr and Clare, 2014; Gow, Pattie and Deary, 2017). Moreover, numerous findings derive from observational study designs, which may constrain causal inference and introduce the potential for reverse causation, where individuals with superior baseline cognitive function may participate in more cognitively stimulating activities rather than CLA exerting protective effects (Salthouse, 2006; Gow *et al.*, 2012). Finally, significant discrepancies exist in the categorisation and measurement of CLA between studies, specifically concerning the relative importance of activity frequency versus variety and the precise activities that define cognitive engagement, hence diminishing comparability and leading to inconsistent conclusion (Bielak *et al.*, 2014; Morrow-Howell *et al.*, 2014; Li, 2021). These inconsistencies highlight the need for more comprehensive investigation into how, and which types of, CLA engagement may confer cognitive benefits.

1.5 The Relationship Between Subjective Cognitive Decline and Cognitive Leisure Activity Engagement

Research exploring the relationship between SCD and activity engagement remains limited, reflecting the relatively recent emergence of SCD as a distinct research construct. Existing studies have primarily explored activity participation in individuals with SCD in relation to general, physical, or social activities, with comparatively little attention paid to cognitively stimulating leisure activities. For example, a systematic review by Wion et al. (2020), which examined the literature up to 2018, found that greater SCD complaints were associated with reduced engagement in social and physical activities; however, notably, no studies were identified that specifically examined the relationship between SCD and CLA engagement. Since the publication of this review, research interest in SCD has expanded, and new evidence has emerged examining cognitive engagement and self-perceived cognitive change in older adults. As part of the present PhD, an updated systematic review was conducted to synthesise this emerging literature and to examine the association between SCD and CLA engagement. While the findings of this review are presented in detail in Chapter 2, they indicate that the existing evidence base remains characterised by considerable heterogeneity in study design and outcome measures, with inconsistent findings regarding the relationship between SCD and CLA engagement. Taken together, these findings highlight the emerging but still limited and inconsistent evidence regarding the SCD–CLA relationship, underscoring the need for a comprehensive empirical investigation to better understand this association.

1.6 Research Rationale

Subjective cognitive decline is increasingly recognised as a clinically and theoretically important construct, given its association with poorer objective cognitive performance (Li *et al.*, 2023; López-Higes *et al.*, 2025; Zhou *et al.*, 2025), reduced psychological well-being, and its potential role as an early indicator of later cognitive impairment (Hill *et al.*, 2016; Bell *et al.*, 2021; Quek *et al.*, 2022). At the same time, engagement in CLA has been consistently associated with better cognitive functioning (Yates *et al.*, 2016; Marzola *et al.*, 2023) and psychological health in older adults (Poelke *et al.*, 2016; Song *et al.*, 2025), suggesting that CLA may represent a modifiable lifestyle factor with the potential to mitigate some of the adverse outcomes associated with SCD.

Despite this, the relationship between SCD and CLA engagement remains insufficiently understood. As highlighted by recent review (Chapter 2; Akbayrak *et al.*, 2024), research in this area exhibits substantial heterogeneity in study designs, inconsistencies in SCD and CLA measurement, and a predominant focus on memory-related complaints, often assessed using single-item measures. Moreover, studies examining CLA have typically included a narrow range of activities, limiting understanding of how different forms of engagement relate to concerns across multiple cognitive domains, such as attention, language, or executive function. Although previous research indicates that specific types of CLA may benefit distinct cognitive domains (Bielak, Mogle and Sliwinski, 2019; Fernández *et al.*, 2023), no study to date has investigated these domain-specific associations in the context of SCD. In addition, the current evidence base is heavily dominated by quantitative research. While such studies provide valuable information regarding associations between SCD and activity engagement, they offer limited insight into the lived experience of SCD or the influences that shape older adults' decisions to engage or disengage from cognitively stimulating activities. Consequently, little is known about the motivational, emotional, and contextual processes underlying CLA participation among individuals with SCD.

All things considered, these limitations highlight the necessity of a thorough investigation that combines quantitative and qualitative methods. In addition to offering a comprehensive understanding of how older adults experience SCD and how this experience influences their engagement in CLA, a mixed methods design enables the examination of statistical associations between variables. To improve theoretical knowledge of the SCD–CLA

relationship and to guide the creation of targeted interventions and strategies to promote cognitive health in later life, it is essential that these gaps be filled. To address these identified gaps and limitations, the present thesis adopts a systematic and mixed-methods approach, as outlined in the following research aims and questions.

1.7 Aims and Research Questions

As part of this PhD thesis, a systematic review was conducted to synthesise existing evidence on the relationship between SCD and CLA engagement in older adults (Chapter 2; Akbayrak *et al.*, 2024). The aims of the systematic review were: (1) to examine the association between SCD and CLA engagement in older adults; (2) to explore whether different types of CLA are differentially associated with SCD; and (3) to identify methodological limitations and gaps within the existing evidence base to inform future research. The review found several significant limitations in the literature, such as a lack of qualitative or mixed methods research, a predominant focus on memory-related complaints, and variations in measurement techniques for both SCD and CLA engagement. To ensure that the thesis addressed gaps in measurement, cognitive domains, and qualitative insight, these findings directly influenced the design and particular research questions of the empirical phase.

Taking these gaps into account, the overall aim of the empirical component of this PhD thesis was to examine the relationship between SCD and CLA engagement among older adults using a mixed methods approach. The quantitative phase aimed to investigate associations between SCD and CLA engagement, including associations between specific CLA types and domain-specific SCD concerns. The qualitative phase sought to gain a deeper understanding of the lived experience of SCD and to explore the influencing shaping participation or non-participation in activities, such as perceived barriers, motivations, and strategies for engagement. To address the research aims, the following research questions were investigated:

Quantitative Phase

- What is the relationship between SCD and CLA engagement in older adults, including domain-specific cognitive concerns and sociodemographic variations?

Qualitative Phase

- What shapes engagement in CLA among older adults with SCD, including motivations, barriers, and strategies for sustaining participation?

Integration Phase

- How do quantitative and qualitative findings together enhance understanding of the SCD–CLA relationship?

1.8 Research Objectives

The following research objectives were developed to address the research questions and guide the research:

1. To systematically review the literature and identify what is known about the relationship between SCD and CLA engagement (Chapter 2)
2. To evaluate the relationship between SCD and CLA engagement among a sample of older adults using a quantitative survey, including the association between total and domain-specific SCD scores and CLA participation frequency and variety, as well as the relationship between specific CLA types and domain-specific SCD concerns, and to determine whether CLA engagement is protectively associated with fewer SCD concerns (Chapter 4)
3. To explore the lived experiences of older adults with SCD, including the impact of SCD on cognitive and psychological functioning, social engagement, and coping strategies, through semi-structured interviews, providing contextual insight into the factors influencing CLA participation (Chapter 5)
4. To investigate the influences shaping engagement in CLA among older adults with SCD, including barriers, motivations, and strategies to facilitate participation (Chapter 6)
5. To integrate the quantitative and qualitative findings employing a joint display method to provide a comprehensive understanding of the SCD–CLA relationship (Chapter 7)
6. To discuss the findings in relation to the existing literature and provide practical recommendations for researchers, healthcare professionals, and policymakers to support and enhance CLA engagement among older adults with SCD (Chapter 8)

1.9 Chapter Summary

This chapter introduced the broader context of ageing and cognitive health, highlighting the increasing prevalence and impact of cognitive decline and dementia. It provided background on SCD as a condition affecting older adults' cognitive, emotional, and social well-being, and on CLA as a modifiable lifestyle factor that may help mitigate these impacts. The chapter also discussed the potential relationship between SCD and CLA engagement, and concluded by outlining the research's rationale, aims, research questions, and objectives of the present research. The following chapter presents a systematic review of the literature on SCD and CLA engagement, synthesising current evidence, identifying gaps, and informing the aims and design of the empirical phases of this thesis.

Note on Publication Status

The following chapter reproduces a peer-reviewed journal article published in *The Gerontologist*. The chapter is reproduced without substantive modification. Minor formatting adaptations (e.g., the use of full section headings and the renumbering of supplementary materials) have been made to ensure consistency with the structure of this thesis.
The full, citable version of record is:

Akbayrak, E., Powell, P.A., Tunc, N., & Barnes, S. (2025). The relationship between subjective cognitive decline and cognitive leisure activity engagement: A systematic review. The Gerontologist, 65(2), gnae176. https://doi.org/10.1093/geront/gnae176

CHAPTER 2- The Relationship Between Subjective Cognitive Decline and Cognitive Leisure Activity Engagement: A Systematic Review

2.1 Introduction

This chapter presents a systematic review conducted as part of this PhD thesis. The review synthesises current empirical evidence examining the relationship between subjective cognitive decline (SCD) and cognitive leisure activity (CLA) engagement in older adults. By systematically reviewing observational, mixed method, and qualitative research, the review aimed to clarify whether and how SCD is associated with CLA participation, and whether certain types of CLA may be more or less related to SCD. This work was an essential first step in developing the present PhD thesis because it identified key conceptual and methodological gaps in the existing literature. Accordingly, the findings of the review informed the design and focus of the empirical research presented in the subsequent chapters of this thesis.

2.2 The Relationship Between Subjective Cognitive Decline and Cognitive Leisure Activity Engagement: A Systematic Review

Akbayrak, E., Powell, P.A., Tunc, N., & Barnes, S. (2025). The relationship between subjective cognitive decline and cognitive leisure activity engagement: A systematic review. The Gerontologist, 65(2), gnae176. https://doi.org/10.1093/geront/gnae176

Abstract

Background and objectives: Subjective cognitive decline (SCD) is a common experience of self-perceived decline without objective cognitive impairment. It has been theorised that SCD is associated with participation in cognitive leisure activities (CLA), but the evidence base is multifarious and unclear. The purpose of this systematic review was to synthesise current evidence to determine the association between SCD and CLA engagement.

Research Design and Methods: Systematic searches were conducted in EMBASE, MEDLINE, PsycINFO, and Web of Science (last searched April 2023). Data were extracted against a priori inclusion criteria and synthesised narratively using Synthesis without Meta-

Analysis guidelines. Risk of bias was assessed using the Newcastle–Ottawa Scale (NOS) and Mixed Methods Appraisal Tool (MMAT). Reporting follows PRISMA guidelines.

Results: From 4447 records, 11 articles were included. Due to study heterogeneity, evidence on SCD and CLA association is inconclusive. While a modest correlation was found between greater engagement in CLA and fewer reports of SCD, the heterogeneity in study designs and outcomes, particularly in those addressing only perceived memory decline and CLA engagement, challenges definitive conclusions on this relationship. Evidence from mixed method and qualitative studies indicated that perceived memory decline may cause negative feelings, such as shame and frustration, which may influence participating in CLA.

Discussion and Implications: These findings suggest that participation in CLA is moderately associated with, and may act protectively against, SCD. However, establishing a directional or causal relationship between CLA participation and SCD outcomes requires further investigation through longitudinal and/or interventional studies.

Keywords: Cognitive activity engagement, memory, subjective cognitive decline, systematic review

2.3 Introduction

Subjective cognitive decline (SCD) refers to an individual's sense of worsening in their cognitive functions in the absence of objective deficits (Jessen *et al.*, 2014). It is characterised by a variety of terms, including subjective cognitive concerns, subjective memory decline (SMD), or forgetfulness (Jessen *et al.*, 2014). Based on data from fifteen countries, the prevalence of SCD in people aged 60 and over has been estimated between 23.8% and 25.6% (Röhr *et al.*, 2020). SCD is receiving increased attention in the literature because of its growing prevalence, especially among older people, and as potentially one of the earliest markers of cognitive impairment (Jessen *et al.*, 2014). Furthermore, a link has been found between SCD, impaired mental health (Hill *et al.*, 2016), and worse quality of life (Hill *et al.*, 2017).

A large and growing body of evidence has linked SCD with an increased risk of cognitive impairment, including Alzheimer's Disease (AD) and related dementias (Amariglio *et al.*, 2012; Scheef *et al.*, 2012). In a longitudinal study, Jessen et al. (2020) highlighted that people with SCD have a 40-62% expected risk either to develop mild cognitive impairment or dementia within three years. The prevalence of dementia is expected to almost triple by 2050

and it is predicted that the cost of AD and related dementias will escalate from $2.8 trillion in 2019 to $4.7 trillion in 2030 (Nandi *et al.*, 2022). Moreover, cognitive impairment prevents people from successfully living independently, imposing a great deal of financial and societal burden on people, caregivers, and society (Lindsay and Anderson, 2004). Consequently, SCD is regarded as a key early indication, serving as an opportunity to detect symptoms early to postpone or reverse the irreversible damage of these diseases.

It is considered that identification of SCD is an important opportunity for influencing modifiable risk factors and altering the trajectory of cognitive and functional decline (Jessen *et al.*, 2020). One such modifiable risk factor is cognitive leisure activity (CLA). Cognitive Reserve (CR) refers to the brain's ability to adapt and maintain functionality despite age-related changes or damage and explains why some individuals are more resilient to brain ageing than others (Stern *et al.*, 2020). CR is not fixed but continues to evolve across the lifespan, and CLA engagement is a key component in developing and sustaining CR, helping individuals better cope with brain ageing and damage (Stern *et al.*, 2020). Engaging in CLA has been found to be favourably correlated with cognitive function, physical functioning, and mental health (Scarmeas and Stern, 2003; Sala *et al.*, 2019). Evidence indicates that CLA engagement is related to a 26% reduced risk for AD onset (Carlson *et al.*, 2008), delays cognitive decline (Krell-Roesch *et al.*, 2017), and shows positive contributions in specific cognitive domains in older people (Stieger and Lachman, 2021). Numerous studies have also concluded that CLA engagement is associated with higher quality of life (Silverstein and Parker, 2002; Seinfeld *et al.*, 2013).

The relationship of CLA participation with cognitive function, which is evaluated using objective tests, is now well-established (Stern and Munn, 2010; Fallahpour *et al.*, 2016). However, little is known about the association of SCD with CLA engagement. It is important to investigate and systematically characterise the relationship between SCD and CLA participation for two reasons. First, considerable evidence has accumulated showing that CLA is related to a lower risk for objective cognitive impairment (Krell-Roesch *et al.*, 2017; Stieger and Lachman, 2021), suggesting that it may also have an association with fewer SCD complaints. Second, the other health outcomes associated with SCD, inducing psychological health problems and lower quality of life are among the issues in which CLA may play a protective role (Scarmeas and Stern, 2003; Sala *et al.*, 2019). As SCD is a precursor to objective impairment, it represents an earlier opportunity for meaningful cognitive interventions.

Moreover, understanding which CLA have a stronger negative association with SCD and/or are preferred by older people (e.g., passive vs. active CLA), will help to inform the design of potential interventions.

While a previous review has explored SCD and activity participation, a systematic understanding of the association between SCD and CLA engagement is lacking (Wion *et al.*, 2020). Searching up to 2018, Wion et al. (2020) examined SCD and activity participation in their systematic review by separating activities into physical, social, and cognitive domains. They concluded that greater SCD was associated with lower social and physical activity participation, but that there was an absence of studies exploring the specific relationship between CLA participation and SCD. However, the review was limited to quantitative studies and given the evolving nature of research in this field, new evidence has emerged over the last five years on the association between SCD and CLA participation. Hence, the objective of this review was to address the following primary research questions:

1. What is the association between SCD and CLA engagement?
2. Are different CLA more or less related to SCD?

2.4 Method

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist (Page *et al.*, 2021) was followed (see PRISMA checklist in Appendix 2.1, page 237). The review protocol was registered with the Prospective Register of Systematic Reviews (PROSPERO; CRD42023408726, https://www.crd.york.ac.uk/prospero/display_record.php?ID=CRD42023408726).

2.4.1 Eligibility criteria

The PICOS method was used to define eligibility as follows:

(P) Population: Participants consisted of people who have SCD recruited from any setting (e.g., community-dwelling, nursing homes, or other care facilities). Due to the lack of standardised assessment tools for SCD, broad inclusion criteria were adopted, using definitions of SCD specified by each study. Although SCD is usually observed in older people, it can also affect middle-aged or young adults (Jessen *et al.*, 2014), therefore, there was no age restriction.

(I) Intervention/Exposures: Participation in CLA where seeking or processing information is central, and which involve minimal physical activity or social interaction (Wilson *et al.*, 2007).

For this review, CLA must be unstructured, meaning they did not follow a formal or predetermined framework. Examples include solving puzzles, crosswords, or Sudoku; reading books; or writing for pleasure, such as keeping a diary.

(C) Comparison: Was not required but may have included individuals who participated in less or no CLA than the target group (exposed to or engaged in CLA).

(O) Outcomes: SCD in cognitive domains, including memory, executive functioning, attention, orientation, visuospatial abilities, and language skill.

(S) Study design: Qualitative, quantitative, or mixed methods.

Studies included those examining the relationship between SCD and CLA engagement, even if they were not the primary focus but provided relevant data on these variables. Where necessary, we contacted the corresponding authors for missing or further data. The studies needed to be written in English, and primary research articles only were included. No time restriction was applied.

The exclusion criteria involved individuals with objectively diagnosed cognitive impairments. Because they were delivered with the goal of training or learning, cognitive training interventions (e.g., playing video games, learning a foreign language) were excluded (i.e., they are not 'leisure').

Detailed inclusion criteria for SCD and diagnostic frameworks for excluding people with cognitive impairments are available in the Appendix 2.2 (page 241).

2.4.2 Search strategy

Database searching was conducted, using EMBASE, MEDLINE (via Ovid), PsycINFO, and Web of Science, from inception until 19th April 2023. Moreover, an investigation of additional relevant literature was conducted by screening references and citations of included articles via Google Scholar (last searched 5th June 2023). An expanded list of search terms was used (see Appendix 2.3, page 245, for a full list of terms).

2.4.3 Selection process and data extraction

All search results were imported into Zotero reference management software and de-duplicated. Title/abstract screening and subsequent full-text screening were performed by two

independent reviewers (E.A. and N.T.). Initially, title/abstract screening was completed in line with prearranged inclusion/exclusion criteria independently. Records were selected for full text review if considered relevant, potentially relevant, or if doubt existed and examined independently. Full text review results were screened by both reviewers collaboratively for inclusion based on predetermined eligibility criteria, ensuring a thorough and unbiased selection of relevant studies. Any discrepancies encountered at full text review were resolved by discussion with the other members of the research team (S.B. and P.P.).

Data extraction was carried out by two researchers using a standardised data extraction form developed during the review. This included the following: study characteristics (author(s), year, location, and design of the study); participant characteristics (sample size, age); method (tools/questionnaires used for measuring SCD and CLA engagement); and outcomes on the association between SCD and CLA engagement.

2.4.4 Quality assessment

Cross-sectional and longitudinal cohort studies were assessed using an adapted version of the Newcastle-Ottawa Scale (NOS), focusing on three quality parameters (selection, comparability, and outcome) across eight items (Wells *et al.*, 2009). The McGill Mixed Methods Appraisal instrument (MMAT) was used to assess qualitative and mixed method studies. Responses were categorised as "can't tell," "no," or "yes" (Hong *et al.*, 2018). The total score on the MMAT was computed as a percentage, with a higher percentage indicating greater adherence to the specified methodological criteria, thereby correlating with a reduced risk of bias. Two reviewers (E.A. and N.T.) independently assessed risk of bias. Any disagreements were resolved through discussions with other research team members (S.B. and P.P.). All studies were used for synthesis, irrespective of the quality assessment score, rather, quality assessment results were incorporated into the synthesis process narratively (For full results of the quality assessment see Appendix 2.4, page 250).

2.4.5 Data synthesis

Meta-analysis was not feasible methodologically due to the heterogeneity of the study designs and outcomes. Thus, findings were narratively synthesised without using meta-analysis in accordance with the Synthesis Without Meta-Analysis (SWIM) guidelines (M. Campbell *et al.*, 2020) (Appendix 2.5, page 256). This evidence synthesis took into consideration the characteristics and quality of each study. For synthesis, findings were grouped based on the

cognitive domains evaluated in the measurement of SCD, in terms of assessing solely perceived memory decline or perceived decline in multiple domains. Next, the quantitative evidence was summarised on the association between SCD or SMD and CLA participation depending on reported statistics, drawing on study findings with reference to quality appraisal. Our primary summary measure was Pearson's correlation (*r*), when available. Secondary measures included odds ratio (OR), beta coefficient (β), and unstandardised regression coefficient (*b*), when available. The main findings from the included mixed method and qualitative studies were summarised and discussed, in the context of whether the results supported the quantitative findings.

2.5 Results

A total of 3618 records were identified via database searching, from which 590 duplicates were removed and 3028 were screened at title and abstract (Figure 2.1). A total of 177 were further assessed for eligibility at full text, of which 166 were rejected (see Figure 2.1 for reasons for exclusion). A total of 829 records were identified from additional sources (Google Scholar citation searches and reference tracking), but none were suitable for inclusion (see Figure 2.1 for reasons for exclusion). In total, 11 studies identified via databases were included (nine quantitative studies, one mixed method study and one qualitative study).

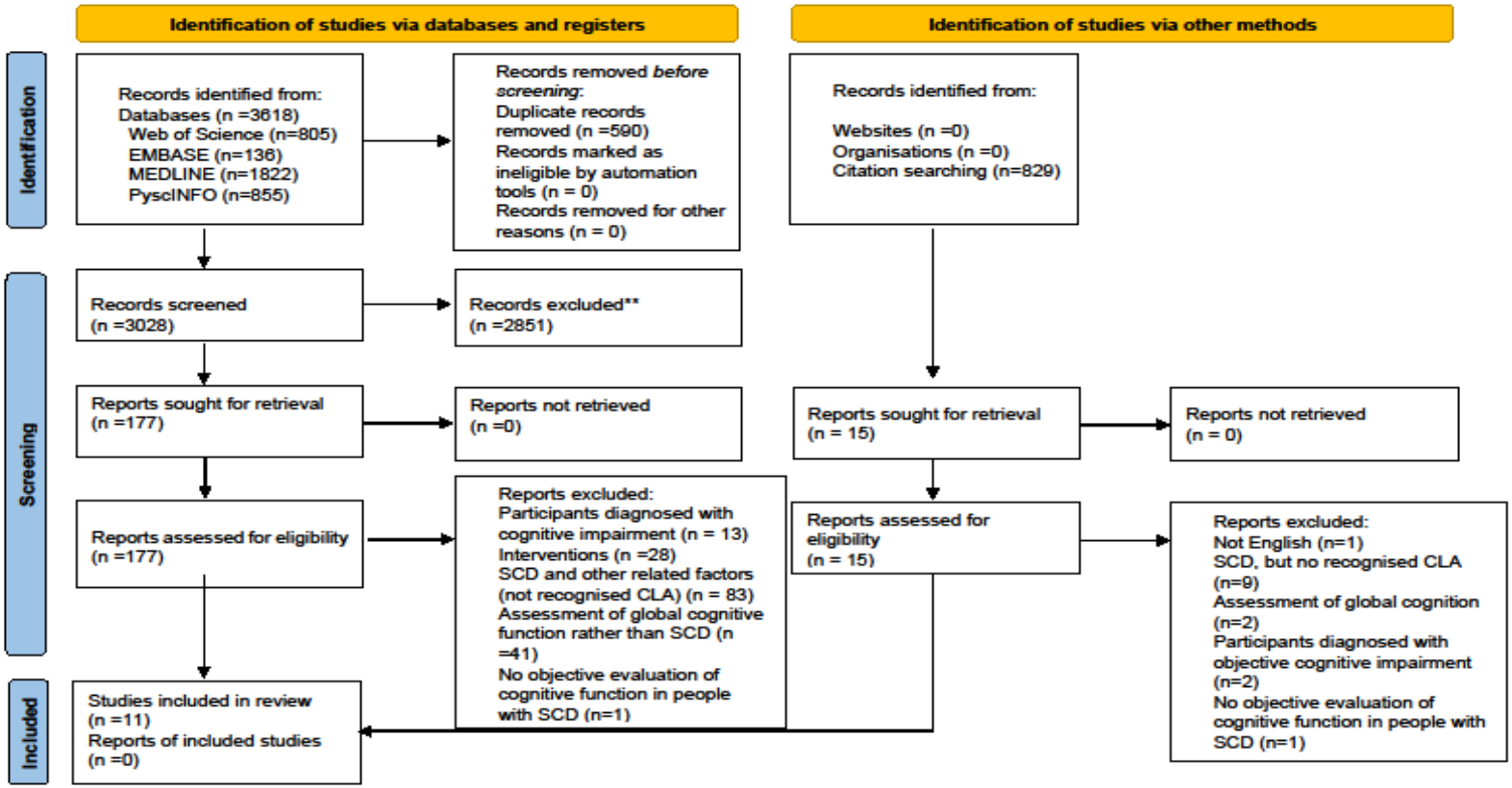

Figure 2. 1. Article selection and inclusion process flow diagram. CLA = Cognitive Leisure Activity; SCD = Subjective Cognitive Decline

2.5.1 Study characteristics

Included studies are summarised in Table 2.1. All articles were published between 2016 and 2023. Six were cross-sectional; two were longitudinal; and one each had a qualitative, mixed methods, and secondary data analysis design. The studies were carried out in the United States and Japan (three from each); Canada (two studies); Australia (two studies); South Korea and Israel (one from each). Across the 11 studies, there were 20,700 participants, with sample sizes ranging from 19 to 8321 participants. The mean age of study samples ranged from 57.21 to 80.7 years.

Table 2.1. Study characteristics

Citation (Country)	Study Design	Sample (% female)	SCD measurement (Domain)	CLA measurement	Aim(s)	Outcome(s)	Risk of bias
Benge *et al.* (2023) (United States)	Quantitative Cross-sectional study	N=219 37.9% Community-based Sample age over 65 Mean age (SD) 75.01 (5.21)	The Everyday Cognition Scale (ECOG) Multidomain	A survey on technological activities asked participants to rate their frequency of use of a variety of devices and internet services from 0 (Never) to 6 (Many times a day). A focus of the current study was a) the use of general devices across smartphones, computers, and tablets, b) the use of interpersonal activities (namely texting and video phone calls), and c) the use of social media	To determine whether older adults' use of digital technology is associated with better or worse subjective cognitive concerns	A higher frequency of technology use was associated with a lower level of overall cognitive concerns (r=−0.216, p = .001), less reported memory concerns (r=−0.199, p < .01) and less executive concerns (r=−0.248, p < .01), indicating modest association between variables	Low
Bransby *et al.* (2022) (Australia)	Quantitative Cross-sectional study	N=1864 75.75% Community-based Sample age between 40 and 70 Mean age (SD) 57.21 (7.16)	The Cognitive Function Instrument (CFI) Multidomain	The Cognitively Stimulating Leisure Activities (CSLA) Survey was used. It explores engagement with current affairs (e.g., politics, economics), entertainment or lifestyle information, and interests in science, history, or technical skills. The survey also	To assess the associations between cognitively stimulating leisure activities and cognitive performance and subjective ratings of cognition	No significant relationship was found between frequency (β=0.015, SE=0.022, p=.499) and variety (β=0.009, SE=0.022, p=.679) of engagement in cognitively stimulating leisure activities and subjective ratings of cognition	Moderate

Citation (Country)	Study Design	Sample (% female)	SCD measurement (Domain)	CLA measurement	Aim(s)	Outcome(s)	Risk of bias
				examines social and community engagement, including craft activities, community group involvement, and social events. It assesses technological use, covering ownership and usage patterns for computers, tablets, and mobile phones. Language skills are evaluated, focusing on multilingual capabilities and the practice of learning new languages. Lastly, it addresses artistic and musical activities, detailing participation in playing instruments and engaging in artistic pursuits like painting and sculpting. This survey provides a comprehensive assessment of individuals' engagement in these activities.			
Bransby *et al.* (2023) (Australia)	Quantitative Cross-sectional study	N=1610 75.9% Community-based	The Cognitive Function Instrument (CFI) Multidomain	CELA (Cognitive Engagement in Leisure Activities) Survey includes “reading books, craft activities	To identify the association of multidomain modifiable dementia risk factors (MDRFs), including	No significant relationship was found between leisure cognitive engagement (CELA Survey) and subjective cognition (r= -0.028).	Moderate

Citation (Country)	Study Design	Sample (% female)	SCD measurement (Domain)	CLA measurement	Aim(s)	Outcome(s)	Risk of bias
		Sample age between 40 and 70 Mean age (SD) 57.42 (7.07)		(e.g., pottery, quilting, or sewing), computer activities, playing games (e.g., playing cards or doing crossword puzzles), and social activities (e.g., going to the movies or going out with friends)" (Krell-Roesch *et al.*, 2019). Participants were asked how frequently they engaged in each mentally stimulating activity using a structured survey with ordinal responses (once a month or less, 2–3 times a month, 1–2 times a week, 3–4 times a week, 5–6 times a week, and daily)	cognitive activity, with cognitive performance and subjective ratings of cognition		
Hill *et al.* (2018) (United States)	Mixed methods study	N=19 57.9% Community-based Sample age 60 and over Mean age (SD) 80.7 (6)	A 1-10 scale, with higher scores indicating more frequent memory problems. Memory	The Columbia Extended Instrumental Activities of Daily Living (E-IADLs), including more challenging leisure activities	To describe the experiences of older adults living with varying degrees of subjective memory impairments by assessing how subjective memory impairments fit with the impact of memory problems on daily life as described by older adults	A higher level of subjective memory impairment was associated with withdrawal from engaging in cognitively protective behaviours	Low

Citation (Country)	Study Design	Sample (% female)	SCD measurement (Domain)	CLA measurement	Aim(s)	Outcome(s)	Risk of bias
Hill *et al.* (2021) (United States)	Quantitative Longitudinal study	N=8321 in total N=6718 NHATS 58.28% No mean age given. N=663 EAS 63.60% Mean age (SD) 78.10 (5.23) Community-based N=940 MAP and MARS 77.87% Mean age (SD) 76.40 (7.10) Care retirement communities and low-income housing Sample age 65 and over	Depending on questions related to perceived memory change within 1 year in EAS, NHATS; or over 10 years in EAS, MAP/MARS, e.g., Compared with one year ago, do you have trouble remembering things more often, less often, or about the same? Memory	In EAS, CLA engagement was evaluated by asking the following questions regarding activities in the last month, with response options of 0 = no (N/A) and 1 = yes (weekly/monthly): reading newspapers or books; playing board games, card games, or computer games; doing crossword puzzles; using the Internet or sending emails; writing for pleasure; playing a musical instrument; participating in an adult learning program; going to the theatre or a concert; participating in a support group; singing in a choir or similar group; visiting museums; watching TV; knitting or crocheting. In MAP/MARS, CLA engagement was evaluated by asking the following questions regarding activities in the last year, with response options of 0 = no (once a year/several	To examine intraindividual differences in relationships among self-perceived memory decline and participation in cognitive activities in older adults without cognitive impairment over time	There was no significant relationship between one-year or ten-year perceived decline and cognitive activity: in MAP/MARS, the relationship between ten-year perceived decline and participation in cognitive activity is r=0.008. In EAS, the relationship between one-year perceived decline and participation in cognitive activity is r=−0.025 and the relationship between ten-year perceived decline and participation in cognitive activity is r=−0.022, which are not statistically significant.	High

Citation (Country)	Study Design	Sample (% female)	SCD measurement (Domain)	CLA measurement	Aim(s)	Outcome(s)	Risk of bias
				times a year); 1 = yes (several times a month/several times a week/every day/almost every day): reading newspapers, magazines or books; visiting a library; writing letters; playing games like checkers or other board games, cards, puzzles, word games, mind teasers, or any other similar games; visiting a museum; attending a concert, play, or musical.			
Iizuka *et al.* (2021) (Japan)	Quantitative Cross-sectional study	N=436 73.9% Community-based Sample age 65 and over Mean age (SD) 74.1 (5.8)	Depending on the question "Do you have complaints of forgetfulness?" Memory	The frequency of (ranging from never to almost every day) the following daily intellectual activities: "reading newspaper, reading magazine, reading books, entries in a diary, writing letters, using computers, using cell phones, watching TV, and listening to the radio"	To determine the frequency of specific day-to-day intellectual activities among older adults who complain of forgetfulness	Watching TV and listening to the radio, which were defined as passive activity, reading and technology use were found to be the most preferred daily intellectual activities respectively among participants with complaints of forgetfulness.	Moderate
Katayama *et al. (*2022) (Japan)	Quantitative Longitudinal study	N=2569 51.3%	Depending on four questions that "Do you have any difficulty	Cognitive activity was measured by the following questions: (1) "Do you read books or	To examine whether community-dwelling older adults with SCD have more modifiable	It was found that people with SCD showed more CLA engagement than those with cognitive impairment.	High

Citation (Country)	Study Design	Sample (% female)	SCD measurement (Domain)	CLA measurement	Aim(s)	Outcome(s)	Risk of bias
		Community-based Sample age 65 and over Mean age (SD) 70.9 (4.6)	with your memory?"; (2) "Do you forget where you have left things more than you used to?"; (3) "Do you forget the names of close friends or relatives?"; and (4) "Do other people find you forgetful?" Memory	newspapers"; (2) "Do you drive a car"; (3) "Do you use a personal computer"; (4) "Do you engage in activities that use your brain (shogi, learning, etc.)"; and (5) "Do you operate a video/DVD player"?	protective factors, including cognitive activities, against the risk of dementia than older adults with objective cognitive decline		
Lee, Sung and Choi, (2020) (South Korea)	Quantitative Cross-sectional study	N=182 64.3% Community-based Sample age 65 and over Mean age (SD) 78.4 (5.91)	The Cognitive Failure Questionnaire (CFQ) Multidomain	The Cognitive Activities Scale, including watching television; listening to the radio; reading the newspaper, magazines, and books; playing games and visiting museums. In this study, "Visiting museums" has been deleted and three additional items have been added: "attending lectures or continuing education classes, attending concerts or plays and using the computer or a smartphone".	To investigate factors influencing subjective cognitive decline and cognitive function in older South Koreans	Even though the correlation analysis indicated a weak negative association between CLA participation and SCD complaints ($r = -0.210$, $p = 0.005$), the multiple regression analysis showed that this relationship is not statistically significant when controlling for other variables ($\beta = 0.079$, $p = 0.335$).	Low

Citation (Country)	Study Design	Sample (% female)	SCD measurement (Domain)	CLA measurement	Aim(s)	Outcome(s)	Risk of bias
Nemoto *et al.* (2018) (Japan)	Quantitative Cross-sectional study	N=5328 54.5% Community-based Sample age 65 and over No mean age given	The Kihon Checklist (KCL) Multidomain	During the last seven days, the subjective average duration of television viewing and reading books or newspapers was evaluated. Each activity was classified into four categories based on the amount of time spent on sedentary behaviour: <1 h/day, 1–2 h/day, 2–3 h/day, and 3 h/day for television viewing; <10 min/day, 10–20 min/day, 20–30 min/day, and 30 min/day for reading.	To explore the relationship between single and combined factors of sedentary behaviour and physical activity with subjective cognitive complaints in older adults living in the community	The reading behaviour was correlated with subjective cognitive complaints in a dose-response manner, with reading more than ten minutes per day associated with a reduced risk of subjective cognitive complaints than reading less than ten minutes (OR for 10–20 min/day = 0.63; 95% CI = 0.53–0.75; OR for 20–30 min/day = 0.59; 95% CI = 0.49–0.71; OR for ≥30 min/day = 0.47; 95% CI = 0.39–0.57)	Low
Parikh *et al.* (2016) (Canada)	Qualitative study	N=37 in total 45.95% Sample age 60 and over Normal memory (N=23) Mean age (SD) 72.5 (6.4) Amnestic Mild Cognitive Impairment (N=14) Mean age (SD) 79 (4.3)	The Multifactorial Metamemory Questionnaire (MMQ) Memory	Not specified	To gain a more comprehensive understanding of how memory changes affect the daily lives of individuals with normal ageing and mild cognitive impairments with amnesia	Participants who experienced self-reported memory change stated that they participated in more cognitively engaging activities for their brain health benefits	Low

Citation (Country)	Study Design	Sample (% female)	SCD measurement (Domain)	CLA measurement	Aim(s)	Outcome(s)	Risk of bias
Rotenberg, Maeir and Dawson, (2020) (Israel and Canada)	Quantitative Secondary data analysis	N=115 65.2% Community based Sample age 60 and over Mean age (SD) 77.88 (7.15)	The Multifactorial Memory Questionnaire (MMQ) Memory	The Activity Card was used, including leisure with low physical demands (e.g., hand crafts, watching television, attending concerts)	To examine perceived changes in participation among older adults with SMD compared to their own participation five to ten years ago. To explore the correlations between participation, subjective memory decline, and objective cognitive performance	A notable decrease has been identified in engagement cognitively stimulating activities among people with SMD, with a withdrawal rate of 83%. There is a moderately strong and statistically significant positive correlation between greater CLA participation and less subjective memory concern (r=0.35, p=0.001).	Moderate

Note. *b*=unstandardized regression coefficient*;* EAS= The Einstein Aging Study; MAP/MARS= The Rush Memory, and Aging Project/ The Minority Aging Research Study; NHATS= The National Health and Aging Trends Study; *r*= Pearson correlation coefficient; SE= Standard error, β=Beta coefficient

CLA engagement across various studies was assessed through questionnaires, measuring participation frequency (ranging from many times daily to never) and activity types. While some studies adhered to the six CLA recommended by Verghese et al. (2003), including reading, writing, doing crossword puzzles, playing board games or cards, participating in group discussions, and playing musical instruments (Hill, Mogle, *et al.*, 2021; Iizuka *et al.*, 2021), variations existed. Activities such as reading and playing games were frequently examined by CLA. Additionally, the use of computers, smartphones, and tablets were also included as CLA (Iizuka *et al.*, 2021; Katayama *et al.*, 2022; Benge *et al.*, 2023). Watching TV and listening to the radio, which are considered as 'passive mental activities', were included among the CLA in some studies (Lee, Sung and Choi, 2020; Rotenberg, Maeir and Dawson, 2020; Iizuka *et al.*, 2021), beyond commonly assessed CLA, activities such as hand crafts (Rotenberg, Maeir and Dawson, 2020; Bransby *et al.*, 2023), driving cars and operating a video/DVD players (Katayama *et al.*, 2022) were also regarded as CLA.

SCD assessment methods varied, with six focusing solely on memory decline and five assessing multiple domains (Table 2.1). Typically, SCD was evaluated with validated tools, asking questions about the frequency and/or severity of perceived changes/complaints in cognitive functions or using a rating scale to assess memory concerns (Appendix 2.2).

To classify subgroups and exclude individuals with objective cognitive impairment, many studies used standardised neuropsychological tests to exclude participants with objective cognitive impairments. For instance, the Montreal Cognitive Assessment (Hill *et al.*, 2018; Lee, Sung and Choi, 2020; Rotenberg, Maeir and Dawson, 2020; Iizuka *et al.*, 2021), the Mini-Mental State Examination (Katayama *et al.*, 2022), and the Cogstate Brief Battery (Bransby *et al.*, 2022, 2023). Hill *et al.* (2021) selected eligible participants through comprehensive in-person neuropsychological assessments. Nemoto et al. (2018) included only individuals who had never utilised long-term health insurance services. Benge et al. (2023) asked participants if they had been diagnosed with MCI or dementia; those who responded negatively were included. See Appendix 2.2 for detailed information.

2.5.2 Association between subjective cognitive decline and cognitive leisure activity engagement

Two high-quality cross-sectional studies provided evidence that CLA participation was related to fewer SCD complaints (Nemoto *et al.*, 2018; Benge *et al.*, 2023). Benge et al. (2023)

concluded that frequent use of technological devices was moderately linked to fewer SCD concerns in older people. A Japanese study demonstrated a dose-response relationship between CLA engagement and lower SCD risk among community-dwelling older people (Nemoto *et al.*, 2018). Specifically, reading more (vs. less) than ten minutes a day was found to be significantly related to a lower risk of SCD. Overall, these high-quality cross-sectional studies identified a moderate association between greater CLA engagement and less SCD concerns, especially among older individuals.

Two moderate-quality cross-sectional studies (Bransby *et al.*, 2022, 2023) and one high-quality cross-sectional study found no significant association between SCD and CLA engagement (Lee, Sung and Choi, 2020). A study among South Korean older adults reported no significant association between CLA participation and SCD (Lee, Sung and Choi, 2020). Bransby et al. (2023) examined the association of multi-domain modifiable dementia risk factors with SCD in middle-aged adults, including cognitive/social engagement. They showed that the correlation of greater SCD with CLA engagement was non-significant (Bransby *et al.*, 2023). Similarly, a study in Australia reported that neither CLA engagement frequency nor variety showed a significant relationship with SCD in middle-aged adults aged 40 to 70 (Bransby *et al.*, 2022). It is noteworthy that participants in both studies were not obligated to complete all assessments in a single sitting, potentially leading to varied sample sizes for each test and survey, which may introduce high non-response bias. Consequently, interpretations of these findings should be approached with caution, given their moderate risk of bias.

2.5.3 Association between subjective memory decline and cognitive leisure activity engagement

The six studies investigating perceptions of memory decline and CLA participation had heterogeneous study designs and conclusions. Two of the studies were longitudinal, one was cross-sectional, one was a secondary data analysis, one was a mixed method study, and one a qualitative study (Table 2.1). Among these, the mixed method and qualitative studies were graded as high-quality, while the cross-sectional and secondary data analysis studies were rated as moderate-quality, and the two longitudinal studies were graded as low-quality. Two studies reported higher participation in CLA among individuals with SMD, whereas two others suggested lower engagement. One study found negligible association between SMD and CLA participation, while another specifically explored the types of CLA frequently engaged in by individuals with SMD.

Two studies (one longitudinal, one qualitative study) reported that people with SMD showed greater CLA participation (Parikh *et al.*, 2016; Katayama *et al.*, 2022). In a 4-year longitudinal study, community-dwelling older participants were divided into four groups: those with SMD, those with normal cognition, those with objective cognitive decline, and those with both SMD and objective cognitive decline, to understand whether people with SMD had a more modifiable protective lifestyle than others (Katayama *et al.*, 2022). It was concluded that older adults with normal cognition and the SMD-only group adopted significantly more modifiable protective lifestyle behaviours, especially by maintaining cognitive engagement (Katayama *et al.*, 2022). However, it is important to bear in mind the possible bias in this conclusion because this was a low-quality study (see Appendix 2.4). A high-quality qualitative study among older adults in Canada investigated the impact of SMD on daily life and demonstrated that participants with SMD were motivated to participate in more CLA (Parikh *et al.*, 2016). This study noted that older participants reported some negative life experiences that caused embarrassment or frustration because of SMD, including forgetting the names of acquaintances, losing household items, and repeating themselves in conversations. However, their awareness of the link between intellectual engagement and brain health motivated them to engage in more CLA participation, such as doing crossword puzzles, to compensate for their memory change (Parikh *et al.*, 2016).

Table 2.2. Adapted Newcastle-Ottawa Scale for quality assessment of cross-sectional and longitudinal studies

Adapted Newcastle-Ottawa Scale for Quality Assessment of Cross-sectional Studies					
Study	**Selection**	**Comparability**	**Outcome**	**Total score**	**Risk of bias**
Benge *et al.*, 2023	***	**	**	7	Low
Bransby *et al.*, 2023	**	**	**	6	Moderate
Bransby *et al.*, 2022	**	**	**	6	Moderate
Iizuka *et al.*, 2021	**	**	**	6	Moderate
Lee, Sung and Choi, 2020	***	**	**	7	Low
Nemoto *et al.*, 2018	***	**	**	7	Low
Rotenberg, Maeir and Dawson, 2020	**	**	**	6	Moderate
Newcastle-Ottawa Scale for Quality Assessment of Longitudinal Studies					
Study	**Selection**	**Comparability**	**Outcome**	**Total score**	**Risk of bias**
Hill *et al.*, 2021	**	**	*	5	High
Katayama *et al.*, 2022	***	**	0	5	High

Note. Cross-sectional studies were classified into high risk (4 or fewer points), moderate risk (5–6 points), or low risk of bias (7–8 points) (Moskalewicz and Oremus, 2020). It was assigned high risk (5 or fewer points), moderate risk (6–7 points), or low risk (8–9 points) categories according to bias evaluation for longitudinal studies (Wells *et al.*, 2009).

Two studies (one cross-sectional and one mixed methods study) reported an association between having SMD and withdrawal from CLA participation (Hill *et al.*, 2018; Rotenberg, Maeir and Dawson, 2020). A mixed methods study conducted by Hill et al. (2018) in the United States (US), investigated how SMD impacts daily life in older participants. It was observed that individuals reporting higher levels of SMD tended to engage less in cognitively protective behaviours. Furthermore, these individuals reported experiencing negative emotions such as frustration and embarrassment (Hill *et al.*, 2018). It suggests a link between SMD and less engagement in CLA, alongside increased negative emotions. Likewise, Rotenberg, Maeir and Dawson (2020) examined changes in activity participation in older adults with SMD compared to five-to-ten years ago. They found an association between older adults with SMD and a

significant reduction in activity engagement, with withdrawal rates of 83% for cognitively stimulating activities. Nevertheless, this study also indicated that more preserved activity participation is associated with less frequent memory problems in daily life (Rotenberg, Maeir and Dawson, 2020).

In a longitudinal study in the US with over 8,000 participants and up to 20 years follow-up, Hill et al. (2021) revealed that SMD (evaluated over 1 or 10 years, depending on the data source) did not directly influence participation in CLA over time among older adults. However, caution is warranted in interpreting these findings due to the high risk of bias (see Appendix 2.4).

One cross-sectional study examined the preferred type of CLA among older adults with forgetfulness, conducted in Japan (Iizuka *et al.*, 2021). The study categorised CLA engagement into passive and active groups. Watching TV and listening to radio were considered passive, and 98.6% of the participants affirmed that they do these activities almost daily. Reading, technology use and writing were classified as active and, while most of the participants stated that they read newspapers, books, or magazines nearly every day (85.8%), over half of the participants reported that they used technology daily. Overall, watching TV, listening to the radio, reading, and technology use emerged as the most frequently preferred CLA types among participants experiencing forgetfulness (Iizuka *et al.*, 2021).

2.6 Discussion

The aim of this review was to synthesise evidence on the association between SCD status and participation in CLA. Overall, there was a lack of consistency in studies on this topic due to different outcomes, varying magnitudes of association, and study design, making it difficult to determine the nature of the relationship between them. Nevertheless, high-quality studies investigating the relationship between SCD and CLA participation found a modest association between greater CLA engagement and fewer SCD concerns (Nemoto *et al.*, 2018; Rotenberg, Maeir and Dawson, 2020; Benge *et al.*, 2023). While this may suggest CLA engagement is protective for SCD, it is important to acknowledge the possibility of reverse causation, where individuals experiencing less SCD may be more likely to engage in CLA. Previous research supports this bidirectional relationship, with studies finding that higher initial memory performance is linked to slower declines in intellectual social leisure activities (Armstrong *et*

al., 2022) and that individuals with better baseline cognitive performance are more likely to increase their activity levels over time (Bosma *et al.*, 2002).

The review identified that almost half of the studies examining the relationship between SCD and CLA engagement assessed only subjective decline in memory (Table 2.1). The results of the included studies indicated that older adults with SMD are more likely to be engaged in CLA and to continue participating in activities than older adults with objective cognitive impairments (Rotenberg, Maeir and Dawson, 2020; Katayama *et al.*, 2022). Even though it is not possible to draw a definitive conclusion due to the lack and heterogeneity of evidence, it has been observed that CLA participation might be influenced by feelings such as embarrassment and disappointment in people with SMD. Moreover, it has been shown that older people with forgetfulness were more likely to participate in types of CLA that require less cognitive challenge, but this evidence was based on only one moderate-quality cross-sectional study (Iizuka *et al.*, 2021).

Findings regarding greater CLA participation with less SCD complaints are corroborated within the literature (Chen *et al.*, 2014; Lee, 2014). Despite the well-established link between CLA participation and objective cognitive functioning (Stern and Munn, 2010; Fallahpour *et al.*, 2016), this review suggested a predominantly modest or negligible correlation between CLA and SCD, with limited support for a substantial link. It is conceivable that this result arises from the multifaceted nature of SCD, which can be influenced by and in turn affect CLA participation. Notably, SCD is associated with heightened levels of depression and a poor perception of health, with existing studies indicating the detrimental impact of these factors on overall activity engagement (Kimura *et al.*, 2013; Schuch *et al.*, 2017). For instance, research has demonstrated that individuals experiencing depression are four times more likely to report SCD and twice as likely to encounter confusion or memory loss affecting their work or social interactions (Brown, Hill and Haider, 2022). Similarly, it has been acknowledged that perceived health status and depression may influence the relationship between CLA engagement and SCD (Lee, Sung and Choi, 2020). These findings highlight the need for consideration of other related factors in trying to determine the association between SCD and CLA participation.

The results concerning SMD and reduced CLA participation also align with existing literature, indicating a connection between SMD and its potential adverse impact on engagement in CLA, particularly influenced by negative emotions. Rotenberg, Maeir and Dawson (2020) revealed

that SMD is linked to withdrawal from social and leisure activities and the loss of meaningful life roles because of emotional responses such as embarrassment, frustration, and anger. As supported by Buckley et al. (2015), SMD can trigger negative emotional reactions such as shame, anger, and disappointment and is more distressing when it occurs in the presence of others, or when the task is considered significant. In addition, it has been argued that people with SMD might refrain from participating in social activities due to the attitudes of others towards their cognitive abilities (Paanalahti *et al.*, 2023). Considering that SMD experienced by individuals is often perceived as a concern or surprise by relatives or friends (Cromwell, 1994), it is noted that people may take measures to compensate for their forgetfulness, such as planning. This underscores the idea that individuals may avoid participating in CLA due to a desire to conceal their SMD. Given that negative emotions, such as anger, are known to influence lifestyle choices (Anton and Miller, 2005), it can be asserted that emotional responses and the perceptions of others regarding the cognitive abilities of individuals with SCD might be factors influencing a decrease in CLA participation.

An important consideration in the current evidence is the lack of consistency in both SCD and CLA participation assessments, making it difficult to arrive at a definitive conclusion. 'Memory decline' is considered one of the foremost and distinct signs of cognitive impairment, and studies on this subject generally revolve around SMD and related modifiable factors (Jessen *et al.*, 2020). SCD is not limited to memory (Jessen *et al.*, 2014), however, the results obtained from these studies may have been impacted by the fact that the participants answered only questions regarding subjective decline in memory. Jacova, Smith and Robertson (2020) have shown that there is an age-related trajectory in how people evaluate their cognition, with younger individuals focusing primarily on memory, while older individuals considering both memory and language. Considering that most participants in the reviewed studies were older adults (Table 2.1), assessing only memory may lead to different results. Additionally, different questions in SCD evaluation may lead to inconsistent results. For instance, Takechi et al. (2020) assessed SCD with three questions capturing different aspects of SMD. Although one question correlated with increased activity participation, the others correlated with decreased activity participation (Takechi *et al.*, 2020). Consideration of the duration of SCD is also crucial in its assessment. However, in studies included in this review by Iizuka et al. (2021) and Katayama et al. (2022), only one or two general questions were used without inquiry into the timeframe. Inconsistent assessments, limited focus on non-memory domains, and varied questions

emphasise the need for standardised approaches in future studies to ensure clarity and consistency.

Likewise, there is also no standard classification and assessment of CLA participation. In contrast to the general classification of CLA (Fallahpour *et al.*, 2016); using computers and reading were considered as 'sedentary leisure time' activities by Cohen, Ardern and Baker (2017). They indicated that people who participated in less sedentary leisure time activities had better SCD. Additionally, daily social media use was found to be related to increased same-day and subsequent memory problems (Sharifian *et al.*, 2020). Conversely, in this review, technology use (Benge *et al.*, 2023) and reading (Nemoto *et al.*, 2018) have been associated with less SCD. These activities, classified as sedentary by Cohen, Ardern and Baker (2017), have been evaluated as cognitively challenging in the literature (Stern and Munn, 2010; Fallahpour *et al.*, 2016) and linked to less SCD (Ramos *et al.*, 2021). Consequently, considering these contrasting findings, it is worth considering that the classification of CLA may play a crucial role in the varied outcomes observed. Another noteworthy aspect in the assessment of CLA engagement is that only the frequency of activities was evaluated, while the impact of different types of activities on SCD was overlooked. However, the effect of both CLA frequency and type on SCD may vary (Ramos *et al.*, 2021).

The complicated interplay between sociodemographic characteristics and SCD may contribute to the observed inconsistency in the acquired data. For example, age has been associated with an increase in SCD complaints (Taylor, Bouldin and McGuire, 2018; Jessen *et al.*, 2020) and reduced activity participation (Perlmutter *et al.*, 2010). Corroborating this view, studies investigating the correlation between SCD and CLA engagement (Parikh *et al.*, 2016) revealed that individuals who sought more CLA participation were, on average, nearly six years younger than those who withdrew from CLA engagement (Hill *et al.*, 2018; Rotenberg, Maeir and Dawson, 2020), even in the presence of similar negative mood experiences stemming from SCD. However, there is evidence that younger individuals may be more affected by SCD. Taylor, Bouldin and McGuire (2018) reported that older adults may be less aware of the effects of SCD, considering it a normal part of ageing, whereas younger adults may attribute limitations in their lifestyles to SCD and may be more sensitive to its effects**.** This perspective is also supported by Chen et al. (2014), who claimed that young and middle-aged adults frequently report SMD, suggesting a lower tolerance for memory difficulties in these age groups, possibly due to increased cognitive demands associated with concurrent tasks and

responsibilities. Moreover, several studies have shown that SCD does not correlate with age in a significant way (Lee, Sung and Choi, 2020; Bransby *et al.*, 2023). Although conclusive evidence on the impact of age on the relationship between CLA participation and SCD is lacking, emerging findings indicate that age could play a significant role in this association.

Another possible explanation for the observed inconsistencies in the effects of CLA engagement could be the level of education and its relation to CR. The literature suggests that CLA engagement may have more positive effects on older adults with lower education levels (Ihle *et al.*, 2015). This is supported by data from Nemoto et al. (2018), included in this review, which indicated that a reading habit was associated with less SCD among participants who were not highly educated. Highly educated individuals are often presumed to have higher CR due to their more stimulating intellectual environments and experiences (Scarmeas and Stern, 2003). This elevated CR might make them less likely to benefit from CLA as significantly as those with lower CR, as they may already have a greater buffer against cognitive decline. Furthermore, highly educated individuals might be more sensitive to subtle declines in cognitive function, making them more adept at detecting and addressing changes before they impact daily life (Rabin, Smart and Amariglio, 2017). Thus, the varying effects of CLA engagement could reflect differences in CR, which influences how individuals benefit from such activities. Future research should incorporate measures of CR, employ longitudinal designs, control for CR, and explore interaction effects to better understand the role of CR in CLA engagement.

This systematic review has highlighted a prevalent focus on memory decline within the literature on SCD, often neglecting the broader spectrum of multidomain cognitive experiences. Most of the included studies were cross-sectional, revealing a modest correlation between less SCD concerns and greater CLA engagement, in line with existing literature. However, the diversity in study designs and outcomes between SMD and CLA engagement complicates drawing definitive conclusions. Notably, the overall inconsistency in the results is likely attributed to the diverse methods employed in assessing both SCD and CLA participation, along with sociodemographic variations among participants.

2.7 Strengths and Limitations of Review

This systematic review is the first to investigate the relationship between SCD and CLA participation, encompassing observational studies of quantitative, mixed method, and

qualitative designs across diverse population groups. Most studies in our review were rated as high or moderate quality, with fewer rated as low quality.

This review has some limitations that should be considered. Non-English language studies were excluded, potentially overlooking relevant research. Due to heterogeneity in methods and data presentation, meta-analysis was unfeasible, necessitating a narrative synthesis of findings. Given this heterogeneity and study limitations, the literature yields inconclusive evidence on the SCD and CLA association. Lastly, the estimated association between SCD and CLA may differ between studies based on sample characteristics and may be affected by third variables, such as depression.

2.8 Recommendations for Future Studies

This review identifies key gaps warranting further research. Firstly, existing evidence primarily focuses on memory decline, neglecting assessment across all cognitive domains in SCD. Understanding individuals' assessment of various cognitive functions and their CLA engagement is crucial. Secondly, future research should explore the protective role of specific CLA types and preferences of individuals with SCD. Thirdly, a qualitative exploration of the barriers to CLA engagement and motivational sources for individuals with SCD would provide valuable insights, benefitting healthcare providers, policymakers, and researchers. Fourthly, an imbalance in gender representation is noted in the included studies, with a predominance of female participants, underscoring the importance of maintaining gender balance in SCD research. Finally, most studies exhibit a cross-sectional design or are of lower quality, highlighting the need for more high-quality longitudinal research. Longitudinal studies are crucial for disentangling the directionality of the relationship between SCD and CLA participation, as they track changes over time to provide definitive insights into whether increased CLA engagement leads to improvements in SCD or if individuals with less SCD are more inclined to participate in CLA.

2.9 Conclusion

Given the diverse study designs and outcomes, evidence on the link between SCD and CLA participation is inconclusive. However, risk of bias assessments and reported effect sizes suggest a modest association between greater CLA engagement and fewer SCD complaints. Regarding the association of SMD with CLA engagement, there is inconclusive evidence suggesting that adverse emotional states induced by SMD, such as embarrassment and

frustration, may be related to less CLA participation. Moreover, an additional finding from studies investigating the link between SMD and CLA engagement suggests that individuals with SMD exhibit more modifiable protective factors, notably heightened CLA participation, compared to those with objectively measured cognitive impairment. This finding provides optimism as it may suggest that given the literature highlighting the elevated risk of objective cognitive impairment in individuals with SCD, protective factors could be adopted in a timely manner, potentially reducing the irreversible impacts of objective cognitive decline. In conclusion, further research is needed to understand the relationship between SCD, modifiable risk factors, and CLA engagement to help safeguard cognitive health effectively.

2.10 Chapter Summary

This chapter reported a systematic review that examined the association between SCD and CLA participation (Akbayrak *et al.*, 2024). The review concluded that although higher quality studies suggest a modest association between higher CLA engagement and fewer SCD complaints, the evidence remains inconsistent due to methodological heterogeneity and variations in the measurement of both constructs. The review identified significant research gaps, including the need for longitudinal and qualitative investigations to explore the directionality and underlying mechanisms of the SCD–CLA relationship. These findings directly informed the empirical components of this thesis by shaping the research questions, the mixed methods design, and the inclusion of both quantitative and qualitative approaches to capture the complexity of this relationship. The next chapter presents the methodology for the empirical phases of this thesis, outlining the design, participant recruitment, data collection, and analysis procedures for both the quantitative and qualitative studies.

CHAPTER 3- Methods

3.1 Introduction

The aim of this chapter is to explain the overall method used in the research, which is a mixed methods approach, to answer the research questions and achieve the goals set out in Chapter 1. The chapter starts with an introduction to the research paradigm and design, then provides the reasons for selecting specific research methods and ways of choosing participants. It then explains the two stages of collecting data, quantitative and qualitative, covering how participants were selected, how data was gathered, how it was analysed, and how its quality was ensured. Next, it discusses why a mixed methods approach was chosen and the ways used to maintain the quality and connection between the two phases. Lastly, the chapter describes the ethical steps taken to make sure the research was carried out with integrity, transparency, and in line with the ethical standards of the institution.

3.2 Methodology

3.2.1 Research paradigm

A research paradigm is a set of ideas that guides how researchers develop questions, select methodologies, and interpret results (Hughes and Sharrock, 2016; Creswell, 2023). In mixed methods research, defining one's paradigm is particularly crucial, as it helps align philosophical assumptions with methodological choices and ensures a coherent interpretation of results (Kaushik and Walsh, 2019). Each paradigm is underpinned by distinct ontological, epistemological, and methodological assumptions that shape the research approach. Ontology concerns the nature of reality and what exists; epistemology concerns how knowledge is known and validated; and methodology concerns how research is conducted (Creswell, 2018b; Denzin and Lincoln, 2018). Understanding these presumptions is crucial because they form the basis of research philosophy and ultimately influence the entire research process (Scotland, 2012).

The three most prevalent paradigms are pragmatism, positivism, and interpretivism/constructivism. The interpretivist or constructivist traditions that seek to comprehend human experience through socially constructed meanings are usually the foundation of qualitative research. These methods develop theories inductively from the data in natural settings, emphasising the perspectives of participants and the researchers' influence (Denzin and Lincoln, 2013; Creswell, 2023). On the other hand, positivism, which is frequently

connected to quantitative research, uses measurement, observation, and hypothesis testing to try and explain phenomena. It emphasises objectivity, empiricism, and the identification of cause–effect relationships that can be generalised to predict outcomes (Hughes and Sharrock, 2016; Creswell, 2023).

Pragmatism, by comparison, rejects the necessity of adhering to a single philosophical system or reality viewpoint. Rather, it prioritises the research problem itself and employs qualitative, quantitative, or both approaches that work best to address it (Allemang, Sitter and Dimitropoulos, 2022). Pragmatism emphasises the practical application of research and concentrates on producing knowledge that is practical, grounded in context, and able to guide action in the real world (Allemang, Sitter and Dimitropoulos, 2022). Thus, the idea of *"what works"* serves as a guide for pragmatic researchers, who integrate various data types to produce thorough and useful insights (Morgan, 2014).

This research adopts a pragmatic paradigm to align with its mixed methods design. Pragmatism provides a flexible and problem-centred framework that allows the integration of quantitative and qualitative data to gain a more comprehensive understanding of the relationship between subjective cognitive decline (SCD) and cognitive leisure activity (CLA) engagement. By emphasising practical outcomes and the usefulness of findings, the pragmatic approach supports the aim of this research to generate knowledge that can inform real-world interventions and promote cognitive health in later life (Morgan, 2014; Allemang, Sitter and Dimitropoulos, 2022).

3.2.2 Mixed methods approach and design

A mixed methods approach involves using both quantitative and qualitative research techniques in one study to address complex research questions that cannot be fully answered by one method alone (Creswell, 2014). In mixed methods research, selecting an appropriate design involves considering three key aspects: priority, interaction, and timing (Dawadi, Shrestha and Giri, 2021):

Priority refers to the relative emphasis placed on the quantitative and qualitative components within the study. Mixed methods studies can adopt a quantitative priority, a qualitative priority, or equal priority, depending on the research objectives. In this research, equal priority was assigned because both the quantitative and qualitative components were considered equally important for addressing the research questions, with neither being dominant.

The degree to which quantitative and qualitative elements are linked during the research process is known as interaction (Dawadi, Shrestha and Giri, 2021). The interaction between datasets can occur at various stages, such as during design, sampling, data collection, analysis, or interpretation (Creswell, 2011). Integration took place in this research at several stages, such as sample selection, data collection, and result merging at the interpretation stage, enabling each stage to support and educate the others.

Timing refers to the sequencing of data collection (Dawadi, Shrestha and Giri, 2021). Mixed methods designs can be concurrent, in which both phases take place at the same time, or sequential, in which one phase informs the next (Creswell, 2014). This research adopted a sequential design, in which findings from the quantitative survey informed both the sampling and the content of the qualitative interviews.

Mixed methods research commonly follows one of three designs: convergent parallel, explanatory sequential, or exploratory sequential (Creswell, 2014, 2018a). In convergent designs, quantitative and qualitative data are collected concurrently and merged during interpretation. In exploratory sequential designs, qualitative data are collected first to explore participants' perspectives, and these findings then inform a subsequent quantitative phase. Conversely, explanatory sequential designs begin with quantitative data collection and analysis, followed by a qualitative phase designed to explain and deepen understanding of the initial results (Creswell, 2014, 2018a).

This research employed an explanatory sequential mixed methods design (Figure 3.1), beginning with a cross-sectional quantitative survey (phase one), followed by qualitative semi-structured interviews (phase two). The survey guided both the sampling and the interview schedule for the second phase. The purpose of the quantitative survey was to explore the relationship between SCD concerns and CLA engagement among older participants, to investigate whether CLA engagement is protectively associated with fewer SCD concerns, and to examine which specific types of CLA are associated with total and domain-specific SCD concerns. The purpose of the semi-structured interviews was to explore older adults' experiences of SCD and their engagement in CLA, including the motivations and barriers influencing participation, and to provide deeper insights into the quantitative results.

Integrating both methods was essential, as neither alone could provide a comprehensive understanding of the relationship between CLA engagement and SCD. By combining

quantitative findings with qualitative insights, this research offered a more holistic understanding of the factors influencing CLA participation and the lived experience of SCD among older adults.

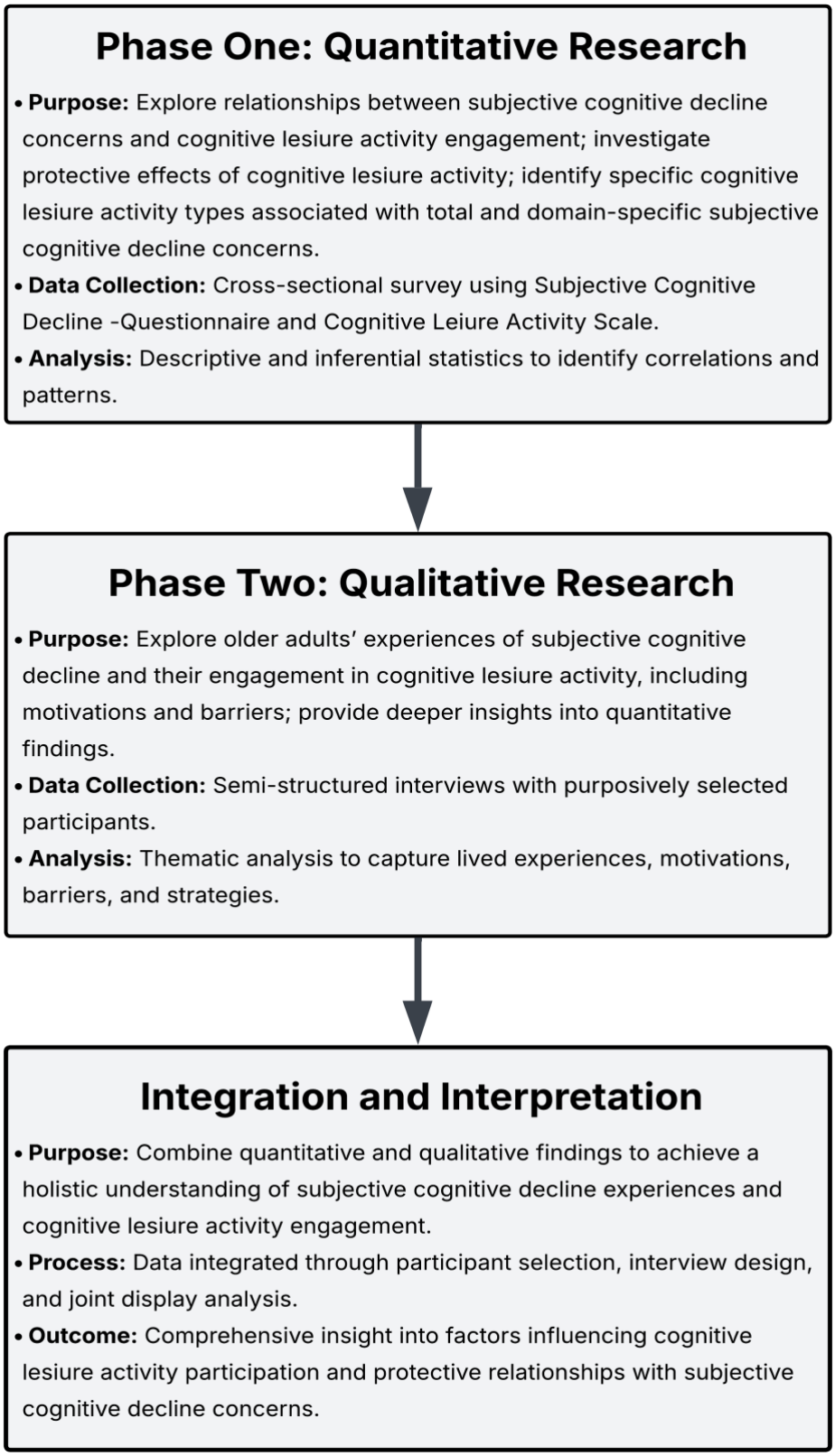

Figure 3. 1. Sequential explanatory mixed methods design used in this PhD thesis

3.2.3 Theoretical justification for research methods and sampling approaches

This section outlines the theoretical justification for the research methods and sampling strategies used in this research. It draws on methodological literature to explain the suitability of the chosen quantitative and qualitative approaches, including survey and interview methods, as well as the use of convenience and purposive sampling. The rationale for these methodological choices is discussed in relation to the research aims, population characteristics, and practical constraints of conducting research with older adults.

3.2.3.1 Justification for the quantitative method (survey)

In the social and health sciences, surveys are a popular technique for effectively gathering quantitative data from large populations (Bowling, 2023). They are especially useful for finding trends, correlations, and possible risk or protective factors, which gives future studies and the creation of interventions an empirical basis (Bowling, 2023).

Depending on the target population, the research context, and logistical considerations, surveys can be conducted online or through paper-based questionnaires (Wolf *et al.*, 2016). Online surveys enable effective data collection and processing while providing participants with a worldwide reach, flexibility, and convenience (Evans and Mathur, 2005). However, they are prone to measurement errors like inattentive responding and may exclude people with limited internet access or digital literacy, especially older adults (van Gelder, Bretveld and Roeleveld, 2010). Paper-based surveys have been linked to higher response rates in some groups and are beneficial for populations with low levels of digital literacy (Hayslett and Wildemuth, 2004; Millar and Dillman, 2011). Nevertheless, they tend to be more time-consuming in distribution and data processing, and are more susceptible to incomplete responses, as shown by lower rates of fully completed questionnaires compared to digital methods (Hassler, Pearce and Serfass, 2018). In this research, a mixed-mode survey design that included both online and paper-based questionnaires was chosen considering the advantages and disadvantages of each format. This approach enhances accessibility, improves response rates, and reduces coverage bias by allowing participants to select their preferred format (Leeuw, 2005). Because they consider different levels of digital literacy and technological familiarity, mixed-mode designs are especially appropriate for older populations, ensuring a broader and more representative sample.

3.2.3.2 Justification for sampling strategies

The selection of participants is determined by sampling, which is essential for the validity and applicability of research findings (Acharya *et al.*, 2013). Probability sampling, such as simple random sampling, is preferred for quantitative research due to its ability to reduce bias and support generalisability. Each member of the population has an equal chance of being chosen, but this approach can be expensive and time-consuming and necessitates a full sampling frame (Thompson, 2012; Acharya *et al.*, 2013). Non-probability sampling methods, such as convenience sampling, involve selecting participants based on their availability and willingness to take part (Stratton, 2021). This method is widely used in health and social research due to its efficiency, ease of implementation, and cost-effectiveness (Jager, Putnick and Bornstein, 2017). Nonetheless, it carries limitations such as selection bias and reduced external validity, as the sample may not accurately represent the broader population (Jager, Putnick and Bornstein, 2017; Stratton, 2021). In the quantitative phase of this research, convenience sampling was used to address practical challenges in accessing older adults in community settings.

Purposive sampling, which aims to achieve maximum diversity, is frequently used in qualitative research to find participants who can offer rich, pertinent, and varied perspectives that are in line with the goals of the study (Campbell *et al.*, 2020). This approach assumes that certain individuals are particularly well positioned to offer insight into the phenomenon under investigation (Lewis-Beck, Brayman and Liao, 2004; Campbell *et al.*, 2020). The possibility of researcher bias in participant selection is one of its drawbacks (Etikan, Musa and Alkassim, 2016). In the qualitative phase of this research, purposive sampling was adopted to ensure inclusion of participants with relevant experiences. Although they were taken into consideration, other qualitative sampling techniques like theoretical sampling and snowball sampling were not used. Theoretical sampling was not appropriate as the present research did not aim to generate new theory (Coyne, 1997), and snowball sampling was avoided to reduce the risk of sample homogeneity and compounded selection bias (Parker, Scott and Geddes, 2019).

3.2.3.3 Justification for the qualitative research approach and data collection

The goal of qualitative research is to comprehend how people make sense of their experiences. It is especially well-suited for investigating intricate, subjective phenomena that are difficult to measure (Denzin and Lincoln, 2018). Because it offers deeper insights into people's

experiences, beliefs, and behaviours, especially when combined with quantitative methods, it is becoming more and more valued in health-related studies (Pathak, Jena and Kalra, 2013).

Phenomenology, grounded theory, narrative research, and discourse analysis are just a few of the qualitative approaches that provide distinct epistemological and analytical orientations for comprehending lived experience (Creswell, 2018b). While these approaches were considered, none were fully aligned with the aims of the present research. For instance, phenomenological analysis seeks for the fundamental, universal meaning of a phenomenon (Moustakas, 1994; Williams, 2021). Although this research touches on lived experiences, it does not seek to uncover a universal essence of SCD or CLA engagement, as participants' experiences were expected to be diverse and contextually shaped.

Using iterative sampling and analysis, grounded theory focuses on developing new theories directly from data (Cutcliffe, 2000; Charmaz, 2006). This approach was not adopted because the goal of the current research was to interpret and gain a deeper understanding of the patterns found in the previous quantitative phase rather than to develop a new theoretical model. Since the focus of this research was on the content of participants' accounts rather than linguistic form or positioning, discourse analysis, which studies how language is used to construct meaning and social identity, was also judged inappropriate (Gee, 2014). Narrative analysis was similarly considered; however, this method usually entails meticulous reconstruction of life stories and narrative structure (Riessman, 2008), whereas the current research aimed to identify recurring patterns of meaning across participants rather than analyse narrative form or chronology. Although useful in applied and policy-focused research (Furber, 2010; Kiernan and Hill, 2018), framework analysis was not chosen because of its more rigid, matrix-based structure, which might limit the open-ended investigation of themes that arose inductively in this research.

Rather than adopting a specific qualitative methodological tradition, this research employed thematic analysis as a flexible analytic approach. Consequently, the data collection method needed to support the generation of rich, in-depth accounts that captured participants' experiences, meanings, and interpretations.

Interviews are a popular technique for gathering qualitative data because they allow participants to express their opinions in their own words while delving deeply into personal experiences (Leavy, 2020). There are different types of interviews, varying in structure and flexibility. While unstructured interviews resemble casual conversations and offer maximum

freedom but may lack focus and consistency across participants, structured interviews adhere to a set question order that may restrict in-depth exploration (DiCicco-Bloom and Crabtree, 2006). Through the use of a topic guide that ensures important topics are covered while permitting variation in question order and phrasing, semi-structured interviews, as used in this research, offer a balance between flexibility and structure. This format facilitates the generation of rich, detailed data, encourages participants to elaborate on personally meaningful issues, and supports natural conversational flow (Leavy, 2020). This method was thought to be especially appropriate for older adults because it made it possible for them to talk about their experiences with SCD and CLA engagement in a comfortable and guided way. Since the research concentrated on individual subjective experiences rather than observable behaviours or group interaction, other methods like observation or focus groups were deemed inappropriate (Rabiee, 2004; Angrosino, 2007; Hammersley and Atkinson, 2019).

Face-to-face, telephone, and video-based platforms can all be used for interviews; each has advantages and disadvantages of its own (Opdenakker, 2006). Face-to-face interviews improve data richness by fostering rapport and enabling the observation of nonverbal cues; however, they can be logistically challenging and may restrict participation from people who are geographically dispersed or have limited mobility (Opdenakker, 2006; Vogl, 2013). Video-based interviews provide a flexible substitute that combines accessibility with some of the interpersonal advantages of in-person interaction, permits the observation of body language and facial expressions, and yields data of a quality comparable to face-to-face interviews (Archibald *et al.*, 2019; Irani, 2019). However, video-based interviews may be affected by technical challenges (Lobe, Morgan and Hoffman, 2020; Khan and MacEachen, 2022), particularly among older adults and reduced access to non-verbal cues (Archibald *et al.*, 2019; Lobe, Morgan and Hoffman, 2020). Despite these limitations, studies have shown that videoconferencing platforms can generate data of comparable quality to in-person interviews, especially when rapport is successfully established (Archibald *et al.*, 2019). Depending on participant preferences and accessibility, both in-person and video-based interviews were used in this PhD thesis to ensure inclusivity and meet individual needs.

3.3 Methods

This research was conducted in accordance with the ethical standards set by the University of Sheffield and received formal approval from the Sheffield Centre for Health and Related Research (ScHARR), ensuring that all stages of the research adhered to appropriate ethical and

governance protocols (Ref. No. 056899). Details of the ethical approval letter are provided in Appendix 3.1 (page 269). Data collection for both the quantitative and qualitative phases took place between January and November 2024.

3.3.1 Study design

A sequential explanatory mixed methods design was used in this research. The first phase involved a cross-sectional quantitative survey, followed by a qualitative phase in which semi-structured interviews were conducted.

3.3.2 Phase one – quantitative research method

The quantitative research aimed to examine the relationship between SCD and CLA engagement among older adults. Specifically, this phase investigated the associations between overall and domains-specific (memory, language, and executive function) SCD and both the frequency and variety of CLA engagement, whether CLA engagement was protectively associated with fewer SCD concerns and the relationships between engagement in specific types of CLA and domain-specific SCD concerns. Sociodemographic variables, including age, gender, education level, and marital status, were also examined to describe the sample and to explore their associations with total and domain-specific SCD scores, thereby providing important contextual information for the interpretation of the main analyses.

3.3.2.1 Study setting

Survey data were collected from various regions across the United Kingdom (UK), primarily through charitable organisations and community groups engaging older adults. Two key settings facilitated recruitment:

1. Organisations based in the Sheffield region of the UK, where the researcher personally visited some groups to distribute paper-based surveys and engage participants face-to-face. In addition, online versions of the survey were also shared through local networks and community leaders' digital platforms.
2. Organisations and groups located outside Sheffield, where participants were primarily reached through online means. In these cases, survey links were shared via social media pages, email, and websites of relevant community or charitable organisations. Hard copies were posted to community organisations outside Sheffield for distribution among older adults with limited digital access.

This multi-setting, multi-modal strategy was designed to enhance accessibility and reach participants with diverse preferences and digital literacy. A full list of organisations involved, and the number of participants recruited from each, is provided in Appendix 3.2 (page 270).

3.3.2.2 Participants

Individuals aged 60 and above, following the World Health Organization's definition of older adults (WHO, 2025a), were considered eligible if they did not have mental health conditions such as major depression or schizophrenia, or diagnosed cognitive disorders like dementia or Alzheimer's Disease. The age threshold was chosen based on evidence showing that the prevalence of SCD increases with age (Jessen *et al.*, 2020). Since there is a known connection between SCD and mental health issues, participants with these conditions were excluded. Mental health problems may affect how individuals subjectively evaluate their own cognitive abilities. For example, those with mental health conditions might rate their cognitive functions more negatively than others, which could influence their responses (Hill *et al.*, 2016).

Before the main survey, preliminary screening questions were used to ensure eligibility. Participants were asked whether they were 60 or older, whether they had any diagnosed cognitive impairment, and whether they had any current mental health diagnoses or treatments. These questions were administered after obtaining informed consent.

3.3.2.3 Sampling strategy and recruitment

For this stage, a convenience sampling method was used, with participants recruited through both online and in-person methods between January and July 2024. The researcher contacted various charitable organisations and community groups in the UK that could help find eligible older adults. These organisations were asked to share the online survey link, created via Qualtrics (www.qualtrics.com) through their mailing lists, social media channels, or other communication networks.

The recruitment process moved slowly because older adults had limited experience with technology, and some organisations were hesitant to share the study link due to security concerns. To address these challenges, ethical approval was revised to include in-person recruitment using paper-based methods, which started in March 2024. The face-to-face approach significantly accelerated the recruitment process. Personal visits to charitable organisations allowed the researcher to introduce herself and her research directly, which increased participants' willingness to complete the survey. The researcher personally

administered the self-report questionnaires. Additionally, survey packs, including the Participant Information Sheet (PIS) (Appendix 3.3, page 272), consent form (Appendix 3.4, page 275), and questionnaire, were mailed to organisations upon request, who then distributed them to older adults in their networks. Only fully completed surveys from individuals meeting the inclusion criteria were included in the final dataset.

All participants received a PIS explaining the purpose of the study, and informed consent was obtained prior to participation. Online participants completed a digital consent form via Qualtrics, while paper-based participants completed printed consent forms. As part of the updated ethics amendment, permission was granted to share the online survey with English-speaking participants outside the UK; however, only two responses were received from Australia, which were excluded to maintain consistency in the study population and national context.

The participant recruitment process was therefore conducted only online from January to March 2024 and via a combination of online and face-to-face methods from March 21 to July 2024, ensuring that the minimum sample size was achieved.

3.3.2.4 Quantitative data collection: Survey

A survey was selected as the primary method for quantitative data collection, as it enabled examination of the relationship between SCD and CLA participation, central to this research, and could provide insights relevant to public health planning, including guiding future resource allocation and interventions. Data were collected using a mixed-mode survey design, comprising both online and paper-based questionnaires.

The online survey, created and distributed via Qualtrics, consisted of six sections: (1) PIS, (2) informed consent form, (3) screening questions, (4) sociodemographic data form, (5) Subjective Cognitive Decline Questionnaire, and (6) Cognitive Leisure Activity Scale. At the end, a qualitative phase two PIS invited participants to indicate willingness to take part in follow-up interviews, providing contact details if interested. The survey concluded with guidance and thanks, encouraging participants experiencing significant cognitive decline to consult a General Practitioner (GP). The full survey content (excluding the PIS and consent form, provided in Appendices 3.3 and 3.4 respectively) is included in Appendix 3.5 (page 276).

The paper-based survey mirrored the online version in structure and content. During face-to-face recruitment, participants received printed materials and were supported by the researcher to ensure complete responses. Additional paper surveys were distributed by charitable organisations upon request.

3.3.2.5 Measures

The survey comprised three components:

1. A sociodemographic data form, which collected information on participants' age, education level, gender, and marital status (see Appendix 3.5, page 276),
2. Subjective Cognitive Decline Questionnaire (SCD-Q; Rami *et al.*, 2014) to assess subjective cognitive concerns (see Appendix 3.5, page 277),
3. Cognitive Leisure Activity Scale (CLAS; Galvin, Tolea and Chrisphonte, 2021) to measure engagement in cognitive activities (see Appendix 3.5, page 278).

3.3.2.5.1 Subjective Cognitive Decline Questionnaire

The SCD-Q was used in this research to assess SCD among older adults. There is no 'gold standard' tool for identifying early signs of SCD in this population, as discussed in Chapter 1 (see Section 1.3.2). Many existing scales focus primarily on memory and often rely on single-item questions (e.g., "Have you had any problems related to your memory recently?"), overlooking other cognitive domains and the gradual nature of decline (Rabin *et al.*, 2015, 2023; Ibnidris *et al.*, 2022). The SCD-Q was selected because it evaluates perceived changes in multiple cognitive domains, including memory, language and executive function, over a recent, defined period of approximately two years. The questionnaire is practical, with clear and concise items, and its scoring system allows SCD to be analysed as a continuous variable. A SCD-Q is intended to capture subjective perceptions of cognitive change rather than to serve as a diagnostic tool for evaluating objective cognitive impairments.

The SCD-Q was designed to quantify perceived SCD over the past two years, evaluating memory tasks with 11 items, language tasks with 6 items, and executive function tasks with 7 items. It is a robust tool comprising 24 items, divided into two main sections: MyCog and TheirCog (Rami *et al.*, 2014). The MyCog section contains items answered by the subjects themselves, focusing on their perception of cognitive decline. The TheirCog section is completed by informants who know the subjects well, providing an external perspective on the subjects' cognitive changes (Rami *et al.*, 2014). However, for the purpose of this research, only

the MyCog section was employed. This decision aligned with this research's main aim of evaluating older people's perceptions of their *own* cognitive functions. The MyCog score has already demonstrated reliability in distinguishing individuals with SCD from those who do not have SCD, based on a cut-off score of 7 (Rami *et al.*, 2014). Accordingly, participants who answered yes to 7 or more of the 24 items were classified as having SCD. The SCD-Q has demonstrated excellent internal consistency reliability, with a Cronbach's alpha score of 0.90 for MyCog, providing valuable insights into individuals' perceptions of their cognitive health and aiding in the early detection of self-perceived cognitive changes (Rami *et al.*, 2014).

In addition to the 24 main items, the SCD-Q includes three preliminary questions that assess participants' general awareness of cognitive changes and their help-seeking behaviour. These questions ask whether participants perceive memory or cognitive difficulties (metacognition), whether they would consult a doctor about these difficulties, and whether they have experienced a decline in cognition or memory over the past two years. In the present research, responses to these items were used to examine participants' help-seeking intentions and behaviours in relation to perceived cognitive changes, complementing the analysis of the main items in Chapter 4 (see Section 4.4.3).

3.3.2.5.2 Cognitive Leisure Activity Scale

The CLAS is a brief, validated instrument designed to quantify CLA engagement in older adults, capturing both the frequency and variety of engagement in cognitively stimulating pursuits over the past year (Galvin, Tolea and Chrisphonte, 2021). Higher scores indicate more frequent engagement, providing an overall measure of CLA participation. The CLAS was developed to address the lack of standardised measures capable of estimating cognitive activity engagement in older populations, an important methodological challenge when investigating lifestyle influences on cognitive health and decline. The scale consists of 16 items reflecting common cognitive and leisure activities (e.g., reading, puzzles, musical activities) and uses a 6-point Likert-type frequency scoring system, allowing comparison across individuals and contexts (Galvin, Tolea and Chrisphonte, 2021).

The CLAS has demonstrated good psychometric properties, including acceptable internal consistency (Cronbach's $\alpha = .73$) and meaningful correlations with measures of cognition, function, physical activity, supporting both its construct validity and practical utility in research settings (Galvin, Tolea and Chrisphonte, 2021).

Compared with other tools, the CLAS offers distinct advantages: it is brief and easy to administer, focuses specifically on cognitively stimulating leisure activities rather than overlapping with activities of daily living or physical activity, and allows quantification of engagement over the past year, making it particularly suitable for community-based and prevention research (Galvin, Tolea and Chrisphonte, 2021). While the CLAS captures a wide range of cognitively stimulating activities, some items (e.g., board games, socialising, clubs) involve social interaction or physical effort, which is not fully aligned with the definition of CLA adopted in this thesis. Nevertheless, the scale was selected for its validation and practicality, particularly for use with older adults, and for its ability to assess both frequency and diversity of cognitively stimulating activities in this population.

3.3.2.6 Sample size

G*Power was used to determine a minimum required quantitative sample size, using the parameters for *F tests - Linear multiple regression: Fixed model, R^2 increase* based on the following criteria:

Effect size (f^2): 0.048, as derived from a previous study (Lee, Sung and Choi, 2020). The study by Lee, Sung and Choi (2020) was relevant for extracting this effect size because it evaluated factors associated with SCD and cognitive function, including activity participation. The study provided the Pearson correlation value for the relationship between SCD and CLA engagement, which was then converted to Cohen's f^2 to use in this analysis.

Alpha level (α): 0.05 to control for Type I error, ensuring that the probability of falsely rejecting the null hypothesis is kept at 5%.

Power ($1 - \beta$): 0.80 to minimise the risk of Type II error, ensuring an 80% chance of detecting a true effect (Cohen, 2013).

Number of tested predictors: 1 (Cognitive leisure activity engagement),

Total number of predictors (i.e., including covariates): 5 (Subjective cognitive decline, age, gender, marital status, and education level).

This calculation yielded a minimum target sample size of at least 166 participants.

3.3.2.7 Quantitative data analysis

Statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS), version 29. The data were entered into SPSS, where scoring, data cleaning, and reliability checks were conducted to ensure data quality and consistency. Normality tests were performed, and descriptive statistics were calculated to examine the distribution of the data and assess its suitability for further analysis. Bivariate correlations were conducted to explore relationships between key variables, including total and domain-specific SCD scores, CLA engagement, and sociodemographic factors. To further examine the associations between SCD and CLA engagement, a series of regression analyses were performed. Additionally, moderated regression analyses were conducted to investigate whether CLA engagement buffered or intensified the effect of key predictors on SCD scores. Finally, follow-up analyses examined the associations between specific types of CLA and SCD outcomes to identify which individual activities were most closely linked to lower SCD concerns. These sequential analyses were designed to comprehensively address the research questions and test the hypothesised relationships.

3.3.2.7.1 Data preparation and variable coding

To facilitate analyses, several variables were prepared and/or re-coded.

Specifically:

Total SCD Score: A continuous variable, ranging from 0 to 24, where higher values indicate greater SCD concerns. In addition to the total SCD score, domain-specific scores were calculated from the SCD-Q to reflect self-perceived concerns in three cognitive domains: memory (ranging from 0 to 11), language (ranging from 0 to 6), and executive function (ranging from 0 to 7).

Presence of SCD: A binary variable (0 = no SCD, 1 = has SCD). Participants who scored 7 or above on the SCD-Q were classified as having SCD (Rami *et al.*, 2014). This variable was used to determine SCD status for sampling in the qualitative phase of the research and for descriptive purposes in the quantitative phase.

CLA Engagement Frequency Score (Continuous): This variable was calculated by summing responses across all 16 CLA items on the 6-point Likert scale (0 = Never, 1 = Several times per year, 2 = Several times per month, 3 = Once per week, 4 = Several times per week, 5 =

Daily), resulting in a total score ranging from 0 to 80. Although ordinal in nature, this total score was treated as continuous for correlational and regression analyses, consistent with common practice when multiple ordered categories are used (e.g., Norman, 2010). The continuous score reflects overall engagement frequency across all CLA.

CLA Engagement Types (Binary): To explore associations between specific types of CLA and SCD outcomes, each of the 16 activity items was re-coded into a binary format. For each activity, 'Never' (0) was contrasted with all other levels of engagement (1 = several times per year or more). This binary transformation allowed identification of which specific CLA types were associated with lower SCD concerns or reduced likelihood of reporting SCD.

CLA Engagement Variety Score: A continuous (count) variable indicating the number of different activities (from a list of 16) in which participants participated, with scores ranging from 0 to 16.

Age: A continuous variable (in years).

Education Level: Re-coded as a binary variable as follows: university degree or higher (1) included bachelor's or equivalent first-degree level qualification, master's or equivalent higher degree level qualification, and PhD or equivalent doctoral level qualification; no degree (0) included GCSE or equivalent secondary school qualifications, A-level or equivalent post-secondary level qualifications, none of the above, and prefer not to say.

Marital Status: Recoded as a binary variable (0 = not married, 1 = married). The 'not married' category included single, separated, widowed, divorced, and prefer not to say.

Gender: A binary variable with two categories (0 = woman, 1 = man), based on the responses received in the survey. Other gender identities, such as non-binary or prefer not to say, were provided as options in the survey but did not result in any responses.

3.3.2.7.2 Data reliability

To ensure the reliability of the measurement instruments used in this research (SCD-Q and CLAS), reliability analysis was conducted. Specifically, internal consistency was assessed through the calculation of Cronbach's alpha for each scale. Cronbach's alpha is generally acceptable between 0.70 and 0.95, with a maximum of 0.90 recommended to maintain

construct validity (Tavakol and Dennick, 2011). However, alpha values slightly below 0.70 are considered acceptable for shorter scales or those measuring diverse constructs (Cortina, 1993; Streiner, 2003). Similarly, Schmitt (1996) and DeVellis (2022) noted that while higher alpha values are desirable, they are not always necessary for practical purposes, especially in exploratory research. Thus, instruments with alpha values below 0.70 can still be useful depending on the research context.

3.3.2.7.3 Descriptive analysis

Initially, the collected data was subjected to preliminary analysis to ensure its quality and suitability for further examination. This included:

- Missing Data Analysis: Data were entered into SPSS and cleaned to address missing values, ensuring dataset integrity. Frequency tables were generated for each variable, followed by an assessment of missing data patterns using SPSS's Missing Value Analysis function. No missing data were present in the final dataset, as only fully completed surveys from participants meeting the inclusion criteria were included in the analyses.
- Normality Testing: Normality tests are essential in health-related research as they determine the appropriate measures of central tendency and guide the selection of suitable statistical methods for accurate data analysis (Hatem *et al.*, 2022). Skewness measures the degree of asymmetry in a variable's distribution, with values near 0 indicating symmetry, while values away from 0 suggest skewness toward the right or left tail. Skewness can be classified as approximately normal (-0.5 to +0.5), moderately skewed (-1.0 to -0.5, +0.5 to +1.0), or highly skewed (<-1.0 or >+1.0) based on the classifications by Bulmer (1979) (Piovesana and Senior, 2018). Kurtosis, on the other hand, compares the distribution of data to a normal distribution, indicating the presence of heavy or light tails; high or positive kurtosis suggests the presence of outliers or extreme values, while low or negative kurtosis indicates a lack of outliers and lighter tails (Hatem *et al.*, 2022). For kurtosis, values outside the range of -2 to +2 are often considered indicative of non-normality (Blanca *et al.*, 2013). In this research, skewness and kurtosis were examined accordingly and supported by visual inspection of histograms.
- Descriptive Statistics: Means, standard deviations, and frequencies were computed for each variable to provide an overview of the dataset.

3.3.2.7.4 Inferential analysis

Inferential analyses were conducted using the continuous SCD score, as it provides a more detailed exploration of relationships with sociodemographic factors and CLA engagement using the full response scale. Analyses based on the binary presence of SCD (based on the cut-off) yielded consistent but weaker results and are reported in the Appendix for completeness.

Independent samples *t*-tests and Mann–Whitney U tests were conducted to examine differences in total and domain-specific SCD score (memory, language, executive function) by education level, marital status, and gender. Mann–Whitney U tests were used for variables with non-normal distributions (total SCD, memory, and executive function), whereas *t*-tests were used for the language domain, which met normality criteria. Effect sizes for *t*-tests were calculated using Cohen's *d* (Cohen, 2013) with values of 0.2, 0.5, and 0.8 representing small, medium, and large effects, respectively. Correlations (Pearson's *r* or Spearman's *rho*, depending on normality) were calculated between CLA engagement, age, and SCD scores. Coefficients were interpreted according to Cohen's (2013) guidelines: 0.1 = small, 0.3 = medium, 0.5 = large effect. Variables showing significant associations, including sociodemographic and CLA variety/frequency scores, were entered into linear regression models to assess their independent predictive value for total and domain-specific SCD scores.

Moderated regression analysis was conducted to examine whether CLA engagement moderates the relationship between significant predictors (e.g., age) and SCD score, testing the hypothesis that CLA may buffer the negative impact of certain risk factors (i.e., the relationship between a sociodemographic predictor, such as age, and SCD may weaken in the presence of greater CLA). Interaction terms were included to assess moderation effects. Continuous variables were centred to reduce multicollinearity and improve interpretability.

Finally, correlations using binary CLA engagement data (0 = Never, 1 = Engaged) were performed to identify which CLA types were most associated with SCD concerns. Based on these results, hierarchical regression analyses were planned to determine whether significantly associated CLA types predicted SCD score after accounting for relevant sociodemographic variables (e.g., age).

3.3.2.8 Quality assessment of quantitative research

This quantitative research's quality assessment was conducted using the Strengthening the reporting of observational studies in epidemiology (STROBE) guideline (Vandenbroucke *et*

al., 2007), for cross-sectional studies. The STROBE guidelines provide a structured framework to ensure comprehensive and transparent reporting. A completed STROBE checklist for this research is provided in Appendix 3.6 (page 280).

3.3.3 Phase two – qualitative research method

Phase two of the research aimed to explore older adults' experience of SCD and the influences shaping their engagement in CLA within this context. The qualitative approach was chosen to gain rich, in-depth insights into participants' personal experiences of cognitive changes, and the emotional, social, and contextual factors shaping their engagement in CLA. Semi-structured interviews were employed to allow participants to describe these experiences and influences in their own words, providing detailed information to complement and contextualise the quantitative findings. The following sections describe how the qualitative research was conducted.

3.3.3.1 Study setting

Qualitative interviews were conducted with individuals living in the UK. The interviews were semi-structured and carried out either in person or through online video calls, based on the participants' choices and situations. Most face-to-face interviews happened in the participants' homes, which provided a familiar and comfortable setting, though one interview took place in a university meeting room at the participant's request. Online interviews were conducted using Google Meet. This flexible and participant-focused method helped ensure that participants felt accessible and comfortable, especially considering the age and physical limitations of the group being studied.

3.3.3.2 Participant and sampling strategy

Participants who had completed the quantitative survey, expressed interest in further research, and scored 7 or above on the SCD-Q (indicating the presence of SCD), were invited to participate in semi-structured interviews. Purposive sampling was used to select participants.

The cut-off score of 7 identified participants with SCD. Within this group, individuals with more pronounced SCD concerns (higher scores) were prioritised, as they were expected to provide more comprehensive insights. For example, instead of selecting a participant with a score of 7, a participant with a score of 15 was chosen.

Participants were also selected based on their level of engagement with CLA to ensure that both high and low engagement groups were represented. The average CLAS score of the sample (M = 31) was used as a threshold: those scoring 31 or above were classified as high CLA engagement, while those scoring below 31 were considered low engagement. This method was necessary because there is no defined cut-off for CLAS (Galvin, Tolea and Chrisphonte, 2021), and it helped provide a more detailed understanding of participants' experiences.

3.3.3.3 Sample size

Identifying data saturation is a key part of qualitative research, as it helps ensure that the data gathered fully addresses the research goals and supports the reliability of the findings (Mwita, 2022). Saturation is reached when enough information has been collected, no new ideas are emerging, and further coding is no longer needed (Guest, Bunce and Johnson, 2006). It has also become a benchmark for determining purposive sample sizes in health science research (Guest, Bunce and Johnson, 2006). However, there is ongoing discussion about how best to determine when saturation is truly achieved.

There are different ways to decide on the number of participants in qualitative research. Hennink and Kaiser (2022), in their systematic review, found that most studies reached saturation within 9 to 17 interviews, with an average of 12–13 interviews. Similarly, Guest, Bunce and Johnson (2006) reported that saturation often occurred within the first 12 interviews. Rather than relying solely on the number of interviews, researchers are encouraged to assess data in terms of richness (quality) and thickness (quantity) (Morse, 2000; Fusch and Ness, 2015). Thick data refers to a large volume of information, while rich data is detailed and layered; ideally, both should be achieved (Fusch and Ness, 2015). Thus, saturation is about depth and quality, not simply sample size.

Taking these principles into account, a target sample of 20 participants was purposely selected, 10 with high and 10 with low CLA engagement, to ensure a balanced and diverse sample capable of providing rich insights aligned with the research objectives. This division enabled an in-depth exploration of how varying levels of CLA engagement relate to SCD. A saturation grid (see Appendix 3.7, page 283) was used to systematically track theme emergence. Saturation was observed around the 15th–16th interview, with subsequent interviews reinforcing existing themes. This confirmed that the selected sample size was sufficient to achieve thematic depth and balance across CLA engagement levels.

3.3.3.4 Participants recruitment

The recruitment process targeted individuals who had expressed interest in participating in the second phase of the research and had provided their contact information. Initial contact was made via email invitations, which reminded participants when and how they had first joined the study. For those who had met the researcher face-to-face during the quantitative phase, the emails also referenced the specific event or setting, which helped foster positive responses. Each email included a PIS (Appendix 3.8, page 288), detailing the purpose and procedures of the qualitative phase. If no response was received within one week, a reminder email was sent. Participants who did not respond after a second week were contacted by phone only if they had previously provided a number and consented to telephone contact. The purpose of the phone call was to follow up and, where appropriate, arrange a mutually convenient date, time, and location for the interview.

All participants retained the right to decline or withdraw at any stage, as stated in the PIS; if a participant chose not to participate or withdrew, another eligible individual, based on SCD and CLA engagement scores, was invited according to the purposive sampling strategy. Two participants could not be reached, one withdrew shortly before the scheduled interview, and two declined; replacements were recruited to ensure diversity. Individuals who expressed interest in participating but did not meet the inclusion criteria (e.g., SCD scores below the threshold) were not invited for interviews.

3.3.3.5 Qualitative interview schedule

The semi-structured interview schedule (Appendix 3.9, page 291) was designed to explore older adults' subjective experiences of cognitive changes, their emotional and social responses to these experiences, and how these factors relate to engagement in cognitive activities. Questions were organised into three sections: opening, key, and closing to allow gradual progression from personal experiences to broader reflections.

Opening questions focused on participants' awareness and interpretation of cognitive changes, including when they first noticed difficulties and how these changes affected their emotions and daily lives. This section was primarily informed by existing literature highlighting the emotional and subjective dimensions of cognitive concerns, including associations between perceived cognitive decline and emotional responses such as frustration or anxiety (Hill *et al.*, 2022; Kiene, Hildebrandt and Roheger, 2025). Participants were also asked about strategies

they used to manage forgetfulness and how family members or close others responded to these changes, enabling exploration of the social context surrounding cognitive concerns. Questions relating to help-seeking were embedded within this broader discussion. Their inclusion was informed by the quantitative phase of the research, which assessed participants' intentions to seek professional support for cognitive concerns. The qualitative questions were therefore designed to explore the reasoning underlying these intentions, focusing on participants' explanations for seeking or not seeking help and how they interpreted their cognitive changes. Lay terminology such as "forgetfulness" and "brain function" was deliberately used to encourage open discussion and to avoid the use of theoretical terminology that might limit participants' ability to describe their experiences in their own words.

Key questions focused on participants' understanding and engagement in "brain health activities", a deliberately chosen, accessible term that encompasses a broad range of cognitively and mentally stimulating activities and was used instead of the more technical "cognitive leisure activities" to facilitate participants' interpretation and discussion of their own experiences. Participants were first invited to describe what such activities meant to them before discussing the types of activities they engaged in. This sequencing allowed participants' own conceptualisations to emerge prior to exploring motivations, barriers, and perceived benefits. The design of these questions was guided by constructs assessed in the quantitative phase, which measured both subjective cognitive concerns and levels of engagement in cognitive activities. This approach ensured that the qualitative exploration could capture participants' perceptions of how cognitive changes might relate to their engagement in brain health activities, as well as their views on the potential benefits of these activities.

The interview concluded with reflective questions exploring participants' expectations of healthcare professionals, researchers, and community or policy-level organisations, as well as advice they would offer to others experiencing similar concerns. A final open-ended question provided participants with the opportunity to raise any additional issues they felt were important, and they were thanked for their time and contribution.

3.3.3.6 Qualitative interview procedure

Interviews were conducted face-to-face or via video conferencing, according to participants' preferences and practical considerations. Of the total interviews, 14 were conducted face-to-face and 6 were conducted online. All interviews were conducted one-to-one, providing a private and comfortable environment. Consent was obtained prior to the interviews (Appendix

3.10, page 293). For face-to-face interviews, participants signed a hard copy of the consent form, while for online interviews, consent was collected electronically via Qualtrics. Audio recording was used with participants' permission for later transcription. Interviews lasted between 30 minutes to 1 hour and 20 minutes, with an average duration of approximately 45 minutes, and were conducted between September and November 2024.

3.3.3.7 Data analysis

The qualitative data were analysed using thematic analysis (Braun and Clarke, 2006), a flexible approach suitable for exploring diverse experiences of SCD and engagement in CLA among older adults. This method allowed identification of shared patterns while preserving individual perspectives.

Transcription and coding: All interviews were audio recorded, then verbatim transcriptions were made into Word documents. The transcription captured not only participants' words but also exclamations, pauses, and emotions, preserving the nuances of expression. While transcription can be time-consuming and sometimes challenging (Riessman, 2008), it is essential for qualitative analysis, allowing the researcher to become deeply familiar with the data (Braun and Clarke, 2006). I personally transcribed all interviews verbatim, which facilitated early and in-depth familiarisation with the data. During the transcription process, I recorded initial reflections, noting recurring ideas, potential patterns, and early impressions of key themes. Anonymised transcripts were uploaded to NVivo (version 14) for methodical coding to ensure rigor. To ensure consistency, one interview was independently coded by three researchers, the primary researcher and two supervisors. Four transcripts were also shared with an institutional colleague for independent coding; comparisons improved validation and reduced potential bias. The coding framework was improved, and transparency was raised through this cooperative process. After each interview, I also made brief field notes documenting initial thoughts, notable points, and emerging ideas about potential themes. Following the completion of each transcript, I revisited these notes and added further reflections, allowing early interpretations to evolve prior to formal coding.

Word frequency analyses were carried out using NVivo to visualise the prominence of frequently mentioned words throughout the dataset to supplement the coding and thematic analysis. This method supported theme identification and improved familiarity with the data by offering a complementary, visual overview of the data patterns.

To guide the analysis, Braun and Clarke's (2006) six-phase process was followed: (1) familiarisation with the data, (2) generation of initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report. Each step was conducted systematically to ensure a transparent and rigorous analytic process.

The analysis was conducted iteratively, involving continuous movement between the data, codes, and emerging themes. Earlier transcripts were revisited throughout the process to refine interpretations and ensure consistency across the dataset.

Step 1 - Data familiarisation: To fully comprehend the data, the researcher had to become fully immersed in it. Immersion usually entails reading the data several times and actively interacting with it to find patterns, meanings, and other insights. Since the researcher was in charge of gathering the data, she had the benefit of being familiar with the subject, which allowed for initial impressions prior to the start of the analysis stage. Deeper interaction with the data was also made possible by field notes taken either during or immediately following the interviews. When the researcher thought back on her experience, she discovered that taking field notes made it easier for her to stay connected to the data and remember important details from the analysis. In addition, my direct involvement in both data collection and transcription enabled early engagement with the data, allowing initial ideas about patterns and meanings to develop prior to formal coding.

Step 2 - Initial code generation: The researcher created preliminary codes to classify and interpret the data according to what was deemed intriguing and significant after reading it several times and becoming fully immersed in it. This helped the researcher gain a general understanding of the context and scope of the data. In this stage, the data was used directly to create the initial codes. Initial codes were created to organise the data by breaking the text up into smaller units, like sentences or short phrases, which helped structure the information and represented important characteristics. For this procedure, NVivo and manual coding were used to analyse the transcribed data. To find possible patterns, relevant text was highlighted, and notes were written next to it. The fundamental components of qualitative data analysis, coding and theme development, were implemented using NVivo. After that, the original codes were combined to create more comprehensive themes. Both the general literature on the relationship between SCD and CLA engagement and the knowledge acquired during the data familiarisation stage were used to create the codes. Coding was initially conducted on a transcript-by-transcript basis; however, full and systematic coding across the dataset was

finalised after all interviews had been transcribed, allowing for a more comprehensive and consistent analytical approach. Initial codes were continuously refined as new data were analysed.

Step 3 - Searching for themes: All of the previously coded data was arranged into possible themes during this stage. To identify more general themes, the coded data was reviewed, and smaller codes were grouped together. As recommended by Braun and Clarke (2006), visual aids like mind maps were employed to help organise the codes into themes. By showing the connections between codes, themes, and sub-themes, these visual aids assisted in mapping out the emerging patterns. As a result, a variety of themes surfaced, including expected themes, surprisingly unexpected themes, and difficult-to-classify themes that either overlapped with other themes or didn't neatly fit into any designated category. At this stage, the significance of each theme began to take shape, providing insight into the data and contributing to the final analysis.

Step 4 - Reviewing themes: During this stage, the themes and subthemes were examined and improved. To make sure that themes could be easily distinguished from one another, the researcher looked at the internal coherence of the data within each theme. Some themes were rearranged for clarity, while others were eliminated because there was insufficient evidence to support them. To consider theme boundaries and overlaps, the researcher had conversations with a research colleague during this phase. Through this collaborative process, a number of themes with similar scope and meaning were found. To eliminate repetition and improve analytical clarity, some themes were combined. Through these conversations, the researcher was able to critically evaluate preliminary interpretations and make sure that the final thematic structure better reflected the stories of the participants. By the end of this phase, the thematic map had been simplified and made more coherent, allowing the overall story within the data to emerge more clearly and meaningfully.

Step 5 - Defining and naming themes: This step involved naming, labelling, and providing a precise definition and description for each theme. The original theme names were created to be impactful and succinct, with the goal of quickly capturing each theme's essential meaning. Both supervisors then provided the researcher with thorough feedback, suggesting that some labels that had been originally phrased in more neutral or descriptive terms could be changed to better reflect the qualitative richness of the data. Consequently, several theme names were changed

to reflect a language that was more interpretive and experience-driven, more in line with the characteristics of qualitative research.

A thorough analysis was carried out for every theme, identifying significant trends in the data and outlining how they related to the research questions. To minimise needless overlap and enhance coherence, careful consideration was also given to how each theme related to the narrative as a whole and to other themes.

The themes were examined for coherence and breadth as part of this process. The experience of SCD, including perceived cognitive deterioration, coping mechanisms, and its detrimental effects, and the relationship between SCD and CLA engagement, including motivations, barriers, and strategies to support participation, naturally fell into two broad categories, even though all themes contribute to understanding CLA engagement in the context of SCD. To ensure a more logical flow of findings while preserving a distinct narrative, these are organised into two distinct chapters. By the time this phase was over, the thematic map had been streamlined and improved in coherence, which made it easier to see the data's overall narrative. Following the completion of theme development, a detailed framework was constructed to map initial codes, subthemes, and their occurrence across participants. This framework is presented in Appendix 3.11 (page 294) to enhance transparency and demonstrate the analytic process. Although thematic analysis guided the analytic process, this framework was used as an organisational tool to provide a clear and transparent audit trail of how initial codes developed into final themes.

Step 6 - Writing-up: To ensure that the reader comprehends the validity and coherence of the analysis, the writing phase of thematic analysis entails presenting the intricate findings in an understandable and captivating way. The final write-up sought to provide a succinct, coherent, and captivating story while avoiding repetition and emphasising the underlying messages of the data across the identified themes. Instead of being presented descriptively, quotes were carefully chosen to convey the core of each theme and incorporated into an analytical narrative.

In addition to being easier to read, this thematic arrangement reflects a deeper analytical logic by showing how various facets of participants' experiences are connected and change over time. The main objective was to make sure that the results were presented in a way that appropriately reflected the intricacy of the data and its applicability to the research questions.

3.3.3.8 Rigour and trustworthiness of qualitative research

Trustworthiness is the key element that determines the rigour of qualitative research (Amankwaa, 2016). To ensure trustworthiness, Lincoln and Guba's (1985) four key criteria, namely credibility, transferability, dependability, and confirmability, were applied in this research to assess its quality (Shenton, 2004).

Credibility: Credibility refers to the degree of confidence in the truth of the findings and how accurately they reflect participants' perspectives and experiences (Shenton, 2004). Several techniques were employed in this qualitative research to improve credibility throughout the phases of data collection and analysis.

Initially, peer debriefing was used all along the way. During the interview guide design, the researcher consulted supervisors to ensure questions were clear, relevant, and aligned with research aims and quantitative findings. During analysis, regular discussions with supervisors and collaboration with a research colleague strengthened reliability. Four anonymised transcripts were double-coded, and comparisons helped challenge assumptions, reduce bias, and reinforce interpretation consistency.

Second, maximum variation purposive sampling ensured representation of a broad range of experiences, including both high and low CLA engagement. This provided a more comprehensive understanding of the phenomenon.

Third, iterative questioning was incorporated into interviews. In addition to the core questions in the interview guide, follow-up and probe questions were used to encourage participants to elaborate or clarify their responses. This helped extract more comprehensive data and improved the depth and accuracy of the findings.

These strategies collectively supported the trustworthiness of the data and helped ensure that the themes derived from the analysis were well grounded in participants' actual accounts.

Transferability: Transferability refers to how findings can be applied to other contexts or populations (Jones, 2012). Qualitative research is more concerned with comprehending particular contexts than quantitative research, which strives for generalisability (Shenton, 2004). Readers are able to assess transferability when comprehensive contextual information is provided (Guba, 1981; Shenton, 2004). The research setting, participant characteristics, recruitment, and interview procedures were all described in detail. While Sheffield was home

to most participants, some came from other UK cities. Applicability to similar populations is further supported by including people with a range of CLA engagement levels.

Dependability: Dependability is the degree to which a study would produce the same findings if it were carried out again under comparable circumstances (Rohleder and Lyons, 2017). Dependability is prioritised over reliability in qualitative research (Shenton, 2004). To improve reliability, thorough records of procedures, recruitment, data analysis, and coding choices were kept, enabling replication in comparable situations. Transparency and traceability were ensured throughout the process by keeping clear records, such as field notes and coding justifications, even though interpretation may differ amongst researchers.

Confirmability: Confirmability ensures that the results are based on participant responses rather than the researcher's prejudice (Noble and Smith, 2015; Rohleder and Lyons, 2017). Reflexivity, sampling diversity, and an audit trail were used to accomplish this (Amankwaa, 2016). An audit trail is a clear and transparent account of the research steps taken, allowing others to trace the process through documented decisions and procedures (Amankwaa, 2016). A detailed account of the methodological process enables external evaluation of confirmability. Additionally, purposive sampling across CLA engagement levels enriched data diversity and supported findings grounded in varied participant experiences.

3.3.3.8.1 Reflexivity in qualitative research

The critical analysis of how the researcher's identity, background, and presumptions may affect the research process and results is known as reflexivity (Amankwaa, 2016). These factors may have an impact on participant interactions, data collection, interpretation, and the researcher's overall role in the study (Mays and Pope, 2000; Shenton, 2004). In conducting this research, I continuously reflected on my positionality and how my background, experiences, and assumptions might shape the research. My interest in gerontology began during my undergraduate studies and developed further through my master's dissertation, which deepened my understanding of older adults' experiences.

I considered how language influenced the research as a young, educated woman conducting interviews in a second language. During the first few interviews, I sometimes felt less confident guiding participants back to the research questions when their responses diverged from the topic. For instance, I recall one participant saying, "I am giving you what you want, are you sure?", which likely reflected my initial uncertainty. At times, I repeated or rephrased questions

to clarify meaning and ensure participants fully understood, which occasionally caused slight delays or repetitions in the interview flow. However, this process also enhanced my attentive listening, as I needed to carefully process participants' responses to avoid missing important nuances. In this way, the language challenge increased my focus and encouraged detailed field notes immediately after each interview, improving data familiarisation and quality.

Another factor that required reflection was my familiarity with the research topic. Having conducted systematic review on CLA engagement and SCD, I entered the thematic analysis with some assumptions. At the start, I anticipated that maintaining cognitive function would be the main driver of participants' engagement in CLA. However, during the process of analysis, I observed that participants' priorities did not always align with this expectation. Recognising this helped me stay alert to the participants' own perspectives rather than relying on assumptions, ensuring that the analysis remained grounded in their lived experiences.

Dual coding helped me challenge my assumptions, working with an institutional colleague who specialises in older adults and social support. During the thematic analysis, I initially classified participant's emphasis on maintaining social connections under *motivation*. My colleague suggested that this could also be interpreted as a coping strategy, because participants used social connections to manage cognitive challenges as well. This prompted a discussion about the boundaries between motivation and coping, helping me reconsider my initial assumptions and refine the coding framework. These discussions provided concrete examples of how interpretation can be influenced by perspective. This process ensured that my analytic decisions were transparent and faithful to participants' lived experiences.

Overall, reflexivity was an ongoing and essential process. I consistently reflected on how my positionality and prior knowledge might influence interpretation, aiming to maintain integrity, transparency, and analytical balance throughout the research.

3.3.3.9 Quality assessment of qualitative research

This qualitative research's quality assessment was conducted using the Standards for Reporting Qualitative Research (SRQR; O'Brien *et al.*, 2014). A completed version of the SRQR checklist for this research is provided in Appendix 3.12 (page 298).

3.3.4 Rationale for using mixed methods

This research adopted a mixed methods approach to fully capture the complexity of the relationship between SCD and CLA engagement. The rationale for combining quantitative and qualitative methods is grounded in both theoretical and practical considerations. Based on established frameworks (Tariq and Woodman, 2013; Dawadi, Shrestha and Giri, 2021), five justifications are outlined below.

Complementarity: Complementarity is the use of results from one approach to enhance or make sense of results from another. The relationship between CLA participation levels among people with and without SCD was investigated in this research's quantitative phase. The qualitative phase that followed investigated the causes of these trends, emphasising lived experiences, barriers, and motivations. When taken as a whole, they contributed to a better understanding of the variables affecting older adults with SCD's participation in CLA.

Development: The application of one approach was influenced by the results of the other. The purposive selection of participants for the qualitative phase was guided by quantitative results, ensuring the inclusion of people with SCD and different levels of CLA engagement. They also influenced the creation of the interview guide, which made it possible for qualitative research to examine the contextual elements and underlying reasons found in the survey.

Initiation: This rationale calls for utilising the outcomes of both approaches to produce fresh perspectives and understandings. While the qualitative phase investigated the reasons, obstacles, and contextual meanings underlying participation trends, the quantitative phase identified them. The goal of combining the two stages was to reveal viewpoints that might not surface using just one approach.

Expansion: This entails applying various techniques to investigate various facets of the research question. While qualitative interviews offered in-depth, subjective accounts of individual experiences and perceptions, the quantitative phase gave a broad picture of the frequency of CLA participation among older adults with SCD.

Triangulation: Results could be compared and verified across datasets by combining the two approaches. It was anticipated that the qualitative data would either confirm or challenge quantitative trends, enhancing the validity and thoroughness of interpretations.

Mixed methods designs are increasingly recognised in health research for their ability to address complex questions and overcome the limitations of single-method approaches (Wasti *et al.*, 2022). However, such designs remain underused in the context of CLA engagement and SCD. To date, no studies employing a similar mixed methods approach have been conducted in the UK (Chapter 2; Akbayrak *et al.*, 2024), which made this present research timely and valuable.

3.3.5 Quality assessment of mixed methods research

In health services research, the lack of transparency in reporting has made it challenging to evaluate several aspects of the quality of mixed methods studies. To address this issue, the guideline of the Good Reporting of a Mixed Methods Study (GRAMMS) checklist has been followed in this PhD (O'Cathain, Murphy and Nicholl, 2008), as presented in Table 3.1:

Table 3.1. Quality assessment of mixed methods research - GRAMMS

Good Reporting of a Mixed Methods Study (GRAMMS)	Where addressed in this research
Describe the justification for using a mixed methods approach to the research question	3.3.4 Rationale for using mixed methods (page 96)
Describe the design in terms of the purpose, priority, and sequence of methods	3.2.2 Mixed methods approach and designs (pages 68-70)
Describe each method in terms of sampling, data collection and analysis	3.3.2 Phase one quantitative research method (pages 75-85) 3.3.3 Phase two qualitative research method (pages 85-95)
Describe where integration has occurred, how it has occurred and who has participated in it	3.3.6 Data integration (pages 98-99)
Describe any limitation of one method associated with the present of the other method	Chapter 8.4 Strengths and Limitations (pages 198-201)
Describe any insights gained from mixing or integrating methods	Chapter 7 Integration of Findings (pages 175-187) Chapter 8 Discussion and Conclusion (pages 190-198)

3.3.6 Data integration

In mixed methods research, integration is the phase where quantitative and qualitative elements work together to produce a deeper and more thorough understanding of the phenomenon being studied (Fetters, Curry and Creswell, 2013). It facilitates communication between strands so that each informs and enhances the other (O'Cathain, Murphy and Nicholl, 2010). Integration can occur at multiple stages of the research process, including data collection, sampling, analysis, interpretation, and reporting (Creamer, 2018).

According to Fetters, Curry and Creswell (2013), integration commonly occurs through two mechanisms: *connecting* and *building*. Integration through connecting links one type of data to another, often via the sampling framework, for example, when interview participants are selected from survey respondents. Integration through building occurs when findings from one phase shape the design or focus of the next phase.

In this research, integration took place at several points. Quantitative survey results guided the purposive selection of participants for the qualitative interviews, ensuring the inclusion of individuals with SCD and varying levels of CLA engagement. The quantitative findings also helped to develop the qualitative interview schedule. For example, the survey included measures of CLA engagement and SCD concerns, which allowed subsequent interview questions such as *"How do you think your memory or attention difficulties affect your participation in brain health activities?"* to explore how participants perceive the impact of cognitive changes on their engagement in CLA. Similarly, the interview questions included items probing the perceived benefits of CLA engagement (e.g., *"Do you feel that engaging in these activities helps with your memory or thinking skills?"*) to deepen understanding of patterns anticipated from the quantitative data.

Integration was further achieved during interpretation and presentation through the use of joint displays, which array quantitative and qualitative results side by side to illustrate convergence, divergence, and complementarity (Guetterman, Fetters and Creswell, 2015). These displays (see Chapter 7) provided a transparent and systematic means of combining findings, yielding insights that could not have been derived from either dataset alone.

3.3.7 Ethical considerations

Ethical approval for this research was obtained from the University of Sheffield Research Ethics Committee (Ref: 056899). All participants were fully informed about the research through an approved PIS, which detailed the research purpose, data handling procedures, and their rights, including the voluntary nature of participation and the right to withdraw at any time without giving a reason. Written or electronic informed consent was obtained prior to participation, depending on the mode of interview (face-to-face or online).

Given the vulnerability of the older adult population, particularly those with concerns about cognitive health, additional safeguards were implemented to minimise potential distress. Participants were reassured that the research focused on their subjective experiences rather than providing clinical assessments or diagnostic feedback. They were advised to consult their GP if they had serious concerns about their memory. After each interview, participants were provided with an information sheet listing support services and resources related to memory and cognitive health (Appendix 3.13, page 302).

Throughout the research, participants were generally open about their cognitive concerns and willing to discuss strategies for cognitive activity engagement, highlighting the importance of creating a supportive and respectful interview environment.

Data management procedures for this PhD thesis followed the University of Sheffield's *Research Data Management Policy* and the *Policy on Good Research and Innovation Practices (GRIP)*. All quantitative and qualitative data were anonymised and stored in the University's secure File store, accessible only to the researcher and supervisors. Identifiable information, such as participant contact details and audio recordings, was stored separately from research data and permanently deleted once no longer required. Paper copies of consent forms (and questionnaires, where applicable) were stored in locked, secure cabinets accessible only to the researcher. In accordance with university regulations, anonymised datasets and metadata will be retained on the University's Online Research Data (ORDA) repository for a minimum of ten years after project completion before being securely destroyed.

Overall, ethical considerations were carefully managed to ensure participant well-being, informed consent, and transparency throughout the research.

3.4 Chapter Summary

This chapter described the methodological framework and procedures adopted in this PhD thesis. It began by outlining the pragmatic paradigm underpinning the research and the use of an explanatory sequential mixed methods design, comprising a quantitative cross-sectional survey followed by qualitative semi-structured interviews. Each phase was presented in detail, covering the research setting, participants, sampling strategies and recruitment, data collection procedures, sample size, data analysis methods, and approaches to ensuring quality and rigour. The chapter also provided the rationale for employing a mixed methods approach, explained how and where integration was achieved across the quantitative and qualitative phases, and discussed the procedures used to assess the quality of the mixed methods design. Finally, ethical considerations, including approval procedures and principles of informed consent, confidentiality, and data protection, were outlined. The following chapter presents the quantitative findings from the research, detailing associations between SCD and CLA engagement among older adults.

CHAPTER 4- Quantitative Research Findings

4.1 Introduction

This chapter presents the key findings from the quantitative analyses conducted to investigate the relationship between subjective cognitive decline (SCD) and cognitive leisure activity (CLA) engagement among older adults. The analyses also examined specific cognitive domains, such as memory, language, and executive function, to provide a more comprehensive understanding. The aims of this quantitative phase were: (1) to examine the associations between overall and domain-specific SCD and the frequency and variety of CLA engagement, including variation across sociodemographic factors; (2) to explore whether CLA engagement moderates the relationship between age and SCD; (3) to investigate associations between engagement in specific types of CLA and domain-specific SCD concerns. The chapter begins with an overview of the sample size and response rate, followed by a reliability analysis of the measurement instruments. Descriptive analyses then summarise participant characteristics, missing data patterns, variable distributions, and summary statistics. Subsequently, inferential analyses, including correlation analyses, explore the relationships between sociodemographic factors, CLA engagement, and SCD. Regression analyses are then presented to examine predictive relationships and to test the potential moderating role of CLA engagement on SCD. Furthermore, correlation and hierarchical regression analyses controlling for age were conducted to investigate associations between specific CLA types and total and domain-specific SCD scores. The chapter concludes with a discussion of the key quantitative findings in relation to the research's overall aims.

4.2 Sample Size and Response Rate

A total of 267 participants were initially recruited, exceeding the calculated minimum sample size requirement of 166 participants (see Chapter 3.3.2.6). Of these, ten participants were excluded for not meeting the inclusion criteria:

- Three participants did not complete the online survey.
- Two participants were under the age of 60.
- Three participants reported mental health issues.
- Two participants reported diagnosed cognitive disorders such as Alzheimer's disease or dementia.

In addition, two participants recruited from Australia were excluded to maintain consistency with the United Kingdom (UK) sample. Despite further amendments to ethical approval for recruitment from additional English-speaking nations, the limited number of international participants (n = 2) was considered inadequate for significant cross-country comparisons. Therefore, to ensure cultural and contextual homogeneity, only participants from the UK were included in the final sample, thus resulting in 255 participants. Their characteristics are summarised in Table 4.2, alongside key descriptive statistics.

4.3 Reliability Results

For the Subjective Cognitive Decline Questionnaire (SCD-Q), Cronbach's α was 0.89, indicating a high level of internal consistency. The Cognitive Leisure Activity Scale (CLAS) showed a Cronbach's α of 0.67. Although this value falls slightly below the conventional threshold of 0.70, it was considered acceptable given the scale's brevity and other methodological considerations, as outlined in Chapter 3.3.2.7.2. Accordingly, the reliability coefficients obtained for both the SCD-Q and CLAS provided sufficient justification to proceed with subsequent descriptive and inferential analyses.

4.4 Descriptive Analysis Results

Descriptive analyses were conducted to examine data completeness, assess distributional properties, and summarise sample characteristics.

4.4.1 Missing values

The analysis confirmed that no missing values were present in the dataset, as verified through frequency tables and the Missing Value Analysis. Consequently, no further handling of missing data was required, and the dataset was deemed complete for subsequent analyses.

4.4.2 Data normality

The normality of key continuous variables was assessed using skewness and kurtosis statistics, alongside visual inspection of histograms (see Appendix 4.1, page 303). Following the classification outlined in Chapter 3.3.2.7.3, variables with skewness values between -0.5 and +0.5 were considered approximately normal, values between ±0.5 and ±1.0 moderately skewed, and values beyond ±1.0 highly skewed.

As shown in Table 4.1, the total SCD (skewness = 0.62), memory (0.93), and executive function (0.84) were identified as moderately skewed. The language (0.24), CLA engagement frequency (0.08), and CLA engagement variety (-0.22) variables fell within the range of normal distribution. Histogram inspection supported these interpretations. All kurtosis values fell within the acceptable range (±2), further supporting the interpretation of normality.

Given the presence of moderate skewness in some key dependent variables, non-parametric statistical methods were used where appropriate to ensure robustness and adherence to distributional assumptions. CLA engagement variables (frequency and variety) were correlated with all SCD domains using the appropriate method based on the distribution of each SCD variable. Parametric methods were used for the language domain, as it met normality assumptions.

Table 4.1. Skewness and kurtosis statistics for key variables

Variable	Skewness	Kurtosis	Normality Classification
Total SCD	0.62	- 0.22	Moderately skewed
SCD-Memory	0.93	0.24	Moderately skewed
SCD-Language	0.24	- 0.99	Normal
SCD-Executive Function	0.84	- 0.20	Moderately skewed
CLA Engagement Frequency	0.08	- 0.09	Normal
CLA Engagement Variety	- 0.22	- 0.42	Normal

Note. SCD (Subjective Cognitive Decline); CLA (Cognitive Leisure Activity)

4.4.3 Sample characteristics

Table 4.2 presents the descriptive characteristics of the research sample, including demographic variables, SCD domain scores, and CLA engagement levels. The mean age of participants was 76.94 years (*SD* = 8.21), ranging from 60 to 95. Most participants were women (75%) and did not hold a degree-level qualification. Marital status was diverse, with the largest group being married (42%), followed by widowed participants (35%). Just over half of the sample (51%) met the cut-off criteria for presence of SCD.

The mean score for domain-specific SCD indicators were as follows: memory (*M* = 2.70, *SD* = 2.60, range = 0-11), language (*M* = 2.44, *SD* = 1.78, range = 0-6), and executive function (*M*

= 2.04, *SD* = 1.95, range = 0-7), reflecting varying levels of self-perceived difficulties across domains.

Participants also provided their views on cognitive perceptions and help-seeking intentions through three preliminary yes/no questions included in the SCD-Q. A total of 34.1% of participants reported perceiving cognitive difficulties. When asked whether they would consider seeking medical help for such difficulties, 46.3% indicated they would do so. Additionally, 37.6% of subjects indicated a deterioration in their cognitive function over the past two years. Responses to these questions provide insight into participants' general awareness of their cognitive state and attitudes towards help-seeking.

Table 4.2. Descriptive characteristics of the quantitative research sample

Variable		Mean (*SD*)	Range
Age (years)		76.94 (8.21)	60-95
Total SCD		7.17 (5.56)	0-24
SCD-Memory		2.70 (2.60)	0-11
SCD-Language		2.44 (1.78)	0-6
SCD-Executive Function		2.04 (1.95)	0-7
CLA Engagement Frequency		31.38 (9.01)	10-59
CLA Engagement Variety		9.97 (2.72)	3-16
Variable		**N**	**Percentage (%)**
Gender			
	Man	64	25.1
	Woman	191	74.9
Education Level			
	GCSE or equivalent secondary school qualification	68	26.7
	A-level or equivalent post-secondary level qualification	48	18.8
	Bachelor's or equivalent first-degree level qualification	35	13.7
	Master's or equivalent higher degree level qualification	15	5.9
	None of the above	81	31.8
	Prefer not to say	8	3.1
Marital Status			
	Single	20	7.8
	Married	106	41.6
	Divorced	35	13.7
	Separated	3	1.2
	Widowed	90	35.3
	Prefer not to say	1	.4
Presence of SCD			
	Yes	130	51
	No	125	49

Note. N=Number of participants; SCD (Subjective Cognitive Decline); CLA (Cognitive Leisure Activity)

4.5 Inferential Analysis Results

Inferential statistical analyses examined the relationships between SCD, CLA engagement, and sociodemographic factors using independent samples *t*-tests, Mann–Whitney U tests, Pearson's and Spearman's correlation analyses, depending on normality assumptions (Research Aims 1). These were followed by linear regression analyses to examine the effects of age and CLA engagement frequency on SCD score (Research Aims 1). Moderated regression assessed whether CLA engagement moderated the association between age and SCD score (Research Aim 2). In addition, bivariate correlations were performed to explore associations between engagement with specific types of CLA and total and domain-specific SCD score (Research Aims 3). Hierarchical regression analyses were subsequently conducted to examine whether these associations remained significant when controlling for age.

4.5.1 Association between sociodemographic factors and subjective cognitive decline

As presented in Table 4.3, no statistically significant differences were found in total SCD score or in any of the domain-specific scores (memory, language, executive function) across gender, education level, or marital status. Marital status was analysed as a dichotomous variable reflecting whether participants were living alone (single, divorced, or widowed) or living with someone. Non-parametric Mann-Whitney U tests were conducted for total SCD, memory, and executive function scores due to deviations from normality, whereas independent samples *t*-tests were applied for the language domain, which met the assumption of normality. Effect sizes (Cohen's d) for the language domain were minimal and consistent with the non-significant results.

For the non-parametric comparisons of total SCD, memory, and executive function scores, Cohen's d effect sizes were calculated following a two-step procedure. First, the rank-biserial correlation (*r*) was derived from the Mann-Whitney U test. This was done by taking the standardised test statistic (*z*) from the Mann-Whitney U test and dividing it by the square root of the total sample size, providing a standardised measure of the association between the groups (Tomczak and Tomczak, 2014). Second, the resulting rank-biserial correlation was converted into Cohen's d to allow comparison with parametric effect sizes (Borenstein, 2009). Effect sizes were minimal (see Table 4.3), consistent with the non-significant group differences. Similar

results were obtained when SCD status was used as the outcome variable (see Appendix 4.2, page 305).

Table 4.3. SCD score by education level, marital status, and gender

Domain	Variable	Test (U/*t*)	*p*-value	Cohen's d
Total SCD	Gender	U = 6036.50	*p* = .88	d = -.019
	Education level	U = 5030.50	*p* = .84	d = -.025
	Marital Status (Living alone / with someone)	U = 7841.00	*p* = .92	d = -.014
SCD-Memory	Gender	U = 6092.50	*p* = .97	d = -.005
	Education level	U = 4976.00	*p* = .75	d = -.004
	Marital Status (Living alone / with someone)	U = 7800.00	*p* = .87	d = -.024
SCD-Executive Function	Gender	U = 5628.50	*p* = .33	d = -.121
	Education level	U = 4902.00	*p* = .63	d = -.006
	Marital Status (Living alone / with someone)	U = 7862.50	*p* = .95	d = -.008
SCD-Language	Gender	*t* = -.31	*p* = .75	d = -.045
	Education level	*t* = .35	*p* = .73	d = .055
	Marital Status (Living alone / with someone)	*t* = .18	*p* = .86	d = .023

Note. **(**SCD) Subjective Cognitive Decline**,** (U) Mann-Whitney U test; (t) Independent Samples t-test.

4.5.2 Association between cognitive leisure activity engagement, age and subjective cognitive decline

Correlation analyses were conducted to examine relationships between CLA engagement, age, and SCD score based on the distribution of the variables (Table 4.4). CLA engagement

variables (frequency and variety) were approximately normally distributed, whereas the total SCD score, and the memory and executive function subdomain scores showed moderate skewness. Accordingly, Spearman's rho correlations were used for analyses involving these skewed SCD measures, while Pearson's correlations were applied for the language domain, which met normality assumptions. This approach ensured that the selection of correlation methods was consistent with the distributional characteristics of the dependent variables.

Results indicated that greater CLA engagement and variety were significantly associated with lower SCD concerns across all domains, with correlation coefficients ranging from -.123 to -.186 ($p < .05$). Age demonstrated small but significant positive correlations with SCD score in all domains, ranging from .127 to .208 ($p < .05$). Age showed a small, significant negative correlation with CLA engagement variety, indicating a slight decline in the diversity of activities with increasing age, while no significant association was observed with CLA engagement frequency, suggesting that participation frequency does not change substantially with age. These findings indicate consistent associations between age, CLA engagement, and SCD measures. Similar analyses with SCD status as the outcome variable showed consistent results (see Appendix 4.2, page 306).

Table 4.4. Correlation coefficients among SCD scores, CLA variables, and age

Variables	1	2	3	4	5	6	7
1. CLA Engagement Variety	1	.823**	-.152*	-.163**	-.168**	-.123* †	-.144*
2. CLA Engagement Frequency	.823**	1	-.063	-.186**	-.182**	-.170**†	-.146*
3. Age	-.152*	-.063	1	.174**	.151*	.127* †	.208**
4. Total SCD	-.163**	-.186**	.174**	1	.910**	.854**†	.842**
5. SCD-Memory	-.168**	-.182**	.151*	.910**	1	.674**†	.654**
6. SCD-Language	-.123*†	-.170**†	.127*†	.854**†	.674**†	1	.620**†
7. SCD-Executive Function	-.144*	-.146*	.208**	.842**	.654**	.620**†	1

Note. ** p < .01, * p < .05, two-tailed tests; SCD (Subjective Cognitive Decline); CLA (Cognitive Leisure Activity). Spearman's rho correlations were used for all associations except those involving the language domain, which was assessed using Pearson correlation (†).

4.5.3 Regression analysis

Linear regression analyses were conducted to examine the extent to which age and CLA engagement predicted total SCD concerns. CLA engagement variety was excluded from the regression models due to its high correlation with CLA engagement score ($\rho = .823$, $p < .01$), which raised concerns about multicollinearity. Age was included as a covariate because it showed a significant bivariate relationship with total SCD scores, whereas other demographic variables did not. To ensure robustness of parameter estimates and to address potential non-normality in residuals, percentile bootstrapping with 1,000 resamples was applied to generate 95% confidence intervals. B, Standard Error, Beta, *t*, and *p*-values are reported from the standard regression coefficients table, whereas 95% confidence intervals were derived using percentile bootstrapping with 1,000 resamples. Effects were interpreted as statistically robust if the bootstrapped confidence intervals did not include zero (Efron, 1993; Field, 2024).

The regression model predicting total SCD score was statistically significant (F (2, 252) = 9.394, $p < .001$), explaining approximately 6.2% of the variance (Adjusted $R^2 = .062$) (see Table 4.5). Age had a significant positive association with SCD score ($b = .114$, $\beta = .169$, $p = .006$, 95% CI [.029, .206]), indicating that older participants reported higher levels of SCD concerns. CLA engagement frequency showed a significant negative association with SCD score ($b = -.118$, $\beta = -.191$, $p = .002$, 95% CI [-.198, -.042]), suggesting that greater CLA engagement was linked to fewer SCD concerns.

A binary logistic regression using SCD status as the outcome variable yielded similar results, with both age and CLA engagement frequency remaining statistically significant predictors (see Appendix 4.2, page 307).

Table 4.5. Linear regression predicting total SCD score

Variable	*b*	Standard Error	Beta (*β*)	*t*	*p*-value	95% CI Bootstrap
Constant	7.182	.337	–	21.283	< .001	[6.522, 7.934]
Age	.114	.041	.169	2.770	.006	[.029, .206]
CLA Engagement Frequency	-.118	.038	-.191	-3.136	.002	[-.198, -.042]
Model Summary	$R^2 = .069$, Adjusted $R^2 = .062$, F (2, 252) = 9.394, $p < .001$					

Note. 95% confidence intervals (CI) calculated using 1000 bootstrap samples; SCD (Subjective Cognitive Decline); CLA (Cognitive Leisure Activity)

The regression model predicting memory score was statistically significant, F (2, 252) = 7.362, p < .001, with an adjusted R^2 of .048 (see Table 4.6). Age significantly predicted memory score (b = .044, β = .138, p = .026, 95% CI [.004, .085]), indicating that older individuals reported greater memory-related concerns. Similarly, CLA engagement frequency were a significant negative predictor of memory score (b = -.052, β = -.181, p = .003, 95% CI [-.090, -.013]), suggesting that higher engagement in CLA was associated with fewer memory complaints.

Table 4.6. Linear regression predicting memory score

Variable	*b*	Standard Error	Beta (*β*)	*t*	*p*-value	95% CI Bootstrap
Constant	2.698	.159	–	16.966	< .001	[2.401, 3.037]
Age	.044	.019	.138	2.246	.026	[.004, .085]
CLA Engagement Frequency	-.052	.018	-.181	-2.949	.003	[-.090, -.013]
Model Summary	R^2 = .055, Adjusted R^2 = .048, F (2, 252) = 7.362, p < .001					

Note. 95% confidence intervals (CI) calculated using 1000 bootstrap samples; SCD (Subjective Cognitive Decline); CLA (Cognitive Leisure Activity)

The regression model predicting language score was statistically significant, F (2, 252) = 5.573, p = .004, with an adjusted R^2 of .035 (see Table 4.7). CLA engagement frequency score significantly and negatively predicted language score (b = -.032, β = -.162, p = .009, 95% CI [-.057, -.007]), suggesting that greater CLA engagement frequency was associated with fewer language-related cognitive concerns. Age was a marginally significant positive predictor (b = .025, β = .116, p = .061, 95% CI [.003, .050]), indicating a trend toward increased language-related complaints with advancing age.

Table 4.7. Linear regression predicting language score

Variable	*b*	Standard Error	Beta (*β*)	*t*	*p*-value	95% CI Bootstrap
Constant	2.442	.110	–	22.185	< .001	[2.223, 2.653]
Age	.025	.013	.116	1.881	.061	[.003, .050]
CLA Engagement Frequency	-.032	.012	-.162	-2.622	.009	[-.057, -.007]
Model Summary	R^2 = .042, Adjusted R^2 = .035, F (2, 252) = 5.573, p = .004					

Note. 95% confidence intervals (CI) calculated using 1000 bootstrap samples; SCD (Subjective Cognitive Decline); CLA (Cognitive Leisure Activity)

The regression model predicting executive function score was statistically significant, F (2, 252) = 8.656, $p < .001$, with an adjusted R^2 of .057 (see Table 4.8). Age significantly predicted executive function score (b = .045, β = .191, p = .002, 95% CI [.015, .075]), indicating that older individuals reported more executive-related cognitive concerns. CLA engagement frequency also significantly and negatively predicted executive function score (b = -.033, β = -.155, p = .012, 95% CI [-.061, -.009]), suggesting that greater engagement in CLA was associated with fewer executive complaints.

Table 4.8. Linear regression predicting executive function score

Variable	*b*	Standard Error	Beta (*β*)	*t*	*p*-value	95% CI Bootstrap
Constant	2.042	.119	–	17.201	< .001	[1.809, 2.276]
Age	.045	.015	.191	3.120	.002	[.015, .075]
CLA Engagement Frequency	-.033	.013	-.155	-2.531	.012	[-.061, -.009]
Model Summary	R^2 = .064, Adjusted R^2 = .057, F (2, 252) = 8.656, $p < .001$					

Note. 95% confidence intervals (CI) calculated using 1000 bootstrap samples; SCD (Subjective Cognitive Decline); CLA (Cognitive Leisure Activity)

4.5.4 Moderated regression analysis of subjective cognitive decline

Moderated regression analyses were performed using a hierarchical approach to examine whether CLA engagement moderated the association between age and total SCD score. Age was selected as the predictor variable to be moderated based on prior analyses, which showed that age had a significant bivariate and multivariate association with SCD score, whereas other demographic variables (e.g., gender, education level, marital status) did not. All predictor variables were mean centred prior to computing the interaction term between age and CLA engagement frequency. Bootstrapping was applied, as described above.

In Step 1, age and CLA engagement were entered as predictors, explaining a significant portion of variance in SCD score (R^2 = .069, F (2,252) = 9.394, $p < .001$). Both age (β = .169, p = .006) and CLA engagement (β = -.191, p = .002) were significant predictors. In Step 2, the interaction term (Age × CLA engagement) was added; however, the change in explained variance was not significant (ΔR^2 = .001, ΔF (1,251) = .396, p = .530), indicating that CLA engagement did not significantly moderate the relationship between age and SCD concerns.

Thus, age was associated with higher SCD concerns, but this relationship did not differ by CLA engagement level in this sample. This non-significant moderation is consistent with the non-significant correlations observed between age and CLA engagement variables (see Table 4.4).

Table 4.9. Moderated regression analysis predicting total SCD score

Variable	*b*	Standard Error	Beta (*β*)	*t*	*p* value	95% CI Bootstrap
Model 1						
Constant	7.182	.337	–	21.283	< .001	[6.507, 7.880]
Age	.114	.041	.169	2.270	.006	[.029, .207]
CLA Engagement Frequency	-.118	.038	-.191	-3.136	.002	[-.199, -.043]
Model Summary	R^2 = .069, Adjusted R^2 = .062, F (2, 252) = 9.394, p < .001					
Model 2						
Constant	7.198	.339	–	21.243	< .001	[6.517, 7.906]
Age	.118	.042	.174	2.825	.005	[.033, .207]
CLA Engagement Frequency	-.120	.038	-.195	-3.179	.002	[-.203, -.047]
CLA Engagement Frequency x Age	.003	.005	.039	.629	.530	[-.008, .014]
Model Summary	R^2 = .071, ΔR^2 = .001, F (3, 251) = 6.380, p < .001 ΔF (1,251) = .396, p = .530					

Note. 95% confidence intervals (CI) calculated using 1000 bootstrap samples; SCD (Subjective Cognitive Decline); CLA (Cognitive Leisure Activity)

The same moderated regression analysis was repeated for each SCD domain (memory, language, and executive function). In all models, the interaction between age and CLA engagement frequency score remained non-significant, indicating that CLA engagement frequency did not moderate the relationship between age and domain-specific SCD concerns. Full results are presented in Appendix 4.3 (page 311). Similar moderated logistic regression analyses were conducted using SCD status as the outcome variable. The results mirrored those regressions, with no significant age × CLA engagement frequency interaction effect observed (see Appendix 4.2, page 308).

4.5.5 Relationship between cognitive leisure activity types and subjective cognitive decline

To explore the relationship between specific CLA types and SCD score, correlation analyses were conducted for both total SCD score and domain-specific scores, including memory,

language, and executive function (Table 4.10). Given the non-normal distribution of total SCD, memory, and executive function scores, Spearman's rho correlations were used for these domains, whereas Pearson correlation was applied for language score, which showed a normal distribution. Additionally, hierarchical regression analyses controlling for age were performed to examine whether the observed associations remained significant when accounting for age. Bootstrapping was applied, as described above.

Several CLA types were significantly associated with lower SCD score. Notably, activities such as crossword/jigsaw/sudoku, reading newspapers or books, attending the theatre or concerts, and exercising showed significant negative correlations with total and/or sub-domain SCD score. For example, exercise and engaging in crossword, jigsaw or sudoku were consistently related to lower SCD concerns across all domains (total, memory, language, and executive function). Some activities, such as playing chess, checkers or backgammon and attending a club or group activity outside the home, were specifically correlated with memory score only. Other CLA types, including playing cards, socialising, and arts and crafts, showed no significant associations. Similar patterns were observed when using SCD status as the outcome variable, with individuals who engaged in crossword, jigsaw, or sudoku, attended theatre or concerts, or exercised being less likely to report having SCD (see Appendix 4.2, page 309).

Hierarchical regression analyses controlling for age revealed that the significant associations between CLA participation and continuous SCD measures, including total and sub-domain scores, remained significant. For SCD status, age-adjusted logistic regression analyses indicated that engagement in certain CLA types (e.g., crossword/jigsaw/sudoku and exercise) remained significantly associated with a lower likelihood of SCD, whereas participation in attending the theatre, concert, or symphony showed a trend-level association (see Appendix 4.2). These findings suggest that the observed relationships between specific CLA participation and lower SCD concerns were largely independent of age differences. Detailed regression results for continuous SCD scores are presented in Appendix 4.4 (page 315).

Table 4.10. Correlations between specific CLA types and SCD score

CLA Activity Types	Total SCD score	Memory Score	Language Score	Executive Score
Chess/Checkers/Backgammon	-.116	**-.156**	-.051	-.082
	p =.063	***p* =.013**	*p* =.415	*p* =.192
Crossword/Jigsaw/Sudoku	**-.161**	**-.169**	**-.129**	**-.148**
	***p* =.010**	***p* =.007**	***p* =.040**	***p* =.018**
Playing cards/Board Games	-.036	-.041	-.065	-.002
	p =.564	*p* =.511	*p* =.303	*p* =.980
Socialising with friends	-.037	.003	-.075	-0.45
	p =.561	*p* =.956	*p* =.233	*p* =.474
Attending a club or group activity outside the home	-.120	**-.154**	-.080	-.066
	p =.056	***p* =.014**	*p* =.202	*p* =.294
Volunteering	-.059	-.045	-.018	-.098
	p =.345	*p* =.475	*p* =.775	*p* =.120
Painting/drawing/arts crafts	-.001	.008	-.021	-.002
	p =.993	*p* =.901	*p* =.738	*p* =.970
Singing or playing instrument	-.096	-.100	-.060	-.087
	p =.125	*p* =.110	*p* =.336	*p* =.168
Watching TV/listening to music	-.018	.003	-.066	-.021
	p =.777	*p* =.956	*p* =.292	*p* =.735
Reading a newspaper, book, or magazine	**-.151**	**-.188**	**-.155**	-.028
	***p* =.016**	***p* =.003**	***p* =.013**	*p* =.653
Attending the theatre, concert or symphony	**-.148**	**-.150**	-.080	**-.152**
	***p* =.018**	***p* =.016**	*p* =.203	***p* =.015**
Going to a museum or exhibition	-.107	-.104	-.056	-.099
	p =.089	*p* =.096	*p* =.371	*p* =.115
Attending a conference, lecture, or course	-.053	-.035	-.016	-.090
	p =.398	*p* =.575	*p* =.804	*p* =.151
Attending a religious service	.095	.080	.055	.098
	p =.131	*p* =.203	*p* =.378	*p* =.119
Writing (letter, poem, journal, diary)	.009	-.006	.001	.056
	p =.884	*p* =.926	*p* =.993	*p* =.374
Exercise (any type)	**-.230**	**-.197**	**-.207**	**-.228**
	***p* <.001**	***p* =.002**	***p* <.001**	***p* <.001**

Note. SCD (Subjective Cognitive Decline); CLA (Cognitive Leisure Activity)

4.6 Discussion

This chapter's investigation explored the correlation between SCD and participation in CLA among older individuals, considering sociodemographic influences. SCD concerns, both total

and across memory, language, and executive function domains, were not significantly associated with gender, education level, or marital status, suggesting that these demographic variables may play a limited role in explaining subjective perceptions of cognitive change. However, age was significantly associated with SCD, indicating that as age increased, individuals reported more SCD concerns. Greater engagement and variety in CLA were also consistently linked to lower SCD concerns across all domains. Nevertheless, no moderating effect of CLA engagement was found on the relationship between age and SCD. Finally, several specific types of CLA, such as puzzle-solving, reading, attending club or group activity, and exercise, were identified as particularly beneficial in relation to lower SCD concerns. Taken together, these findings suggest that active and varied engagement in cognitively stimulating activities may play a supportive role in maintaining subjective cognitive health in later life.

This research's significant correlation between older age and greater SCD concerns corresponds with prior findings that identifies age as a robust predictor of SCD complaints. Older individuals frequently report cognitive concerns even in the absence of objective decline (Genziani *et al.*, 2013; Rijs *et al.*, 2015; Taylor, Bouldin and McGuire, 2018; Wen *et al.*, 2021). Such reports may indicate increased awareness of age-related changes or genuine neurobiological modifications linked to ageing. The present findings extend prior research by demonstrating that the age–SCD association is apparent not only in the overall SCD score but also in domain-specific issues, including memory and executive function. The correlation between age and language-related SCD concerns was weakly associated. Although this finding may appear to contrast with some published research, it is broadly consistent with evidence suggesting that language abilities are relatively resilient to age-related cognitive changes compared with other domains. Routine language functions and everyday communication tend to be preserved well into later life, especially when linguistic demands are low or familiar (Maruta and Martins, 2019; Zhang *et al.*, 2025). Moreover, age-related difficulties in speech production and word retrieval often emerge under more demanding conditions or later stages of cognitive change, which may limit the detectability of subtle subjective language concerns in cross-sectional analyses (Busby *et al.*, 2022). Together, these factors may explain why age-related language concerns did not reach statistical significance in the current sample. Additionally, this research did not identify significant associations between SCD and gender or marital status. This contrasts with previous studies reporting higher levels of SCD among women (Roh, Dan and Kim, 2021; Lin *et al.*, 2022; Reynolds *et al.*, 2022; Carter *et al.*, 2023)

and among individuals who are unmarried (Weng *et al.*, 2020; Wen *et al.*, 2021; Ma *et al.*, 2024). Being single, divorced, or widowed has been linked to elevated risk for SCD concerns due to reduced social and cognitive stimulation, emotional support, and health-related assistance commonly found in paired relationships (Ma *et al.*, 2024; Zhang, Zheng and Li, 2024). It is possible that the absence of significant differences in this sample is due to limited variability, as most participants were women and a large percentage were married or widowed, reducing the statistical power to detect differences between groups.

Besides sociodemographic correlates such as age, gender, and marital status, educational background plays an important role in SCD. Although several studies have reported that lower education increases the risk of SCD (Chen *et al.*, 2014; Schütz *et al.*, 2020; Weng *et al.*, 2020; Mondini *et al.*, 2022), the present research found no significant relationship between education level and SCD outcomes. There may be some explanation for this phenomenon based on the Cognitive Reserve theory, which claims that greater educational attainment mitigates cognitive decline by compensating for age-related neuropathological changes (Stern, 2009). In support of this, Karr et al. (2024) demonstrated that subjective concerns may not necessarily reflect poor neuropsychological performance, rather subtle neural changes or an absence of high memory and executive function scores in high-functioning older adults. This means that individuals with high levels of education may still report SCD despite having intact objective cognition (Karr *et al.*, 2024). Conversely, higher levels of education may increase awareness of subtle changes, resulting in more frequent SCD reports among cognitively healthy individuals (Rabin, Smart and Amariglio, 2017; Carter *et al.*, 2023). It is also possible that there is no significant association in this research because of the sample characteristics: most participants had no degree-level qualifications, and few held a bachelor's degree or higher, reducing the variability of educational background. Furthermore, many respondents selected *"None of the above"* when asked to indicate their highest educational attainment. This may have been due to difficulty mapping older qualifications into contemporary survey categories, such as O-levels or School Certificates that were phased out or replaced by GCSEs in the late 1980s. As a result, details may have been lost or misclassified. Although these factors may not have had a significant impact on the overall analyses, they may have reduced the variability and limited the ability to detect more subtle associations. Therefore, the non-significant findings likely reflect both the educational profile of the sample and the complex, multifactorial relationship between education and SCD.

The present research found that greater engagement in CLA was significantly associated with fewer SCD concerns. These findings align with previous evidence, including a recent systematic review carried out by the researcher (Chapter 2; Akbayrak *et al.*, 2024), which reported consistent associations between higher CLA participation and lower SCD. Similarly, Lee (2014) found that older adults engaging in more CLA reported fewer memory complaints, while a longitudinal study by Stieger and Lachman (2021) showed that individuals who increased their CLA over nine years experienced smaller declines in executive function. Taking these results together, they are consistent with previous evidence and collectively support the Cognitive Reserve framework (Stern, 2009), which posits that mental stimulation may improve one's ability to cope with age-related brain changes without causing noticeable symptoms. This research further highlights the importance of CLA variety. Previous research indicates that greater diversity in daily cognitive, physical, and social activities is linked to better objective cognitive outcomes, including global cognition, executive function, and episodic memory (Lee, Charles and Almeida, 2021; Brown *et al.*, 2023; Leng *et al.*, 2024). This research extends this evidence to subjective cognitive experiences by showing a positive relationship between higher CLA diversity and lower SCD concerns. Engaging in a broader range of activities may therefore contribute not only to objective cognitive health but also to more positive perceptions of one's cognitive ageing.

Despite this, the degree of CLA engagement did not moderate the relationship between age and SCD, contrary to expectations based on prior theoretical accounts of Cognitive Reserve (Stern, 2009). Although cognitively stimulating leisure activities are generally thought to protect against age-related cognitive decline (Bielak *et al.*, 2014; Mao, Xie and Lu, 2023), cross-sectional data from this research did not support a moderating effect. Longitudinal evidence suggests that activities such as adult literacy, computer use, and puzzles can reduce risk of dementia over a period of 10 years in older adults (Wu *et al.*, 2023). It is also possible that certain types of CLA may be beneficial in protecting against cognitive decline as people age (Wu *et al.*, 2023). Although consistent with the present findings, longitudinal data from four ageing cohorts showed that higher CLA engagement was associated with better cross-sectional cognitive performance, but baseline activity did not moderate age-related cognitive decline (Gibbons *et al.*, 2012). Overall, these findings suggest that although CLA engagement is often considered beneficial in the literature, its moderating effect on the age–SCD relationship may not be consistent. This may reflect the cross-sectional design of the research, which cannot capture long-term protective effects. There is also a possibility that CLA did not emerge as a

significant moderator due to the linear relationship assumed in the analysis: any increase in CLA engagement is treated equally beneficial. However, in reality, moving from no engagement to some engagement might provide more protection than incremental increases among already engaged individuals. This suggests that the protective effect of CLA may not be dose-dependent, which could explain the absence of a moderation effect in the current cross-sectional analysis in this research.

The results of this research regarding specific CLA types and their associations with both total and domain-specific SCD are broadly consistent with prior studies. Research has demonstrated that activities such as word puzzles and long-term involvement with jigsaw puzzles can improve cognitive performance across several domains (Brooker *et al.*, 2019), and that regular crossword participation may delay the onset of memory decline (Fissler *et al.*, 2018). Reading has similarly been associated with fewer subjective memory complaints (Nemoto *et al.*, 2018), and a reduced risk of cognitive decline over time (Chang, Wu and Hsiung, 2021). In addition, the present research found that participation in club-based or community-based social activities was associated with fewer SCD concerns, in accordance with previous findings that linked social engagement to better cognitive functioning in later life (Lee and Kim, 2016; Li, Feng and Chen, 2025). However, volunteering did not show a significant association with SCD in this research, diverging from some literature reporting cognitive benefits of volunteering (Sharifian *et al.*, 2020). This discrepancy may reflect unmeasured factors such as motivation, intensity, or the social context of volunteering. As a result, despite prior studies primarily focusing on objective cognitive outcomes, the present findings expand this understanding by demonstrating that diverse types of CLA are also associated with lowered SCD concerns, highlighting their broader relevance for cognitive ageing. These findings emphasise that maintaining diverse cognitive activity may be as important as frequency for sustaining subjective cognitive health in later life.

4.7 Chapter Summary

This chapter used statistical analysis to examine the relationship between SCD and engagement in CLA among older adults. Preliminary analyses confirmed data reliability and sample adequacy, ensuring the robustness of subsequent tests. Descriptive and inferential analyses revealed that while age was significantly associated with greater SCD concerns, gender, education, and marital status were not. Both the frequency and diversity of CLA engagement

were strongly associated with lower SCD concerns across total and domain-specific measures (memory, language, and executive function). The relationship between age and SCD was not moderated by participation in CLA, but several specific kinds of activity, including puzzle-solving, reading, participating in groups or clubs, were significantly associated with lower probability or severity of SCD, even after controlling for age. These findings suggest that active and varied engagement in cognitively stimulating activities may contribute to maintaining subjective cognitive health in later life. While these findings are discussed in relation to previous literature here, a more detailed interpretation, including consideration of methodological strengths and limitations, and integration with qualitative research findings is presented in Chapter 7 and discussed further in Chapter 8. The following two chapters present the findings from the qualitative semi-structured interviews, providing deeper insight into older adults' experience of SCD and engagement in CLA.

CHAPTER 5- Participants' Experiences of Subjective Cognitive Decline

5.1 Introduction

This chapter presents the findings from the qualitative research that investigated the experiences of individuals with subjective cognitive decline (SCD) and the influences shaping their engagement in cognitive leisure activity (CLA). Although the primary focus of this phase was to explore issues influencing CLA participation, the qualitative findings also provide deeper insights into how individuals experience SCD, its perceived impacts, and the coping strategies they employ. This chapter begins with a detailed description of the research participants, followed by a summary of the key themes identified through the analysis of in-depth, semi-structured interviews. For clarity, the qualitative findings are presented across two chapters (Chapters 5 and 6). The following sections present the themes related to participants' experiences with SCD, including how they perceive cognitive changes, how these changes affect their daily life, and the coping responses they employ. Chapter 6 then explores the relationship between SCD and CLA engagement, examining the motivations, barriers, and strategies that support participation.

5.2 Participant Demographics

A total of 20 participants with SCD, identified by an SCD score of 7 or higher on the Subjective Cognitive Decline Questionnaire (SCD-Q: Rami *et al.*, 2014), took part in semi-structured interviews. Participants were purposively sampled to reflect variation in both SCD severity and levels of CLA engagement. Specifically, individuals with higher SCD scores were prioritised to align with the research's focus on more pronounced cognitive concerns. To ensure diversity in CLA engagement, participants were categorised into two groups based on their score on the Cognitive Leisure Activity Scale (CLAS; Galvin, Tolea and Chrisphonte, 2021): ten participants had lower engagement (score below 31), and ten had higher engagement (score of 31 and above).

Descriptive characteristics of the qualitative participants are presented in Table 5.1. Participants ranged in age from 60 to 85 years (16 women and 4 men), with SCD-Q score ranging from 7 to 20 and CLAS total score from 20 to 55. CLA variety score ranged from 7 to

14, indicating a wide range of engagement patterns. Fourteen interviews were conducted face-to-face in participants' homes or community settings, while the remaining six participants, who were unable to take part in face-to-face interviews, were conducted online via Google Meet. The gender imbalance reflected the lower proportion of male participants in the original quantitative sample (25.1%) and was further influenced by limited eligibility and willingness among male participants to take part in interviews. Despite this limitation, the purposive sampling strategy aimed to maximise diversity and capture a range of experiences from the available pool of interested participants.

In addition to demographic characteristics and scale scores, Table 5.1 also presents participants' responses to three key self-report questions assessing subjective cognitive awareness, perceived change over time, and help-seeking intentions. These questions provide contextual insight into how participants interpreted their cognitive experiences and whether such concerns lead into intentions to seek professional support. Including these items allows for a more comprehensive interpretation of participants' narratives within the qualitative analysis.

Table 5.1. Interviewee characteristics

Participant's ID	Age	Gender	SCD-Q score	CLAS score	Highest level of education	Living Arrangements	Do you perceive memory or cognitive difficulties?	Would you ask a doctor about these difficulties?	In the last two years, has your cognition or memory declined?
P1	80	Male	7	39	A-level	With spouse	No	No	No
P2	78	Female	12	28	Bachelor's degree	With spouse	Yes	Yes	Yes
P3	80	Female	16	36	A-level	With family	Yes	No	Yes
P4	71	Male	12	23	GCSE	With family	Yes	No	No
P5	70	Female	9	27	A-level	With spouse	No	Yes	Yes
P6	85	Male	13	42	Bachelor's degree	Alone	Yes	No	No
P7	70	Female	17	31	GCSE	Alone	No	Yes	No
P8	65	Male	15	39	Master's degree	Alone	Yes	No	No
P9	83	Female	20	28	GCSE	Alone	Yes	No	Yes
P10	66	Female	14	43	Master's degree	With spouse	Yes	No	Yes
P11	84	Female	14	24	Bachelor's degree	Alone	Yes	No	Yes
P12	60	Female	14	34	Bachelor's degree	With spouse	Yes	No	Yes

Participant's ID	Age	Gender	SCD-Q score	CLAS score	Highest level of education	Living Arrangements	Do you perceive memory or cognitive difficulties?	Would you ask a doctor about these difficulties?	In the last two years, has your cognition or memory declined?
P13	60	Female	11	20	Bachelor's degree	With partner	Yes	No	Yes
P14	67	Female	11	22	A-level	With spouse	Yes	Yes	Yes
P15	68	Female	12	25	GCSE	With spouse	Yes	No	Yes
P16	80	Female	17	27	GCSE	With spouse	Yes	Yes	Yes
P17	76	Female	13	33	Master's degree	With spouse	Yes	No	No
P18	81	Female	11	39	Master's degree	With spouse	Yes	No	Yes
P19	79	Female	7	28	Bachelor's degree	Alone	Yes	No	Yes
P20	74	Female	9	55	A-level	With family	No	Yes	No
Mean (*SD*)	74.5 (7.8)	-	13.2 (3.5)	33.5 (9.2)	-	-	-	-	-

Note. A-level = Advanced Level; GCSE = General Certificate of Secondary Education; Cognitive Leisure Activity Scale (CLAS) scores range from 0 to 80, with higher scores indicating more activity participation; Subjective Cognitive Decline Questionnaire (SCD-Q) scores range from 0 to 24, with higher scores indicating greater subjective cognitive decline concerns.

5.3 Overview of Overarching Themes

Thematic analysis of the interview data resulted in three overarching themes: (1) *Lived Experience of Subjective Cognitive Decline,* (2) *Negative Impacts of Subjective Cognitive Decline*, and (3) *Coping Strategies for Subjective Cognitive Decline*. Each theme captures a distinct but interconnected aspect of participants' experiences, encompassing how they perceive cognitive changes, the emotional and social consequences of these experiences, and the ways in which they attempt to cope and adapt. Together, these themes illustrate the multifaceted nature of SCD and the dynamic ways individuals navigate its challenges in their daily lives. The overarching themes and their interrelationships are summarised in Figure 5.1. The following sections present each theme in detail, supported by illustrative quotations.

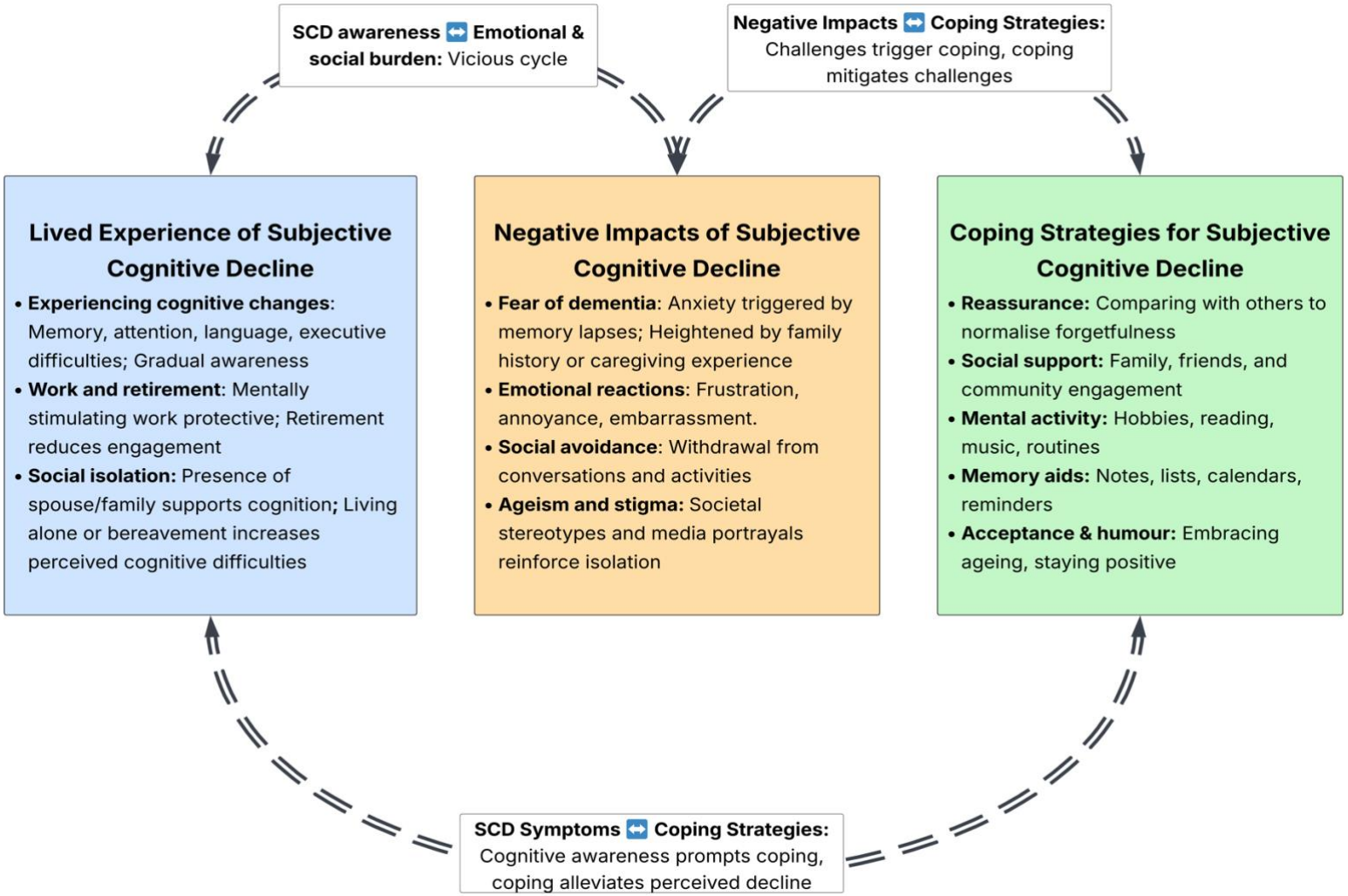

Figure 5.1. A conceptual model of the subjective cognitive decline (SCD) experience, psychosocial impact, and coping process.

5.4 Lived Experience of Subjective Cognitive Decline

This theme brings together the personal and social dimensions of SCD, as participants described how daily cognitive challenges, work experiences, and social connectedness influenced their perceptions of mental sharpness. Most participants said they had some symptoms of SCD, and these symptoms affected their daily activities in different ways. Many first noticed problems with memory, like forgetting names or places, but also talked about trouble with attention, planning, and language. They thought about when they first noticed these changes, and some connected them to important events in their lives. Even though many had different symptoms, only one participant had sought medical advice; others did not pursue professional help. Previous occupations that required a lot of mental effort were seen as helpful in keeping the mind active, while retiring often made SCD symptoms worse by breaking up daily routines and cutting down on social contact. Feeling lonely or isolated, especially for those living alone or who had lost a partner, was also mentioned as something that made cognitive decline feel more intense. The following sections investigate these connected aspects more closely, demonstrating how both internal processes and external circumstances contribute to the subjective reality of cognitive change in later life.

5.4.1 Living with the symptoms

Participants frequently mentioned a variety of perceived cognitive challenges that impacted their day-to-day lives when discussing their experiences with SCD, including issues with memory, attention, language, and executive function. Many participants described these problems as overlapping and interwoven aspects of their cognitive decline rather than as discrete issues.

Participants frequently considered when and how they initially became aware of these cognitive challenges. Many people saw their experience with SCD as a gradual process developing over several years. Some reported more recent changes, especially within the last one to two years, while others traced the start of their symptoms back ten years or more:

> *"I would say I'm 69 now. I would say about 10 years ago […] it seemed to just reach a level and stay at that level" (P15: SCD=12, low CLA)*

Several participants linked the emergence or acceleration of their cognitive concerns to life transitions such as retirement or to contextual factors like the COVID-19 pandemic. One participant reflected:

> *"Probably, that's probably a couple of years, and I've noticed it more. I think the pandemic had a big effect, as it did, on most people, in that you weren't mixing as much, and therefore you weren't speaking to people." (P2: SCD=12, low CLA)*

These insights highlight how recognising changes in cognitive ability in everyday life is a personal and complex process. They suggest that how individuals notice their symptoms is influenced not just by their actual cognitive performance, but also by their social environment and the situations they find themselves in.

Among the most mentioned challenges were memory-related difficulties, especially when it came to remembering names and specific words. This issue was a frequent topic in interviews and was often linked to social settings where recalling names played an important role. One participant shared:

> *"Ehh, I'm struggling. I struggle with people's names a lot, and I do quite a few groups where I meet up with the same women every week [...] and there's only a handful of people whose names I can remember, and I have to keep asking people 'who' so it's remembering names. I struggle with names. Yeah, I know it's a fairly common thing with a lot of people, but it's definitely got a lot worse with me." (P12: SCD=14, high CLA)*

Despite these difficulties, most participants expressed confidence that they would eventually recall the information they had forgotten and did not focus on their memory lapses. However, a growing sense of cognitive change seemed to be influenced by the frequency of such lapses. A number of participants reported having trouble remembering where they had placed objects, forgetting their purpose when they entered a room, or having brief memory failures that interrupted conversations. Some reported that they occasionally found it difficult to live independently because they forgot to do important daily tasks like turning off appliances or taking their medications. A typical example of these forgetfulness episodes was described as follows:

"You go into a room, and you forget what you're there for, so you retrace your steps." (P7: SCD=17, high CLA)

The sense of temporal disorientation also emerged in accounts of forgetting dates or seasons:

"I'm looking at that right at the back of the house, looking at brown leaves, and thinking, 'goodness, is it winter', and taking me several seconds to remember it was February, you know." (P17: SCD=13, high CLA)

Even enjoyable activities can be disrupted by distractions, making it more challenging to maintain focus. Participants reported having difficulty concentrating on tasks that required sustained cognitive effort. For instance, reading had become more effortful due to frequent distractions as illustrated:

"My leisure activity is reading. But I notice I am doing less now where I could cheerfully have spent an entire afternoon with a good book. I know something distracts me. I get distracted, […] So, I don't know if it's just the spirit of the age that we are all a bit more scatterbrained." (P17: SCD=13, high CLA)

Some participants found that they lost track during conversations or became easily sidetracked while completing routine tasks. As one participant expressed:

"As I try to hold a conversation, you know that my concentration isn't the same as that I would lose track of what I'm saying at times. Whenever I'm having a conversation." (P15: SCD=12, low CLA)

Closely related to memory and attention difficulties were challenges in language and verbal expression. Many participants described struggles with word-finding, sentence formulation, and fluency, one participant articulated this experience:

"I can start sentences and forget in the middle what I'm talking about, I completely forget. I just forget loads and loads of nouns, and then I might just pick up the first letter or similar words […]. I mean, it's different from when people forget. When you're younger, people are always forgetting the odd thing, aren't they, but this feels different." (P11: SCD=14, low CLA)

Participants often made up for language-related difficulties by using different words or detailed explanations, or by taking longer pauses to find the right words. Some mentioned that their speech became slower overall, noting it required more time and effort to express their thoughts clearly.

In addition, participants talked about challenges with their executive functions, such as taking longer to make decisions, having a harder time planning and organising tasks, and needing more help from others or tools. One person mentioned hesitating to handle new tasks on their own because they found it harder to plan, while another explained how poor organisational skills made traveling more difficult:

> *"I've always loved to travel. We've always travelled and now, not particularly because of my forgetfulness, but because my organisational skills are not as good. So that makes me more reluctant to plan holidays all over the world, you know, managing the trains, the planes, whatever. I couldn't do that easily. And now it's more stressful to do it, and therefore I avoid that stress." (P2: SCD=12, low CLA)*

Additionally, multitasking became more challenging, and some reported an increasing tendency to lose track of their routines or abandon tasks before finishing them. These overlapping cognitive difficulties highlight the intricate and frequently disjointed nature of the lived experience of SCD, where various cognitive domains, such as memory, attention, executive function, and language, interact and exacerbate one another daily.

It's worth noting that only one participant reported consulting a doctor about their cognitive issues, despite having symptoms in several different cognitive domains. She pointed out that neither a definitive conclusion nor additional support resulted from the consultation. For the rest, professional assistance was not sought, even in cases where symptoms were bothersome or persistent. Instead of seeing their cognitive function changes as a medical condition that needed to be treated, most participants saw them as a typical aspect of ageing. Awareness of the lack of effective treatments for conditions like dementia or Alzheimer's disease also contributed to reluctance to seek help, often reinforced by witnessing such illnesses in others. Some avoided medical advice to prevent worrying family members, particularly children and grandchildren, preferring instead to share concerns only with peers who might better understand their experiences.

5.4.2 The role of work and subjective cognitive decline

This subtheme emerged inductively during analysis and was not anticipated at the outset of the research. Participants frequently and spontaneously referred to their previous work roles when discussing cognitive changes, and these accounts were initially considered within the broader theme of coping strategies, specifically under the subtheme ‘keeping the mind occupied’, before being refined into a distinct subtheme. This subtheme examines how participants' professional experiences, their move into retirement, and their views on changes in cognitive ability are connected. Many participants described their careers as times when they were highly engaged mentally, especially when their jobs required diverse tasks or frequent problem-solving. For many, work was seen as a way to keep their minds active and to maintain their ability to think clearly and adjust to new situations. However, when they retired, there was often a noticeable drop-in daily mental activity, which was frequently linked to a growing awareness of cognitive changes.

Several participants emphasised the value of having a wide range of challenging and mentally stimulating duties during their working years. They believed that the mental effort needed to lead teams, process information, or respond to different situations helped them stay sharp. As one participant described:

> *“I used to manage agencies for [company’s name] [...] plan the programs for the people that visited all the convenience stores. So, it was quick. You had to be quick, got to really think about what you were doing [...] It was a hectic job, long hours, hectic, great job. I loved it, yeah [...] I've definitely noticed the decline over the last five years. So, I would definitely say yes [...] I wouldn't be able to go back now, because of the deterioration.” (P14: SCD=11, low CLA)*

In line with this, participants in cognitively demanding professions, such as management roles, described these environments as mentally stimulating and cognitively protective. Some mentioned that even less enjoyable jobs still offered a *“mental workout”* through activities like accounting, organising, or continuous learning. As one participant shared:

> *“I'm pretty sure it is, yeah. Because it involves a whole range of it involves, you know, for quite a lot of social interaction, involves planning and organizing and it involves numerical analysis and modelling and stuff. So, there's a number of different aspects to*

it that all of which, I think, keep your brain ticking over. Yeah." (P8: SCD=15, high CLA)

Participants working in dynamic environments, such as teaching or speech therapy, highlighted the necessity of thinking on their feet and tailoring their responses to different situations. This ongoing cognitive engagement was viewed as beneficial for maintaining mental sharpness over time. Those in leadership roles, such as head teachers, further emphasised that the challenges of managing staff and making critical decisions kept them mentally active and engaged:

"Yes, it was always a challenge. And for the last 10 years, I was a head teacher, so, you know, I got some management skills there to manage the school with 150 staff and about 600 children, so that kept me on my toes to be honest." (P2: SCD=12, low CLA)

However, retirement was described as a key turning point in cognitive engagement for many participants. Without the cognitively stimulating routines of work, some noticed the onset or acceleration of cognitive difficulties. Others also observed changes in social connections and daily structure, which they felt worsened any underlying forgetfulness. For these individuals, retirement was not just a life transition but a point at which SCD symptoms became more noticeable or more concerning:

"There's definitely been a change since I stopped really working and not having that kind of activity in your brain, that there's definitely a difference […] that I was still functioning on absolutely everything. I've noticed now that, like now, I do not stutter, but I slowdown in what I'm trying to say. I don't have all the wherefore like I used to have before, all the terminology, all the words, all the shall I say, the buzz words that used to be around when I used to be working. So, I've noticed a difference in that avenue." (P7: SCD=17, high CLA)

Some people experienced a decrease in social interaction and a loss of purpose as a result of this cognitive shift, which exacerbated feelings of loneliness or withdrawal. Retirement frequently results in a smaller social circle, fewer daily interactions with coworkers, and an increase in feelings of loneliness, all of which can have an impact on cognitive health. These more general shifts in daily routine and identity after retirement seemed to have an impact on how participants perceived and interpreted their cognitive challenges, though they weren't always made clear.

Taken together, these accounts suggest that the loss of cognitively demanding work and, for some, its associated social connections, may represent a turning point in the lived experience of SCD. While work was seen as a protective factor, retirement often highlighted or amplified perceived declines, shaping participants' understanding of their cognitive health in everyday life. In this way, continued mental stimulation through work, whether from challenging tasks, social interactions, or ongoing learning, emerged as a key element in participants' sense of 'keeping the mind sharp'.

5.4.3 The effect of social isolation on subjective cognitive decline

Having a spouse or a close family member in the household was seen as a source of comfort that helped reduce feelings of social isolation and loneliness, and it played a significant role in shaping participants' experiences with SCD. Frequent conversations and shared daily activities were considered important ways to keep the mind active, which in turn helped with memory and emotional stability. One participant mentioned how living with a spouse provided ongoing chances for meaningful conversation.

> *"I think it's fortunate we've got one another (implying her husband), because we've always got conversation going [...] I would think that you know, conversation is important. Conversations are going to be stimulating in some way." (P16: SCD=17, low CLA)*

However, those who had experienced bereavement or lived alone described how the absence of a companion made them more aware of their cognitive difficulties. Without someone to share experiences with, they felt disconnected from the world, which heightened their awareness of forgetfulness. One participant explained how living with a spouse could have helped with memory:

> *"And I think if my husband was alive, I would forget less, because when we do something together, we have someone to share it with and talk to. For example, when you go somewhere and you have conversations like 'do you remember that it was over there, right, yes I remember, did you see that?' it's good to keep that memory active." (P11: SCD=14, low CLA)*

A lack of such interaction, especially in the evenings, often led participants to withdraw further from activities, deepening their sense of isolation:

"No one to talk to… And you tend not to go out so much in the evenings, for instance, if you're on your own, so you're not meeting other people, and you don't get that stimulation. Yes, and you've got no one to argue with (laughing) is that stimulating, isn't it? I think yes (laughing)." (P19: SCD=7, low CLA)

This withdrawal, combined with loneliness, was perceived as a major factor contributing to worsening cognitive concerns. Participants frequently linked isolation to low mood and reduced alertness, which in turn made memory difficulties more noticeable:

"Other than that, so if I was totally on my own, I think there would be quite a difference, because it's then, well, what are you doing apart from sitting down? […] If I was on my own […] I did go through a patch like this, which I think might have been a bit of depression, especially after COVID, was don't need to go outside." (P7: SCD=17, high CLA)

They struggled to maintain consistent cognitive stimulation in the absence of support or reminders from others. Perceptions of decline seemed to be reinforced by this cycle of withdrawal, loneliness, and decreased activity.

Overall, participants viewed the presence of a spouse or close family member as crucial for staying mentally active and emotionally supported. Such relationships offered both comfort and cognitive stimulation, whereas those living alone were more likely to experience loneliness and social isolation, often linked to greater SCD concerns. Notably, participants who reported feeling lonely also tended to have higher SCD scores, lower CLA engagement, and were generally older. Regular social contact and emotional support were therefore regarded as key to maintaining cognitive and emotional well-being.

5.5 Negative impacts of Subjective Cognitive Decline

Perceived cognitive changes is associated with a variety of emotional and social challenges that deeply affect participants' daily lives. Many described how memory lapses and other cognitive difficulties triggered distressing emotional responses, such as frustration, anger, embarrassment, and fear of dementia, while also leading to negative social responses, including withdrawal or avoidance. These reactions were not only shaped by personal concerns over cognitive decline but also heightened by societal stigma, ageism, and the negative portrayal of dementia. Together, these factors intensified participants' sense of anxiety, isolation, and

vulnerability. A word frequency analysis was conducted to visually summarise the key concepts associated with this theme (see Figure 5.2).

Figure 5.2. Word cloud of negative impacts of subjective cognitive decline

The following sections examine four interrelated subthemes. First, participants' fears and uncertainties about dementia reveal the pervasive anxiety surrounding potential decline. Second, emotional reactions such as frustration, anger, and embarrassment illustrate how SCD disrupts both internal well-being and daily life. Third, social withdrawal and reluctance to engage in conversations demonstrate how reduced confidence limits social participation. Finally, the subtheme on ageism and stigma highlights how societal narratives and media representations further isolate individuals with SCD, reinforcing negative self-perceptions and avoidance.

5.5.1 Concern about dementia

Participants frequently expressed a profound fear of experiencing cognitive decline, particularly those with a family history of dementia or prior caregiving experience. For many, everyday experiences of forgetfulness triggered a sense of unease, making them question whether their memory issues were indicative of a more serious cognitive decline. One participant described how forgetting small details in daily life led to immediate anxiety:

“You know, how would you feel if you could pick something up and you were forgetting, and you're coming back empty handed, how would you feel? Anxious, yeah. Anxious. That is trouble.” (P4: SCD=12, low CLA)

Similarly, others expressed concerns about the long-term trajectory of their memory difficulties, worrying about what their cognitive health might look like in the future:

"You start thinking, ‘What’s it going to be like in five years’ time? Are you going to completely forget everything?’’" (P7: SCD=17, high CLA)

Participants with close relatives affected by dementia often cited these experiences as a major source of fear. Witnessing cognitive decline in loved ones intensified their worries about their own future:

“I think when I've filled in the thing for you, I was probably more conscious of the fact that both my parents have got vascular dementia. So, both of them have got […] And that's sort of that, that's in the back of my mind, that's probably concerning me, yeah, the fact that they both got it.” (P12: SCD=14, high CLA)

Even minor forgetfulness served as a distressing reminder of what might lie ahead:

"It’s always […] it’s not nice to be aware that you're forgetting things. Also, because of my mother (she had dementia), it makes me slightly worry […] is this the beginning of something?" (P10: SCD=14, high CLA)

The fear of dementia was not only tied to losing cognitive abilities but also to the possibility of becoming a burden to family members if their condition worsened. Some worried about the emotional and practical strain their decline might cause for loved ones:

"We’ve got a big family, you know, coming up, got a daughter and so on and grandkids. I can't put it, if we can eliminate part of that worry for them by trying to find out exactly what it is, and what can we do about it without bringing the full burden on to them, you know." (P1: SCD=7, high CLA)

Those who had previously cared for a relative with dementia described particularly heightened anxiety, often recalling the challenges and emotional strain of caregiving. One participant described caregiving for a loved one with dementia as *"petrifying"*. Another expressed intense

dread of losing their independence, fearing a future where they could no longer care for themselves:

> *"That's the one thing I would worry about, getting to a stage where I couldn't look after myself and I'm stuck in one of those places." (P13: SCD=11, low CLA)*

In summary, while most participants had general concerns about cognitive decline, a strong and emotional fear of dementia became apparent when personal forgetfulness or the decline of a relative made the threat feel more immediate. Importantly, although this fear was present among participants with different levels of CLA engagement and SCD scores, it was most pronounced in older adults (aged 80 and above) who reported greater SCD concerns and lower CLA engagement. This suggests that as people age, increased worry about their cognitive abilities, combined with less mental stimulation, may work together to make the fear of dementia more intense than general concerns about cognitive decline.

5.5.2 Emotional reactions of subjective cognitive decline

Participants described a range of emotional responses to SCD, with frustration, annoyance, and embarrassment emerging as the most prominent. These emotions often overlapped, with one deepening another, particularly when triggered by memory lapses or difficulties in daily tasks and conversations. Many participants linked these reactions to concerns over independence and social interactions.

Frustration was common, especially in situations where participants struggled to recall words, names, or intentions. It was often compounded by fear of losing autonomy:

> *"It's frustrating, irritating. It makes you feel like you know what's coming over the horizon [...] My husband, he'll keep saying to me, 'Oh, you've always been rubbish with names,' but he can't feel what it's like here (indicating brain) [...] And this is frustrating, how it makes me feel." (P14: SCD=11, low CLA)*

Frustration was also heightened by witnessing dementia in relatives, reinforcing worries about dependence:

> *"I've known quite a few people with dementia, and seeing how they become lost souls [...] you can see the frustration and the anxiety that it causes [...] And it's the repetitiveness, it's the draining side [...] you'll know that you're going to be a strain on*

the family and the frustration and not being able to express either yourself [...] It's having that independence taken away from you [...] It's like these simple things that I've done forever, yes, suddenly go, and you can't, you haven't got that ability to do things. And I think, it is frustrating." (P7: SCD=17, high CLA)

Annoyance typically emerged as a temporary reaction to these frustrations, caused by disrupted routines. At times, this anger was turned inward, especially when people misplaced items or forgot regular tasks, which made them feel less efficient.

"Yeah, I get quite annoyed with myself because it seems such a simple thing [...] When I lost track I spent the next 10 minutes hunting around for it. I get quite annoyed because it's just a waste of time." (P8: SCD=15, high CLA)

For others, the annoyance was rooted in social interactions, with forgetfulness interrupted conversations or hindered their ability to participate fully:

"It's annoying, yes, it's annoying. Because especially in conversations with my friends, it's tiring to constantly try to remember words and keep the sentence in mind. That's why sometimes I just want to be quiet and sit down." (P11: SCD=14, low CLA)

Moreover, some participants felt anger when confronted with a changing sense of self, particularly when they were no longer able to function as they once had. They struggled to reconcile their past memory capabilities with their current difficulties, leading to further frustration and annoyance:

"Yeah, so it's annoying. I'm annoyed by it, because I've always been so sort of on the ball and able to remember things for everybody else." (P18: SCD=11, high CLA)

Embarrassment was also common when memory lapses were visible to others. Forgetting names, details, or losing track during conversations often led to humiliation, especially when participants feared being judged by those around them. One participant described the embarrassment of forgetting a familiar name during a group activity:

"Forgetting people's names is quiet, I find it quite embarrassing, because these are people I see every week [...] when you're playing with team members, and you think you want to call out to them to pass them the ball, and you can't remember them." (P12: SCD=14, high CLA)

Here, the social context played a significant role in how participants responded to these moments of forgetfulness. In familiar and supportive environments, participants were more likely to brush off their memory lapses. However, in less familiar or formal settings, fear of judgment was more pronounced, leading to heightened feelings of embarrassment:

> *" Well, in that particular group, I wouldn't mind, because it's obviously, it's a group that understands these issues, and there we have become friendly. So, in that particular group, that would be okay. But in one of the other committees, I'm on, which is a small board of a choir, and then I think I would withdraw, because then I feel I would be holding the other, I would be holding them back, and I don't know them well enough to feel comfortable. I would be embarrassed. Basically, it would be a question of extreme embarrassment." (P15: SCD=12, low CLA)*

Overall, frustration, annoyance, and embarrassment were closely linked, often influencing each other in a cycle. Frustration usually led to anger when people faced the problems caused by their memory issues, and both emotions contributed to embarrassment during social situations. These feelings together show the emotional impact of SCD, both in personal and social situations, and reflect participants' understanding of their declining cognitive abilities and how this affects their relationships and self-esteem.

5.5.3 Social avoidance

Participants often talked about how memory loss and trouble with thinking clearly affected their interactions with others. They mentioned that these problems caused a lot of emotional pain. In many cases, these difficulties led to social withdrawal, with individuals fearing embarrassment or feeling unable to participate fully in conversations. These concerns made them feel lonely, especially when they felt embarrassed or unsure of themselves. One person shared how forgetting things like stories or news made them feel less confident and caused them to stay away from people:

> *"But yeah, I mean, if I'm asked to relate a story to somebody, or like talking about the news that I forget details of it, and find it hard, and you lose your confidence. You know you tend to try to avoid it, or you maybe don't want to get involved in a conversation as often. You know you back away because your confidence is going. […] It affects my daily life, […] I would find it very easy to withdraw and not get involved, […] because*

I just feel silly, I can't explain myself as well as I used to. I used to be on the ball with everything." (P15: SCD=12, low CLA)

Minor cognitive lapses interfered with participants' engagement in daily tasks, affecting concentration and participation:

"Well, it is irritating. It slightly stops you from joining in conversations, because you might be about to start, and you've forgotten, I think it makes you less sociable. […] So, it affects your concentration as well. I mean, even if you're looking at something on television. So, you're following a series on television, and you find that in the middle of it, you've wandered off somewhere else and started doing something really, I think it's a huge, a huge barrier to being part of society." (P11: SCD=14, low CLA)

One participant explained how memory difficulties and fear of embarrassment limited their ability to participate independently:

"It's usually frustrating, but it can be embarrassing. You know, if you're trying to talk to a group of strangers, we tend to go to meetings together (with her husband). I don't do meetings on my own. Now I can't." (P14: SCD=11, low CLA)

Because they were afraid of getting distracted, forgetting crucial information, or finding it difficult to follow complicated conversations, many people started avoiding conversations. This avoidance was a reflection of a general decline in communication confidence as well as a growing unwillingness to engage in social situations or group discussions. Such withdrawal eventually reduced chances for previously pleasurable interactions and strengthened feelings of loneliness, highlighting the significant psychosocial effects of SCD.

5.5.4 Ageism and social stigma

Alongside this, participants reported the wider societal stigma linked to ageing and memory loss, mentioning that these cognitive changes are frequently met with mockery or confusion. They noted that societal stereotypes and negative media images of dementia increase worries and fear about cognitive decline.

Some participants observed that media portrayals often show forgetfulness and dementia as something that cannot be reversed, with little focus on how people can cope or adapt. They felt that such depictions strengthen negative views of ageing and foster a sense of despair about cognitive decline. One participant criticised these portrayals:

> *"Tell you what I do see there's recently, I've been looking on, you know, [streaming service name]and there seems to be more TV series and movies that revolve around somebody having memory loss or dementia and that being a negative thing.[…] There never seems to be a solution to it always seems to be, that's it you've got dementia, and it's just going to get worse, and then we're going to lose you. I find it quite lazy; that's the way that forgetfulness is perceived in the media, it's just sort of perpetuating this." (P13: SCD=11, low CLA)*

Participants also noticed the presence of societal ageism, observing that older people are frequently not respected for their wisdom and life experiences. They stated that difficulties with memory and thinking are often met with stigma rather than being seen as a normal part of getting older. Some younger individuals tend to mock forgetfulness instead of recognising it as a natural aspect of ageing. The participants voiced a desire for more respect towards older adults, stressing that challenges related to memory and cognitive difficulties should not be ridiculed but rather treated with empathy and understanding:

> *"I think there's definitely ageism there. […] There's a part of society who looks down on older people […] if you do forget something, they would think it's funny in a bad way." (P15: SCD=12, low CLA)*

These discourses show that the negative social reactions connected with SCD are complex. On one hand, the cognitive difficulties linked to SCD lead people to avoid social events, mainly to prevent being embarrassed and to keep their self-esteem. On the other side, these personal struggles are made worse by outside pressures from society, like age discrimination and negative portrayals in the media, which make people feel even more isolated. Even though many participants described similar patterns of avoiding social situations, the specific reasons and situations that caused these feelings differed. This highlights the need to investigate both personal experiences and cultural factors when understanding how SCD affects social life.

In general, these negative effects show the many ways SCD affects people, influencing not just their emotions but also how they feel about being part of their community. Participants deal with emotions like fear, frustration, and embarrassment as they try to move through a social environment that often has a biased attitude about ageing and memory loss. Looking at the four main topics in this part, a common trend appeared showing that stronger negative effects of SCD, especially emotional distress and social withdrawal, were more often reported by people with higher SCD scores and less engagement with CLA. This was especially clear in topics about avoiding social situations and facing stigma, where people with more worries about SCD and less involvement in CLA showed more feelings of being vulnerable, uncomfortable in social settings, and less confident in their interactions with others.

5.6 Coping Strategies for Subjective Cognitive Decline

Building on the emotional and social difficulties mentioned in the earlier themes, participants shared different ways they dealt with cognitive complaints, reduced stress, and kept their independence. These strategies included comparing their own experiences with others to make forgetfulness seem more common, staying connected with friends and family, participating in activities that kept their mind active, using tools to help with memory, and adopting an accepting or humorous outlook. In the following sections, participants explain how these strategies helped them feel better and less affected emotionally and socially by the symptoms of SCD, as discussed earlier. These strategies weren't clearly linked to participants' age or the seriousness of their SCD symptoms. Instead, participants seemed to choose coping strategies based on how they personally felt and experienced cognitive changes.

5.6.1 Social comparison for reassurance

A common coping strategy among participants was comparing their SCD with peers. Many individuals found reassurance in recognising that forgetfulness was a shared experience rather than a personal deficit. Through this theme, participants not only engaged in social comparison for reassurance but also indirectly normalised their memory lapses, illustrating the overlapping functions of coping strategies. Conversations with friends of a similar age allowed them to validate their concerns while normalising their memory lapses. The perception that *"everyone experiences this"* helped alleviate anxiety and prevented excessive worry about cognitive decline. One participant illustrated this by highlighting how interactions with friends provided reassurance:

"90% of my friends are around my age, and they'll go, 'Oh, don't worry about it. I have the same,' and that diffuses the situation." (P5: SCD=9, low CLA)

Participants found comfort in the shared nature of forgetfulness, reinforcing that these difficulties were common rather than alarming. As one participant expressed humorously:

"They are all the same (laughing). I think I still try (laughing), because I know that other people are the same. Yeah, I think that's quite reassuring." (P19: SCD=7, low CLA)

For some, this comparison went beyond their immediate social circle, as they assessed their cognitive state in relation to people who had more severe impairments. This viewpoint helped them recognise their own good condition, which in turn eased their worries. One participant shared:

"But I find out that talking to other people, that other people also suffer from this. [...] I do not worry about myself, and I do not need to worry when I look at [his friend's name having dementia] and other people. Why would have I got to worry about? Because I'm not half as bad as these people, you know." (P1: SCD=7, high CLA)

Observing younger individuals occasionally forgetting things helped challenge assumptions that memory lapses were solely age-related or indicative of cognitive decline. One participant explained:

"Yeah, and the thing is that always reassures me, because I don't think my issues are really any different to anybody else's of my age. We all forget things, the same sort of things, really. We all forget, and it's always good for me to see a younger person forgetting things, because, you know, my assumption is, as soon as I forget something, I think that's my age, or I'm getting dementia or something. But sometimes it's just normal." (P10: SCD=14, high CLA)

Through social comparison, participants reframed concerns about memory lapses, reducing distress and promoting a more accepting attitude toward cognitive changes. Such comparative reassurance illustrates how group belonging and shared experiences can buffer against excessive worry about SCD, highlighting the role of social context in coping strategies.

5.6.2 Social connection and support

Participants consistently highlighted the importance of social connections and support systems in dealing with SCD and maintaining their overall well-being. Many shared how staying socially active, whether through family, friends, or community groups, was essential for keeping their minds active and emotionally supported. In addition, social comparisons often motivated participants to build or strengthen their social networks, which helped reduce worries about SCD. For some, these relationships provided a deep sense of purpose and inspiration, while for others, they offered practical help in managing the challenges of cognitive ageing and memory loss. Importantly, this aligns with earlier discussions about loneliness, where participants noted that being socially isolated made their concerns about SCD worse (see Chapter 5.4.3). On the other hand, maintaining strong social connections seemed to ease these worries, reinforcing the idea that being socially involved can act as a protective factor against cognitive concerns.

Several participants stressed the need for regular social interaction as a way to keep their minds sharp. Spending time with peers, especially those of a similar age, was seen to stay involved in life, share experiences, and support cognitive health. One participant talked about the negative impact of social isolation, explaining how being disconnected from others could make cognitive decline worse:

> *"I think that is really important, being with other people. Well, the thing is, once you stop meeting people, you get worse and worse, don't you? […] We all need other people. Yes, and it's probably better if it's people around you, you need some young people. Obviously, you need family. People around your own age, your expectations of each other are the same, and you can laugh at forgetfulness (laughing), that kind of thing, can't you? Instead of worrying about it." (P19: SCD=7, low CLA)*

For some individuals, relationships across generations were considered just as essential. Several participants shared how engaging with people of different ages, such as children, grandchildren, or younger members of their community, helped them remain informed, engaged, and connected to their surroundings. They believed these relationships offered important perspectives from younger generations, which helped maintain their cognitive clarity and reduce feelings of loneliness:

"I do think that socialising is really good for me. I think socialising is far and away the best, the best thing A: it keeps your brain active as you make an attempt to remember what they said to you last time. And I forget what B was going to be (pauses to think and laughs). Oh, it doesn't give you it stops you're thinking about it really, because you're participating with your brain in some activity. So, I would have to get worse." (P11: SCD=14, low CLA)

Additionally, family support was consistently identified as a key factor in managing the cognitive challenges of ageing. Several participants acknowledged the value of having close family members who provide both emotional and physical assistance, helping them navigate daily tasks and offering a sense of security, which was crucial in managing SCD:

"I consider myself to be extremely fortunate to have left what I've got left and to have backing. I get physical help from my friends. I get emotional help. And I get this interactive help, which is what I think a lot of old people suffer from. So, I'm extremely fortunate to have people who understand me" (P6: SCD=13, high CLA)

5.6.3 Keeping the mind occupied

Keeping the mind active became important for participants to cope with SCD. Many noted that participating in mentally challenging activities helped them fight forgetfulness, keep their cognitive abilities strong, and feel a sense of purpose and self-reliance. For some, these activities also brought emotional benefits, making them feel more connected and less alone.

One approach was staying involved with what's happening in the world. Reading news and staying updated helped participants keep their general knowledge up to date, which in turn kept their minds sharp and allowed them to take part in discussions with others. As one participant said:

"Read. Read topical things. Read what's happening in the world today, what's happening around you. So, you've still got a general knowledge to be able to go out and think, 'Oh, I saw that. Oh, yeah'. And it brings things back into your mind and encourages conversation. That's what I think, other than sitting here doing a word search day after day after day that drives me nuts. Yes, that's not what I've done." (P5: SCD=9, low CLA)

Participants also highlighted hobbies, social activities, and volunteer work as ways to stay active and prevent cognitive decline. For example, one participant shared how juggling social and caregiving responsibilities, along with volunteering, helped keep their mind sharp:

> *"I try to keep my brain active by doing. I play scrap on the iPad. I play games. I go to several groups. I'm trying to juggle caring for my husband and doing things for my own social life. I don't want to give up my own social life. So, I'm still trying to meet with friends. I'm a secretary of a couple of groups, and I have minutes to write, and you know, of agendas and things to prepare. So, I try to keep myself active in that respect, because I can see this at my age, it could happen very easily. I could slip into forgetfulness." (P2: SCD=12, low CLA)*

Music was another common strategy for keeping the mind occupied. Participants reported that listening to music from their past evoked memories and provided mental stimulation and emotional comfort:

> *"So, I think that's another thing is to listen to music, especially the old music that we're used to like, and that brings back memories of when you're a youngster. So that's another coping one that I find love is finding the music that I, you know, grew up with, which is quite a variety, because I don't just stick to one kind of genre. It's just quite some classical music. There's just all sorts of life, I think, really." (P7: SCD=17, high CLA)*

Additionally, participants emphasised the importance of keeping a regular routine to stay mentally active. They noted that having a consistent schedule helped them remember things better and gave their day a clear structure. This routine made it easier for them to know where they were in the week and remain engaged. One participant mentioned how joining different groups on certain days helped them keep track of time and stay involved:

> *"To try to have a routine as well, that's a good idea. So, if it's Monday, I go to connect with nature group, on Tuesday, it's the lunch club, and then Wednesday, it's a church group and so on. Not too many things, but just if there is a routine there, you're more likely to remember where you are. You don't think, 'oh, what day of the week is it?' I know what day of the week it is because I'm doing this activity." (P3: SCD=16, high CLA)*

However, for others, the lack of a routine in later life presented challenges, with some noting that without the regular schedule they had when working, it became harder to maintain cognitive function. One participant reflected on the difficulty of adjusting to a more irregular routine and how this might contribute to memory issues:

> *"It's quite hard when you're older, because you don't have the routine you had when you were going to work. You know, it's not a regular routine. Every day is different, so I think that impacts on memory a bit." (P19: SCD=7, low CLA)*

This divergence in experiences shows that, although some participants considered routines to be an important strategy for maintaining engagement, others found that the lack of structure in retirement led to cognitive challenges. Thus, while it was generally accepted that engaging in hobbies, music, social activities, and routines helped keep the mind active, the effectiveness of these activities varied depending on the type of routine and how participants adapted to changes in their lifestyle.

5.6.4 External memory aids

Participants reported relying on external memory aids such as notes, to-do lists, and calendars to compensate for forgetfulness. Writing things down helped them stay organised and ensured everyday tasks were completed, particularly for activities requiring time management, such as cooking or errands:

> *“That I have a to-do list. I mean, everybody has, but I absolutely could not function without it. If I'm in the kitchen and something needs cooking for 30 minutes and I come up here to study, there is no way I will get back down in 30 minutes if I haven't written it down or set the timer on my phone.” (P17: SCD=13, high CLA)*

Others described a shift in how they managed their memory over time. While they may have previously relied on remembering things without assistance, they found themselves increasingly depending on written notes, lists, and digital reminders. This was reflected in participants’ responses, such as:

> *“Well, one is writing things down. So, if I'm going shopping, I used to remember what I needed, more or less, and I didn't usually write a list, but I write a lot more lists now. […] but also, I use my calendar and my phone to put reminders for things, which I*

think, you know, 10 years ago, I would have been confident that I would remember those things. But now (laughing).” (P10: SCD=14, high CLA)

These techniques were not only helpful but also essential for many people to keep up daily routines. While some talked about using digital tools like phone calendars and alarms, others talked about using physical planners or diaries. They were able to confidently continue their regular activities by adjusting to memory problems through the use of structured reminders and writing things down.

While most participants thought these techniques were helpful, one participant expressed dissatisfaction with taking notes, suggesting that it occasionally caused confusion rather than memory improvement:

“Oh, I actually make my life worse by taking notes. I make notes of everything, and then I forget when I've pulled them, so I start another lot of notes, repeating them. [...] So even yesterday, I said to my daughter, I'm going to remember to tear the pages out and throw them away, because I've got four books that I do notes in and it's confusing. I'm making myself more confused.” (P11: SCD=14, low CLA)

Overall, participants used a variety of methods to compensate for memory difficulties, with many viewing lists, calendars, and reminders as essential tools. However, individual experiences varied, and for some, these strategies did not always provide the intended benefits.

5.6.5 Accepting life with subjective cognitive decline

Participants explained that they accepted their forgetfulness experiences as a normal part of growing older and did not view these changes as a cause for concern. They now saw memory lapses as inevitable rather than strange or concerning. They were able to carry on with their everyday activities without the worry or anxiety that frequently accompanies forgetfulness thanks to this acceptance. One participant described how this mindset prevented them from placing unnecessary strain on themselves:

"Not frightened of admitting that we forget things. [...] So I think you've just got to embrace it and say, 'My memory is not what it was.' Don't make you know, if ever I forget anything, I just think it'll come to me a bit later on, don't put the pressure on.

[…] It's not being ashamed and not being afraid to admit that your memory is not what it was. [...] Admit it. [...] just embrace it." (P20: SCD= 9, high CLA)

Participants acknowledged that memory changes were inevitable and that they were a normal aspect of ageing. The majority took a pragmatic, adaptive stance, emphasising adaptation over resistance, though a few mentioned occasional sadness. They were able to preserve their independence and carry on with their lives by accepting these changes. One participant considered how generational attitudes facilitate acceptance:

"The situation is more than acceptable, and at the moment, I am more than accepting it. I consider myself to be extremely fortunate to have what I've got left and to have backing. […] What else would you expect? Perhaps our generation and I are more accepting. […] You're old, you're losing it. You're losing a bit every day. If you get a stroke, you lose it overnight. So, find something that you can do. [...] you've got to be prepared emotionally for the fact that you're going to lose it. Whatever you do, you only alter the rate." (P6: SCD=13, high CLA)

Normalising these experiences was crucial for managing them, as participants gradually adjusted their expectations and stopped seeing memory lapses as something to be afraid of. They placed a higher value on carrying out daily tasks and staying active, rather than focusing on their forgetfulness.

Humour became an important tool in dealing with these challenges. Many participants highlighted how laughter helped them cope with memory slips. Instead of feeling frustrated or upset, they accepted their forgetfulness in a light-hearted way. This mindset made it easier to deal with embarrassment and frustration, allowing them to handle difficult moments more easily and keep a positive attitude.

"I think if you make a silly mistake because you've forgotten something, you just have to laugh it off. Well, you see, I'm a very old lady, so that's how it happened. [...] Having a sense of humour is very important. I have done a silly thing. Well, that is okay. Have a laugh about it. Does not matter." (P3: SCD=16, high CLA)

Notably, participants who used humour and accepted forgetfulness as a part of ageing often reported higher CLA engagement. This suggests that having a positive attitude toward cognitive changes may help maintain involvement and psychological well-being in later life.

Personality traits such as determination, enthusiasm, and optimism also influenced how participants dealt with SCD.

These traits helped them stay active and engaged in life despite cognitive changes. For example, one participant shared how their personal determination enabled them to remain proactive:

> "*If I'm feeling a bit forgetful, I'm probably more inclined to want to take up tasks that will get my brain going again. I don't want to, kind of 'oh, forget about it'. […] I'm more be enthusiastic, I think, because I've experienced, as I said, my partner's mum had dementia, and my mum kind of with for health reasons, she withdrew from so much […] when she was ill, she refused to see a doctor, all that kind of stuff, and that's made me more determined that I'm not going to be like her." (P13: SCD=11, low CLA)*

This determination reflects a refusal to accept SCD passively, encouraging active engagement with life. Similarly, optimism allowed participants to focus on positives, remaining active and refusing to let memory lapses define their experiences.

5.7 Discussion

This chapter investigates how people with SCD experience their daily lives, showing how participants viewed gradual changes in their memory, language, attention, and executive function. These cognitive challenges were strongly influenced by emotional and social factors, especially among older individuals who had greater concerns about SCD and were less involved in CLA. In this group, feelings of loneliness and worry about developing dementia were particularly strong. These difficult experiences prompted participants to use various coping methods, such as comparing themselves to others, building social connections, accepting their situation, using humour, relying on memory tools, and maintaining their routines. Those who had a more accepting or playful attitude towards forgetfulness were more likely to stay engaged in CLA, indicating a possible connection between emotional strength and continued involvement in such activities.

These results are generally in line with earlier studies that highlight the experience of SCD in older adults. In particular, prior research frequently documented memory-related issues, particularly word-finding challenges and regular memory lapses (Rotenberg, Sternberg and

Maeir, 2020; Schütz *et al.*, 2020; Kiene, Hildebrandt and Roheger, 2025). Perceived difficulties in attention, executive function, and language were also noted, impacting communication, planning, financial management, and task completion (McAlister and Schmitter-Edgecombe, 2016; Pearman, 2021; Paanalahti *et al.*, 2023). While most participants mentioned a slow decline in their cognitive abilities rather than a sudden start, some connected their worsening symptoms to particular life events, like the COVID-19 pandemic. This aligns with recent studies showing that even though actual cognitive function may not have changed much, people reported more memory issues during lockdowns (Nogueira *et al.*, 2022; Kassam and McMillan, 2023). This is probably because loneliness increased and social interactions decreased (Nogueira *et al.*, 2022; Kassam and McMillan, 2023). This shows how social and environmental factors can influence how people perceive their cognitive abilities. Participants who reported higher cognitive concerns often described isolation, particularly after retirement or bereavement, consistent with evidence linking SCD to higher loneliness and lower emotional stability (Borelli *et al.*, 2022; Reynolds *et al.*, 2022; Pecchinenda *et al.*, 2024). Together, it was emphasised that SCD is influenced by both changes in cognitive function and the surrounding social environment, highlighting the need to take social factors into account when helping older adults.

Participants often thought about their previous occupations, mentioning that mentally challenging work had kept them both cognitively and socially active. They saw this as helpful in preventing current symptoms of SCD. This aligns with research showing that complex jobs lower the risk of cognitive problems later in life (Then *et al.*, 2017; Pettigrew and Soldan, 2019). From the Cognitive Reserve theory (Stern, 2002, 2009), mentally stimulating work may help keep cognitive abilities strong and slow down cognitive decline, as shown by longitudinal studies indicating that job complexity is linked to better cognitive stability, even for those with SCD (Mondini *et al.*, 2022). However, demanding work can also make people more aware of small cognitive issues, leading to more complaints even if there is no objective cognitive decline (Aarts *et al.*, 2011; Rijs *et al.*, 2015). This duality reflects the interplay between resilience and self-perceived deficits: while cognitively complex occupations build reserve, they may also raise expectations and self-monitoring (Buckley *et al.*, 2015; Rijs *et al.*, 2015). As previous studies have shown, many participants noted an increase in SCD symptoms after retiring, possibly because they are less mentally engaged, see themselves differently outside of work, and have smaller social groups. Overall, these findings highlight how occupational history shapes both protective and vulnerability aspects of SCD experiences.

Beyond its impact on cognitive abilities, SCD was strongly connected to negative emotional and social experiences, such as fears related to dementia, emotional distress, social withdrawal, and societal stigma. A frequent reaction was the fear of developing dementia, which was often made worse by observing family members who had the condition (Corner and Bond, 2004). This fear involved worries about losing independence, personal identity, and self-respect (Corner and Bond, 2004; Mol *et al.*, 2008; Divers *et al.*, 2022; Hill *et al.*, 2022). Participants also described feeling frustrated, embarrassed, and angry when they had memory problems in daily life, especially during important tasks or in social situations, which led to lower confidence and self-worth (Imhof *et al.*, 2006; Parikh *et al.*, 2016; Rotenberg, Sternberg and Maeir, 2020; Shaikh *et al.*, 2021). These feelings often made individuals avoid conversations or activities to prevent being judged, resulting in disconnection and loneliness (Hill *et al.*, 2018; Pearman, 2021; Shaikh *et al.*, 2021; Ross, Hofbauer and Rodriguez, 2022). In addition to their own emotional difficulties, they reported facing negative attitudes and stigma from others, which contributed to accepting age-based discrimination and feelings of being less capable (Mol *et al.*, 2008; Buckley *et al.*, 2015), increasing their stress and making them less likely to participate in activities (Meredith *et al.*, 2023). Furthermore, negative stereotypes about older adults, such as seeing them as inactive or incapable, can harm their sense of self, mood, and cognitive abilities (Chapman *et al.*, 2022). Overall, these findings show the complex relationship between cognitive, emotional, and social elements in SCD, highlighting the importance of interventions that tackle both cognitive symptoms and psychological and social challenges.

The experience of SCD and its emotional and social effects led participants to create coping strategies, which aligns with earlier studies. A frequent strategy is social comparison, where people assess their cognitive changes in relation to others, helping them understand lapses and feel reassured (Parikh *et al.*, 2016; Birt *et al.*, 2020; Pearman, 2021; Carter *et al.*, 2023). Many also depend on social support from family, friends, and peers, which offers emotional comfort and practical guidance, reducing feelings of isolation and promoting understanding (Weng *et al.*, 2020; Ross, Hofbauer and Rodriguez, 2022; Carter *et al.*, 2023). In addition to social strategies, participants used practical tools like lists, calendars, and reminders to handle daily responsibilities and keep their independence, although some found it hard to use these consistently (Rotenberg, Sternberg and Maeir, 2020; Pearman, 2021; Ross, Hofbauer and Rodriguez, 2022; Carter *et al.*, 2023). Others participated in mentally stimulating activities, such as puzzles, board or card games, and quizzes, to remain cognitively engaged and manage

memory issues (Rotenberg, Sternberg and Maeir, 2020; Kiene, Hildebrandt and Roheger, 2025). Extending this evidence, the current research found that volunteering and listening to music also played a unique role, supporting cognitive engagement while providing emotional comfort and a sense of social purpose. Emotional acceptance also became a key strategy, as participants dealt with forgetfulness by using humour, gratitude, and focusing on their remaining abilities, which is consistent with previous findings (Weng *et al.*, 2020; Pearman, 2021; Ross, Hofbauer and Rodriguez, 2022; Carter *et al.*, 2023). Taken together, these findings show the various coping methods, including social, practical, cognitive, and emotional that people with SCD use to maintain control, support their wellbeing, and adjust to perceived decline.

Overall, by highlighting the dynamic interaction between contextual, social, and individual factors, these qualitative findings contribute to our understanding of how SCD is experienced on a daily basis. Importantly, SCD is embedded within emotional, relational, and societal contexts rather than being purely a cognitive phenomenon, the analysis expands on previous research. It also emphasises the importance of work history, the complexity of coping, and the widespread effects of ageism and stigma. As a result, these findings offer a more practical and person-centred understanding of SCD, highlighting the significance of acknowledging both psychosocial and cognitive aspects when assisting older adults with SCD. These insights provide a deeper comprehension of the mechanisms connecting SCD and CLA engagement by laying conceptual underpinnings for later integration of quantitative and qualitative findings.

5.8 Chapter Summary

This chapter presented the qualitative investigation of older adults' experiences with SCD. It explored key themes including the nature of cognitive difficulties (memory, language, executive function), the emotional and social consequences of these difficulties (e.g., frustration, fear of dementia, social withdrawal, experiences of ageism), and the coping strategies participants employed to manage these impacts. The findings highlighted how these themes were interconnected, with cognitive challenges often leading to negative emotions, which in turn shaped coping behaviours. While these findings are discussed in relation to previous literature here, a more detailed interpretation, including consideration of methodological strengths and limitations, and integration with quantitative research findings is presented in Chapter 7 and discussed further in Chapter 8.

CHAPTER 6 - Motivations and Barriers to Cognitive Activity Participation

6.1 Introduction

This chapter presents the qualitative findings on engagement in cognitive leisure activity (CLA) among older adults with subjective cognitive decline (SCD). While Chapter 5 explored participants' experiences and perceptions of SCD, this chapter focuses on what shapes their CLA engagement, including the motivations that encourage participation, the barriers that hinder involvement, and the types of support or strategies that participants believe healthcare professionals, community organisations, and policymakers could offer to facilitate and sustain engagement. The following sections present the findings thematically, drawing on participants' reflections on motivations, barriers, and strategies to maintain CLA involvement.

6.2 Overview of Key Themes

Thematic analysis of the interview data identified three interrelated themes capturing how individuals with SCD engage with CLA: (1) *Motivations for Cognitive Leisure Activity Engagement*, (2) *Barriers to Cognitive Leisure Activity Engagement*, and (3) *Strategies to Support Cognitive Leisure Activity Engagement*. These themes illustrate the dynamic interplay between older adults' desire to maintain mental stimulation and the challenges that may constrain this engagement. The findings suggest that motivations and barriers often coexist, influencing each other in complex ways, for instance, a strong motivation to preserve cognitive health may be undermined by feelings of low self-efficacy or health-related limitations. The third theme highlights participants' reflections on how external support, social encouragement, and appropriate guidance could help overcome these barriers and sustain participation. Collectively, these themes provide a comprehensive picture of how individuals with SCD negotiate their engagement in CLA within both personal and contextual boundaries.

6.3 Motivations for Cognitive Leisure Activity Engagement

Participants shared a wide variety of reasons for taking part in CLA, which showed both personal enjoyment and a desire to keep their cognitive and emotional well-being. Many found these activities to be satisfying and fun, while others saw them as helpful for keeping their cognitive function sharp, avoiding cognitive decline, or dealing with emotional issues linked to SCD. CLA was also seen to build confidence and feel in control of their cognitive abilities,

giving them a sense of accomplishment. Moreover, the social side of CLA played a vital role in encouraging people to engage, as many enjoyed staying connected, avoiding loneliness, and feeling part of a community.

These motivations are shown in Figure 6.1, which lists the most common words participants used to describe their involvement in CLA. The following subthemes go into more detail about these motivations, explaining how older adults with SCD understood and experienced their engagement in CLA.

Figure 6.1. Word cloud of motivations for cognitive leisure activity engagement

6.3.1 Enjoyment of cognitive leisure activities

A key theme that emerged in the participants' stories was that their involvement in CLA was mainly because they enjoyed it. Most said they took part in these activities out of real interest and fun, rather than to keep their minds sharp. For many, these activities gave them a sense of being active and provided a nice break from their usual day-to-day routines, which helped them stay mentally and emotionally involved.

The activities people chose were usually based on what they liked, such as reading, sewing, doing puzzles, or volunteering, rather than because they thought they would be good for their cognitive health. Although some participants admitted that these activities might help keep

their minds active, they didn't see this as the main reason they took part. As one participant shared:

> *"I do them because I really enjoy doing them, and the same with reading and sewing. But I don't think it helps [for cognitive function]." (P5: SCD=9, low CLA)*

Similarly, CLA was seen as a way to pass the time and have something enjoyable to look forward to, especially when old hobbies were no longer possible because of physical challenges. One participant talked about how reading let them escape mentally and stay engaged, even if they weren't sure about its effects on their cognitive benefits:

> *"It's fun doing it. [...] I don't know whether it does any good or not, but at least it gives you something to look forward to, something to occupy yourself with [...] and that's why I love reading, because you're off in another world." (P9: SCD=20, low CLA)*

In sum, participants highlighted that intrinsic enjoyment was central to their involvement in CLA:

> *"Enjoy, enjoy it. It's for fun. It's not because I feel I should." (P10: SCD= 14, high CLA)*

Focusing on pleasure and personal fulfilment helped them sustain motivation and consistently return to these activities.

6.3.2 Preventing cognitive decline

Participants shared that their involvement in CLA was a proactive step driven by worries about cognitive decline, especially dementia. Many saw these activities to *"keep the brain active,"* assisting them in preserving cognitive function and maintaining emotional well-being as they aged. Their reasons for engaging in CLA stemmed from a desire to keep their cognitive skills sharp, protect their sense of self, and avoid the difficulties linked to memory loss. Although some were concerned about dementia, others focused on the benefits of staying cognitively active. CLA was viewed as a way of self-protection, helping people deal with fears of decline and feel more comfortable as they aged.

The idea of 'use it or lose it' was commonly mentioned. One participant shared:

"I want to stay active. I don't want to vegetate and forget everything. But yeah, I like to do stuff, so that's why we (participant and her husband) have lots of crafts and games and things like that." (P13: SCD=11, low CLA)

Several participants noted that engaging in these activities allowed them to distance themselves from the fear of dementia, stating:

"To keep the thought of dementia away. I wouldn't be working now, neither of us (participant and her husband) would be working now if we weren't scared from dementia." (P14: SCD=11, low CLA)

The emotional dimension of cognitive health was also evident. Participants described concerns about how dementia might affect their sense of self, independence, and quality of life. For some, these fears were intensified by personal experiences of witnessing relatives with dementia:

"I suppose I look at dementia, and I can see how cruel it is. And my mother had a type of dementia too, and I think, "oh, gosh", I hope that, you know, I don't develop that. So, you look around, and you look at the statistics, and you think, I've got to keep myself active." (P2: SCD=12, low CLA)

Participants expressed a belief in the tangible cognitive benefits of CLA, often citing perceived improvements in memory and language. These perceptions offered reassurance that their cognitive capabilities were still intact. As one participant described:

"The more that I use language, the more I feel that I will actually remember the words, because I feel that if I use recent words that I would be using, I will remember but if I haven't used them for a while, I will forget them. [...] So yes, I do feel that activity has kept me going. Yes, it's definitely been a benefit, [...] whenever I'm interested in something, you know, I really find actually, my brain can work well." (P15: SCD=12, low CLA)

Furthermore, participants observed that interest and engagement appeared to enhance their cognitive performance, suggesting a perceived link between motivation and mental sharpness. Several emphasised that staying mentally active could delay or slow down cognitive decline:

"I think brain health activities definitely keep it at bay. Help it keep the problem at bay. [...] I definitely noticed that when I be back at work in a couple of days ago, because we go on holiday a lot [...] But I have definitely noticed that when I come back to work and gradually get switched on to what I'm doing, my ability goes up again. Working helps, it helps me." (P14: SCD=11, low CLA)

For many, the belief in the cognitive benefits of CLA, such as better word-finding, memory recall, or sharper thinking, was both a reason for participating and a way to cope. These benefits helped them feel in control and supported their emotional health. It is worth noting that even though some participants admitted they weren't entirely sure about the effectiveness of CLA based on their own experiences, this uncertainty didn't stop them from being motivated. They still believed that CLA would provide long-term benefits:

"I'm convinced that they're going to be good for me, that keeps me motivated to keep doing them. […] But it's hard to tell on yourself, isn't it? Really whether it's helping, it's hard to know." (P10: SCD= 14, high CLA)

Overall, participants saw CLA as a means of taking control over their cognitive and emotional health in the face of fears related to ageing. While the belief in cognitive benefits offered comfort, the main driving force was the feeling of having control and resisting decline.

6.3.3 Confidence and sense of achievement

Participants described how engaging in CLA enhanced their confidence in managing forgetfulness and maintaining independence, reassuring them of their ability to cope with everyday cognitive challenges. One participant noted how staying engaged in a variety of mentally demanding activities boosted their overall confidence:

"Make me feel more confident about managing forgetfulness. Yeah, they make me feel more confident about managing life in general. And I suppose a part of that is managing forgetfulness. You know, if I wasn't doing very much, then I think I imagine, I would tend to lose confidence in doing things, whereas when I am doing a fair variety of things, some of which are quite demanding, then it keeps me confident." (P8: SCD=15, high CLA)

Additionally, CLA was connected to cognitive ability and personal development. Participants explained how taking on mentally challenging tasks, volunteering, or taking up new skills promoted a sense of accomplishment and strengthened self-worth. Recalling information or resolving issues successfully was seen as proof of resilience and preserved ability. One participant described how taking on difficult tasks resulted in a strong sense of accomplishment despite initial reluctance:

> *"I just wanted to see what I could do. And I feel a tremendous sense of achievement not being terrified. [...] I'm seeking for reward whatever makes you feel better, and some things that hurt make you feel better. It's not as easy to just go for the easy things, because I did struggle with the [online university training], but it made me feel better when I was a bit successful." (P6: SCD=13, high CLA)*

Participants' perceptions of cognitive competence and advancement were further strengthened by engaging in demanding or goal-oriented activities, such as remembering bridge strategies or finishing difficult tasks. Even minor accomplishments, such as winning a game or remembering specifics, were characterised as concrete proof of mental sharpness.

Overall, CLA increased participants' sense of autonomy and self-efficacy while also strengthening their confidence in their cognitive capacities. They were reassured that they could continue to function independently and that their efforts to maintain cognitive health were validated by observable signs of progress.

6.3.4 Maintaining social engagement

Participants stated that participating in CLA offered structured chances to connect with others, which helped strengthen social relationships and avoid feelings of isolation. Whether they joined a knitting group, played bridge, or took part in group exercise classes, these activities were appreciated not only for their benefits to cognitive health but also for the opportunity to interact socially and feel a sense of belonging. This desire was especially noticeable among participants who had previously discussed experiencing loneliness and isolation (see Chapter 5.4.3), as they mentioned that these experiences had worsened their SCD symptoms and decreased their involvement in activities. Engaging socially through CLA therefore became a way to counter these effects and stay connected, showing a link between earlier emotional experiences and later life motivations.

One participant explained how their knitting group offered a regular and meaningful opportunity to interact socially, stressing that this was key to their reason for attending:

> *"I look forward to going to 'knit and natter', which is where you met me originally, and that's social interaction. I look forward to that and am keen to go on with it." (P16: SCD=17, low CLA)*

Social interaction through CLA also helped improve emotional well-being, making participants feel more secure, less isolated, and more positive about daily life. Another participant shared their experience of attending dance fitness classes and friendship lunches, showing the emotional importance of these social events:

> *"I do a dance fit once a week, so that's another thing to try and keep me active, which is good, because then that's a different group of people to meet with. I do go to these other friendship lunches, because, again, that's meeting people and making you feel better that you've seen other people." (P7: SCD=17, high CLA)*

For some people, socialising itself was the main reason they participated in CLA rather than a secondary effect. The chance to connect influenced their choice of activities and, in some cases, major life choices. One participant mentioned how the need for social contact affected her decision to move:

> "*I'm obviously motivating myself by trying to think about moving house to have more social life (laughing). So, I think that's the biggest factor, really. I'm hoping to move to [neighbourhood] because I know a few people there, and there's so much community you can join in with, and it just keeps you going, you know, looking forward to the next thing." (P19: SCD=7, low CLA)*

Participants also pointed out that CLA encouraged a wide range of social interactions. These activities went beyond close friendships to include broader community connections and interactions across different age groups.

In summary, participants' motivations for engaging in CLA were shaped by a combination of internal and practical factors, including enjoyment, cognitive health, self-confidence, and social connection. Patterns across subthemes were influenced by CLA engagement levels, SCD scores, and age. Enjoyment and confidence were particularly salient among participants with

high CLA engagement, regardless of age or SCD severity. In contrast, motivations linked to fears of cognitive decline, especially dementia, were more common among older adults with higher SCD scores, echoing patterns observed earlier (see Chapter 5.5.1).

6.4 Barriers to Cognitive Leisure Activity Engagement

This theme explores the barriers that prevented participants from participating in CLA; Figure 6.2 displays a word cloud that illustrates these obstacles. These challenges, which included practical, psychological, physical, and cognitive difficulties, were diverse and frequently connected. Many participants talked about how mental exhaustion and perceived cognitive difficulties made it difficult for them to participate in once-enjoyed activities, making even routine tasks seem difficult. Significant barriers also included decreased motivation and self-confidence, with some people expressing reluctance or anxiety about taking on mentally demanding tasks. In addition to limiting participation in activities, physical health issues like arthritis, hearing loss, and decreased mobility also led to social disengagement and a lowered sense of cognitive capacity. Additionally, caregiving responsibilities and other daily commitments left little time or energy for personal cognitive engagement, especially among those balancing multiple roles. The following subthemes illustrate the complex factors that shaped participants' ability, or inability, to sustain engagement in CLA.

Figure 6.2. Word cloud of barriers to cognitive leisure activity

6.4.1 Perceived inability to engage in activities

Participants often mentioned challenges in taking part in CLA because of their belief that their cognitive abilities had declined, they felt mentally tired, and they found tasks that used to be easy now required more cognitive effort. A common issue was having trouble with activities that were once simple. Some could no longer follow patterns or instructions for things they used to enjoy. For example, one person who had knit several cardigans before explained how difficulty understanding knitting instructions made them give up on the activity:

> *"I think knitting. I'm knitting a little cardigan. And I've done about five or six before this, but I've come to a part, a point where I can't understand what the instructions are telling me to do, and I've had a lot of goes with this cardigan. And I've decided I'm going to shelve it (laughing), because I just can't work through it like before I would have been able to just persevere and get an answer. " (P16: SCD=17, low CLA)*

This feeling of cognitive struggle was often connected to memory problems, which made participating in CLA more difficult. Some participants were frustrated by their inability to remember new information or recall important details, such as dance steps or complex game strategies. As explained earlier (see Chapter 5.5), participants often felt frustrated and emotionally distressed when struggling to complete tasks they used to find easy. These difficulties reinforced their belief that their cognitive abilities' declining and made them less likely to try similar activities again.

Mental fatigue was another major obstacle, making participation in CLA more difficult and less enjoyable. For example, one choir member explained that keeping up with multiple conversations and following rehearsals had become exhausting, leading to slow withdrawal from the activity:

> *"I have always sung in choirs; there were even me and my friends a couple of nights ago. It's very tiring. I think it takes me longer to process what's going on around me. I began to be exhausted at the end of a choir rehearsal, and just thought, I have rather let that go. And with the dinner, just four of us around a table, I actually had to say to them, 'Can we just have one conversation? Can we not have two people and two people?' I need to just have one conversation. So, I'm afraid that it may not be strictly speaking memory, but it's something to do with brain function. It just takes a bit longer." (P17: SCD=13, high CLA)*

For some, activities that used to bring pleasure now reminded them of their cognitive struggles, leading to disengagement. Frustration and questioning their own abilities were common emotional responses. The fact that an activity had become much harder to do contributed to avoidance. One participant, who used to enjoy solving complicated puzzles and playing strategy games, described how these activities now made them feel their cognitive abilities had declined:

> *"They show you that you're getting worse. You know, because gradually over the years, the puzzles I used to be able to do the really, really hard ones, and now I can't actually. So obviously my brain is and when I'm playing Rummikub, if my move involves me making three or more, it is demanding. […] as I said, like doing crossword Sudoku reminds me that my brain functions are getting worse." (P11: SCD=14, low CLA)*

In response to these challenges, some participants chose to adjust their level of involvement rather than completely stopping. They preferred less cognitively demanding alternatives, for example, switching from intricate knitting patterns to simpler items like scarves, or choosing to watch TV instead of reading long articles.

Overall, the belief that they were unable to engage in CLA was influenced by cognitive difficulties, memory issues, and an increased need for mental effort. While some stopped participating due to frustration, others found ways to change their activities to better match their changing abilities, showing adaptability and strength.

6.4.2 Psychological and emotional barriers

Internal struggles were a major influence in limiting participation in CLA. These challenges came from lower motivation, reduced confidence, and personal preferences. Many older adults admitted that cognitive issues, like trouble remembering things or fear of not doing well, made them less confident and less willing to take part in activities they used to enjoy.

Past negative experiences, brain-related difficulties, and social influences also led to avoidance. For example, one participant explained how confusion during the COVID-19 pandemic made them less likely to travel alone, which in turn reduced their ability to take part in CLA:

> *"I don't go on the bus into town very often. I think I lost confidence when it was covid. And now I haven't got much confidence for going out on my own, because I did have*

one experience once when I was in town and I couldn't remember the number of the bus to get back home, and I couldn't find that bus stop, and I got really panicked. I didn't know how to get home. And ever since then, I've been very worried of being on my own getting lost. […] I might not find my way back to the car or back to the bus stop or back home. Yeah, it does." (P3: SCD=16, high CLA)

Some participants also mentioned they didn't feel confident about learning and keeping track of new skills, especially those that involved following steps or remembering information. They often hesitated because they worried about making mistakes or feeling like they weren't good enough. They were also worried about being embarrassed if they forgot something or were judged by others. Social issues, such as age-related stereotypes and the stigma around losing cognitive abilities, were also mentioned as making these worries worse (see Chapter 5.5.4). One participant described how the mental effort required in a dance class made them feel uncomfortable:

"That is an activity, actually, which, because with that sort of dance, you do need to have in mind the sequence and a number of moves in order to start to get good at it, and I did not get to the stage of really being confident about that, I am slightly semi panic sometimes." (P8: SCD=15, high CLA)

Personal traits, like being hesitant to try new things or preferring to stick with what they know, added more barriers. This reluctance was often linked to the fear of failing or being uncomfortable with unfamiliar situations, which kept people from trying new experiences. This tendency made it easier for them to avoid cognitively challenging activities and stick to what was familiar:

"Laziness (laughing). So, it's actually about the character of the person. Rather than an obstacle, if you want to do it, you do it, if you don't want to, you don't." (P11: SCD=14, low CLA)

"But I think it's, it frightens people to do new things and to go out. That's the barrier." (P20: SCD=9, high CLA)

These internal struggles, like fear, low confidence, and personal choices, created a cycle that made it harder to stay involved. When an activity was difficult, people were less likely to try it again, which made them feel even more inadequate and limited future participation. Overall,

these internal factors, whether they were related to cognitive problems, emotional discomfort, or personal habits, were key to understanding why CLA engagement was limited.

6.4.3 Health-related limitations

Comorbid health conditions were identified as a significant barrier to engagement in CLA. Physical limitations, chronic illnesses, and sensory impairments limited participation in both direct and indirect ways, leading to social withdrawal, reduced confidence, and lower motivation.

One participant explained how hearing problems affected social interaction and cognitive involvement:

> *"I have a hearing problem, […] if you have a hearing problem and not being able to hear people, I feel what's the point in going out? So then if you don't go out, you're not keeping your brain active, and you're maybe going to fall into this habit of making the memory worse [...]and your brain isn't necessarily working the same […] And I didn't realise just how hearing connects can affect you until it started to happen to me, […]I'm not going out because I can't hear and I just look foolish in front of people, and I embarrass them because they're constantly being asked to repeat what they say." (P15: SCD=12, low CLA)*

This example shows how sensory impairments can limit opportunities for cognitive engagement. Communication challenges and the fear of being embarrassed often caused people to withdraw socially, which in turn lowered self-esteem and weakened the feeling of being connected to others.

Physical health problems, such as arthritis, were also mentioned as obstacles. One person described how thumb arthritis made knitting very painful:

> *"I used to do quite complicated knitting. [...] But I've got arthritis in my thumbs, so it became very painful. So, the stitching, the last attempt at a counted cross stitch, was an absolute disaster." (P18: SCD=11, high CLA)*

Serious illnesses and hospital stay further interrupted participation in CLA. Even after recovering, participants might struggle to get back into their usual routines:

"I had a period when I was in hospital, which was due to an infected cyst on a kidney, and I was seriously ill in hospital for about three months. And I think that had an effect on me. I wasn't doing the normal things that I would have been doing using a computer, doing the things that I would have been doing and so on. I am not getting out as much as I used to, I think it's things like that that have affected confidence as well." (P16: SCD=17, low CLA)

Mobility limitations, whether age-related or due to chronic conditions, were also reported. Challenges like climbing stairs, walking long distances, or moving around the home environment limited involvement in both in-home and community-based CLA:

"Well, for me, living here, you see, it was quite a long walk, and when you go back, you have to go up the hill. I can't do that now, so I have to rely on my husband taking me to places. [...] And that's a nuisance. So actually, physically, not being as mobile, that's a big drawback." (P3: SCD=16, high CLA)

Even those who are currently mobile expressed worries that future physical decline might hinder participation, particularly in community or outdoor settings.

In sum, participants emphasised that comorbid health conditions create multiple barriers to CLA, both direct and indirect. Physical pain and mobility challenges cause immediate difficulties in daily functioning, sensory impairments lead to social withdrawal, and serious illnesses disrupt established routines. Mobility problems not only restrict independent participation but also point to the need for accessible and supportive transportation.

6.4.4 Time constraints and caregiving responsibilities

Other commitments, especially caregiving and family duties, were identified by participants as major obstacles to engaging in CLA. These responsibilities, such as looking after a spouse or other family members, often required a lot of time and energy, leaving little room for personal cognitive or leisure activities. One participant mentioned that her role as a primary caregiver limited her ability to participate in activities she enjoyed, such as exercise and social events:

"And barriers, gosh, I suppose, because I'm a caregiver at the moment, that's a big barrier, because a lot of my time is spent looking after my husband, and I don't have as much time to do my own. I'm trying to balance all the time what I can do with what he

can do and do all our care responsibilities. [...]I normally go to Tai chi class, Friday morning, which is in the centre of town. But I have not been for a few months, because it clashed with the memory café [for husband]. I am missing out on exercise, not just because of my physical disability but because of my caring role." (P2: SCD=12, low CLA)

These caregiving responsibilities made it hard for people to focus on their own activities, often leading them to put others' needs before their own well-being. Another participant described how her family responsibilities restricted her chances to engage in the activities she preferred:

"And still having to run this house looking after my husband and my daughter. She lives downstairs, but she has mobility problems as well, so there's always a lot to do. Otherwise, I could do more of the things I like." (P3: SCD=16, high CLA)

The lack of time and energy resulting from these responsibilities prevented engagement in activities that could provide cognitive and emotional benefits. Caregiving and family responsibilities, therefore, were found to be important barriers because they limited time, energy, and opportunities, even when individuals were interested in participating.

Taken together, a range of barriers to CLA were reported, including perceived cognitive difficulties, emotional reluctance, health problems, and caregiving responsibilities. Health-related limitations and caregiving demands were more commonly reported among those with lower CLA engagement, reflecting externally imposed constraints. In contrast, internal barriers, such as reduced motivation, low confidence, or fear of failure, appeared across both low and high engagement groups. Importantly, some individuals continued active participation despite internal challenges, suggesting that personal resources or coping strategies can moderate their impact. This contrast highlights that structural and health-related barriers directly limit participation, whereas the influence of internal barriers depends on individual factors.

6.5 Strategies to Support Cognitive Leisure Activity Engagement

Participants shared a range of different methods they use to help older people stay involved in CLA, based on their own experiences and what they have seen in their communities. They also recognised the difficulties faced by people who are socially isolated or face challenges due to structural barriers. When asked about ways to make these activities more accessible, they

stressed the importance of informing people about the opportunities available, especially in their local areas. They also suggested making activities easier to reach, such as by improving transport options and helping people develop digital skills. In addition to practical assistance, they highlighted the value of encouragement from family, friends, and peers. They also thought that professional support, given with care and understanding, was key to helping older people feel included, confident, and empowered. The following subthemes show the most effective strategies for keeping older people engaged in CLA.

6.5.1 Availability, accessibility, and awareness of cognitive activities

Participants believed that increasing awareness of available opportunities was essential for encouraging involvement. Although there are many activity groups, many people are not aware of them, and participants felt more effort was needed to promote these groups. They also suggested that activities should combine cognitive stimulation with social interaction, and that better coordination among organisations would help create well-structured and easy-to-access options, including low-cost or free tickets to help with financial challenges.

One participant emphasised the need for effective communication and advertising:

> *"'Friendship at Home' do a good job of advertising and letting people know that they are available. [...] We do have those days here, so it's just really making sure everybody knows about these things that are there." (P20: SCD=9, high CLA)*

Another recommended providing a comprehensive list of activities and resources to facilitate participation:

> *"I would like to have some kind of comprehensive list of resources which may help. [...] a list or a leaflet or some kind of information of what activities would be available and how to get hold of them." (P2: SCD=12, low CLA)*

Beyond awareness, practical accessibility emerged as critical, particularly for those living alone or with mobility difficulties (see Chapter 6.4.3). Transport was described as essential for participation, not just an optional convenience:

> *"Being social, I think it's important you know, you can go out to social clubs [...] but as well as that, then you need transport to get there. Yes, so you need the transport. [...]*

And people need to know that they're there, they need to be able to get there." (P15: SCD=12, low CLA)

Another participant emphasised that transportation was often what determined whether someone could attend an activity, particularly among older adults with reduced independence:

"And I do belong to a couple of older people's groups, and so I do quite a lot of talking with them. And what they really appreciate, and this is what I hear from them, is that they like to go out for their lunch's activity clubs, but what stops them is transport and their mobility. […] There's nobody there to come and collect them. There's no transport that will take them anywhere." (P7: SCD=17, high CLA)

These insights show that transport assistance is not just about getting people to an activity but about enabling them to participate, especially for those who have mobility issues, are isolated, or lack confidence. Supportive transport solutions such as community-organised rides or subsidised travel were seen as important parts of inclusive engagement strategies.

In addition to traditional access, participants highlighted the role of technology in helping older people stay involved in community activities, particularly for those with mobility limitations. Having access to smartphones, TVs, or online resources allowed them to take part in activities like quizzes and games that keep their minds active:

"You know, when you've got a phone, you can do, there's so many activities that you can do. And then there are quite a few things on TV, yeah, you know, quizzes that help stimulate." (P12: SCD=14, high CLA)

Overall, the focus was on improving awareness, making activities more accessible, and offering a wide variety of high-quality options. Locally tailored programs and the use of technology were viewed as important tools for keeping older adults engaged. These approaches show a desire for inclusive, responsive, and empowering opportunities that allow older people to remain cognitively active.

6.5.2 The role of social encouragement

Social encouragement was crucial for supporting CLA engagement, particularly for those experiencing self-doubt or low motivation due to SCD. Reassurance from family, friends, or community members helped participants overcome hesitation:

"You need somebody to encourage you." (P10: SCD=14, high CLA)

Several participants explained that even when activities were available, the emotional challenge of initiating participation could be significant. In these situations, having someone to encourage them, whether by inviting them to an event, reminding them of an activity, or simply showing interest in their involvement, was seen as critical:

> *"It's a series of tiny breakthroughs. But you need help. You need somebody to stimulate you, because you've got the fears." (P6: SCD=13, high CLA)*

Shared in-person experiences were particularly motivating for individuals with memory difficulties or low confidence, making engagement feel less intimidating:

> *"Because there are online resources, but if you have memory problems and you're beginning to lose your confidence, you wouldn't do them, would you do online? I think you need to be with somebody you know, to have, like, a social group or where you can do it with other people." (P19: SCD=7, low CLA)*

Beyond initiation, social encouragement supported ongoing participation by fostering regular contact, companionship, and a sense of accountability. These supportive relationships helped reduce anxiety related to cognitive lapses, increased confidence, and made CLA more meaningful (see Chapter 5.6.2 for earlier reflections on social support as a coping strategy).

Together, encouragement from family, friends, and peers emerged as a powerful facilitator, providing both emotional reassurance and practical motivation for sustaining cognitively stimulating activities.

6.5.3 Empathy and tailored professional guidance

Participants highlighted that empathy and personalised support from professionals are essential for meaningful involvement in CLA, especially when individuals feel their personal experiences are understood.

One participant mentioned that, although healthcare professionals have good intentions, they may find it difficult to fully understand the challenges older adults face, particularly those related to cognitive issues, which can lead to emotional distress:

"I think that although professionals try to understand the elderly, it is difficult for them to put themselves in our shoes and approach them, because they have not experienced the same things, that is, they cannot fully understand what is happening, what you are going through." (P11: SCD=14, low CLA)

Some highlighted the importance of patient, empathetic communication, particularly when older individuals repeat themselves, suggesting that such understanding can reduce embarrassment and encourage participation:

"Certainly, it would help if there was a national focus on, you know, this is a growing issue, and we need to do something about it. We need to put things in place to try and help and support people." (P13: SCD=11, low CLA)

Others shared positive experiences reported by individuals working in senior support organisations, who noted that health professionals are increasingly recommending CLA alongside traditional approaches when addressing SCD. It reflects growing awareness of cognitive engagement as part of comprehensive support for older adults.

Overall, genuine, person-centred, and empathetic professional support was seen as vital for maintaining confidence and motivation to participate in CLA, stressing the need for training and awareness programs to help professionals better meet the specific needs of individuals with SCD.

6.6 Discussion

This qualitative research aimed to examine the main issues that influence CLA engagement among older adults with SCD and findings revealed several connected patterns. Enjoyment and confidence were identified as key motivators for participating in CLA, suggesting that personal satisfaction and a sense of ability are crucial for continued involvement. Fear-based motivations, especially worries about dementia, were also reported, especially among older participants with higher SCD concerns, indicating that perceptions of cognitive risk can encourage engagement as a form of protection. Participants who felt lonely reported social connection as a major driver, highlighting how emotional needs intersect with participation in group-based activities. Despite cognitive, emotional, and health-related challenges, some individuals remained highly engaged in CLA, showing how internal motivation and social support can help overcome obstacles. Furthermore, structural barriers like health problems and

caregiving duties directly limited participation, particularly among those with lower CLA engagement levels. These patterns demonstrate how personal goals, emotional concerns, perceived cognitive vulnerability, and external factors combine to influence CLA engagement, providing insight for developing interventions that better support older adults with SCD.

Findings support previous evidence showing that the main reasons older adults' engagement in CLA in later life are enjoyment, confidence, maintaining cognitive abilities, and social interaction. A study by O'Neil-Pirozzi (2021) found that older adults felt more confident when CLA was seen as both challenging and fun, and enjoyment had a strong effect on how confident they felt about themselves. A recent review also found that enjoyment and being motivated are important for keeping up with leisure activities, and they help with cognitive benefits such as improved flexibility and attention (Wenzel *et al.*, 2024). A key contribution of this research is that enjoyment and confidence, more than cognitive preservation alone, were particularly prominent motivations among individuals with SCD, supporting ongoing engagement and emotional coping. Many older adults also engage in CLA to keep their minds active and slow down any decline (Buckley *et al.*, 2015; Parikh *et al.*, 2016), consistent with evidence that mentally stimulating activities support brain health and overall well-being (Ball *et al.*, 2007; Litwin, Schwartz and Damri, 2017). Fear-driven motivations, stemming from awareness of subtle cognitive changes, were also emotionally salient drivers of participation. Social connections were also an important reason for staying involved, with friendship, being with others, and feeling part of a group helping people keep participating (Ball *et al.*, 2007; Ihle *et al.*, 2018). Participants often said that loneliness made SCD feel worse, but joining CLA with others helped reduce feelings of isolation and kept things feeling normal. All together, these findings show that engagement in CLA is influenced by a dynamic interplay of enjoyment, confidence, cognitive concerns, and social ties. This highlights the need to focus on both the personal reasons people get involved and their social and emotional needs.

Older adults with SCD experience various, often connected, obstacles that make it hard for them to take part in CLA. One major issue found in this research is the belief that they cannot succeed in tasks that require a lot of cognitive effort. This is consistent with previous research that shows problems with remembering words, keeping up in conversations, and recalling past discussions often lead people to avoid social and leisure activities (Parikh *et al.*, 2016; Rotenberg, Sternberg and Maeir, 2020). This perception can lower confidence when dealing with complex or new situations, causing individuals to choose fewer demanding options instead

(Imhof *et al.*, 2006; Paanalahti *et al.*, 2023). Psychological and emotional challenges, such as low self-belief, reduced motivation, and feelings of frustration or embarrassment, are closely linked to this perception. Participants shared how memory problems and past negative experiences increased stress and made them avoid activities, similar to findings that show older adults with memory issues report less satisfaction with meaningful activities, especially when others notice their forgetfulness (Akasaki *et al.*, 2024). SCD is also connected with higher levels of anxiety, depression, and emotional stress (Hill *et al.*, 2016; Jessen *et al.*, 2020), which further reduces motivation and makes it harder to participate in CLA (Hill *et al.*, 2022; Akbayrak *et al.*, 2024). Although these internal barriers are common, their effects can differ based on how people cope and the support they receive, suggesting that these issues could be addressed through support or tailored approaches. Structural and situational barriers had a more significant impact: physical limitations such as mobility issues and hearing loss made participation difficult, consistent with evidence linking physical restrictions to wider psychosocial consequences (Goins *et al.*, 2015; Ha and Pai, 2018). Time issues, especially from caregiving duties, also reduced the chances of opportunities for CLA (Dunn and Strain, 2001; Schüz *et al.*, 2015; Rokicka and Zajkowska, 2020). Overall, the evidence indicates CLA participation being shaped by a dynamic interaction between personal and structural challenges.

The current qualitative results show that digital technologies support CLA engagement by allowing people to engage in activities that challenge the cognitive function, especially for those with mobility issues. This aligns with previous research showing that having access to digital tools helps older adults engage in mentally stimulating activities, connect socially, feel more independent, and improve their overall well-being, especially if they live alone (Yan and Xing, 2025). Online platforms, such as video channels based on interests and virtual groups, help reduce barriers to participation by filling information gaps and offering meaningful interactions and companionship (Yan and Xing, 2025). New research suggests using digital devices often is linked to fewer complaints about SCD, especially in executive functioning (Benge *et al.*, 2023). A recent pilot study also found that a mobile-based lifestyle program, including digitally delivered cognitive activities and training, was well-received and led to better health habits and cognitive function over 24 weeks, showing the potential and effectiveness of digital methods in promoting CLA (Lin *et al.*, 2025). Technology can act as both a preventive and support tool by offering structured mental challenges and social opportunities, allowing continued CLA participation even when physical movement or other

constraints prevent in-person involvement. These digital solutions can be customised to suit individual needs and abilities, ensuring they are accessible and help individuals feel more in control and motivated.

Participants stressed that caring and personalised professional support is key to effectively addressing SCD and helping older adults sustain with cognitively stimulating activities. How healthcare professionals communicate and respond affects how much trust people have in assessments and how willing they are to accept concerns about SCD (Corner and Bond, 2004; Birt *et al.*, 2020). If interactions are dismissive or unclear, individuals may feel ignored or unsure about how to manage their cognitive changes (Birt *et al.*, 2020). Many people feel their symptoms are not taken seriously unless there's clear evidence of impairment, pointing to the need for both subjective and objective evaluations (Kiene, Hildebrandt and Roheger, 2025). The findings from this research show that social support helps by giving motivation, reassurance, and company. Although subjective memory issues are related to less emotional support (Ha and Pai, 2018), the participants in this research used social connections both as a way to cope and as a reason to engage in CLA. Combining compassionate professional guidance with social support enables older adults with SCD to stay involved in CLA, which benefits both their cognitive abilities and their emotional and cognitive health.

Overall, these results show that intrinsic motivations, psychological states, and external constraints interact dynamically to shape CLA engagement among older adults with SCD. While perceived cognitive challenges, emotional distress, and situational constraints functioned as barriers, enjoyment, confidence, cognitive preservation, and social connectedness emerged as important drivers. Importantly, supportive interventions, such as social encouragement, individualised guidance, and coping mechanisms adopted by participants, can frequently reduce intrinsic barriers, such as low confidence or fear of cognitive decline. Targeted solutions, like accessible programs, digital inclusion, or transportation facilitation, are needed to address structural and practical constraints like mobility limitations or caregiving demands. By integrating these insights, findings from this research enhance understanding of how personalised, community-based strategies can sustain CLA engagement and promote cognitive, emotional, and social wellbeing among older adults with SCD. These findings also advance current knowledge by linking motivations, barriers, and enabling strategies, offering practical and theoretical guidance for future research, intervention development, and community practice.

6.7 Chapter Summary

This chapter presented the qualitative findings on the motivations, barriers, and strategies shaping CLA engagement among older adults with SCD. Engagement was driven by enjoyment, cognitive preservation, enhanced confidence, and social connection, while participation was constrained by perceived cognitive difficulties, emotional hesitations, health-related limitations, and caregiving responsibilities. Participants suggested that accessibility, social encouragement, and tailored professional guidance could facilitate sustained engagement. While these findings are discussed in relation to previous literature here, a more detailed interpretation, including consideration of methodological strengths and limitations, and integration with quantitative research findings is presented in Chapter 7 and discussed further in Chapter 8. The following chapter integrates the qualitative and quantitative findings to provide a comprehensive understanding of the relationship between SCD and CLA engagement.

CHAPTER 7-Integration of Findings

7.1 Introduction

This chapter integrates the quantitative and qualitative findings of this research to provide a comprehensive understanding of the relationship between subjective cognitive decline (SCD) and cognitive leisure activity (CLA) engagement in older adults. Using a mixed methods approach, it examines how the two strands of data converge, complement, or diverge across the three quantitative research questions. Integration is structured around a joint display that summarises results from both phases, enabling the identification of patterns such as bidirectional relationships, perceived benefits, links between specific activity types and domain-specific cognitive concerns (Guetterman, Fetters and Creswell, 2015). The joint display is followed by a narrative synthesis that interprets the integrated findings, combining the breadth of quantitative results with the depth of qualitative insights.

7.2 Summary of Quantitative and Qualitative Research Findings

Table 7.1 provides a concise summary of the key quantitative and qualitative findings, which informed the integration process. Quantitative results highlighted associations between SCD, CLA engagement, and sociodemographic factors, while qualitative themes enriched this understanding by capturing participants' lived experiences, including their motivations, perceived barriers, and everyday strategies for engagement. These findings together set the stage for integration addressing the research questions.

Table 7.1. Summary of key quantitative and qualitative findings

Quantitative Findings	Qualitative Findings
No significant differences in SCD concerns were observed across gender, education, or marital status; however, older age was significantly associated with greater SCD concerns. Greater CLA engagement frequency and variety linked to fewer SCD concerns. Moderated regression analyses indicated that CLA engagement did not moderate the relationship between age and SCD. Specific CLA types (puzzles, reading, theatre, group activities) showed domain-specific associations with SCD, independent of age.	Lived experience of SCD: Participants predominantly reported memory-related concerns, followed by difficulties in language, executive functioning, and attention. Loneliness was perceived to exacerbate SCD symptoms, whereas former work roles were viewed as having a protective influence. Negative impacts of SCD: These symptoms often led to emotions such as fear of decline, shame, anger, and frustration, which in turn contributed to social avoidance. External factors such as ageism and societal stigma further intensified these experiences. Coping strategies for SCD: Participants described using strategies such as peer comparison, seeking social support, and employing memory aids to manage these challenges. Motivations for CLA: Participants' engagement was driven by enjoyment, maintaining cognitive health, building confidence, and sustaining social engagement. Barriers to CLA: Barriers were primarily cognitive and psychological (e.g., fatigue, anxiety, low confidence), alongside health-related and practical constraints such as time and caregiving responsibilities. Strategies to support CLA: Suggested strategies included improving availability and accessibility, fostering social encouragement, and providing empathetic and tailored guidance.

Note. SCD (Subjective Cognitive Decline); CLA (Cognitive Leisure Activity)

7.3 Integration of Findings

Integration followed an explanatory sequential design, where qualitative findings were used to contextualise and enrich the interpretation of quantitative results. A joint display (Table 7.2) brings together both strands of data, organised around the three research questions, as follows:

1. What is the relationship between SCD and CLA engagement among older participants, including variation across sociodemographic groups and domain-specific cognitive concerns (memory, language, executive function)?
2. How might engagement in CLA influence the relationship between age and SCD, including domain-specific concerns?
3. What is the relationship between engagement with different types of CLA and SCD, including domain-specific concerns?

The joint display is followed by a narrative synthesis that interprets convergent patterns, complementary insights, and areas of divergence between the two datasets.

Table 7.2. Joint display of integrated findings

Research Question	Quantitative findings	Qualitative findings	Integration	Integration label
1. **What is the relationship between SCD and CLA engagement in older participants?**	Higher CLA engagement was associated with lower total and domain-specific SCD concerns, independent of age.	SCD symptoms (e.g., memory lapses, difficulties with concentration) reduced motivation and confidence for CLA due to perceived inability and negative emotions, including frustration, embarrassment. SCD-related concerns and fear of further cognitive decline functioned as a motivator for some participants, prompting engagement in CLA as a self-initiated strategy to preserve cognitive health and, often linked to a desire to delay or avoid dementia. Personal coping strategies such as humour, memory aids, peer support, and determination supported sustained CLA engagement. Social encouragement, access to activities, transport, and empathetic professional support facilitated continued CLA engagement.	Bidirectional relationship: While greater CLA engagement may be theorised to protect against SCD, symptoms can lower motivation and confidence via negative emotions (such as fear, embarrassment, frustration), leading to withdrawal, especially when combined with ageism and stigma. Yet, these same emotions can also motivate CLA as a self-driven effort to maintain cognitive health ("*keep the brain going*"). Coping resources and beliefs about CLA (e.g., "*use it or lose it*") shape engagement patterns: Normalising memory lapses as part of typical ageing, along with the use of humour to reduce embarrassment, helped participants maintain confidence and continue engaging in CLA. Peer comparison provided reassurance, while practical tools such as to-do lists, calendars, and digital reminders supported a sense of autonomy and daily functioning.	**Complementary / Expansion –** Quantitative and qualitative findings complement each other, with qualitative insights explaining the mechanisms behind the observed association.

Research Question	Quantitative findings	Qualitative findings	Integration	Integration label
			Social and environmental supports (family and/or friend encouragement, accessible activities, transport, empathetic professional guidance) play a complementary role in enabling ongoing CLA participation, highlighting that both internal and external factors are crucial to sustain CLA despite SCD symptoms.	
How do levels of SCD vary across sociodemographic groups?	No significant differences in total or domain-specific SCD scores (memory, language, executive function) were observed based on education level, marital status, or gender. Older age was associated with higher total and domain-specific SCD concerns, with a small but statistically significant effect, except marginally for the language domain.	Older participants, especially those aged 80 and above, experienced greater emotional distress and reduced CLA engagement. Living alone was linked to increased loneliness and higher SCD concerns but also motivated greater CLA engagement to maintain social connection. Mentally stimulating occupations appeared protective; retirement often led to reduced engagement, heightening SCD concerns.	While sociodemographic characteristics did not significantly predict SCD score (except for age), qualitative findings revealed that age, marital status, and work experience appeared to influence the emotional and cognitive experience of SCD. Participants frequently reported language difficulties in daily life, such as word-finding problems, pauses or hesitations in conversation, and difficulty formulating sentences, even if the quantitative association with age was only marginal.	**Complementary –** Qualitative findings elaborate on minimal quantitative differences, highlighting emotional and contextual dimensions.

Research Question	Quantitative findings	Qualitative findings	Integration	Integration label
			Older participants (those aged 80 and above), and those without partners described greater loneliness and distress. Social connections served as both essential coping resources and key motivators for engaging in CLA. Cognitively demanding occupations were perceived as protective, suggesting that occupational cognitive engagement may impact SCD concerns.	
2. **How might engagement in CLA influence the relationship between age and SCD?**	Hierarchical moderation analyses indicated that CLA engagement did not significantly moderate the relationship between age and SCD, suggesting that the effect of age on SCD was similar regardless of participants' level of CLA engagement.	Participants perceived cognitive benefits from CLA, such as improved memory, concentration, word recall, and language fluency, which motivated continued engagement despite uncertainty about actual effects. CLA participation boosted confidence and self-worth, increasing a sense of capability and motivation to remain cognitively active. Keeping the mind occupied through routines, hobbies, music, news, games were used as a coping strategy to	Quantitative data showed no statistical moderation effect, but qualitative data revealed a perceived subjective buffering role of CLA. CLA served as a psychological and emotional moderator, fostering perceived cognitive control, effectiveness and resilience. The social dimension of CLA, providing structure, social connection, and protection from isolation, emerged as a powerful motivator and perceived protective	**Discrepant / Expansion –** While quantitative analyses showed no moderation effect of CLA on the age–SCD relationship, qualitative findings revealed perceived cognitive, emotional, and social buffering effects. CLA supported participants' sense of cognitive control, self-efficacy, and resilience, highlighting subjective protective

Research Question	Quantitative findings	Qualitative findings	Integration	Integration label
		maintain structure, avoid rumination, and reduce cognitive decline. Maintaining social engagement through CLA like knitting, games and choir reduced isolation, improved mood, offered purpose, and in some cases motivated major life changes such as moving house to increase participation in group activities.	factor, even if not captured quantitatively.	mechanisms not captured by standard statistical models.
3. What is the relationship between engagement with different types of CLA and both total and domain-specific SCD?	Greater variety in CLA engagement was associated with lower total and domain-specific SCD concerns. Specifically: • Engaging in puzzles (crosswords, jigsaws or sudoku) was related to reduced total and domain specific SCD concerns. • Reading, and attending the theatre, concerts, or symphonies were linked to lower total SCD concerns.	Some participants reported that puzzles and reading increased their awareness of cognitive decline, sometimes leading to frustration. Others perceived little measurable benefit yet continued engagement for enjoyment, habit, and a sense of mental stimulation. Participants described group-based CLA, such as knitting and bridge, as providing opportunities for socialising, as well as emotional and cognitive benefits, which were perceived as protective. Volunteering was valued for providing purpose, social connection, and a sense of continued cognitive competence.	Quantitative data demonstrated clear associations between engagement in certain CLA and reduced SCD concerns, whereas qualitative findings revealed mixed subjective experiences. Cognitively demanding activities, such as puzzles and reading, were sometimes experienced as *double-edged*, both mentally stimulating and sources of frustration when difficulties were noticed. Although socialising was not significant in the quantitative findings, participants used social connection both as a coping mechanism for SCD-related symptoms and as a motivator for	**Partially Complementary / Mixed –** Quantitative and qualitative findings generally converge but also diverge in perceived effectiveness, highlighting the multidimensional and experiential character of CLA engagement.

Research Question	Quantitative findings	Qualitative findings	Integration	Integration label
	• Playing chess, checkers, backgammon, reading, and attending group activities or performances were associated with fewer memory concerns. • Reading was linked to reduced language concerns. • Attending the theatre, concert or symphony was associated with fewer executive function concerns. Age-controlled hierarchical regression analyses confirm that the observed associations between specific CLA participation and lower SCD score remained significant after controlling for age.	Music-related activities were described as cognitively stimulating and memory-enhancing.	continued CLA engagement, perceiving socialising as emotionally and cognitively beneficial. Activities such as volunteering and music participation provided perceived cognitive and emotional rewards.	

Note. SCD (Subjective Cognitive Decline); CLA (Cognitive Leisure Activity)

7.3.1 Relationship between subjective cognitive decline and cognitive leisure activity engagement

The joint display in Table 7.2 illustrates a bidirectional and integrated relationship between CLA engagement and SCD among older adults. When considered together, the quantitative and qualitative findings demonstrate not only an association between lower CLA engagement and higher SCD concerns but also illuminate the emotional and psychological mechanisms through which this relationship operates. Quantitative findings demonstrated that higher levels of CLA were associated with lower overall and domain-specific SCD concerns, even after controlling for age. These statistical associations are meaningfully explained by the qualitative data, which revealed that experiences such as memory problems, difficulty finding words, or trouble concentrating often reduced motivation and confidence to engage in cognitively challenging activities. Negative emotions, including fear of developing dementia, feelings of embarrassment, and frustration, emerged as key linking processes connecting SCD symptoms with reduced CLA involvement. These feelings can cause some people to stop participating in activities they think are cognitively challenging. These emotional and psychological barriers were reported by both highly and less engaged participants. Their influence appears widespread, but their impact can be lessened by personal coping strategies and support from others. Yet, the fear of cognitive decline can also be a driving force for some, pushing them to get more involved in CLA to keep their mind active. This ambivalence was particularly evident among older participants with higher SCD concerns, for whom fear of decline simultaneously functioned as both a threat and a motivational driver.

When examined alongside quantitative patterns, qualitative findings further clarified how individuals maintained CLA engagement despite experiencing SCD symptoms. Participants described a range of adaptive strategies, including accepting memory lapses as a normal part of ageing, using humour to manage embarrassment, and making downward social comparisons, all of which helped to sustain confidence and emotional resilience. Practical tools like to-do lists, calendars, and digital reminders helped people stay on track and keep their independence. Personality traits like being determined, optimistic, and enthusiastic also helped people keep participating. Notably, integration revealed that while enjoyment and confidence functioned as consistent motivators across participants, those who adopted acceptance-based coping approaches, such as humour, gratitude, and self-compassion, were particularly successful in sustaining CLA engagement despite cognitive concerns. These adaptive perspectives seemed

to reinforce intrinsic motivations and a sense of achievement, helping to sustain engagement even in the presence of cognitive concerns. Besides these personal strategies, participants also mentioned the importance of external support such as encouragement from others, activities that are easy to find and promote, transportation help, and professional guidance that is understanding and personalised. Together, these social and environmental resources interacted with personal coping strategies to offset emotional barriers such as fear and self-doubt. However, more concrete problems, like taking care of others or having health issues, were mainly reported by those who were less involved in CLA, suggesting that these structural barriers had a more direct effect on their ability to participate. Collectively, these findings suggest that sustained CLA engagement in the context of SCD is shaped not only by cognitive symptoms themselves but by the availability of adaptive coping strategies, intrinsic motivation, and supportive social and environmental contexts.

While the quantitative results showed limited sociodemographic factors predicting SCD, other than age, the qualitative data gave deeper understanding of how ageing was experienced cognitively and socially. Older individuals, especially those 80 and above, often expressed greater worry about cognitive slips, which seemed to lower their confidence and involvement in CLA. However, quantitative findings showed no significant association between age and CLA engagement frequency, suggesting that despite increased worry, older adults did not engage less frequently in these activities. Although the link between age and concerns about language-related SCD was not significant in the quantitative analysis, the qualitative findings showed that difficulty with language was one of the most common cognitive changes mentioned. Many participants reported trouble finding words, losing their thought flow during conversation, or struggling to express themselves clearly. These experiences often led to feelings of embarrassment or frustration, especially in social situations, and seemed to increase their awareness of cognitive changes. These issues might reflect minor declines in verbal fluency or working memory that are not fully captured by quantitative measures, showing the value of personal experiences in understanding language-related aspects of SCD. In addition to age, participants' past occupations influenced their cognitive experiences. Jobs that required a lot of cognitive effort were seen as helpful, helping to keep the mind sharp and providing a sense of purpose. Retirement, on the other hand, often meant a change, with less mental activity and fewer social connections. This shift seemed to increase awareness of cognitive problems, especially when daily life no longer included regular social and intellectual interaction.

Although quantitative analysis did not reveal a significant association between marital status and SCD, qualitative findings highlighted how living alone or being widowed contributed to loneliness, social disconnection, and reduced opportunities for cognitive engagement, demonstrating that subjective experiences can reveal subtle differences not captured by statistical measures. In contrast, married participants generally described being thankful for having a partner to share ideas, memories, and keep their minds active. For those without a partner, loneliness was seen as both upsetting and a barrier to participating in CLA. Social connections worked as both a way to cope and a way to stay motivated, as lonely people often joined group-based CLA such as singing in a choir, playing bridge, knitting, or volunteering to reduce isolation and keep their minds active. Taken together, these findings show that while growing older and living alone might increase SCD-related worries and reduce participation in activities, social connections help support emotional well-being and continued CLA engagement.

Help-seeking was not the main focus of this research, but it became a significant theme. In terms of numbers, 46.3% of the participants said they would think about getting help from a professional for cognitive decline, such as forgetfulness, difficulty concentrating, or trouble with language. However, the qualitative results showed that there was a difference between what people intended to do and what they actually did. Many participants thought their symptoms of possible early cognitive decline were normal parts of getting older, which made them feel less urgent about talking to a healthcare provider. Moreover, participants who had taken care of someone with dementia or had seen how it progresses were less likely to seek help, as they knew there is no cure, and they often felt that seeing a doctor was not helpful but was a burden. These feelings were made stronger by their worries about making their family members upset, their experiences of not being taken seriously by loved ones, and a tendency to talk to others who could understand their situation instead. Because of this, most participants used their own ways to cope with these changes, such as comparing themselves to others, using humour, and using tools to help with memory, to handle their cognitive changes and to maintain daily functioning.

7.3.2 Moderating role of cognitive leisure activity engagement

When examining the potential protective role of CLA engagement in relation to SCD, findings revealed partial convergence between the quantitative and qualitative data. While quantitative analyses indicated no significant moderation of the relationship between age and SCD

concerns, qualitative findings provided richer insights into participants' experiences. Older adults mentioned several benefits they saw from doing CLA, such as better memory, improved concentration, better word recall, and clearer speech. These improvements helped them feel more confident, accomplished, and motivated to keep participating, even if they weren't sure about the actual results. Engaging in cognitively challenging activities also helped them stay cognitively active, reduce negative thoughts, and keep their minds sharp. Additionally, participating in these activities helped them stay connected with others, gave them structure in their day, and reduced loneliness, which improved their emotional health and made them feel more resilient. Overall, even though quantitative data didn't support the idea that CLA reduces SCD-related concerns, participants felt that CLA helped protect them in different ways, offering support for their cognitive health, their mental health, and their social connections.

The lack of a statistically significant moderation effect of CLA in the quantitative analyses may be due to multiple reasons. Age showed no significant association with CLA engagement frequency (see Table 4.4), and this independence between the two variables may help explain the non-significant moderation effect: if participation frequency does not vary meaningfully with age, there is limited statistical basis for CLA frequency to differentially buffer the relationship between age and SCD concerns. This could be related to the linear assumptions of the statistical model and the fact that the benefits of CLA are not always dose dependent. This might hide threshold or non-linear effects that individuals experienced on a personal level. Statistical models may also not be sensitive enough to capture subjective psychological changes, especially when the effects are small. Participants' beliefs and expectations may also influence their experience, as believing in the cognitive benefits could maintain motivation and a sense of self-efficacy regardless of actual outcomes. Additionally, CLA engagement might offer emotional or social advantages, such as stress relief, resilience, and support through interactions with others, which are not measured by standard quantitative tools for measures of SCD. These points suggest that CLA could function more as a psychological and social buffer rather than a direct cognitive enhancer. They also highlight the limitations of traditional moderation models in capturing internal processes like self-belief, perceived benefits, and emotional regulation, and emphasise the importance of combining quantitative and qualitative methods to differentiate between measurable and perceived effects on cognitive health in later life.

7.3.3 Types of cognitive leisure activity and domain-specific subjective cognitive decline

The integration of quantitative and qualitative findings offers more comprehensive insights into how different types of CLA relate to specific concerns in SCD, beyond just statistical associations. Quantitative results show that greater involvement in CLA is linked to fewer cognitive complaints, and certain activities like puzzles, reading, and group-based activities have specific associations with cognitive domains. Qualitative data enrich these insights by revealing the complexity of participants' experiences. Some participants reported that engaging in cognitively challenging activities, such as puzzles and reading, sometimes made them more aware of their cognitive decline and caused frustration, while others felt little difference. Despite these mixed effects, many continued with these activities for routine, enjoyment, mental stimulation, and social interaction.

Activities such as volunteering and music engagement were seen as meaningful in both cognitive and emotional terms, even when there was no strong quantitative link to SCD concerns. Volunteering offered a sense of purpose, social connection, and the feeling of maintaining cognitive ability, while music was often described as mentally stimulating and memory-supporting, similar to a revision process. Social interaction also had multiple roles. Although socialising did not show significant associations with SCD in quantitative analysis, participants valued it as a way to manage symptoms related to SCD and as a reason to continue participating in CLA, perceiving both emotional and cognitive benefits. Group-based activities that include social interaction, such as attending concerts, theatre performances, and symphonies, were found to have a significant association with lower concerns about SCD. However, general socialising as a whole did not reach statistical significance in the quantitative analyses. One possible reason for this is that these structured group activities combine social interaction with cognitive challenges, whereas casual socialising usually involves simple conversations that might not offer enough cognitive stimulation to impact SCD measures. Overall, these results suggest that some CLA are directly linked with lower perceived cognitive decline, while others benefit individuals through emotional, motivational, and psychosocial pathways, highlighting the complex and multifaceted nature of cognitive health in older adults.

7.4 Chapter Summary

This chapter combined quantitative and qualitative findings to give a more complete picture of the relationship between CLA participation and SCD. The joint analysis showed areas where the data agreed, differed, and supported each other. Quantitative results showed that more CLA engagement was associated with lower total and specific domain concerns about cognitive decline. Qualitative data provided insight into the emotional, motivational, and contextual influences that shape CLA participation, including coping strategies and support from others. While sociodemographic factors beyond age had limited predictive value in quantitative analyses, qualitative findings showed that living arrangements and past work experiences could influence how individuals perceive their cognitive decline. The findings suggest that CLA engagement provides cognitive, emotional, and social benefits, even when there is no clear evidence of measurable cognitive protection. Overall, these results highlight the value of a mixed methods approach for capturing both objective and subjective aspects of the SCD–CLA relationship and set the stage for the integrated discussion in Chapter 8.

CHAPTER 8- Discussion and Conclusion

8.1 Introduction

This final chapter brings together the key findings of the research, situating them within the broader literature on subjective cognitive decline (SCD) and cognitive leisure activity (CLA) engagement in older adults. The chapter begins by summarising the principal findings of the thesis. It highlights how the present research sought to address specific gaps in the existing literature, particularly through the integration of quantitative and qualitative findings. This joint interpretation illustrated the unique contributions of each methodological strand to addressing the research questions. Following the summary, the core findings are discussed in relation to prior literature, drawing connections and distinctions where relevant. The chapter then reflects on strengths and limitations of the research, considering their implications for the interpretation and generalisability of the results. Based on these insights, practical and policy recommendations are offered for professionals, researchers, and policymakers working with ageing populations. Finally, directions for future research are outlined, with attention to both conceptual and methodological considerations. The chapter concludes by revisiting the overarching aims of the thesis and reflecting on its contributions to the field.

8.2 Summary of Key Findings

This PhD thesis set out to examine the relationship between SCD and CLA engagement in older adults, through a range of methodological approaches. The following key findings summarise the main insights from the systematic review, quantitative, and qualitative research, highlighting how CLA engagement interacts with SCD in older adults:

Association between CLA engagement and SCD in the literature is inconsistent and heterogeneous: A published systematic review (Chapter 2; Akbayrak *et al.*, 2024) as part of this PhD found a moderate link between higher CLA engagement and lower SCD, but results varied across studies due to differences in study design, outcome measures, and the cognitive domains examined.

Higher engagement in CLA is linked to lower levels of SCD concerns: Quantitative analyses indicated that engaging in a greater variety and frequency of CLA is associated with lower levels of both total and domain-specific SCD concerns. Qualitative findings further

illustrated how personal motivations, coping strategies, perceived barriers, and available social support enabled participants to maintain activity despite cognitive complaints.

SCD and CLA engagement influence each other in a bidirectional and complex manner: Integrated findings show that SCD concerns can both discourage and motivate participation in CLA. This dynamic is shaped by individual coping strategies, psychological resources, social support, and perceived benefits, demonstrating that engagement is influenced by both internal and external factors.

CLA enhances well-being, even if it doesn't quantitatively moderate age-SCD: While quantitative analyses did not identify a significant moderating effect of CLA on the relationship between age and SCD, qualitative findings revealed that participation supported perceived cognitive function, psychological wellbeing, and social connectedness. These subjective benefits were seen by participants as protective against cognitive decline and contributed to maintaining motivation and engagement.

Certain types of CLA were differentially associated with domain-specific SCD concerns: Some activities showed domain-specific or total associations with lower SCD concerns, while some cognitively demanding activities could provoke frustration; despite this, participants continued engagement due to perceived cognitive, emotional, and social benefits.

8.3 Discussion of Integrated Findings

Building on the key findings summarised above, the following discussion explores each research question in greater depth.

8.3.1 Relationship between subjective cognitive decline and cognitive leisure activity engagement

Previous research has largely focused on the unidirectional influence of CLA on cognitive outcomes, showing that frequent participation in activities such as reading, puzzles, or group discussions is associated with improved cognition in older adults (Geda *et al.*, 2011; Sposito, Neri and Yassuda, 2015; Yates *et al.*, 2016), and is also linked to fewer SCD concerns, as evidenced in the systematic review carried out as part of this thesis (Chapter 2; Akbayrak *et al.*, 2024). The current research in this thesis builds on these findings by showing a more complex relationship between engagement in CLA and SCD. Quantitative results showed that

higher levels of CLA engagement are associated with fewer overall and specific SCD concerns. Qualitative insights, on the other hand, reveal the emotional, motivational, and situational reasons behind participation in CLA. Many participants mentioned fear of cognitive decline and a wish to *"stay sharp"* as main reasons for their involvement, a pattern consistent with prior studies showing that concerns about memory can encourage people to engage in cognitively stimulating activities among individuals with SCD (Parikh *et al.*, 2016; Rotenberg, Sternberg and Maeir, 2020). These findings suggest that how people perceive their cognitive changes and the emotions they feel about these changes are key factors in deciding to engage in CLA. They also affect how individuals understand and deal with their symptoms through everyday actions. These processes are well known in health psychology, where they are studied in relation to self-regulation and how people cope with perceived health threats (Hagger and Orbell, 2003; Leventhal, Phillips and Burns, 2016). This gives a useful way to understand CLA participation in the context of SCD.

At the same time, this research also shows that some individuals may reduce their CLA engagement when they experience cognitive symptoms. Problems such as forgetfulness, difficulty finding words, and lapses in attention can lead to withdrawal or avoidance because of embarrassment, fear of being judged, or feeling inadequate. This is in line with previous evidence that subjective concerns about memory can lead people to avoid situations that demand cognitive effort to prevent possible embarrassment (Lee and Foster, 2023). Feelings of frustration and a negative self-image are also common when dealing with memory issues, which can result in disengagement from activities that are cognitively or socially challenging (Hill *et al.*, 2018; Paanalahti *et al.*, 2023; Akbayrak *et al.*, 2024). In a qualitative study focusing on older adults living in the community (with an average age of around 80.7 years), Hill et al. (2018) found that individuals who experienced greater subjective memory issues were more likely to stop engaging in activities that protect cognitive function, especially in daily tasks like following conversations or recalling names. Social norms, shared beliefs about how others view and judge memory problems, may reinforce perceived forgetfulness (Mol *et al.*, 2008). The fear of being criticised or disapproved of can lead to avoidance behaviours, which in turn limit opportunities for cognitive activity (Mol *et al.*, 2008). Overall, these findings show a complex, bidirectional relationship where perceived cognitive symptoms can both encourage and discourage participation in cognitively stimulating activities. While people may want to keep their cognitive abilities strong, negative feelings can reduce their involvement.

Even with these challenges, the qualitative results show that participants used various coping methods, such as social comparison and accepting life with SCD, to alleviate worries and negative feelings linked to SCD, such as social withdrawal or perceived age-related stigma. Participants also mentioned that thinking of SCD as a normal part of ageing ('*this happens to everyone*') helped them feel less burdened and continue taking part in activities. This idea was also noted by Pearman (2021) who pointed out that admitting brief lapses in social situations can help keep people involved. Participants also emphasised that being in familiar places or with others who had similar experiences made them feel understood and at ease, which helped them keep engaging. Specifically, acknowledging that age-related cognitive changes are common and focusing on their existing abilities helped participants view things more positively, reducing their worry about cognitive decline and helping them adjust to ongoing changes, which aligns with earlier research (Sabatini *et al.*, 2021; Hill *et al.*, 2025). By reframing experiences in this way, participants maintained their independence, felt capable, and reduced negative emotions, creating the right mental and emotional conditions to continue with stimulating activities (Wittlinger *et al.*, 2022). By contrast, Chapman et al. (2022) showed that seeing ageing as fixed and unavoidable was connected with more complaints about SCD, which shows the importance of viewing ageing in a positive light to support effective coping and continued involvement. Together, these findings suggest that accepting SCD experiences can reduce the emotional impact of feeling like one's cognitive ability is declining and strengthen ongoing participation in meaningful cognitive activities, showing a key mechanism in which coping strategies help maintain engagement.

The current research further explored how sociodemographic factors affect experiences of SCD and engagement in CLA. Age and marital status are commonly studied as predictors of SCD in older adults (Jessen *et al.*, 2020; Mondini *et al.*, 2022; Ma *et al.*, 2024). Age is widely acknowledged as a major risk factor for cognitive decline in later years (Lipnicki *et al.*, 2013; Murman, 2015). In line with this, both quantitative and qualitative results showed that older individuals, especially those aged 80 and over, expressed more significant concerns about SCD. There are several possible reasons for this connection. First, these heightened concerns were related to higher levels of emotional distress, which could lead to less involvement in CLA, as found in a systematic review that examined the association between SCD and CLA participation (Chapter2; Akbayrak *et al.*, 2024). Second, advancing age is connected with changes in the brain and slower cognitive functioning (Harada, Natelson Love and Triebel, 2013; Kirk, 2024), making it harder to take part in mentally demanding leisure activities.

Participants mentioned that they had trouble maintaining focus or finishing tasks that used to be easier. These issues made it difficult for them to engage in CLA. Third, age-related health problems can also create obstacles to participation in CLA (Goins *et al.*, 2015; Chen, 2021). In this research, participants stated that mobility issues made it hard to go out, while hearing difficulties made it harder to engage in group activities or social events due to feelings of embarrassment or self-consciousness. Overall, these results show how age influences SCD experiences and CLA engagement through emotional, cognitive, and health-related factors. This highlights the importance of considering these factors when developing interventions to support older adults in staying involved in cognitively stimulating activities.

In the present research, marital status was not significantly associated with SCD in the quantitative data. The results of previous studies, however, generally indicate that being single, divorced, or widowed causes a greater risk of SCD, potentially due to the lack of social and cognitive stimulation and a diminished sense of emotional support (Ma *et al.*, 2024; Zhang, Zheng and Li, 2024). This discrepancy can be attributed to the survey's limitations in capturing the lived experiences of how companionship influences daily cognitive engagement. Qualitative findings provided a deeper understanding of the findings: participants without partners often described loneliness and reduced daily social interaction, which they perceived as intensifying cognitive concerns. The absence of a spouse also limits opportunities for cognitively stimulating activities, such as engaging in conversations, solving problems jointly, or participating in shared hobbies, resulting in a decreased level of engagement in CLA and an increase in SCD concerns. The accounts reported here are consistent with prior research showing that loneliness can lead to forgetfulness and discourage participation in enjoyable social activities, resulting in a cycle of loneliness and decline (Giles *et al.*, 2012; Liu, Zhang and Zhang, 2021; Zhang, Zheng and Li, 2024). Similarly, in a convergent parallel mixed method study of 149 older Thai adults, Sanprakhon et al. (2024) found that loneliness had a significant indirect effect on quality of life through SCD, highlighting the role of social isolation in intensifying cognitive concerns. Contrary to this, daily interactions with a spouse can enhance cognition, induce neural plasticity, and provide emotional support capable of buffering depression, another risk factor for cognitive decline and reduced participation in activities (Giles *et al.*, 2012; Hao and Kim, 2024; Zhang, Zheng and Li, 2024). It can be concluded that these integrated findings demonstrate how marital status shapes subjective experiences of cognitive decline as well as behaviourally by creating or constraining

opportunities for cognitively enriching activities. These findings emphasise the interconnection between living arrangements, CLA participation, and SCD concerns.

While the quantitative and qualitative results were generally in agreement, there were differences in how people approached seeking help. About half of the survey participants (46.3%) said they would think about getting medical help for memory issues, but only one person in the interviews had actually done so. The main reason for this reluctance was the belief that memory changes are a normal part of ageing, not a medical problem. This belief, consistent with previous research (Corner and Bond, 2004; Begum *et al.*, 2013; Giebel *et al.*, 2016), served a protective function: by attributing memory lapses to ageing, participants reduced anxiety and SCD-related worry, important given that excessive worry has been linked to poorer objective cognitive outcomes and greater risk of future impairment (Li *et al.*, 2023; Zhou *et al.*, 2025). However, this belief also made it less likely for people to seek help early. Another reason people avoided seeking help was a lack of trust in medical treatment. Many were unsure if it would help and thought it would be emotionally hard, take up a lot of time, and possibly cause stress for them and their families. While previous research has linked not seeking help to stigma, shame, and fear of a diagnosis (Begum *et al.*, 2013; Hill, Bratlee-Whitaker, *et al.*, 2021), these concerns were not as clear here. Instead, participants adopted a '*living with symptoms*' approach, accepting cognitive changes and maintaining autonomy through internal coping strategies such as humour, positive reframing, and acceptance. They also kept themselves busy with activities that challenged their brain and connected them socially, such as reading, puzzles, and group-based cognitive activities. This aligns with earlier findings showing that older adults often use such activities as a way to cope on their own (Begum *et al.*, 2013; Rotenberg Shpigelman, Sternberg and Maeir, 2019). Altogether, these findings illustrate that older adults navigate SCD by building everyday resilience, emphasising self-reliance, emotional balance, and engagement in meaningful cognitive activities rather than formal medical intervention.

8.3.2 Moderating role of cognitive leisure activity engagement

There is a growing body of research that suggests engaging in CLA may help slow down or reduce the impact of age-related cognitive decline (Wilson *et al.*, 2012; Park *et al.*, 2014; Mao, Xie and Lu, 2023). In this research, CLA was associated with lower SCD concerns, however, CLA did not significantly moderate the relationship between age and SCD, indicating that the effect of age on SCD was similar regardless of participants' level of CLA engagement. Several

reasons might explain this outcome. The benefits linked to CLA could partly be due to placebo effects or expectations, or only certain types of CLA, those that are cognitively challenging, socially engaging, or personally meaningful, might contribute to protective effects. Additionally, the research design might not have had enough statistical power to detect any moderating effects, possibly because there was not much variation in CLA participation among participants. Recent neuroimaging work further contextualises these findings. A randomised controlled trial (RCT) with older adults who had SCD, and practiced calligraphy showed that, while overall cognitive scores stayed the same, practicing calligraphy twice a week for six months improved connections within the default mode network (DMN), a part of the brain linked to memory and self-awareness (Lee *et al.*, 2024). This suggests that the benefits of CLA may first appear at the neural level before they show up in standard cognitive tests. In the same trial, the control group experienced a decline in DMN connectivity even though they kept up their usual activities, while the intervention group that practiced more calligraphy had better neural connections. This indicates that regular cognitive activities may no longer be enough to stimulate the brain effectively, and maintaining benefits might require more frequent, intense, or diverse activities (Lee *et al.*, 2024). In this research, many participants were already involved in CLA, which could have limited the variation and the observed moderating effect of CLA on the relationship between age and SCD. Future research should include a range of outcomes, such as neural and physiological markers, standard cognitive tests, and personal experiences, to better understand the full impact of CLA involvement.

Despite the lack of significant moderation effect in quantitative analyses, participants reported using CLA both to maintain cognitive functioning and as a way to cope with concerns related to SCD. These activities were seen to offer cognitive, psychological, and emotional benefits, which align with findings from RCTs and systematic reviews that show CLA can enhance cognitive performance (Doi *et al.*, 2017; Lv *et al.*, 2025). Lifestyle-based CLA may provide greater memory improvements compared to structured training, possibly due to higher levels of personal motivation and enjoyment (Küster *et al.*, 2016). Engaging in CLA has also been associated with better brain activation and increased cognitive flexibility (Requena and Lapez, 2014), suggesting potential neural benefits that may occur before measurable improvements in test scores. Participants described cognitively challenging tasks as a way to *"keep the mind active,"* which helped build self-confidence, a sense of achievement, and self-worth. This is consistent with research showing that mentally stimulating activities can improve views on ageing and foster personal effectiveness (Tyree and McLaughlin, 2012; Scott, Masser and

Pachana, 2020). Socially embedded CLA, such as book clubs, quizzes, and group-based events, supported social connectedness and motivation, complementing evidence that social engagement may mediate cognitive benefits from leisure activities (Toepoel, 2013; Brown *et al.*, 2016; Duffner *et al.*, 2022). Overall, integrating quantitative and qualitative findings suggests that CLA engagement contributes to cognitive maintenance while providing psychological and social benefits. These effects are likely modest and influenced by contextual factors, including activity type, motivation, and social support, which may explain the null moderation effect quantitatively. Qualitative findings underscore participants' perceived gains and the value of meaningful, enjoyable, and challenging activities.

8.3.3 Types of cognitive leisure activity and domain-specific subjective cognitive decline

Previous research emphasises that the type, frequency, and context of CLA engagement, not simply its occurrence, can shape domain-specific cognitive outcomes, with both cognitive challenge and social embeddedness playing key roles (Bielak, Mogle and Sliwinski, 2019; Fernández *et al.*, 2023). For example, daily changes in CLA participation can have different effects. Activities that involve social interaction, like spending time with family or doing creative tasks, were connected to better working memory and faster processing (Bielak, Mogle and Sliwinski, 2019). However, more game-playing was related to quicker responses but sometimes worse working memory (Bielak, Mogle and Sliwinski, 2019). Similarly, in a study of 45,475 older adults across Europe, Fernández et al. (2023) found that social activities were linked to improved memory and verbal skills, while intellectual activities like reading and problem-solving were associated with better orientation, numeracy, and executive functioning. These findings align with the current research, which showed that certain types of CLA, especially puzzles, reading, and attending cultural events, were related to fewer concerns about SCD. Nevertheless, the qualitative results gave an important insight: even though these activities were connected to lower SCD concerns, they could also make people more aware of small cognitive changes and cause frustration. This shows a conflict: while CLA can help protect cognitive function, it can also make people more conscious of any deficits during cognitively demanding tasks. This dual effect is similar to findings from Pillai et al. (2011), who showed that doing crosswords in later life delayed the onset of rapid memory loss by about 2.5 years, but once memory issues began, those who did crosswords worsened more quickly than those who did not regularly engage in crossword. From the perspective of Cognitive

Reserve (Stern, 2002, 2009), these activities build resilience. But they might also hide problems until the brain's compensatory systems can no longer cope (Stern, 2002, 2009). This understanding resonates with what participants shared, where puzzles and reading were seen as helpful but also emotionally tough, showing the mixed role of CLA: slowing down visible decline while at the same time making people more aware of it.

Although music engagement did not significantly lower SCD concerns when measured quantitatively, people who took part in the qualitative part of the research mentioned clear mental and emotional benefits. They described listening to music as a way to stimulate the mind and improve memory, often bringing back personal memories and helping manage emotions, which aligns with earlier research (Ferreri and Verga, 2016; Chan *et al.*, 2021). For example, Innes et al. (2017) found in a study with people who had SCD that listening to music helped improve both how they felt about their memory and their actual cognitive performance over six months. These personal experiences may reflect benefits that standard tests do not capture, such as remembering personal events, regulating emotions, and improving the ability to think of words quickly. Similarly, even though volunteering was not found to be a major factor in reducing worries about SCD based on survey results, the stories shared in the qualitative part showed that it played an important role in supporting both cognitive and emotional well-being. Participants reported how volunteering gave them a sense of growth, contribution, and learning new skills, which helped them feel more purposeful, cognitively active, and resilient. This is in line with previous studies that show volunteering helps cognitive health by encouraging social interactions, meaningful activities, and a sense of self-efficacy (Anderson *et al.*, 2014; Guiney and Machado, 2018). The insights from the qualitative research may explain why quantitative research did not show significant effects, as the benefits seem to come from personal involvement and experiences that are not directly measured. This is supported by evidence showing that doing something you enjoy or find meaningful is linked to better self-reported memory (Regier *et al.*, 2022), and that feeling happy or enjoying an activity can lead to better performance in tasks that require attention, processing speed, and language skills (Gardner, Strong and Mast, 2022). Altogether, these findings suggest that some benefits of CLA like music and volunteering work through emotional, motivational, and socially connected pathways. This highlights the importance of considering people's personal perspectives to fully understand how these activities can have an impact.

Socialising with friends was not found to be a strong predictor of SCD in the quantitative survey. However, the qualitative findings showed that socialising had two important roles: it encouraged participation in CLA and helped people deal with worries about SCD. Participants mentioned that frequent social interactions helped keep their minds active, gave them emotional support, and made them feel part of a group. This is in line with previous studies that show how being socially active can protect both the actual and the feeling of cognitive ability in older age (Kuiper *et al.*, 2016, 2017; Tomioka, Kurumatani and Hosoi, 2018). Importantly, the quantitative results showed that going to social events that involve cognitive stimulation, like concerts or theatre, was linked to less overall SCD concern and fewer problems with executive functions. This suggests that group activities that challenge the mind might be more helpful than casual social interactions. Longitudinal studies also support this idea, indicating that certain types of social activities can help slow down cognitive decline, and these effects can differ depending on the person's gender and the kind of activity they take part in (Lee and Kim, 2016; Tomioka, Kurumatani and Hosoi, 2018). Viewed collectively, it becomes clear that the effects of leisure activities on subjective experience of cognition can't be fully understood by just looking at statistical data. They are also influenced by personal feelings, emotional value, and individual goals.

8.4 Strengths and Limitations

This PhD thesis has several strengths and limitations, which are described in the following sections.

8.4.1 Strengths

This research employed a sequential explanatory mixed methods design to examine the relationship between SCD and CLA engagement in older adults. The design allowed the quantitative phase to identify statistical associations, while the qualitative phase was able to build upon these findings to provide in-depth explanation and contextual understanding that would not have been possible using a single-method approach. The clear alignment between research questions, data collection, and analysis across phases strengthened the internal coherence and methodological rigor of the research.

A key methodological strength of the research lies in the systematic integration of quantitative and qualitative findings using a joint display table. By using this approach, mixed methods

integration was transparent and structured, allowing convergent and divergent findings to be compared side by side. As a result, the credibility, transparency, and interpretability of the mixed methods findings were enhanced.

A further strength lies in the use of comprehensive and psychometrically robust measures that capture multiple domains of SCD, including memory, language, and executive function. In contrast to much of the existing literature, which has focused predominantly on memory-related concerns (Chapter 2; Akbayrak *et al.*, 2024), this domain-specific approach enabled a more detailed examination of cognitive experiences associated with SCD. Similarly, the assessment of a wide range of CLA (16 distinct activities), capturing both frequency and variety of engagement, allowed for a more fine-grained analysis of engagement patterns than studies relying solely on frequency-based measures (Fallahpour *et al.*, 2016; Wenzel *et al.*, 2024).

Finally, the recruitment strategy combined online and paper-based survey methods, increasing accessibility for older adults with differing levels of digital literacy. This mixed-mode approach supported successful recruitment, exceeded the required sample size, achieved a satisfactory response rate, and resulted in complete datasets with no missing data. Furthermore, the research was carried out in accordance with established reporting guidelines for quantitative, qualitative, and mixed methods research, enhancing transparency, methodological rigor, and the quality of the overall research.

8.4.2 Limitations

In addition to the limitations of the systematic review noted in Chapter 2, the empirical research had a number of limitations. The quantitative phase employed a convenience sampling strategy, which may limit the representativeness of the findings (Jager, Putnick and Bornstein, 2017; Stratton, 2021). Due to the recruitment of participants from community organisations, social clubs, and events for older adults, there is a possibility that the sample was biased toward individuals who were more socially and cognitively active, reflecting selection bias and potentially underrepresenting those who were socially isolated or less engaged.

There was a gender imbalance in the sample, with a higher proportion of female participants. This may have impacted analyses of gender and SCD status or CLA engagement, as well as affected the pool of interviewees used for the qualitative phase. This gender imbalance was also reflected in the qualitative phase, where purposive selection based on SCD status limited

the pool of male participants and may have constrained the diversity of perspectives captured in the interviews.

The cross-sectional design of the quantitative phase limits the ability to make causal inferences about the relationship between SCD and CLA engagement. Although statistically significant associations were observed, the directionality and temporality of these relationships cannot be established. The longitudinal design may provide stronger evidence of temporal effects; however, the resources and timeframes associated with doctoral research required a cross-sectional mixed methods approach to capture both the breadth of associations as well as the depth of lived experiences.

Key demographic variables, such as ethnicity, occupational background (or occupation at retirement), and financial or socioeconomic status, were not collected. These factors are known to be related to cognitive function and risk of cognitive decline and may also influence opportunities to engage in cognitively stimulating activities. This limits interpretation of the observed associations, as the potential influence of these factors could not be examined in this study. In addition, the absence of ethnicity data limits the ability to consider how inclusive the sample was and whether the findings can be generalised across different groups. Future research should aim to include these variables to provide a more complete understanding of cognitive ageing and engagement in CLA.

The measurement of CLA also presents a limitation. The definition adopted in this thesis described CLA as activities requiring minimal physical effort or social interaction; however, several activities included in the CLAS (e.g., board games, socialising, and clubs) inherently involve social engagement, and in some cases physical effort depending on individual ability. This reflects a mismatch between the conceptual definition and the operationalisation of CLA within the study. The scale was selected due to its validation and its suitability for capturing a broad range of cognitively stimulating activities in older adults, including both frequency and diversity of engagement. This inconsistency should be considered when interpreting the findings, particularly in relation to how CLA is defined and experienced in practice.

Finally, reliance on self-report measures introduces the possibility of recall bias, social desirability effects, and limited insight. Although screening questions excluded participants with known cognitive impairments or mental health conditions, no objective cognitive assessments or clinical diagnoses were conducted. Consequently, undiagnosed cognitive

impairment or psychological distress may have been present in the sample. However, the primary aim of the research was not diagnostic classification, but to examine subjective cognitive experiences and their associations with engagement in CLA, which may influence everyday functioning and behaviour regardless of objective cognitive status. These limitations were partly mitigated by keeping the survey concise and accessible, which was considered essential for engaging an older population.

8.5 Contribution to Knowledge

This PhD thesis makes several original contributions to the literature on SCD and CLA in later life.

First, the research contributes novel evidence by being among the first to investigate the relationship between SCD and CLA engagement using a sequential explanatory mixed methods design. By integrating quantitative associations with qualitative accounts of lived experience, the research moves beyond identifying whether SCD and CLA are related to explaining how and why activity engagement is shaped by cognitive concerns, emotional responses, and contextual factors. This addresses a key gap in a literature dominated by quantitative approaches (Chapter 2; Akbayrak *et al.*, 2024).

Second, the findings contribute to our understanding of the relationship between SCD and CLA engagement demonstrating that the relationship is dynamic, bidirectional, and psychologically mediated. While quantitative analyses showed that higher CLA engagement was associated with lower SCD concerns, qualitative findings revealed that SCD symptoms could both motivate and inhibit participation. This bidirectional pattern, influenced by coping strategies, beliefs about cognitive function, emotional responses, and social support, is largely absent from existing research, which has typically conceptualised CLA as a unidirectional protective factor (Chapter 2; Akbayrak *et al.*, 2024).

Third, the research provides novel insight into the psychological and social mechanisms underlying CLA engagement among older adults with SCD. Qualitative findings highlighted the central role of adaptive coping strategies, emotional regulation, perceived benefit, and social connectedness in sustaining engagement, even in the absence of statistically significant moderating effects in the quantitative analyses. These findings challenge assumptions that the benefits of CLA must necessarily be observable through linear or moderating statistical effects, highlighting the value of qualitative insight in understanding subjective cognitive ageing.

Fourth, by incorporating domain-specific assessments of SCD and a broad range of CLA, this research provides a more comprehensive understanding of how different cognitive concerns and activity types intersect. This domain-sensitive and person-centred perspective advances current conceptualisations of SCD by highlighting the importance of lived experience, perceived benefit, and contextual support in shaping cognitive leisure engagement in later life.

Fifth, the research extends the Cognitive Reserve framework to community-dwelling older adults with SCD. While educational attainment was not significantly associated with SCD concerns, engagement in cognitively stimulating activities was linked to lower SCD levels. Qualitative findings further revealed that participants perceived cognitive, emotional, and social benefits from CLA engagement, suggesting that reserve-related processes in later life may be shaped more by ongoing engagement and subjective meaning than by static indicators such as education alone.

Finally, the research contributes methodologically by demonstrating how quantitative findings that did not show significant moderation—specifically, the lack of a statistically significant moderating effect of CLA engagement on the relationship between age and SCD—can be meaningfully interpreted through qualitative evidence. By focusing on participants' subjective experiences rather than assuming reduced cognitive function based on quantitative data alone, this integrated approach provides a more comprehensive understanding of cognitive ageing with SCD and offers a model for future mixed methods research seeking to capture the complexity of subjective cognitive experiences.

8.6 Implications for Policy and Practice

Based on the findings of this thesis, this chapter outlines practical and policy recommendations to support older adults with SCD and enhance engagement in CLA. This research provides evidence-based guidance for healthcare professionals, policymakers, and community organisations.

Integrating psychological health: SCD should be addressed alongside mental wellbeing by healthcare professionals involved in older adults' care. Consistent with both the qualitative findings of this thesis, which highlighted SCD-related emotional distress, and existing evidence linking SCD with depression and anxiety (Zlatar *et al.*, 2018; Jessen *et al.*, 2020; Desai *et al.*, 2021), primary care providers, particularly general practitioners (GPs), could screen for

psychological distress when older adults present with cognitive complaints. However, as the workload for GPs grows, it may not always be practical to conduct routine assessments. A cooperative strategy could involve GPs recognising individuals who report cognitive difficulties and referring them to specialised services, such as memory clinics, clinical psychologists, or community mental health teams, for assessment and assistance. Short cognitive and mood checks can also be introduced using digital self-reporting tools or assessments led by nurses. This can ease the pressure on GPs while helping identify distress at an earlier stage.

Community engagement and voluntary sector awareness: Participants reported feeling more at ease and less cognitively self-conscious when engaging in CLA alongside others with similar experiences, highlighting the importance of supportive social environments. Real-world examples include dementia cafes, lunch clubs, walking groups, hobby or art workshops, and volunteer programmes aimed at older adults with SCD and their caregivers, which can be organised by local councils, charities, community centres, or libraries and offered both in person and online. Public-facing messaging through these settings should help reduce stigma and encourage open conversations about cognitive health without creating unnecessary alarm. Importantly, many of these community and voluntary sector organisations rely on volunteers and peer-led staff who rotate responsibilities rather than trained professionals. This highlights a need for accessible training resources to help these individuals recognise what SCD might look like in practice — such as word-finding difficulties, memory lapses in conversation, or reduced confidence in familiar tasks — so they can respond sensitively, signpost appropriately, and better support participants' cognitive and emotional wellbeing.

Caregiver support: Caring for someone can be time-consuming and emotionally demanding and has been highlighted in this research as a factor that can limit opportunities for engagement in CLA. Policies and support programs should include respite services, easy-to-access and personalised activities, and flexible support structures, created and delivered by local health agencies, social services, community organisations, and caregiver support charities. These programs can help caregivers remain engaged in cognitive and social activities while handling their responsibilities.

A range of accessible interventions: Participants emphasised the importance of being able to access and engage in a variety of activities that are appropriate to their needs, preferences, and circumstances. This included considerations such as mobility, confidence, local availability,

and awareness of opportunities. Interventions should therefore prioritise flexibility, inclusivity, and clear signposting to suitable CLA. Digital tools may also support access for some individuals, for example by enabling participation from home or increasing awareness of available resources. Collaborative efforts between healthcare providers, community organisations, and researchers can help ensure that interventions are accessible, varied, and responsive to the needs of individuals with SCD.

Positioning the findings within current brain health initiatives: The findings of this research resonate with growing national efforts to promote brain health in community settings. Initiatives such as Brain Health Scotland and Alzheimer's Research UK's brain health programmes emphasise the importance of modifiable lifestyle factors, including cognitive and social engagement, in supporting cognitive wellbeing in later life. In England, Brain Health Clinics, which typically focus on early diagnosis and preclinical signs of Alzheimer's disease, are increasingly having to consider care pathways for individuals who may present with SCD in the absence of objective cognitive decline or preclinical biomarkers. The findings of the present research, particularly the role of CLA and social participation in supporting cognitive confidence and emotional wellbeing, may inform the development of such pathways and contribute to a better understanding of what influences brain health in community settings that engage and support people with SCD.

By addressing these areas, psychological wellbeing, public education, social inclusion, caregiver support, and digital accessibility, interventions can adopt a holistic, person-centred approach, coordinated by healthcare providers, community organisations, policymakers, and research teams. Researchers can contribute to the design, evaluation, and refinement of these strategies to ensure they are effective, accessible, and tailored to the needs of older adults with SCD. Such coordinated approaches may help maintain cognitive health, emotional resilience, and social participation, complementing the benefits observed through engagement in CLA.

8.7 Recommendations for Future Research

Building upon the findings and limitations of the present research, several directions for future investigation are proposed.

Employing longitudinal designs to clarify causal relationships: Since the current research was cross-sectional, future studies should use longitudinal or experimental methods to determine

the direction and cause-effect relationship between SCD and CLA engagement. For instance, a longitudinal study could track a group of older adults over a number of years, evaluating both SCD symptoms and CLA engagement at different times. This would help researchers understand if lower CLA engagement leads to an increase in SCD symptoms later on, if higher SCD symptoms lead to reduced CLA engagement in the future, or if there is a two-way relationship over time. Additionally, experimental programs that increase CLA engagement could be tested to see how they affect the progression of SCD.

Recruiting broader and more diverse samples: To make the findings more applicable to a wider range of people, future research should involve participants from different demographic and socioeconomic backgrounds, such as varying genders, marital statuses, education levels, ethnicities, and geographic areas. To do this, researchers could use stratified sampling to ensure each group is appropriately represented, actively reach out through community centres, social groups, and online platforms that focus on underrepresented populations, and offer participation options in various formats like online, in person, or via phone to improve ease of access. Considering the gender imbalance noted in this research, special efforts to attract more male participants would be especially useful for uncovering any gender differences in both SCD and CLA engagement.

Integrating objective cognitive measures: Using objective cognitive tests, such as neuropsychological assessments, along with self-reported questionnaires may help tell the difference between people's concerns and actual cognitive decline. This combination of methods can offer a more complete view of early cognitive decline.

Examining psychological and personality factors: Measuring psychological health, such as levels of depression or anxiety, and personality traits like openness to experience or conscientiousness may help uncover more about the reasons behind SCD and CLA engagement. Even though these factors were not included in the current research due to practical limitations, they remain valuable areas for future exploration.

Refining activity typologies and definitions: Future research should work to better define and classify types of CLA, especially those that may also fall into social or physical activities but might offer cognitive benefits. Qualitative or experimental methods could be used to explore the cognitive benefits and underlying reasons for these activities more thoroughly.

Overall, these suggestions highlight the importance of conducting longitudinal, multi-faceted, and contextually varied research to better understand how CLA engagement contributes to resilience and SCD experiences in older adults.

8.8 Conclusion

This PhD thesis examined the relationship between SCD and engagement in CLA through a systematic review and sequential mixed methods empirical research. The findings provide new evidence of a dynamic and bidirectional relationship, whereby SCD-related concerns and associated emotions, such as fear, worry, and frustration, can both motivate and inhibit participation in cognitively stimulating activities. While the quantitative analyses did not demonstrate a protective effect of CLA engagement on SCD, qualitative findings revealed that participants derived meaningful cognitive, emotional, and social benefits from continued engagement. Certain activities were valued not only for maintaining perceived mental sharpness but also for supporting identity, a sense of agency, and emotional wellbeing. These findings suggest that SCD should be understood not solely as an early marker of neurodegeneration, but as a subjective and psychologically mediated experience shaped by personal meaning, self-perception, and emotional responses to cognitive change.

By integrating quantitative and qualitative evidence, this research advances understanding of SCD as a complex interplay between cognition, emotion, and behaviour, offering a more person-centred perspective on cognitive ageing. The findings indicate that interventions aimed at promoting CLA are likely to be most effective when they acknowledge the emotional significance of cognitive concerns and are tailored to individual preferences, motivations, and lived experiences. Future research should build on these insights through longitudinal and experimental designs to clarify how emotional responses and activity engagement interact over time, and to better determine under what conditions CLA may contribute to cognitive resilience and wellbeing in later life. From a practical perspective, the findings highlight the importance of integrating CLA promotion with mental health support, public education, and community-based initiatives, such as community centre activity programmes, library-based reading groups, and memory cafés designed for older adults. Such approaches may help ensure that older adults with SCD are supported to engage in cognitively stimulating activities in ways that are accessible, socially supportive, and genuinely person-centred.

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Appendix 2.1- PRISMA Checklists

Table 2.1 PRISMA 2020 Checklists

Section and Topic	Item #	Checklist item	Reported (Yes/No)
TITLE			
Title	1	Identify the report as a systematic review.	Yes
BACKGROUND			
Objectives	2	Provide an explicit statement of the main objective(s) or question(s) the review addresses.	Yes
METHODS			
Eligibility criteria	3	Specify the inclusion and exclusion criteria for the review.	Yes
Information sources	4	Specify the information sources (e.g. databases, registers) used to identify studies and the date when each was last searched.	Yes
Risk of bias	5	Specify the methods used to assess risk of bias in the included studies.	Yes
Synthesis of results	6	Specify the methods used to present and synthesise results.	Yes
RESULTS			
Included studies	7	Give the total number of included studies and participants and summarise relevant characteristics of studies.	Yes
Synthesis of results	8	Present results for main outcomes, preferably indicating the number of included studies and participants for each. If meta-analysis was done, report the summary estimate and confidence/credible interval. If comparing groups, indicate the direction of the effect (i.e. which group is favoured).	Yes
DISCUSSION			
Limitations of evidence	9	Provide a brief summary of the limitations of the evidence included in the review (e.g. study risk of bias, inconsistency and imprecision).	Yes
Interpretation	10	Provide a general interpretation of the results and important implications.	Yes
OTHER			
Funding	11	Specify the primary source of funding for the review.	Yes
Registration	12	Provide the register name and registration number.	Yes

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Title Page 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	ABSTRACT Page 2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	INTRODUCTION Pages 3-4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	INTRODUCTION Page 4
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	METHOD Page 4-5, Supplementary Data Section 5
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	METHOD Page 5, Supplementary Data Section 2: Tables 1,2,3, and 4
Search strategy	7	Present the full search strategies for all databases, registers, and websites, including any filters and limits used.	Supplementary Data Section 2: Tables 1,2,3, and 4
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	METHOD Page 5
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	METHOD Page 5
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	METHOD Pages 5-6
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	METHOD Pages 5-6
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	METHOD Pages 6
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	METHOD Page 6, Table 1, Supplementary Data Section 3: Table 1, Table 2
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	METHOD Page 6
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	NA
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Table 1
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	METHOD Page 6
	13e	Describe any methods used to explore possible causes of heterogeneity among	NA

Section and Topic	Item #	Checklist item	Location where item is reported
		study results (e.g. subgroup analysis, meta-regression).	
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	NA
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	NA
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	NA
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	RESULTS Pages 6-7, Figure 2.1 PRISMA flow diagram
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	NA
Study characteristics	17	Cite each included study and present its characteristics.	RESULTS Pages 6-7, TABLE 1
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	RESULTS Pages 7-9, Tables 1 and 2, Supplementary Data Section 4: Tables 1, 2, and 3
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimates and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	NA (no meta-analysis)
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	RESULTS Pages 7-9
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	NA
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	RESULTS Pages 7-8, DISCUSSION Pages 9-10
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NA
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	NA
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	NA
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	DISCUSSION Pages 9-13
	23b	Discuss any limitations of the evidence included in the review.	DISCUSSION Pages 13
	23c	Discuss any limitations of the review processes used.	DISCUSSION Pages 13
	23d	Discuss implications of the results for practice, policy, and future research.	DISCUSSION Page 13-14
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	METHOD Page 4
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	PROSPERO registration site (Registration number: CRD42023408726)
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA (No amendments received at registration)
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 14

Section and Topic	Item #	Checklist item	Location where item is reported
Competing interests	26	Declare any competing interests of review authors.	Page 14 (No Conflicts of Interest)
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Page 14

Appendix 2.2 - Inclusion and Exclusion Criteria

Inclusion and Exclusion Criteria

This review aimed to examine the relationship between subjective cognitive decline (SCD) and cognitive leisure activity (CLA) engagement. Therefore, studies that included participants with SCD were selected, while those with participants having objective cognitive impairment were excluded. SCD is defined by an individual's subjective perception of cognitive decline, identified through two primary criteria: (1) a self-experienced, continuous decline in cognitive abilities compared to a previously normal state, not linked to any acute event, and (2) normal performance on standardized cognitive tests adjusted for age, gender, and education, which help classify mild cognitive impairment (MCI) or early-stage Alzheimer's Disease (AD). The Subjective Cognitive Decline Initiative (SCD-I), started by Jessen et al. (2020), aimed to establish a unified concept and terminology to support research on various aspects of SCD across different settings, promoting comparability and collaboration between studies.

Given that SCD is a relatively new concept, multiple definitions and tools have been used in the included studies to identify and evaluate SCD. While some studies adhere to the terminology established by SCD-I, many limit SCD to perceived declines in the memory domain only. To present the eligibility criteria comprehensively, detailed information for each study on the definitions used to identify individuals with SCD, the methods employed to evaluate SCD, and the procedures for excluding individuals with objective cognitive impairment is provided below:

Benge et al. (2023) did not specify a definition for SCD. They utilized the Everyday Cognition Scale (ECOG) to identify SCD, which is a 39-item tool assessing self-reported cognitive changes compared to an individual's baseline performance. Participants rated their difficulty with cognitive tasks on a scale from 1 (no change compared to 10 years ago) to 4 (much worse than 10 years ago), covering planning, organization, divided attention, episodic memory, language, and visuospatial functioning. Higher scores indicate greater perceived cognitive decline. To exclude participants with cognitive impairment, individuals were asked if they had been diagnosed with MCI or dementia, and only those who responded negatively were included.

Bransby et al. (2023) used the term of *subjective ratings of cognition*. They identified SCD using the Cognitive Function Instrument (CFI), validated to detect cognitive decline and the progression to MCI or dementia. The total score from the CFI was used as the outcome measure for subjective cognitive concerns, with higher score indicating fewer concerns. Cognitive impairment was excluded using the Cogstate Brief Battery, which is sensitive to dysfunction in attention, working memory, learning, and Alzheimer's disease-related cognitive decline.

Similar to their 2023 study, Bransby et al. (2022) did not define SCD but used *subjective ratings of cognition*. The CFI was used to identify individuals with subjective cognitive concerns. Participants with cognitive impairment were excluded using the Cogstate Brief Battery, a cognitive screening tool sensitive to dysfunction and decline in multiple cognitive domains.

Hill et al. (2018) focused on *subjective memory impairment* (SMI), defined as the perception of memory problems or a negative self-evaluation of memory performance. SMI was measured with a self-report scale ranging from 0 (no memory problems) to 10 (daily memory problems), further categorized into lower and higher impairment groups. Objective cognition was assessed with the Montreal Cognitive Assessment (MoCA), with scores ranging from 0 to 30, where lower scores indicate higher levels of cognitive impairment. It has been demonstrated that the MoCA is a reliable (a = .83) and valid screening test in determining an individual's objective cognitive status (Nasreddine *et al.*, 2005).

Hill et al. (2021) used the term *self-perceptions of memory* to assess perceived memory decline over one and ten years across different datasets. In EAS and NHATS, one-year memory decline was assessed by asking participants if they had more trouble remembering things compared to a year ago, with responses indicating "declining" or "not declining." Ten-year memory decline was evaluated similarly in EAS and MAP/MARS. Across the datasets, recruitment of eligible participants was ensured through comprehensive medical and neuropsychological examinations conducted annually via in person.

Iizuka et al. (2021) referred to individuals with SCD as *people with complaints of forgetfulness*, focusing only on memory decline. SCD was identified by asking participants if they had complaints of forgetfulness. The Japanese version of the MoCA (MoCA-J) was used to assess cognitive domains, with a cutoff score of 25/26 to exclude those with MCI. MoCA-J evaluates memory, language, executive functions, attention, visuospatial abilities, and orientation.

Katayama et al. (2022) defined SCD using three criteria: normal cognitive functioning on neuropsychological assessments, absence of objective cognitive decline, and a response of "Yes" to any one of the following four questions: (1) "Do you have any difficulty with your memory?"; (2) "Do you forget where you have left things more than you used to?"; (3) "Do you forget the names of close friends or relatives?"; and (4) "Do other people find you forgetful?" Objective cognition was assessed across four domains—memory, attention, executive function, and processing speed. Two criteria were taken into consideration when identifying individuals with MCI: (1) individuals who showed cognitive impairment, but who were still functionally independent in their daily activities. (2) A decline in at least one cognitive domain was required in order to diagnose MCI. Global cognitive impairment was evaluated using the Mini-Mental State Examination (MMSE), with a cutoff score of 24 to identify cognitive impairment.

Lee, Sung and Choi (2020) defined SCD based on the SCD-I groups' criteria, referring to self-perceived worsening of cognitive domains such as memory, executive function, attention, language, and visuospatial function over time. The revised Korean version of the Cognitive Failures Questionnaire (CFQ-K) was used to assess SCD, containing 25 items about cognitive errors over the past six months, scored on a five-point Likert scale. Lower scores indicate fewer cognitive errors. The Korean version of the MoCA (MoCA-K) was used to assess objective cognitive function, ensuring the exclusion of individuals with cognitive impairment.

Nemoto et al. (2018) used the term *Subjective Cognitive Complaints (SCC)* and evaluated it using the Kihon Checklist (KCL), which assesses frailty risk in Japan. The KCL includes three questions related to cognitive function: Do your family or friends point out your memory loss? Do you make a call by looking up phone numbers? Do you find yourself not knowing today's date? Those who chose an undesirable answer to any of these questions were classified as having SCC. To exclude individuals with cognitive impairment, the study included only those who had never used long-term health insurance services.

Parikh et al. (2016) used the term of *self-reported memory change*, and only the perceived decline in memory was evaluated using the Multifactorial Memory Questionnaire (MMQ). The MMQ, designed to measure different dimensions of memory relevant to clinical assessment and intervention, includes three scales: Contentment (feelings about one's memory), Ability (self-assessment of memory skills), and Strategy (frequency of using memory strategies). The MMQ-Contentment scale consists of 21 items that explore various emotions and perceptions

related to the participant's current memory abilities. It includes statements reflecting positive emotions (e.g., confidence, satisfaction), negative emotions (e.g., embarrassment, irritation), and subjective evaluations (e.g., comparison to peers, belief in having a serious memory problem). Participants rated their agreement with each statement on a 5-point scale (strongly agree, agree, undecided, disagree, and strongly disagree) based on their feelings over the past two weeks. The MMQ-Ability scale features 20 everyday memory scenarios, such as remembering appointments, names, and phone numbers. The MMQ-Strategy scale includes 20 items describing different memory aids and strategies used in daily life, like writing appointments on a calendar and repeating information to oneself (Troyer and Rich, 2002). To assess participant's objective cognitive function, all participants underwent a clinical interview to screen for medical and psychiatric disorders, medications that affect cognition, and substance use. A brief set of cognitive tests was administered to ensure normal cognitive functioning. To make it more convenient for the participants, the testing was conducted over the telephone using cognitive tests validated for this method. These tests evaluated overall cognitive status (Telephone Interview for Cognitive Status), word generation (Phonemic Verbal Fluency), attention span and working memory (Digit Span), and objective verbal memory (Hopkins Verbal Learning Test and Logical Memory).

Rotenberg, Maeir and Dawson (2020) defined SCD as subjective cognitive decline without objective evidence of deficits, similar with SCD-I groups definition. Cognitive status was measured using the MoCA, categorizing participants into SCD (MoCA scores ≥ 26), mild cognitive deficits (MoCA scores 20-25), and severe cognitive deficits (MoCA scores ≤ 19). The MMQ—Ability subscale was used to assess subjective memory, which consists of 20 items scored on a five-point Likert scale, with higher scores indicating better subjective memory ability. The MMQ-Ability has good internal consistency (Cronbach's $\alpha = 0.93$) and excellent content validity (83–100% agreement between raters) in clinical and non-clinical older adult populations (Troyer and Rich, 2002). Cognitive status was assessed using the MoCA, a popular brief screening tool that evaluates various cognitive domains. MoCA scores range from 0 to 30, with higher scores indicating better cognitive function. The MoCA has shown good internal consistency (Cronbach's $\alpha = 0.83$) and adequate known-group validity, proving highly effective in diagnosing MCI and dementia (Freitas *et al.*, 2014).

Appendix 2.3 - Full Search Strategies

Tables showing the full search strategy used in the review.

Table 2.3.1 Database PyscINFO (19 April 2023 at 00:39)

#	Query	Results from 18 April 2023
1	exp Cognitive Impairment/ or subjective cognitive decline.mp.	43,797
2	exp Cognitive Impairment/ or subjective cognitive impairment.mp.	43,716
3	exp Cognitive Impairment/ or subjective cognitive complaint.mp.	43,660
4	exp Cognitive Impairment/ or subjective cognitive deterioration.mp.	43,637
5	exp Cognitive Impairment/ or perceived cognitive decline.mp.	43,644
6	exp Cognitive Impairment/ or perceived cognitive impairment.mp.	43,661
7	exp Cognitive Impairment/ or subjective memory decline.mp.	43,662
8	exp Cognitive Impairment/ or subjective memory impairment.mp.	43,728
9	exp Cognitive Impairment/ or subjective memory complaint.mp.	43,679
10	exp Cognitive Impairment/ or subjective memory deterioration.mp.	43,638
11	exp Cognitive Impairment/ or subjective memory concerns.mp.	43,649
12	exp Cognitive Impairment/ or self-perceived memory.mp.	43,656
13	exp Cognitive Impairment/ or self-perception of memory.mp.	43,653
14	memory/ or forgetting/ or memory decay/	75,933
15	exp Cognitive Impairment/ or subjective memory loss.mp.	43,657
16	exp Forgetting/ or exp Cognitive Impairment/ or complaint of forgetfulness.mp.	47,097
17	exp Cognitive Impairment/ or pre-mild cognitive impairment.mp.	43,644
18	exp Cognitive Reserve/	670
19	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18	117,718
20	leisure time/ or daily activities/ or recreation/ or relaxation/	19,311
21	daily activities/ or leisure time/ or hobbies/ or recreation/	16,757
22	cognitive leisure activity.mp.	10
23	cognitive leisure activities.mp.	19

24	leisure activity.mp.	1,281
25	leisure activities.mp.	6,069
26	recreational activity.mp.	301
27	recreational activities.mp.	1,322
28	protective factor.mp. or exp Protective Factors/	12,510
29	protective factors.mp.	16,711
30	modifiable risk factor.mp.	583
31	modifiable risk factors.mp.	1,342
32	hobby.mp. or exp Hobbies/	663
33	hobbies.mp. or exp Hobbies/	1,331
34	cognitively stimulating leisure activity.mp.	5
35	cognitively stimulating leisure activities.mp.	19
36	cognitively stimulating activity.mp.	13
37	activity participation.mp.	1,904
38	mentally stimulating activity.mp.	4
39	mentally stimulating activities.mp.	32
40	novelty seeking activity.mp.	3
41	novelty seeking activities.mp.	1
42	intellectual activity.mp.	495
43	intellectual activities.mp.	214
44	20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43	50,427
45	19 and 44	1,094
46	limit 45 to (journal article and English)	**855**

Table 2.3.2 Database MEDLINE (via Ovid) (19 April 2023 at 00.57)

#	**Query**	**Results from 18 April 2023**
1	Cognitive Dysfunction/ or subjective cognitive decline.mp.	35,071
2	Cognitive Dysfunction/ or subjective cognitive impairment.mp.	34,813
3	Cognitive Dysfunction/ or subjective cognitive complaint.mp.	34,624
4	Cognitive Dysfunction/ or subjective cognitive deterioration.mp.	34,589
5	Cognitive Dysfunction/ or perceived cognitive decline.mp.	34,603
6	cognition/ or awareness/ or cognitive reserve/	146,055
7	Cognitive Dysfunction/ or perceived cognitive impairment.mp.	34,658
8	subjective memory decline.mp. or Cognitive Dysfunction/	34,626

9	Cognitive Dysfunction/ or subjective memory impairment.mp.	34,744
10	subjective memory complaint.mp. or Cognitive Dysfunction/	34,685
11	Cognitive Dysfunction/ or subjective memory deterioration.mp.	34,591
12	Cognitive Dysfunction/ or subjective memory concerns.mp.	34,604
13	self-perception of memory.mp.	14
14	self-perceived memory.mp. or Cognitive Dysfunction/	34,611
15	Cognitive Dysfunction/ or subjective memory loss.mp.	34,618
16	Cognitive Dysfunction/ or complaint of forgetfulness.mp.	34,595
17	Cognitive Dysfunction/ or pre-mild cognitive impairment.mp.	34,602
18	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17	173,958
19	leisure activities/ or recreation/ or relaxation/	19,083
20	cognitive leisure activity.mp.	17
21	cognitive leisure activities.mp.	29
22	leisure activity.mp.	1,099
23	leisure activities.mp.	12,428
24	recreational activity.mp.	820
25	recreational activities.mp.	2,646
26	protective factor.mp. or Protective Factors/	19,359
27	protective factors.mp. or Protective Factors/	19,816
28	modifiable risk factor.mp.	4,281
29	modifiable risk factors.mp.	8,778
30	hobbies.mp. or Hobbies/	2,124
31	hobby.mp. or Hobbies/	1,731
32	cognitively stimulating leisure activity.mp.	5
33	cognitively stimulating leisure activities.mp.	19
34	cognitively stimulating activity.mp.	14
35	cognitively stimulating activities.mp.	127
36	activity participation.mp.	2,206
37	mentally stimulating activity.mp.	6
38	mentally stimulating activities.mp.	27
39	novelty seeking activity.mp.	3
40	novelty seeking activities.mp.	1
41	intellectual activity.mp.	247
42	intellectual activities.mp.	142
43	19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or	74,219

	29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42	
44	18 and 43	1,916
45	limit 44 to (english and journal article)	**1,822**

Table 2.3.3 Database EMBASE (19 April 2023 at 00:21)

#	Query	Results from 19 April 2023
1	(subjective cognitive decline or subjective cognitive impairment or subjective cognitive complaint or subjective cognitive deterioration or perceived cognitive decline or perceived cognitive impairment or subjective memory decline or subjective memory impairment or subjective memory complaint or subjective memory deterioration or subjective memory concerns or self-perception of memory or self-perceived memory or subjective memory loss or complaint of forgetfulness or pre-mild cognitive impairment or subjective cognitive dysfunction).mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword heading word, floating subheading word, candidate term word]	3,935
2	subjective cognitive decline.mp.	1,964
3	subjective cognitive impairment.mp.	712
4	subjective cognitive complaint.mp.	131
5	subjective cognitive deterioration.mp.	0
6	perceived cognitive decline.mp.	43
7	perceived cognitive impairment.mp.	206
8	subjective memory decline.mp.	101
9	subjective memory impairment.mp.	359
10	subjective memory complaint.mp.	345
11	subjective memory deterioration.mp.	1
12	subjective memory concerns.mp.	46
13	self-perception of memory.mp.	20
14	self-perceived memory.mp.	38
15	subjective memory loss.mp.	45
16	complaint of forgetfulness.mp.	9
17	pre-mild cognitive impairment.mp.	50
18	subjective cognitive dysfunction.mp.	110
19	1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18	3,935
20	leisure/ or recreation/	64,817
21	cognitive leisure activit*.mp.	47
22	leisure/ or leisure activit*.mp.	48,185

23	recreational activit*.mp.	4,306
24	protective factor*.mp.	36,591
25	modifiable risk factor*.mp.	19,870
26	hobb*.mp.	4,376
27	cognitively stimulating leisure activity.mp.	5
28	cognitively stimulating leisure activities.mp.	38
29	cognitively stimulating activit*.mp.	190
30	lifestyle/ or behavior/ or healthy lifestyle/ or sedentary lifestyle/	325,613
31	relaxation.mp. or leisure/	197,983
32	activity participation.mp.	2,827
33	mentally stimulating activit*.mp.	45
34	novelty seeking activity.mp.	4
35	novelty seeking activities.mp.	1
36	intellectual activity.mp.	349
37	intellectual activities.mp.	184
38	20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37	601,515
39	19 and 38	217
40	limit 39 to (English and article)	**136**

Table 2.3.4 Database Web of Science (19 April 2023 at 01.16)

(TS=(subjective cognitive decline OR subjective cognitive impairment OR subjective cognitive complaint OR subjective cognitive deterioration OR perceived cognitive decline OR perceived cognitive impairment OR subjective memory decline OR subjective memory impairment OR subjective memory complaint OR subjective memory deterioration OR subjective memory concerns OR self-perception of memory OR self-perceived memory OR subjective memory loss OR complaint of forgetfulness OR pre-mild cognitive impairment OR subjective cognitive dysfunction))
AND
TS=(cognitive leisure activit* OR leisure activit* OR recreational activit* OR protective factor* OR modifiable risk factor* OR hobb* OR cognitively stimulating leisure activit* OR cognitively stimulating activit* OR relaxation OR activity participation OR recreation OR mentally stimulating activit* OR novelty seeking activit* OR intellectual activit*)
805 Results

Appendix 2.4 - Quality Assessment of Included Studies

Quality Assessment of Included Studies

Overall, five articles had a low risk of bias (Parikh *et al.*, 2016; Hill *et al.*, 2018; Nemoto *et al.*, 2018; Lee, Sung and Choi, 2020; Benge *et al.*, 2023), four articles had a moderate risk of bias (Rotenberg, Maeir and Dawson, 2020; Iizuka *et al.*, 2021; Bransby *et al.*, 2022, 2023), and two had a high risk of bias (Hill, Mogle, *et al.*, 2021; Katayama *et al.*, 2022). In most of the cross-sectional studies, bias commonly occurred in the selection section, whereas in longitudinal studies bias appeared in the outcome section of the Newcastle-Ottawa Scale (NOS). In a longitudinal study by Hill et al. (2021), subjective memory decline was assessed at both one- and ten-year intervals by distinct research groups and the evaluation of cognitive leisure activity participation within the NHATS cohort of 6718 individuals was not conducted. Thus, this study was graded low in quality. In the other longitudinal study graded as low quality (Katayama *et al.*, 2022), there was a high dropout rate that may affect the results, and the follow-up period was short compared to similar longitudinal studies (generally ranging between six and eight years). Additionally, the education level of the participants with SMD was higher than the participants with objective cognitive decline, since it is known that the education level can affect CLA engagement participation (Ihle *et al.*, 2015), it is possible that this result may be due to the difference in the education level of the participants. Therefore, this study was graded low in quality (Katayama *et al.*, 2022). Moreover, there was no comprehensive description regarding the response rate, as well as the characteristics distinguishing respondents from non-respondents, in both cross-sectional and longitudinal studies. The qualitative (Parikh *et al.*, 2016) and mixed method (Hill *et al.*, 2018) studies underwent rigorous quality assessments, affirming the adequacy of their employed methodologies in addressing the research question. Comprehensive justifications were provided for the selected methods, and both studies demonstrated a low risk of bias.

Table 2.4.1 The Newcastle-Ottawa Quality Assessment Scale adapted for cross-sectional studies

Study	Selection (Up to 4 stars)				Comparability (Up to 2 stars)		Outcome (Up to 2 stars)		Total score
	Representativeness of the sample	**Sample size**	**Non-respondents**	**Ascertainment of the exposure**	**The study controls for the most important factors (SCD status and objective cognitive assessment)**	**The study control for any additional factor (e.g., age, sex, educational attainment, depression)**	**Assessment of the outcome**	**Statistical test**	
Benge et al., 2023	Somewhat representative of the average in the target population. (non-random sampling) *	Justified and satisfactory *	No description of the response rate or the characteristics of the responders and the non-responders 0	Validated measurement tool. *	The study controls for the most important factors *	The study control for any additional factor, e.g., education, depression, sex, and age *	Independent blind assessment *	The statistical test used to analyse the data is clearly described and appropriate, and the measurement of the association is presented, including confidence intervals and the probability level (p value) *	**7/Low bias**
Bransby et al., 2023	Somewhat representative of the average in the target population. (non-random sampling) *	Not justified 0	The response rate is unsatisfactory. 0	Non-validated measurement tool, but the tool is available or described. *	The study controls for the most important factors *	The study control for any additional factor, e.g., educational attainment, occupational complexity, depression,	Independent blind assessment *	The statistical test used to analyse the data is clearly described and appropriate, and the measurement of the association is presented, including	**6/Moderate bias**

						and social engagement. *		confidence intervals and the probability level (p value) *	
Bransby et al., 2022	Somewhat representative of the average in the target population. (non-random sampling) *	Not justified 0	The response rate is unsatisfactory. 0	Non-validated measurement tool, but the tool is available or described. *	The study controls for the most important factors *	The study control for any additional factor, e.g., educational attainment, occupational complexity, depression, and social engagement. *	Independent blind assessment *	The statistical test used to analyse the data is clearly described and appropriate, and the measurement of the association is presented, including confidence intervals and the probability level (p value) *	**6/Moderate bias**
Iizuka et al., 2021	Somewhat representative of the average in the target population. (non-random sampling) *	Not justified 0	No description of the response rate or the characteristics of the responders and the non-responders 0	Non-validated measurement tool, but the tool is available or described. *	The study controls for the most important factors *	The study control for any additional factor, e.g., education, age, and sex *	Independent blind assessment *	The statistical test used to analyse the data is clearly described and appropriate, and the measurement of the association is presented, including confidence intervals and the probability level (p value) *	**6/Moderate bias**
Lee et al., 2020	Somewhat representative of the average in the target	Justified and satisfactory *	No description of the response rate or the	Validated measurement tool. *	The study controls for the most important factors	The study control for any additional factor, e.g.,	Independent blind assessment *	The statistical test used to analyse the data is clearly described and	**7/Low bias**

	population. (non-random sampling) *		characteristics of the responders and the non-responders 0		*	education, age, sex, comorbidity, depression, perceived health status, physical activity participation *		appropriate, and the measurement of the association is presented, including confidence intervals and the probability level (p value) *	
Nemoto et al., 2018	Somewhat representative of the average in the target population. (non-random sampling) *	Not justified 0	Comparability between respondents and non-respondents' characteristics is established, and response rate is satisfactory. *	Non-validated measurement tool, but the tool is available or described. *	The study controls for the most important factors *	The study control for any additional factor, e.g., education, sex, age, smoking, health status, and depression *	Independent blind assessment *	The statistical test used to analyse the data is clearly described and appropriate, and the measurement of the association is presented, including confidence intervals and the probability level (p value) *	**7/Low bias**
Rotenberg et al., 2020	Somewhat representative of the average in the target population. (non-random sampling) *	Not justified 0	No description of the response rate or the characteristics of the responders and the non-responders 0	Validated measurement tool. *	The study controls for the most important factors *	The study control for any additional factor, e.g., education, age, sex, and depression *	Independent blind assessment *	The statistical test used to analyse the data is clearly described and appropriate, and the measurement of the association is presented, including confidence intervals and the probability level (p value)	**6/Moderate bias**

								*	

The Adapted Newcastle–Ottawa Scale for quality assessment of cross-sectional studies uses a star rating system.
Each study can receive a maximum of eight stars, allocated for selection (4 stars), comparability (2 stars), and outcome (2 stars). In the comparability section, a study earns 1 star for controlling the most crucial factor (SCD status and objective cognitive assessment) or an additional factor (e.g., sex, gender, education, depression), and 2 stars for controlling both factors. Scoring criteria differed slightly for cross-sectional and longitudinal studies. Cross-sectional studies were classified into high risk (≤ 4 points), moderate risk (5–6 points), or low risk (7–8 points) (Moskalewicz and Oremus, 2020)
.

Table 2.4.2 Newcastle-Ottawa Scale for Quality Assessment of Longitudinal Studies

Study	Selection				Comparability		Outcome			Total score
	Representativeness of the cases	**Selection of the non-exposed cohort**	**Ascertainment of exposure**	**Demonstration that outcome of interest was not present at start of study**	**The study controls for the most important factor**	**The study control for any additional factor**	**Assessment of outcome**	**Was follow-up long enough for outcomes to occur**	**Adequacy of follow up**	
Hill et al., 2021	Somewhat representative of the general population *	No description of the derivation of the non-exposed cohort 0	No validation is mentioned. 0	Yes *	Study controls for Subjective cognitive decline (SCD) and objective cognitive assessment. *	Study controls additional factors e.g., sex, education, income, and depression. *	No objective measurement 0	Yes *	No (The longitudinal study conducted ten years later did not incorporate an examination of the association between SCD and CLA engagement, which constituted most of the sample size.) 0	**5/High risk**
Katayama et al., 2022	Somewhat representative of the general population *	Drawn from the same community as the exposed cohort. *	No validation is mentioned. 0	Yes *	Study controls for SCD and objective cognitive assessment. *	Study controls additional factors e.g., sex, education, sleep duration, physical functions, active lifestyle, and depression. *	No objective measurement 0	No (This study had a 4-year longitudinal design; however, similar studies have used 6.8- to 8-year longitudinal designs)	No (approximately 41% of them dropped out at follow-up) 0	**5/High risk**

								0		

Note. The Newcastle–Ottawa Scale for assessing longitudinal studies employs a star system (max 9 stars). Criteria include selection (4 stars), comparability (2 stars), and exposure (3 stars). In the comparability section, 1 star is given for controlling a key factor (e.g., SCD and objective cognitive assessment) or an additional factor (e.g., sex, gender, education, depression). Earn 2 stars if both factors are controlled. Scoring criteria differed slightly for cross-sectional and longitudinal studies. Longitudinal studies were classified as high risk (≤ 5 points), moderate risk (6–7 points), or low risk (8–9 points) (Wells *et al.*, 2009).

Table 2.4.3 Quality assessment for mixed method studies (Mixed Methods Appraisal Tool -MMAT), 2018

	Screening questions		**Qualitative**					**Overall Score***
MMAT checklist for qualitative study	Are there clear research questions?	Do the collected data allow to address the research questions?	Is the qualitative approach appropriate to answer the research question?	Are the qualitative data collection methods adequate to address the research question?	Are the findings adequately derived from the data?	Is the interpretation of results sufficiently substantiated by data?	Is there coherence between qualitative data sources, collection, analysis, and interpretation?	
Parikh et al., 2016	Yes	Yes	Yes	Yes	Yes	Yes	Yes	*****
MMAT checklist for mixed method study	Are there clear research questions?	Do the collected data allow to address the research questions?	**Qualitative**		**Quantitative**		**Mixed methods**	
			****		*****		*****	****
Hill et al., 2018	Yes	Yes						

In the context of mixed methods studies, where there are 15 criteria for evaluation, it is presumed that the overall quality of the study cannot surpass the quality of its weakest component. Consequently, the overall quality score is determined by the lowest score among the study's components. Specifically, the scoring system operates as follows: 20% (*) when qualitative (QUAL)=1 or quantitative (QUAN)=1 or mixed methods (MM)=1; *a score of 40%* (**) *is designated when the QUAL, QUAN, or MM component earns a score of 2; a score of 60%* (***) is attributed when the QUAL, QUAN, or MM component receives a score of 3; a score of 80% (****) is allocated when both the QUAL and QUAN components attain a score of 4, and the MM component achieves a score of 4; finally, a score of 100% (*****) is granted when the QUAL, QUAN, or MM component garners a score of 5. In summary, the interpretation of the scores is as follows: 5***** or 100% signifies that all quality criteria have been met; 4**** or 80% denotes that 80% of the quality criteria have been met; 3*** or 60% indicates that 60% of the quality criteria have been met; 2** or 40% suggests that 40% of the quality criteria have been met, and 1* or 20% signifies that only 20% of the quality criteria have been met.

Appendix 2.5 - Synthesis Without Meta-analysis (SWiM) Reporting Items

Table 2.5.1 Synthesis Without Meta-analysis (SWiM) reporting items

SWiM is intended to complement and be used as an extension to PRISMA			
SWiM reporting item	**Item description**	**Page in manuscript where item is reported**	**Other***
Methods			
1 Grouping studies for synthesis	1a) Provide a description of, and rationale for, the groups used in the synthesis (e.g., groupings of populations, interventions, outcomes, study design)	METHOD Page 6	
	1b) Detail and provide rationale for any changes made subsequent to the protocol in the groups used in the synthesis	Not applicable	
2 Describe the standardised metric and transformation methods used	Describe the standardised metric for each outcome. Explain why the metric(s) was chosen, and describe any methods used to transform the intervention effects, as reported in the study, to the standardised metric, citing any methodological guidance consulted.	METHOD Page 6	No uniform measure was applied across the articles included in the study. The reported results varied, employing diverse statistical methods such as Pearson's correlation, odds ratios, regression, and beta coefficients. Confidence intervals, p-values, or a combination of both were commonly used, but there was inconsistency in reporting all the essential components required for converting various quantitative

			outcomes into standardized metrics.
3 Describe the synthesis methods	Describe and justify the methods used to synthesise the effects for each outcome when it was not possible to undertake a meta-analysis of effect estimates	METHOD Page 6, TABLE 1	In the absence of a meta-analysis, it was divided the studies into clusters by the types of cognitive domains evaluated in subjective cognitive decline (SCD; only perceived decline in memory domain or perceived decline in multidomain) to make results easier to interpret. It was not possible to show the effect size in all the included studies, the effect size of those that were possible was shown in Table 1.
4 Criteria used to prioritise results for summary and synthesis	Where applicable, provide the criteria used, with supporting justification, to select the particular studies, or a particular study, for the main synthesis or to draw conclusions from the synthesis (e.g., based on study design, risk of bias assessments, directness in relation to the review question)	METHOD Page 6, CONCLUSION Page 14, TABLES 1 and 2	In the absence of meta-analysis, this study utilized results from studies with ascertainable effect sizes and lower risk of bias to derive more robust conclusions and provide a comprehensive summary of the relationship between SCD and cognitive leisure activity (CLA) engagement.

5 Investigation of heterogeneity in reported effects	State the method(s) used to examine heterogeneity in reported effects when it was not possible to undertake a meta-analysis of effect estimates and its extensions to investigate heterogeneity	NA	
6 Certainty of evidence	Describe the methods used to assess certainty of the synthesis findings.	METHOD Page 6, TABLE 1	The included studies were synthesized by considering the given effect sizes and their quality assessments.
7 Data presentation methods	Describe the graphical and tabular methods used to present the effects (e.g., tables, forest plots, harvest plots). Specify key study characteristics (e.g., study design, risk of bias) used to order the studies, in the text and any tables or graphs, clearly referencing the studies included	TABLES 1, and 2; Supplementary Data Section 4; Tables 1, 2, and 3.	Detailed information about the included studies was given in Table 1 (e.g., study designs, outcomes). The quality assessment results of the studies were presented in Tables 2 and 3. Additionally, quality assessments criteria were detailed in Supplementary Data Section 4; Tables 1, 2, and 3.
Results			
8 Reporting results	For each comparison and outcome, provide a description of the synthesised findings, and the certainty of the findings. Describe the result in language that is consistent with the question the synthesis addresses, and indicate which studies contribute to the synthesis	RESULTS Pages 6-9, DISCUSSION Page 9-10, TABLE 1	Given the infeasibility of conducting a meta-analysis in this review, an endeavour has been undertaken to elucidate observations and provide commentary on the

			inferences pertaining to the association between SCD and CLA engagement. This involves a thorough consideration of studies that incorporate an assessment of the relationship's effect size, as well as an evaluation of the potential bias inherent in these studies.
Discussion			
9 Limitations of the synthesis	Report the limitations of the synthesis methods used and/or the groupings used in the synthesis, and how these affect the conclusions that can be drawn in relation to the original review question.	DISCUSSION Pages 9-10, 13	

Table 2.5.2 Interpretation of main findings of included studies based on given statistical value.

Author, year, association	Pearson's correlation (*r*)	Regression coefficient (*b*)	Beta coefficient (β)	Odds Ratio (OR)	Magnitude of effect	Interpretation of main findings
Benge et al., 2023						
Digital technology use x total subjective cognitive concern	r=−0.216, p = .001	NA	NA	NA	Small	The association between digital technology use and subjective cognitive concern exhibited small effect sizes, indicating a small yet consistent inverse relationship between the variables, which was found to be statistically significant.
Digital technology use x memory concerns	r=− 0.199, p < .01	NA	NA	NA	Small	
Digital technology use x executive concerns	r=− 0.248, p < .01	NA	NA	NA	Small to medium	The association between digital technology use and executive concerns demonstrated a small to medium effect size, suggesting a moderate inverse relationship between the variables, which was found to be statistically significant.

Bransby et al., 2022						
Frequency of engagement in cognitively stimulating activities x subjective ratings of cognition	NA	NA	β=0.015, SE=0.022, *p*=.499	NA	Non-significant	Given that the p-values are not statistically significant, we fail to reject the null hypothesis, suggesting that there is no significant relationship between the frequency and variety of engagement in cognitively stimulating leisure activities and subjective ratings of cognition in this study.
Variety of engagement in cognitively stimulating activities x subjective ratings of cognition	NA	NA	β=0.009, SE=0.022, *p*=.679			
Bransby et al., 2023						
Low leisure cognitive activity (CELA survey-cognitive activity engagement) x subjective cognition	*r*= -0.028	NA	NA	NA	Extremely small and non-significant	The correlation between low leisure cognitive activity and subjective cognition is −0.028 and not statistically significant, indicating a very weak negative relationship between low leisure activity and subjective ratings of cognition. This

						suggests that changes in leisure activity do not have a meaningful impact on subjective ratings of cognition within the sample studied.
Cognitive/social engagement x subjective cognition	NA	NA	β=-0.074, SE=0.66, *p*=.259	NA	Non-significant	Based on the provided beta coefficient and non-significant p-value, it appears that there is no significant association between cognitive/social engagement and subjective cognitive concerns in this study.
Hill et al., 2018						
Subjective memory impairment x daily life problems	NA	NA	NA	NA	NA	
Hill et al., 2021						
Perceived one-year memory decline x cognitive activity in EAS	*r*= -0.025	NA	NA	NA	Extremely small and non-significant	This value indicates a very small negative association between one-year perceived decline and cognitive activity. The result suggests that a slight increase in perceived

						cognitive decline over one year is associated with a minimal decrease in participation in cognitive activities, and the relationship is not statistically significant.
Perceived ten-year memory decline x cognitive activity in EAS	r = -0.022	NA	NA	NA	Extremely small and non-significant	This value indicates a very small negative association between ten-year perceived decline and cognitive activity. The result suggests that an increase in perceived cognitive decline over ten years is associated with a minimal decrease in participation in cognitive activities, and the relationship is not statistically significant.
Perceived ten-year memory decline x cognitive activity in MAP/MARS	r = 0.008	NA	NA	NA	Extremely small and non-significant	This value indicates an almost negligible association between ten-year perceived decline and cognitive activity. The

						result suggests that changes in perceived cognitive decline over ten years have virtually no effect on participation in cognitive activities, and the relationship is not statistically significant.
Iizuka et al., 2021						
The frequency of daily intellectual activities x cognitive domains in older adults with complaints of forgetfulness	NA	NA	NA	NA	NA	
Katayama et al., 2022						
The levels of participation between individuals with SCD x those with cognitive impairment	NA	NA	NA	NA	NA	
Lee et al., 2020						
Less cognitive activity participation x greater subjective cognitive decline	$r = -.0210$, $p = .005$	NA	$\beta = 0.079$ $p = 0.335$	NA	Non-significant	Even though statistically significant and weak negative correlation was found between subjective cognitive decline and

						engagement in cognitive activities, suggesting that as SCD increases, there is a slight tendency for CLA engagement to decrease, the multiple regression analysis showed that this relationship is not statistically significant when controlling for other variables.
Nemoto et al., 2018						
Reading behaviour more than half an hour daily x subjective cognitive complaint	NA	NA	NA	OR = 0.47; 95% CI = 0.39–0.57	Small-to-medium	Individuals who read for 30 minutes or more per day are 53% less likely to experience subjective cognitive complaint compared to those who read for less than 30 minutes per day. The 95% confidence interval (CI) of 0.39–0.57 indicates that we can be 95% confident that the true effect size with small in magnitude lies within this

						range. Since the odds ratio (OR) is close to 1, but the confidence interval does not include 1, this suggests a statistically significant association between reading for more than 30 minutes per day and a reduced risk of subjective cognitive complaint.
Parikh et al., 2016						
Memory changes x impact daily life	NA	NA	NA	NA	NA	
Rotenberg, Maeir, et al., 2020						
Subjective memory decline x cognitive activity participation	r=0.35 p=0.001	NA	NA	NA	Medium	This correlation shows a moderately strong and statistically significant positive correlation between increases in leisure cognitive activities and better subjective memory ability.

Appendix 3.1 - Ethical Approval

Downloaded: 27/08/2024
Approved: 16/01/2024

Emine Akbayrak
Registration number: 220238421
Population Health
Programme: PhD School of Medicine and Population Health

Dear Emine

PROJECT TITLE: EXPLORING THE RELATIONSHIP BETWEEN SUBJECTIVE COGNITIVE DECLINE AND COGNITIVE LEISURE ACTIVITY ENGAGEMENT IN OLDER PEOPLE
APPLICATION: Reference Number 056899

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 16/01/2024 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 056899 (form submission date: 05/01/2024); (expected project end date: 31/08/2025).
- Participant information sheet 1131121 version 4 (05/01/2024).
- Participant information sheet 1131122 version 4 (05/01/2024).
- Participant consent form 1131125 version 3 (05/01/2024).
- Participant consent form 1131123 version 3 (05/01/2024).
- Participant consent form 1131124 version 3 (05/01/2024).

The following amendments to this application have been approved:

- Amendment approved: 10/03/2024

If during the course of the project you need to deviate significantly from the above-approved documentation please inform me since written approval will be required.

Your responsibilities in delivering this research project are set out at the end of this letter.

Yours sincerely

Anju Keetharuth
Ethics Admin
Population Health

Please note the following responsibilities of the researcher in delivering the research project:

- The project must abide by the University's Research Ethics Policy: https://www.sheffield.ac.uk/research-services/ethics-integrity/policy
- The project must abide by the University's Good Research & Innovation Practices Policy: https://www.sheffield.ac.uk/polopoly_fs/1.671066!/file/GRIPPolicy.pdf
- The researcher must inform their supervisor (in the case of a student) or Ethics Admin (in the case of a member of staff) of any significant changes to the project or the approved documentation.
- The researcher must comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
- The researcher is responsible for effectively managing the data collected both during and after the end of the project in line with best practice, and any relevant legislative, regulatory or contractual requirements.

Appendix 3.2 - Recruitment Sources: Online and Paper-Based Charitable Organisations/Community Groups

Name of Charitable Organisations/Community Group (UK)	Number of Participants
Church on the Corner Friendship Lunch	7 participants
Newfield Green Library- Coffee Morning	5 participants
ZEST Over 50s Dining Group	4 participants
Ecclesall Library Coffee Morning	11 participants
Handy Hands Group-Shiregreen Community Centre	9 participants
Jubilee Centre City Church-Welcome Space	4 participants
Beighton Lifestyle Centre Knit and Knatter + Welcome Space	18 participants
St Mary's Church Handsworth- Welcome Space	4 participants
Pitsmoor Christ Church- Lunch club	1 participant
Beighton Lifestyle Centre Lunch Club	10 participants
St Peter's & St Oswald's Church-Knitting	7 participants
Bradway Hall Community Chatting/Exercise	6 participants
ShipShape	6 participants
Totley Library-Chair Aerobic	1 participant
Age UK Herbal Wellbeing Group	4 participants
Age UK Friendship Lunches	5 participants
Dore Methodist Church - Warm Space	5 participants
Crospool Tavern Crookes- Friendship Lunch	10 participants
Music Makes Memory Lunch Club-Barnsley	11 participants
Herding Community and Heritage Centre-Warm Space	10 participants
St Peter's & St Oswald's Church-Warm space	6 participants
Westminster Crescent TARA- Welcome Space	3 participants
Park Centre (S2 5QT)- Over 50s Table Tennis	2 participants
Crystal Peak Library- Coffee and chat	2 participants
Park centre (S2 5QT)- Over 50s Dancing	7 participants
Victoria Methodist Church (S2 2SE)- Coffee Morning Warm Space	4 participants
Friendship at home (Hardcopy was sent)	47 participants

	TOTAL 209 (Paper-based recruitment)
Online Recruitment via Qualtrics link (UK)	**Number of Participants**
Community Group in the UK (including Brownhill Community Centre, Sheffield 50+, and other organizations)	17 participants
AGE UK Sheffield	19 participants
OPAAL UK	5 participants
Shipshape	5 participants
	TOTAL 46 (Online recruitment from UK)
	TOTAL 255
Australia (Online)	2 participants (excluded)

Appendix 3.3 - Quantitative Research Participants Information Sheet

Phase 1 Participant Information Sheet

Exploring the Relationship Between Forgetfulness and Participation in Brain Health Activities in Older People

You are being invited to take part in a research study trying to understand how experiencing memory problems (forgetfulness) is related to participation in activities that may be beneficial for brain health (such as reading books, puzzles, Sudoku).

Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

What is the project's purpose?

Have you ever noticed that sometimes you forget where you put your keys or can't remember someone's name?

It happens to all of us, and it's totally normal. But sometimes, older people start to worry about these kinds of forgetful moments happening more often. In this study, when we talk about "feeling a decrease in brain health subjectively" we're basically talking about when someone feels like their memory or thinking skills aren't as sharp as they used to be. It's related solely to your own subjective experiences and does not reflect an objective assessment of brain health.

As we get older, we may feel that our brain health (such as not being able to remember the names of people met recently, having difficulty maintaining a conversation, having difficulty finding words during a conversation) is not as good as it used to be, and this may be related to activities that we participate in. Activities such as reading books/newspapers, playing musical instruments, doing puzzles, and playing chess may have an important role in protecting and maintaining brain health. The aim of this study is to try to explore how feeling forgetful is related to participation in brain health activities.

Why have I been invited to take part?

You have been invited to take part because you are 60 years or over, currently not diagnosed or receiving treatment for any brain health (such as Alzheimer's Disease's, dementia) or mental health issues (such as depression, schizophrenia) and you are on the mailing list of [substitute name of charity] organization.

Do I have to take part?

It is up to you to decide whether or not to take part. Taking part in this study is entirely voluntary and you can withdraw up until you submit your survey responses. You do

not have to give any reasons for why you no longer want to take part, and there will be no adverse consequences if you choose to withdraw.

What will happen to me if I take part? What do I have to do?

If you are interested in participating, first, you should read this information sheet and give your online consent by clicking on the link in the email sent to you.

In the study you are asked to answer the survey questions. The survey questions will explore your complaints about forgetfulness and your participation in activities that may be beneficial for brain health, as well as some questions about you, such as education level, marital status etc. It will take approximately half an hour to complete.

Please note, the researchers are not clinicians but are simply interested in how participants see themselves (personal perception of cognitive functions, not their actual condition). Findings from this study cannot be used to diagnose any actual brain health condition, such as dementia.

What are the possible disadvantages and risks of taking part?

The surveys questions are related to your personal perception of cognitive functions, not your actual condition and will not use for diagnostic purposes. However, if you feel concerned about your brain health as a result of this study, please contact your GP for further advice.

What are the possible benefits of taking part?

Whilst there are no immediate benefits for participating in the project, it is hoped that this work will help understand the relationship between forgetfulness and brain health activity participation.

Will my taking part in this project be kept confidential?

All the information that we collect about you during the research will be kept strictly confidential and will only be accessible to members of the research team. You will not be able to be identified in any reports or publications.

What is the legal basis for processing my personal data?

According to data protection legislation, we are required to inform you that the legal basis we are applying to process your personal data is that 'processing is necessary for the performance of a task carried out in the public interest' (Article 6(1)(e)). Special category data (data about health) will be processed in accordance with Article 9 of the General Data Protection Regulations (GDPR). Further information can be found in the University's Privacy Notice https://www.sheffield.ac.uk/govern/data-protection/privacy/general.'

What will happen to the data collected, and the results of the research project?

Survey data will be securely stored. The data and results of this research will be a part of the researcher's PhD thesis, and we will further disseminate the work to journal and conference publications. You will not be identifiable in any of these outputs.

Who is organising and funding the research?

This PhD study is funded by the Turkish Ministry of National Education and is being carried out at the School of Medicine and Population Health, University of Sheffield.

Who is the Data Controller?

The University of Sheffield will act as the Data Controller for this study. This means that the University is responsible for looking after your information and using it properly.

Who has ethically reviewed the project?

This project has been ethically approved via the University of Sheffield's Ethics Review Procedure, as administered by the School of Medicine and Population Health.

What if something goes wrong and I wish to complain about the research or report a concern or incident?

Any complaint about the way you have been treated during the study or any harm you might have suffered can be addressed by contacting my supervisor Dr Sarah Barnes (s.barnes@sheffield.ac.uk) in the first instance. However, if you feel your complaint has not been handled in a satisfactory way you can contact the Dean of the School of Medicine and Population Health (Professor Mark Strong: m.strong@sheffield.ac.uk). If the complaint relates to how your personal data has been handled, you can find information about how to raise a complaint in the University's Privacy Notice: https://www.sheffield.ac.uk/govern/data-protection/privacy/general.

Contact for further information

If you require further information about this research project, please do not hesitate to contact the lead researcher Emine Akbayrak by email eakbayrak1@sheffield.ac.uk or phone number: +447778688392 or her supervisors, Dr Sarah Barnes (s.barnes@sheffield.ac.uk) and Dr Phil Powell (p.powell@sheffield.ac.uk).

Thank you for taking the time to read this information sheet.

Appendix 3.4 - Quantitative Research Consent Form

Phase 1 Participant e-Consent Form
Exploring the Relationship Between Forgetfulness and Participation in Brain Health Activities in Older People

Please tick each box if you acknowledge and agree with the statement		
Taking Part in the Project	Yes	No
I have read and understood the project information sheet (If you will answer No to this question, please do not proceed with this consent form until you are fully aware of what your participation in the project will mean).	☐	☐
I understand and agree that this study is about people's personal perception of their own brain health. I acknowledge that it does not include an actual assessment of brain health and cannot provide any medical feedback or diagnosis.	☐	☐
I have been given the opportunity to ask questions about the project by contacting the lead researcher.	☐	☐
I agree to take part in the project. I understand that taking part in the project will include participating in an online survey.	☐	☐
I understand that by choosing to participate as a volunteer in this research, this does not create a legally binding agreement nor is it intended to create an employment relationship with the University of Sheffield.	☐	☐
I understand that my taking part is voluntary and that I can withdraw from the study up until submitting the survey. We will use any data we have collected from you up to that point. I do not have to give any reasons for why I no longer want to take part and there will be no adverse consequences if I choose to withdraw.	☐	☐
How my information will be used during and after the project		
I understand my personal details such as name, phone number, address and email address etc. will not be revealed to people outside the project.	☐	☐
I understand and agree that other authorised researchers will have access to this data only if they agree to preserve the confidentiality of the information as requested in this form.	☐	☐
I understand and agree that data I provide may be used in an aggregate and unattributed form in publications, reports and other research outputs.	☐	☐
I understand and agree that other authorised researchers may use my data in publications, reports, web pages, and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form.	☐	☐
So that the information you provide can be used legally by the researchers		
I agree to assign the copyright I hold in any materials generated as part of this project to The University of Sheffield.	☐	☐
I agree to take part in this research project	☐	☐

Project contact details for further information:

Emine Akbayrak, PhD Student
Innovation Centre, The University of Sheffield, 217 Portobello, Sheffield, S1 4DP
Eakbayrak1@sheffield.ac.uk,
Sheffield Centre for Health and Related Research

Appendix 3.5 - Full Survey Questionnaire

Screening Questions

1. **Are you 60 or over years?**
   - o Yes, I am 60 and over years
   - o No, I am not

2. **Do you have any current medical conditions or diagnoses related to brain health, such as Alzheimer's Disease, dementia, or mild cognitive impairment?**
   - o Yes, I do have
   - o No, I do not have

3. **Do you have any current diagnosis or treatment related to mental health, such as major depression, schizophrenia?**
   - o Yes, I do have
   - o No, I do not have

Sociodemographic Data Form

What is your age (in years)? _____

What is the highest educational or school qualification you have <u>completed</u>?

- o GCSE or equivalent secondary school qualification
- o A-level or equivalent post-secondary level qualification
- o Bachelor's or equivalent first-degree level qualification
- o Master's or equivalent higher degree level qualification
- o PhD or equivalent doctoral level qualification
- o None of the above
- o Prefer not to say

Which best describes your gender?

- o Woman
- o Man
- o Non-binary
- o I identify my gender as (please specify): _____
- o Prefer not to say

Which best describes your marital status?

- o Single
- o Married
- o Divorced
- o Separated
- o Widowed
- o Prefer not to say

Questionnaires

Subjective Cognitive Decline Questionnaire

Kindly provide your answers to the following questions based on your experiences roughly in the last two years		
Do you perceive memory or cognitive difficulties?	YES	NO
Would you ask a doctor about these difficulties?	YES	NO
In the last two years, has your cognition or memory declined?	YES	NO
Below is a list of activities. Please answer YES if you believe you perform them WORSE than roughly two years ago		
I find it harder to learn new telephone numbers	YES	NO
I find it harder to find personal possessions (keys, telephone, utensils, etc.)	YES	NO
I find it harder to describe the plots of films	YES	NO
I find it harder to remember doctor's appointments	YES	NO
I find it harder to follow the plot of a book	YES	NO
I'm worse at recalling the details of a recent family event	YES	NO
I find it harder to remember the result of a recent sporting event	YES	NO
I find it harder to remember sums of money (payments or debts)	YES	NO
I find it harder to remember the details of a conversation	YES	NO
I find it harder to remember things without using strategies (lists, diary, etc.)	YES	NO
I find it harder to remember the details of recent news	YES	NO
I find it harder to remember famous people's names	YES	NO
I find it harder to remember the names of people I've met recently	YES	NO
I find it harder to remember street and city names	YES	NO
I'm worse at finding the word I want to use in a conversation	YES	NO
I find it harder to understand things the first time someone says them	YES	NO
I find it harder to remember the names of places I've visited recently	YES	NO
I find it harder to concentrate on what I am doing	YES	NO
I'm worse at planning things that aren't part of my daily routine (travel, excursions, etc.)	YES	NO
I find it harder to use electronic devices	YES	NO
I find it harder to start new or different things	YES	NO
I find it harder to start conversations	YES	NO
I find it harder to do mental arithmetic	YES	NO

I find it harder to do more than one thing at once without getting agitated	YES	NO

Cognitive Leisure Activity Scale

Please indicate how often you do the activities given below over the past year.

	How often do you participate in each activity (Check one)					
Type of Activity	**Never**	**Several times per year**	**Several times per month**	**Once per week**	**Several times per week**	**Daily**
Chess, Checkers, Backgammon						
Crossword puzzles, Jigsaw puzzles, Sudoku						
Playing cards or Board Games						
Socializing with friends						
Attending a club or group activity outside the home						
Volunteering						
Painting, drawing or other arts/crafts						
Singing or playing instrument						
Watching TV or listening to music						
Reading a newspaper, book or magazine						
Attending the theatre, concert, or symphony						
Going to a museum or exhibition						
Attending a conference, lecture, or course						
Attending a religious service						
Writing a letter, poem, journal, or diary entry						
Exercise (any type)						

As part of our research, we warmly invite individuals to take part in a follow-up interview with a researcher. We are exploring the factors that motivate and hinder older individuals with memory concerns from participating in brain activities. If you are interested in participating, kindly express your interest and provide your contact information.

If you prefer not to be contacted, please tick the box indicating that you are not interested.

It's important to note that we will not contact everyone who shares their information for an interview. Thank you for considering this opportunity to contribute to our research!

- o No, I would not like to take part in a follow-up interview.
- o Yes, I would like to take part in follow-up interview.

(Please leave your contact details [name and/or email address] below if you consent to us contacting you about an interview)

Name: _____

Email address: _____

Thank you for taking part in this survey, your responses are very valuable to us in helping to understand the association between brain health and participation in leisure activities.

Please remember that this study is concerned with subjective (one's own) interpretations of brain health and is not designed to identify or diagnose any health conditions.

If you are worried or concerned about your brain health as a result of completing this study, please contact your GP for advice and support.

Appendix 3.6 - Completed STROBE Checklist for the Quantitative Phase

Quality assessment of quantitative research- STROBE

Strengthening the reporting of observational studies in epidemiology (STROBE)	**Where addressed in this research or explanation**
Introduction	
Background/rationale: Explain the scientific background and rationale for the investigation being reported	Chapter 1-Introduction
Objectives: State specific objectives, including any prespecified hypotheses	Chapter 3 3.3.2 Phase one quantitative research method
Methods	
Study design: Present key elements of study design early in the paper	Chapter 3 3.3.1 Study Design
Setting - Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	Chapter 3 3.3.2.1 Study setting
Participants - Give the eligibility criteria, and the sources and methods of selection of participants	Chapter 3 3.3.2.2 Participants 3.3.2.3 Sampling strategy
Variables - Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	In this research, the relationship between cognitive leisure activity (CLA) engagement and subjective cognitive decline (SCD) concerns was examined. SCD concerns were the outcome variable, while CLA engagement was the exposure variable. Sociodemographic factors, including age, education level, gender, and marital status, were considered as predictors.
* Data sources/ measurement - For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	Chapter 3 3.3.2.5 Measures
Bias - Describe any efforts to address potential sources of bias	Potential sources of bias, such as selection bias, were minimised through the use of both online and paper-based recruitment strategies,

	which aimed to reach a broader and more diverse sample. Response bias was addressed by providing standardised, clear instructions within the survey and by ensuring participant anonymity and confidentiality.
Study size - Explain how the study size was arrived at	Chapter 3 3.3.2.6 Sample size
Quantitative variables - Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	Chapter 3 3.3.2.7.1 Data preparation and variable coding
Statistical methods (a) Describe all statistical methods, including those used to control for confounding (b) Describe any methods used to examine subgroups and interactions (c) Explain how missing data were addressed (d) If applicable, describe analytical methods taking account of sampling strategy (e) Describe any sensitivity analyses	Chapter 3 3.3.2.7 Phase one data analysis
Results/Findings	
* Participants a) Report numbers of individuals at each stage of study—e.g. numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed b) Give reasons for non-participation at each stage c) Consider use of a flow diagram	Chapter 4-Quantitative findings 4.2 Sample size and response rate
* Descriptive data a) Give characteristics of study participants (e.g. demographic, clinical, social) and information on exposures and potential confounders b) Indicate number of participants with missing data for each variable of interest	Chapter 4-Quantitative findings 4.4 Descriptive analysis results 4.4.3 Sample characteristics Table 4.1. Descriptive Characteristics of Study Sample Chapter 4.3 Reliability results Chapter 4.4.1 Missing values Chapter 4.4.2 Data normality
* Outcome data - Report numbers of outcome events or summary measures	Chapter 4-Quantitative findings Outcome data (SCD scores, CLA scores, and sociodemographic variables) are reported in detail in

	Chapter 4, including descriptive statistics, group comparisons, correlations, and regression models.
Main results a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (e.g., 95% confidence interval). Make clear which confounders were adjusted for and why they were included b) Report category boundaries when continuous variables were categorized c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	Chapter 4-Quantitative findings 4.5 Inferential analysis results
Other analyses- Report other analyses done—e.g. analyses of subgroups and interactions, and sensitivity analyses	Moderated regression analyses (age × CLA engagement) and hierarchical regression analyses for specific CLA types were conducted; details reported in Chapter 4.5.4 and 4.5.5.
Discussion	
Key results - Summarise key results with reference to study objectives	Chapter 4 Chapter 4.6 Discussion 4.7 Chapter summary Chapter 7- Integration of Findings Chapter 8- Discussion and Conclusion
Limitations - Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	Chapter 8- Discussion and Conclusion
Interpretation - Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	Chapter 8- Discussion and Conclusion
Generalisability - Discuss the generalisability (external validity) of the study results	Chapter 8- Discussion and Conclusion
Other information	
Funding - Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	None

*Give information separately for exposed and unexposed groups. SCD= Subjective cognitive decline, CLA= Cognitive leisure activity

Appendix 3.7 - Saturation Grid Used for Qualitative Data Analysis

Theme 1: Lived Experience of Subjective Cognitive Decline																				
Themes & Subthemes	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**	**P10**	**P11**	**P12**	**P13**	**P14**	**P15**	**P16**	**P17**	**P18**	**P19**	**P20**
1. Living with the symptoms																				
a) SCD symptoms (including memory, language, attention, and executive function)	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
b) Onset of SCD	✓	✓	✓	✓	-	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2. The role of work and subjective cognitive decline	✓	✓	-	-	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-
3. The effect of social isolation on subjective	-	-	-	-	-	-	✓	-	-	-	✓	✓	✓	✓	-	✓	✓	-	✓	-

cognitive decline																			
Theme 2: Negative Impacts of Subjective Cognitive Decline																			
1. Concern about dementia																			
a) Fear of objective cognitive decline	✓		-	-	✓	✓	-	-	✓	✓	✓	-	✓	-	-	-	✓	-	-	-
b) Worry and anxiety	✓	✓	✓	✓	✓	-	✓	-	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-
2. Emotional reactions of subjective cognitive decline																			
a) Frustration	-	✓	-	-	-	✓	✓	✓	-	-	✓	✓	✓	✓	✓	-	✓	✓	✓	-
b) Annoyance	-	✓	-	-	✓		-	✓	-	-	✓	✓	-	-	✓	-	✓	✓	-	-
c) Embarrassment	-	-	-	-	-	-	-	-	-	-	-	✓	-	✓	✓	-	✓	-	-	-
3. Social avoidance	-	-	-	-	✓	-	-	-	-	-	✓	-	-	✓	✓	-	✓	-	-	-
4. Ageism and social stigma	-	✓	-	-	-	-	-	✓	-	-	-	-	✓	✓	✓	-	-	-	-	-
Theme 3: Coping Strategies for Subjective Cognitive Decline																			

1. Social comparison for reassurance	✓	✓	✓	-	✓	-	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓
2. Social connection and support	-	✓	✓	✓	-	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3. Keeping mind occupied	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	✓	✓
4. External memory aids	✓	✓	✓	-	✓	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	-	✓	✓
5. Accepting life with subjective cognitive decline																				
a) Acceptance and normalization	✓	✓	✓	-	-	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	-	-	-	-	✓
b) Sense of humour and personality	-	-	✓	-	-	✓	-	✓	✓	-	-	-	✓	✓	✓	-	✓	✓	-	✓
Theme 4: Motivations for Cognitive Leisure Activity																				
1. Enjoyment of cognitive leisure activities	-	-	✓	-	-	✓	✓	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	-	✓
2. Preventing cognitive decline																				

a) Maintaining cognitive and emotional well-being	✓	✓	-	-	✓	-	-	-	✓	-	-	✓	✓	✓	✓	-	-	-	✓	✓
b) Perceived benefits for cognitive health	-	✓	✓	-	-	-	✓	✓	-	✓	-	-	✓	✓	✓	-	✓	-	✓	✓
3. Confidence and sense of achievement	-	-	-	-	-	✓	✓	✓	-	✓	-	-	✓	-	✓	-	-	-	-	-
4. Maintaining social engagement	-	-	-	✓	-	-	✓	-	-	✓	-	-	-	-	-	✓	-	-	✓	-
Theme 5: Barriers to Cognitive Leisure Activity																				
1. Perceived inability to engage in cognitive leisure activity	✓	✓	-	-	✓	✓	-	✓	✓	-	✓	-	-	✓	-	✓	✓	✓	✓	-
2. Psychological and emotional barriers	-	-	-	-	✓	✓	✓	✓	✓	-	✓	-	✓	✓	✓	-	✓	✓	✓	-
3. Health-related limitations	-	✓	✓	-	✓	-	✓	-	-	-	-	-	-	-	✓	✓	-	✓	✓	-

4. Time constraints and caregiving responsibilities	-	✅	✅	✅	-	-	-	-	-	-	-	✅	-	-	-	-	-	-	-	-
Theme 6: Strategies to support Cognitive Leisure Activity engagement																				
1. **Availability, accessibility, and awareness of cognitive leisure activity**	-	✅	✅	-	✅	-	✅	-	-	✅	-	✅	-	✅	✅	-	✅	✅	✅	✅
2. The role of social encouragement	✅	-	✅	-	-	✅	✅	-	-	-	-	✅	✅	-	-	✅	-	✅	✅	✅
3. Empathy and tailored professional guidance	✅	✅	✅	-	-	-	-	-	✅	✅	✅	-	✅	✅	✅	-	-	✅	-	-

Appendix 3.8 - Qualitative Research Participants Information Sheet

Phase 2 Participant Information Sheet

Exploring the Relationship Between Forgetfulness and Participation in Brain Health Activities in Older People

You are being invited to take part in a research study trying to understand how experiencing memory problems (forgetfulness) affects participation in activities that are beneficial for brain health (such as reading books, puzzles, Sudoku). Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part. Thank you for reading this.

What is the purpose of the interview?

Particularly older adults may complain that their brain health (such as not being able to remember the names of people met recently, having difficulty maintaining a conversation, having difficulty finding words during a conversation) is not as good as it used to be, and this may affect activities that the person continued to do/participate in, such as reading books/newspapers, doing puzzles, and playing chess that are beneficial activities for brain health. The aim of this study is to try to investigate in depth the motivators and barriers to participating in brain health activities in older people with complaints of forgetfulness.

Why have I been invited to take part?

You have been invited to participate because you stated that your forgetfulness complaints occur more frequently, and you volunteered to be contacted to potentially participate in an interview by sharing your personal contact information.

Do I have to take part?

It is up to you to decide whether or not to take part. Taking part in this study is entirely voluntary and that you can withdraw at any time. If you do decide to take part, you will be given this information sheet to keep and be asked to sign a consent at the beginning of the interview.

What will happen to me if I take part? What do I have to do?

If you decide to take part, after the consent form is signed, you will be interviewed face-to-face at a location chosen by you or online, depending on your preference. Interviews are expected to last between 40-60 minutes (although the interview can be shorter if you would prefer), and the interviewer will contact you to sort out the most convenient date and time for you. Note that all interviews will be audio-recorded with your permission.

What are the possible disadvantages and risks of taking part?

There are no disadvantages to take part in this study. If you feel uncomfortable about any interview questions, you can also avoid answering without giving a reason.

What are the possible benefits of taking part?

Whilst there are no immediate benefits for those people participating in the project, it is hoped that this work will give us a better understanding of the barriers and motivators that can affect participation in brain health activities in older people who have forgetfulness.

Will my taking part in this project be kept confidential?

All the information that we collect about you during the research will be kept strictly confidential. You will not be able to be identified in any reports or publications. The audio recordings of your interview will be destroyed after they have been analysed. No other use will be made of the data without your written permission, and no one outside of the University of Sheffield research team will be allowed access to the original recordings.

What is the legal basis for processing my personal data?

According to data protection legislation, we are required to inform you that the legal basis we are applying to process your personal data is that 'processing is necessary for the performance of a task carried out in the public interest' (Article 6(1)(e)). Further information can be found in the University's Privacy Notice https://www.sheffield.ac.uk/govern/data-protection/privacy/general.'

What will happen to the data collected, and the results of the research project?

The audio recording from the interview will be transcribed by researcher at the University of Sheffield. Following the transcription, the researcher will remove any details in the transcript that may identify you such as name(s). The transcript will then be analysed using codes and from this point, no identifiable information will be used. The results of the interview will be analysed and written up in a final report.

The data and results of this research will be a part of the researcher's PhD thesis, and we will further disseminate to journal and conference publications.

Who is organising and funding the research?

The PhD study is funded by the Turkish Ministry of National Education and is being carried out at the School of Medicine and Population Health, University of Sheffield.

Who is the Data Controller?

The University of Sheffield will act as the Data Controller for this study. This means that the University is responsible for looking after your information and using it properly.

Who has ethically reviewed the project?

This project has been ethically approved via the University of Sheffield's Ethics Review Procedure, as administered by the School of Medicine and Population Health.

What if something goes wrong and I wish to complain about the research or report a concern or incident?

Any complaint about the way you have been deal with during the study or any harm you might have suffered can be addressed by contacting my supervisor Dr Sarah Barnes (s.barnes@sheffield.ac.uk) in the first instance. However, if you feel your complaint has not been handled in a satisfactory way you can contact the Dean of the School of Medicine and Population Health (Prof Mark Strong; m.strong@sheffield.ac.uk). If the complaint relates to how your personal data has been handled, you can find information about how to raise a complaint in the University's Privacy Notice: https://www.sheffield.ac.uk/govern/data-protection/privacy/general.

Contact for further information

If you require further information about this research project, please do not hesitate to contact the lead researcher Emine Akbayrak by email eakbayrak1@sheffield.ac.uk or her supervisors, Dr Sarah Barnes by email s.barnes@sheffield.ac.uk and Dr Philip Powell by email p.powell@sheffield.ac.uk.

If you agree to participate in this research, you will be given a copy of this information sheet to keep.

Thank you for taking the time to read this information sheet.

Appendix 3.9 - Qualitative Interview Guide and Schedule

Interview Guide

This semi-structured interview guide was designed to explore the participation of older individuals with forgetfulness in brain health activities. As a flexible guide, not all questions were asked in every interview, and follow-up questions were used as needed.

Pre-Interview Procedures

Participants were asked if they had seen the information sheet and were provided with another copy if necessary.

Consent was obtained via a signed form for face-to-face interviews and digital consent on Qualtrics for online interviews.

A brief introduction to the research was provided, explaining that the study aimed to investigate how participation in brain health activities relates to experiencing forgetfulness. The focus was on understanding experience of forgetfulness, the motivations and barriers to engagement.

Participants were reassured that there were no right or wrong answers, and they were free to skip any questions they found uncomfortable.

Interviews were conducted confidentially, with responses anonymised. With participants' permission, the interviews were recorded for accuracy.

Interview Questions

Opening Questions

1. Can you describe any changes you noticed in your memory or brain health over the past few years or months?
2. Can you share specific moments when you realised you were forgetting things more often? How did that make you feel, and how did it affect your daily life?
3. Did you feel concerned or anxious about your forgetfulness? Did you consult a doctor about it?
4. What coping strategies did you use to manage forgetfulness?
5. How did family, friends, or society generally react to your forgetfulness?
6. What were your favourite and least favourite brain health activities? Why?

Key Questions

7. How did feeling forgetful impact your willingness to engage in brain health activities?
8. Can you share an example of a time when forgetfulness affected your decision to participate in an activity?
9. What do you think are the barriers to engaging in brain health activities?
10. What is/are your motivation/s to participate in brain health activities?
11. What did you do for work before retirement? Some studies suggest certain jobs help maintain brain health—what were your thoughts on this?
12. Did you believe brain health activities helped with forgetfulness? If so, in what ways?

Closing Questions

13. What resources or support systems would you have liked to see for people with memory problems?
14. If you could have offered one piece of advice to others facing similar challenges, what would it have been?
15. What role should healthcare professionals, researchers, or community organisations have played in supporting older individuals with forgetfulness?
16. Was there anything else about your experience with forgetfulness or brain health activities that we hadn't covered but you would have liked to address?

Interviews concluded with a reminder of confidentiality and by thanking participants for their time.

Interview Schedule

STEP	Phase	Key actions
1	Objectives	Identifying the motivations and barriers influencing the participation of individuals with SCD in CLA engagement
2	Introduction	Ensuring the participant has read the PIS and obtains their consent before proceeding. Introducing the study purpose, confidentiality, the participant's right to withdraw, and providing information about the interview process and expected duration. Starting audio or video recording with participants' permission
3	During the interview	Guiding participants through the interview questions Clarifying responses by asking follow-up questions when necessary
4	Ending the interview	Ensuring all prepared interview questions have been addressed. Expressing gratitude to the participant and highlighting the significance of their contribution to the study. Stopping the recording. Providing participants with previously prepared information on relevant support services or resources they can contact for further assistance

Appendix 3.10 - Qualitative Research Consent Form

Phase 2 Participants Consent Form

Evaluation of brain health activity participation of older participants with forgetfulness

Please tick the appropriate boxes	Yes	No
Taking Part in the Project		
I have read and understood the project information sheet (If you will answer No to this question, please do not proceed with this consent form until you are fully aware of what your participation in the project will mean).	☐	☐
I have been given the opportunity to ask questions about the project.	☐	☐
I agree to take part in the study. I understand that taking part in the second phase of the project will include a face-to-face interview which will be audio-recorded and transcribed.	☐	☐
I understand that by choosing to participate as a volunteer in this research, this does not create a legally binding agreement nor is it intended to create an employment relationship with the University of Sheffield.	☐	☐
I understand that my taking part is voluntary and that I can withdraw from the study at any time; I do not have to give any reasons for why I no longer want to take part and there will be no adverse consequences if I choose to withdraw.	☐	☐
How my information will be used during and after the project		
I understand my personal details such as name, phone number, address and email address etc. will not be revealed to people outside the project.	☐	☐
I understand and agree that my words may be quoted in publications, reports, web pages, and other research outputs. I understand that I will not be named in these outputs.	☐	☐
I understand and agree that other authorised researchers will have access to this data only if they agree to preserve the confidentiality of the information as requested in this form.	☐	☐
I understand and agree that other authorised researchers may use my data in publications, reports, web pages, and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form.	☐	☐
I give permission for the data that I provide to be deposited in Sheffield University password protected drive so it can be used for future research and learning	☐	☐
So that the information you provide can be used legally by the researchers		
I agree to assign the copyright I hold in any materials generated as part of this project to The University of Sheffield.	☐	☐
I agree to take part in this research project	☐	☐

Name of participant [printed] Signature Date

Name of Researcher [printed] Signature Date

Project contact details for further information:

Emine Akbayrak
Innovation Centre, The University of Sheffield, 217 Portobello, Sheffield, S1 4DP
Eakbayrak1@sheffield.ac.uk, School of Health and Related Research

Appendix 3.11 - Thematic Analysis Framework

This appendix provides a detailed framework illustrating the development of themes during the thematic analysis of interview data. Initial codes were generated from participants' transcripts, grouped into subthemes, and organised into overarching themes.

Thematic Analysis Framework for Chapter 5 Findings on Participants' Experiences of Subjective Cognitive Decline

Initial Codes	Subtheme	Theme	Quotation
Memory lapses/forgetfulness (forgetting names)	Living with the symptoms	Lived Experience of Subjective Cognitive Decline	*"Ehh, I'm struggling. I struggle with people's names a lot…Yeah, I know it's a fairly common thing with a lot of people, but it's definitely got a lot worse with me." (P12)*
Attention decline (losing/maintaining concentration, distractions)	Living with the symptoms	Lived Experience of Subjective Cognitive Decline	*"I don't know if that's happening up here, or if it's just the spirit of the age is that we are all a bit more scatterbrained." (P17)*
Executive function decline (difficulties in planning, decision making process)	Living with the symptoms	Lived Experience of Subjective Cognitive Decline	*"My organisational skills are not as good. So that makes me more reluctant, at one time, to plan holidays all over the world… managing the trains, the planes, whatever. I couldn't do that easily." (P2)*
Language difficulties (word-finding difficulties, losing track of conversation)	Living with the symptoms	Lived Experience of Subjective Cognitive Decline	*"I can start sentence and forget in the middle what I'm talking about, I completely forget...When you're younger, people are always forgetting the odd thing, aren't they, but this feels different." (P11)*
Onset & gradual decline (family noticing changes, COVID/retirement onset)	Living with the symptoms	Lived Experience of Subjective Cognitive Decline	*"I think it's got worse in about the last six or seven months…" (P19)*
Work as mentally stimulating (Complex task management in work life, Professional	The role of work and subjective cognitive decline	Lived Experience of Subjective Cognitive Decline	*"… it involves a whole range of, you know, for quite a lot of social interaction, involves planning and organizing and it involves numerical analysis and modelling and stuff. …*

roles supporting cognitive sharpness)			*keep your brain ticking over" (P8)*
Loneliness and social isolation (bereavement, living alone)	The effect of social isolation on subjective cognitive decline	Lived Experience of Subjective Cognitive Decline	*"If my husband was alive, I'd forget less…conversations keep memory active." (P11)*
Fear/worry/anxiety (family history of dementia, future concerns)	Fear of dementia	Negative Impacts of Subjective Cognitive Decline	*"What's it going to be like in five years? Are you going to forget everything?" (P7)*
Frustration (fear of losing independence, becoming burden on others), annoyance (disruptions in daily activities), embarrassment (sense of humiliation)	Emotional reactions of subjective cognitive decline	Negative Impacts of Subjective Cognitive Decline	*"Yeah, so it's annoying. I'm annoyed by it, because I've always been so sort of on the ball and able to remember things for everybody else." (P18)*
Social withdrawal, avoidance (confidence loss, fear of looking 'silly')	Social responses to subjective cognitive decline	Negative Impacts of Subjective Cognitive Decline	*"I would find it very easy to withdraw…and not get involved." (P15)*
Ageism & stigma in society (media portrayal, ridicule from younger people)	Ageism and social stigma	Negative Impacts of Subjective Cognitive Decline	*"I think there's definitely ageism… if you forget something, they think it's funny." (P15)*
Comparing experiences with peers and young people	Social comparison for reassurance	Coping Strategies for Subjective Cognitive Decline	*"90% of my friends are around my age… we all have the same problem." (P5)*
Building supportive networks (family, friends, community groups)	Social connection and support	Coping Strategies for Subjective Cognitive Decline	*"I consider myself extremely fortunate… I get emotional help; I get this interactive help." (P6)*
Hobbies, volunteering, reading news, music	Keeping the mind occupied	Coping Strategies for Subjective Cognitive Decline	*"I try to keep my brain active by doing… I play games, go to several groups." (P2)*

Using planners, to-do lists, phone reminders	Using external memory aids	Coping Strategies for Subjective Cognitive Decline	*"I absolutely could not function without [a to-do list]." (P17)*
Self-kindness, normalisation, natural part of ageing, sense of humour, determination	Accepting life with subjective cognitive decline	Coping Strategies for Subjective Cognitive Decline	*"The situation is more than acceptable… What else would you expect? …You're old, you're losing it. You're losing a bit every day." (P6)*

Thematic Analysis Framework for Chapter 6 Findings on Motivations and Barriers to Cognitive Activity Participation

Initial Codes	Subtheme	Theme	Quotation
Enjoying (for fun, feeling happy, enjoyment)	Enjoyment	Motivations for Cognitive Leisure Activity	*"I do them because I really enjoy doing them." (P16)*
Engaging to stay sharp (fear of dementia, preventing cognitive and emotional decline, maintaining brain activity)	Preventing cognitive decline	Motivations for Cognitive Leisure Activity	*"To keep the thought of dementia away." (P14)* *"I want to stay active. I don't want to vegetate and forget everything." (P13)*
Emotional well-being (feeling achieved, boosting confidence, independency)	Confidence and sense of achievement	Motivations for Cognitive Leisure Activity	*"[…] make me feel more confident about managing forgetfulness." (P8)*
Social connection (avoiding loneliness/isolation, Cognitive and emotional stimulation via interaction)	Maintaining social engagement	Motivations for Cognitive Leisure Activity	*"it's just for socializing." (P10)*
Perceived decline in ability (mental fatigue, struggling to maintain)	Perceived inability to engage in cognitive leisure activity	Barriers to Cognitive Leisure Activity	*"[…] like doing crossword Sudoku reminds me that my brain functions are getting worse." (P11)*
Reduced confidence and motivational barriers (laziness, personality, lack of motivation, reduced confidence)	Psychological and emotional barriers	Barriers to Cognitive Leisure Activity	*"But I think it's, it frightens people to do new things and to go out. That's the barrier." (P20)*

Physical health barriers (mobility, hearing problem, arthritis, comorbid health problems)	Health-related limitations	Barriers to Cognitive Leisure Activity	*“[…] once you lose your mobility, I think that stops you from doing all the things […]” (P7)*
Other commitments (caring roles, time pressures from family duties)	Time constraints and caregiving responsibilities	Barriers to Cognitive Leisure Activity	*"And barriers, gosh, I suppose, because I'm a career at the moment, that's a big barrier.” (P2)*
Raising awareness and improving access (informing people, advertising events, transportation)	Availability, accessibility, and awareness of cognitive leisure activity	Strategies to support Cognitive Leisure Activity engagement	*"I think really, it's just a moral case of letting them […]” (P20)*
Social support (encouragement, building confidence with help of others, overcoming hesitations with social support)	The role of social encouragement	Strategies to support Cognitive Leisure Activity engagement	*“You need somebody to stimulate you, because you’ve got the fears." (P6)*
Empathy and support (need for being understood, professional support)	Empathy and tailored professional guidance	Strategies to support Cognitive Leisure Activity engagement	*“We need to put things in place to try and help and support people." (P13)*

Appendix 3.12 - Completed SRQR Checklist for the Qualitative Phase

Quality assessment of qualitative research-SRQR

Standards for Reporting Qualitative Research (SRQR)	Where addressed in this research or explanation
Introduction	
Problem formulation - Description and significance of the problem/phenomenon studied; review of relevant theory and empirical work; problem statement	Chapter 1-Introduction
Purpose or research question - Purpose of the study and specific objectives or questions	Chapter 3 3.3.3 Phase two qualitative research method
Methods	
Qualitative approach and research paradigm - Qualitative approach (e.g., ethnography, grounded theory, case study, phenomenology, narrative research) and guiding theory if appropriate; identifying the research paradigm (e.g., postpositivist, constructivist/ interpretivist) is also recommended; rationale**	Chapter 3 3.2.1 Research paradigm This PhD adopts a mixed methods approach, with the qualitative phase utilising thematic analysis to explore participants' experiences and perspectives. Given the mixed methods design, the research is framed within a pragmatic paradigm, which prioritises the use of methods that best address the research question. No specific guiding theory was applied to the qualitative analysis, as the focus was on identifying and interpreting emerging themes from the data.
Researcher characteristics and reflexivity - Researchers' characteristics that may influence the research, including personal attributes, qualifications/experience, relationship with participants, assumptions, and/or presuppositions; potential or actual interaction between researchers' characteristics and the research questions, approach, methods, results, and/or transferability	Chapter 3 3.3.3.8.1 Reflexivity in qualitative research Researcher's dual position as both insider (due to gerontology background) and outsider (due to age and experience differences) was critically reflected upon during data collection and analysis.
Context - Setting/site and salient contextual factors; rationale**	Chapter 3 3.3.3.1 Study Setting

Sampling strategy - How and why research participants, documents, or events were selected; criteria for deciding when no further sampling was necessary (e.g., sampling saturation); rationale**	Chapter 3 3.3.3.2 Participant and sampling strategy 3.3.3.3 Sample size
Ethical issues pertaining to human subjects - Documentation of approval by an appropriate ethics review board and participant consent, or explanation for lack thereof; other confidentiality and data security issues	Chapter 3 3.3.7 Ethical Considerations Ethical approval was obtained, and participants were informed of their rights, including confidentiality, voluntary participation, and the ability to withdraw.
Data collection methods - Types of data collected; details of data collection procedures including (as appropriate) start and stop dates of data collection and analysis, iterative process, triangulation of sources/methods, and modification of procedures in response to evolving study findings; rationale**	Chapter 3 3.3.3.5 Qualitative interview schedule 3.3.3.6 Qualitative interview procedure
Data collection instruments and technologies - Description of instruments (e.g., interview guides, questionnaires) and devices (e.g., audio recorders) used for data collection, if/how the instrument(s) changed over the course of the study	Chapter 3 3.3.3.5 Qualitative interview schedule 3.3.3.6 Qualitative interview procedure
Units of study - Number and relevant characteristics of participants, documents, or events included in the study; level of participation (could be reported in results)	Chapter 5 5.2 Participant Demographics
Data processing - Methods for processing data prior to and during analysis, including transcription, data entry, data management and security, verification of data integrity, data coding, and anonymization/de-identification of excerpts	Chapter 3 3.3.3.7 Data Analysis Data management: A Data Management Plan (DMP) was created using the University of Sheffield's DMPonline tool (Postgraduate Research DMP template, Faculty of Medicine, Dentistry and Health). The research followed University policies on research data storage and confidentiality. All quantitative and qualitative data were stored in the University's secure Filestore (ScHARR X: Drive), accessible only

	to the researcher and supervisors. Identifiable information (e.g., contact details and audio files) was stored separately and deleted once no longer required. Anonymised datasets and metadata will be retained on the University's Online Research Data (ORDA) repository for a minimum of ten years following completion of the research.
Data analysis - Process by which inferences, themes, etc., were identified and developed, including the researchers involved in data analysis; usually references a specific paradigm or approach; rationale**	Chapter 3.3.3.7 – Data analysis Thematic analysis was conducted following the six-phase approach outlined by Braun and Clarke, (2006), which is a flexible method for identifying, analysing, and reporting patterns (themes) within data. This approach does not require adherence to a pre-existing theoretical framework, which was appropriate for the current research's exploratory aims. An abductive approach was adopted, allowing for both data-driven (inductive) and theory-informed (deductive) insights to emerge during the analysis. The initial coding was performed by the lead researcher, and emerging themes were refined through iterative discussions with supervisors to enhance analytical rigour and reflexivity. This analytic strategy aligns with the pragmatic paradigm underpinning the research, which prioritises practical implications and the generation of meaningful insights over strict theoretical alignment.
Techniques to enhance trustworthiness - Techniques to enhance trustworthiness and credibility of data analysis (e.g., member checking, audit trail, triangulation); rationale**	Chapter 3 Trustworthiness strategies, including credibility (peer debriefing, triangulation, iterative questioning), dependability (audit trail), confirmability (reflexivity, coding checks), and transferability (rich contextual detail), are discussed in

	Sections 3.3.3.8 and 3.3.3.8.1, with reflexivity elaborated in detail under the latter.
Results/Findings	
Synthesis and interpretation - Main findings (e.g., interpretations, inferences, and themes); might include development of a theory or model, or integration with prior research or theory	Chapter 5- Findings on Participants' Experiences of Subjective Cognitive Decline Chapter 6- Findings on Motivations and Barriers to Cognitive Activity Participation
Links to empirical data - Evidence (e.g., quotes, field notes, text excerpts, photographs) to substantiate analytic findings	Chapter 5- Findings on Participants' Experiences of Subjective Cognitive Decline Chapter 6- Findings on Motivations and Barriers to Cognitive Activity Participation
Discussion	
Integration with prior work, implications, transferability, and contribution(s) to the field - short summary of main findings; explanation of how findings and conclusions connect to, support, elaborate on, or challenge conclusions of earlier scholarship; discussion of scope of application/generalizability; identification of unique contribution(s) to scholarship in a discipline or field	Chapter 5.7- Discussion Chapter 6.6 - Discussion Chapter 8- Discussion and Conclusion
Limitations - Trustworthiness and limitations of findings	Chapter 8- Discussion and Conclusion
Other	
Conflicts of interest - Potential sources of influence or perceived influence on study conduct and conclusions; how these were managed	None
Funding - Sources of funding and other support; role of funders in data collection, interpretation, and reporting	None

**The rationale should briefly discuss the justification for choosing that theory, approach, method, or technique rather than other options available, the assumptions and limitations implicit in those choices, and how those choices influence study conclusions and transferability. As appropriate, the rationale for several items might be discussed together.

Appendix 3.13 - Support for Brain Health

Dear all,

If you or someone you know has been experiencing changes in memory function (e.g., forgetfulness) or a problem related to brain health, it's crucial to be aware of the local support available. This guide provides information on resources and support mechanisms tailored for individuals in United Kingdom.

1. Talk to Your GP for concerns about memory

- **Contact your local GP**: Schedule an appointment with your General Practitioner (GP) to discuss any concerns regarding brain health (your forgetfulness). They can assess your condition, provide guidance, and refer you to specialists if needed.

2. Memory Clinics

- **Ask your GP for a referral**: There are memory clinics that specialize in assessing and diagnosing memory and brain health issues. Ask your GP for a referral to a local memory clinic for comprehensive evaluations and support.

3. Contact with Age UK

- Age UK is a leading charity in the United Kingdom that focuses on supporting older individuals through a wide range of services, including advocacy, social activities, health, and well-being programs. You can have the chance to participate in activities that may be beneficial for mental and brain health by facilitating from the services provided by Age UK.
  Website: www.ageuk.org.uk

4. Citizens Advice

- The aim of Citizens Advice is to provide the advice people need for the problems they face. You can get advice about forgetfulness or brain health problems you experience from the Citizens Advice website.
  Website: www.citizensadvice.org.uk/health/

5. Reengage

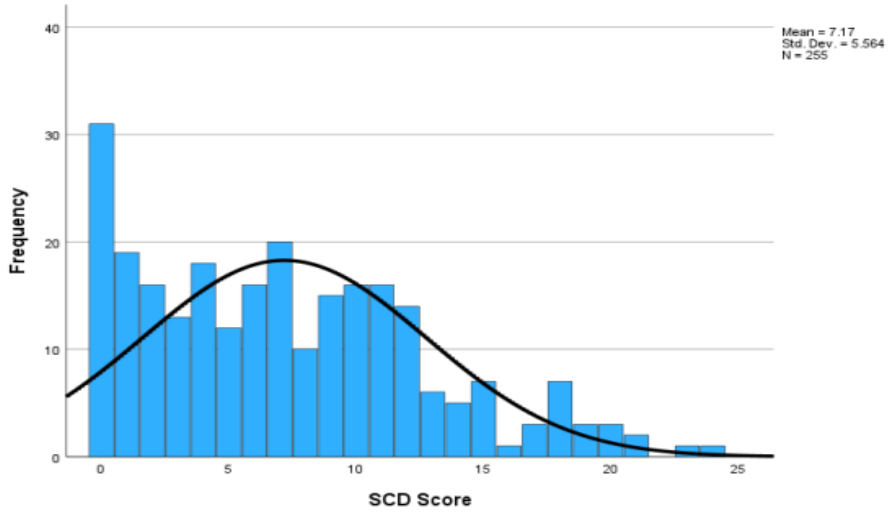
- Reengage provides life-enhancing social connections that are vital for older people at a time when their social circles are diminishing. Since maintaining social relationships can be beneficial for brain and mental health, you can benefit from Reengage services to expand your social connections.
  Website: www.reengage.org.uk

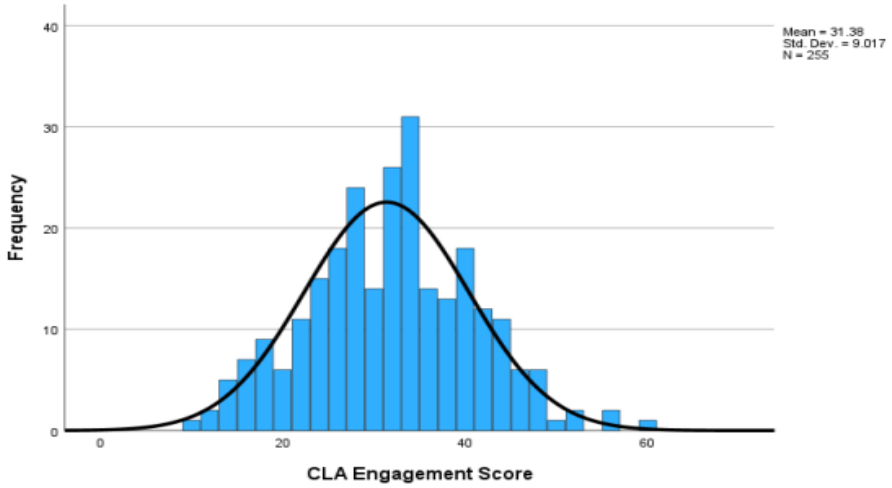
Remember, you are not alone. There are numerous support mechanisms available to help you navigate brain health challenges. Take the first step by reaching out to your GP and exploring the resources mentioned in this guide.

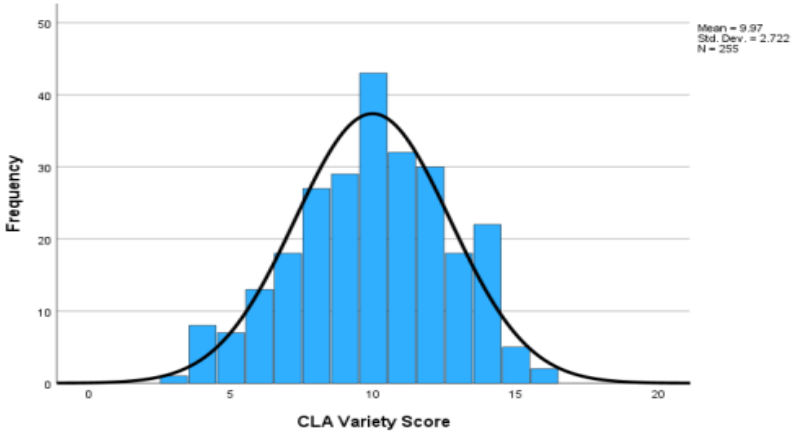
For additional information and support, please consult the listed organizations or speak with your healthcare professional.

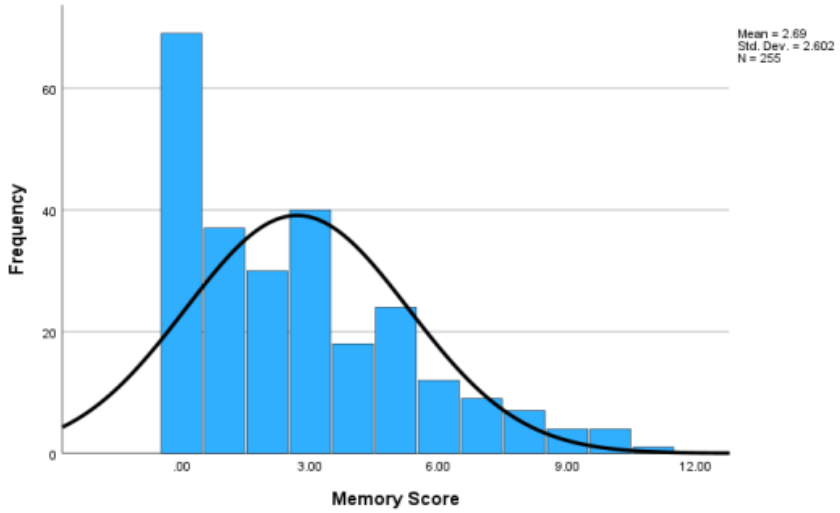
EMINE AKBAYRAK
Eakbayrak1@sheffield.ac.uk

Appendix 4.1 - Histograms and Normality Test Results for Key Variables





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40
20
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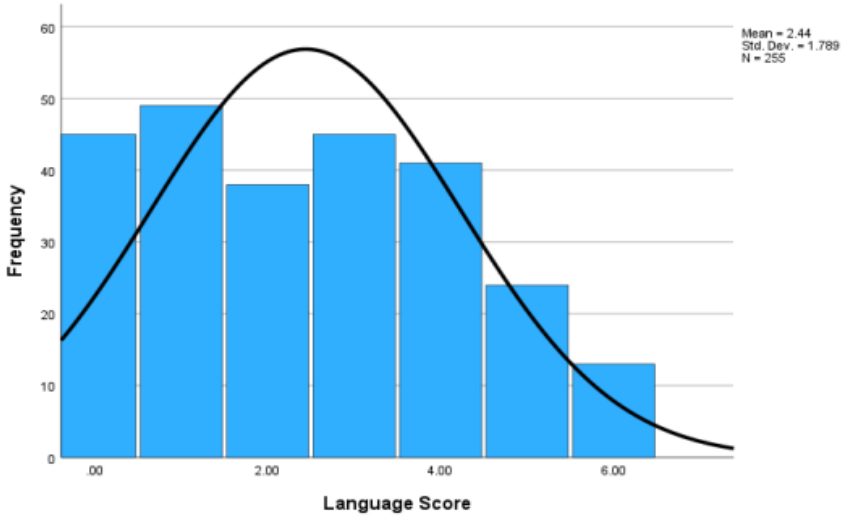
3.00
6.00
9.00
12.00
Memory Score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Std. Dev. = 1.789
N = 255
Frequency
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40
30
20
10
0
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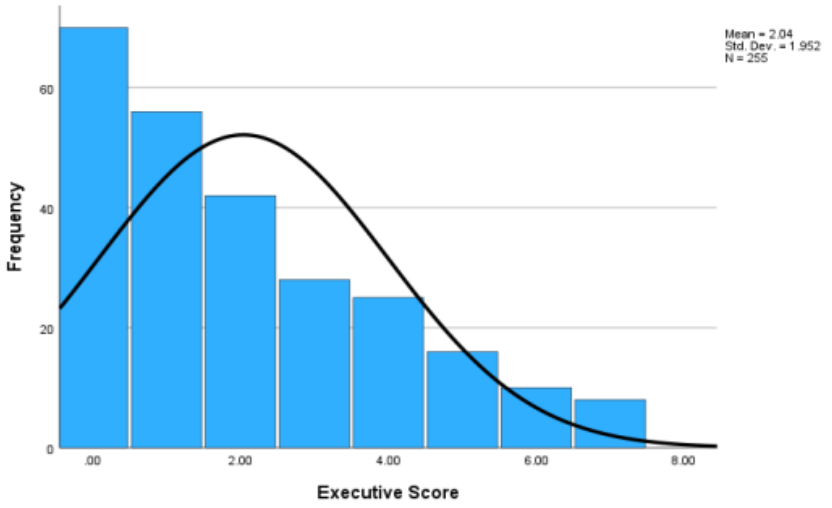
2.00
4.00
6.00
Language Score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Std. Dev. = 1.952
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Frequency
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40
20
0
.00
2.00
4.00
6.00
8.00
Executive Score

Appendix 4.2 - Presence of Subjective Cognitive Decline Statistic Results

Association between presence of subjective cognitive decline and sociodemographic variables

Chi-square tests were conducted to examine the associations between presence of subjective cognitive decline (SCD) and sociodemographic variables including marital status, gender, and education level (Table 4.2.1). There were no significant associations between SCD status and marital status, χ^2 (1) = .25, p = .618, gender, χ^2 (1) = .58, p = .448, or education level, χ^2 (1) = .03, p = .872. These findings indicate that SCD presence was not significantly related to participants' marital status, gender, or whether they held a degree.

Table 4.2.1 Crosstabulation of SCD status by sociodemographic variables

Variable	Category	No SCD (n, %)	SCD (n, %)	Total (n, %)
Marital Status	Not married	75 (60%)	74 (56.9%)	149 (58.4%)
	Married	50 (40%)	56 (43.1%)	106 (41.6%)
Gender	Female	91 (72.8%)	100 (76.9%)	191 (74.9%)
	Male	34 (27.2%)	30 (23.1%)	64 (25.1%)
Education Level	No degree	101 (80.8%)	104 (80.0%)	205 (80.4%)
	Degree	24 (19.2%)	26 (20.0%)	50 (19.6%)

Note. SCD (Subjective Cognitive Decline)

Association between presence of subjective cognitive decline, age and cognitive leisure activity engagement

Independent sample t-tests were conducted to compare cognitive leisure activity (CLA) engagement and age between older adults with and without SCD (Table 4.2.2). Results showed that older adults with SCD were significantly older (M = 78.08, SD = 8.19) than those without SCD (M = 75.75, SD = 8.11; t (253) = -2.285, p = .023, d = -.29). In terms of CLA engagement, participants with SCD reported lower engagement frequency (M = 29.82, SD = 8.34) compared with those without SCD (M = 33.01, SD = 9.43; t(253) = 2.866, p = .005, d = .36) and lower engagement variety (M = 9.62, SD = 2.71 vs. M = 10.33, SD = 2.70; t(253) = 2.081, p = .038, d =.26). These findings indicate that older adults with SCD tend to be older and engage less frequently and with less variety in CLA, with effect sizes in the small-to-moderate range.

Table 4.2.2 Independent samples t-test results comparing CLA engagement and age by SCD status

Variable	SCD Status	N	Mean (*SD*)	*t*	*p*	Mean Difference	95% CI	Cohen's *d*
CLA Engagement Frequency	No SCD	125	33.01 (9.43)	2.866	.005	3.19	[.999, 5.386]	.36
	SCD	130	29.82 (8.34)					
CLA Engagement Variety	No SCD	125	10.33 (2.70)	2.081	.038	0.71	[.038, 1.372]	.26
	SCD	130	9.62 (2.71)					
Age	No SCD	125	75.75 (8.11)	-2.285	.023	-2.33	[-4.343, -.322]	-.29
	SCD	130	78.08 (8.19)					

Note. SCD (Subjective Cognitive Decline), CLA (Cognitive Leisure Activity)

Regression Analysis

A binary logistic regression was conducted to examine whether age and CLA engagement score predict presence of SCD (Table 4.2.3). CLA engagement frequency and CLA engagement variety were highly correlated, so only engagement frequency score was included in the model to avoid multicollinearity. The overall model was statistically significant and explained a small but meaningful proportion of variance (6.4%) in SCD status.

Age was a statistically significant predictor of SCD status ($B = .033$, $p = .036$), indicating that as age increases, the possibility of reporting SCD slightly increases. Specifically, each additional year of age increases the odds of reporting SCD by approximately 3.4% (*Exp(B)* = 1.034). CLA engagement score was also a significant predictor ($B = -.039$, $p = .008$), suggesting that higher engagement in CLA is associated with a reduced possibility of reporting SCD. Specifically, each unit increase in CLA engagement decreases the odds of reporting SCD by approximately 3.8% (*Exp(B)* = .962).

Table 4.2.3 Logistic regression predicting presence of SCD from age and CLA engagement score

Predictor	B	SE	Wald	*p*-value	Exp(B)
Constant	-1.291	1.324	.950	.330	.275
Age	.033	.016	4.385	.036	1.034
CLA Engagement Frequency	-.039	.015	7.130	.008	.962
Model Summary	-2 Log Likelihood = 340.77 Cox & Snell R^2 = .048 Nagelkerke R^2 = .064				

Note. CLA (Cognitive Leisure Activity)

Moderated Regression Analysis

A hierarchical binary logistic regression was conducted to test whether CLA engagement frequency moderated the association between age and the presence of SCD (Table 4.2.4). Age and CLA engagement were mean centred prior to computing an interaction term (Age × CLA engagement). Step 1 included the centred main effects; Step 2 additionally included the interaction term. Percentile bootstrapping (1,000 resamples) was applied to obtain robust 95% confidence intervals for coefficients.

In Step 1, both age (B = .033, p = .036) and CLA engagement frequency (B = -.039, p = .008) significantly predicted SCD status (*Model 1*: -2LL = 340.78; *Cox & Snell* R^2 = .048; *Nagelkerke* R^2 = .064). When the interaction term was added in Step 2, the overall model fit did not improve significantly (Δ-2LL = .284, χ^2 (1) = .284, p = .594). In the final model, age and CLA engagement frequency remained significant, whereas the Age × CLA engagement interaction was nonsignificant (B = .001, p = .594; 95% bootstrapped CI [-.003, .005]), indicating no evidence of moderation (*Model 2* statistics: -2LL = 340.49; *Cox & Snell* R^2 = .049; *Nagelkerke* R^2 = .066).

Table 4.2.4. Moderating role of CLA engagement on the relationship between age and presence of SCD

Predictor	B	SE	Wald	*p*	Exp(B)	95% CI (Bootstrap)
Step 1						
Constant	.045	.128	.125	.724	1.046	[-.182, .332]
Age	.033	.016	4.385	.036	1.034	[.002, .065]
CLA Engagement Frequency	-.039	.015	7.130	.008	.962	[-.072, -.010]
Model summary	-2LL = 340.776 Cox & Snell R^2 = .048 Nagelkerke R^2 = .064					
Step 2						
Constant	.048	.129	.138	.711	1.049	[-.186, .333]
Age	.034	.016	4.582	.032	1.035	[.003, .068]
CLA Engagement Frequency	-.040	.015	7.326	.007	.961	[-.075, -.011]
Age × CLA engagement Frequency	.001	.002	.284	.594	1.001	[-.003, .005]
Model summary	-2LL = 340.492 Cox & Snell R^2 = .049 Nagelkerke R^2 = .066					
Model change	Δ(-2LL) = .284 χ^2 (1) = .284 *p* = .594					

Note. 95% confidence intervals (CI) calculated using 1000 bootstrap samples; SCD (Subjective Cognitive Decline), CLA (Cognitive Leisure Activity)

Relationship between cognitive leisure activity types and presence of subjective cognitive decline

Chi-square tests were conducted to examine the associations between individual CLA types and SCD status (Table 4.2.5). Among the 16 activity types examined, three CLA types were significantly associated with SCD status.

Participation in crossword puzzles, jigsaws, or sudoku showed a highly significant association with SCD status, χ^2 (1) = 9.88, p = .002. Similarly, attending theatre, concerts, or symphony was significantly related to SCD, χ^2 (1) = 4.12, p = .042. Finally, exercise was also significantly associated with SCD status, χ^2 (1) = 8.42, p = .004. No other CLA types demonstrated statistically significant associations (p > .05).

Table 4.2.5. Chi-square results of specific CLA types associated with SCD status

CLA Type	χ^2 (df)	*p*-value
Crossword/Jigsaw/Sudoku	9.88 (1)	.002
Attending the theatre, concert, or symphony	4.12 (1)	.042
Exercise (any type)	8.42 (1)	.004
Other CLA types	–	> .05

Note. SCD (Subjective Cognitive Decline), CLA (Cognitive Leisure Activity)

Separate logistic regression analyses were conducted to examine whether engagement in specific CLA types was associated with the presence of SCD, controlling for age (Table 4.2.6). For each CLA type, age was entered in Step 1, and the CLA type was added in Step 2 to determine whether the relationship with SCD remained significant after adjusting for age. After controlling for age, participation in crossword/jigsaw/sudoku and exercise remained significantly and negatively associated with the presence of SCD. However, participation in attending theatre, concert, or symphony showed a trend toward a negative association with SCD but did not reach conventional levels of statistical significance.

Specifically,

- For *"Crossword/Jigsaw/Sudoku"*, in Step 1, age significantly predicted SCD status, indicating that older participants had a slightly higher likelihood of reporting SCD. In Step 2, after adding engagement in crossword/jigsaw/sudoku, both age (B = .035, p = .029) and crossword/jigsaw/sudoku participation (B = -.897, p = .002) were significant predictors of SCD status, indicating that the association between this activity and SCD status remained significant after adjusting for age. The final model explained a modest proportion of variance (Step 2: *-2LL* = 338.475; *Cox & Snell* R^2 = .057; *Nagelkerke* R^2 = .076).
- For *"Attending Theatre/Concert/Symphony"*, in Step 1, age significantly predicted SCD status, indicating that older participants had a higher likelihood of reporting SCD. In Step 2, after adding engagement in attending theatre, concert or symphony, age remained a significant predictor (B = .034, p = .030). Participation in attending theatre, concert or symphony showed a trend toward significance (B = -.550, p = .055), suggesting that greater engagement in this activity may be associated with a lower likelihood of reporting SCD, although this association did not reach conventional levels

of statistical significance. The model explained a modest proportion of variance (Step 2: -2LL = 344.477; *Cox & Snell* R^2 = .034; *Nagelkerke* R^2 = .046).

- For "*Exercise*", age significantly predicted SCD status in Step 1, indicating that older participants had a slightly higher likelihood of reporting SCD. In Step 2, after adding engagement in exercise, age was no longer significant (B = .027, p = .093), while exercise participation emerged as a significant predictor of SCD status (B = -1.255, p = .018), indicating that exercise participation was associated with SCD status after adjusting for age. The model explained a modest proportion of variance (Step 2: *-2LL* = 341.585; *Cox & Snell* R^2 = .045; *Nagelkerke* R^2 = .060).

Table 4.2.6. Logistic regression results examining the relationship between specific CLA types and presence of SCD, controlling for age

CLA Type	Step	Predictor	B	SE	Wald	p	Exp(B)	95% BCa CI Bootstrap
Crossword/ Jigsaw/ Sudoku	1	Age	.035	.016	5.071	.024	1.036	[.003, .069]
	2	Crossword /Jigsaw/ Sudoku	-.897	.294	9.330	.002	.408	[-1.492, -.341]
Attending Theatre/ Concert/ Symphony	1	Age	.035	.016	5.071	.024	1.036	[.004, .066]
	2	Attending Theatre/ Concert/ Symphony	-.550	.287	3.674	.055	.577	[-1.099, -.035]
Exercise (any type)	1	Age	.035	.016	5.071	.024	1.036	[-.006, .059]
	2	Exercise (any type)	-1.255	.528	5.637	.018	.285	[-2.491, -.507]

Note. 95% confidence intervals (CI) calculated using 1000 bootstrap samples; SCD (Subjective Cognitive Decline), CLA (Cognitive Leisure Activity)

Appendix 4.3 - Moderated Regression Analyses Predicting Domain-Specific Subjective Cognitive Decline Scores

Hierarchical moderated regression analyses were conducted for all three subjective cognitive decline (SCD) domains (memory, language, and executive function) to examine whether cognitive leisure (CLA) engagement frequency moderated the relationship between age and domain-specific SCD scores. Age was selected as the predictor variable based on prior analyses, which showed significant bivariate and multivariate associations with SCD scores, whereas other demographic variables (e.g., gender, education level, marital status) did not. All continuous predictor variables were mean centred prior to computing the interaction term between age and CLA engagement frequency. To ensure robustness of parameter estimates and to address potential non-normality in residuals, bootstrapping with 1,000 resamples was applied to generate 95% confidence intervals. B, Standard Error, Beta, t, and p-values are reported from the standard regression coefficients table, whereas 95% confidence intervals were derived using percentile bootstrapping.

Subjective cognitive decline-Memory

In Step 1, age and CLA engagement were entered as predictors, explaining a significant proportion of variance in memory SCD score (R^2 = .055, F (2,252) = 7.362, p < .001). Both CLA engagement (β = -.181, p = .003) and age (β = .138, p = .026) emerged as significant predictors, indicating that higher CLA engagement was associated with fewer memory concerns, while older age predicted greater concerns. In Step 2, the interaction term (Age × CLA engagement) was added, but the change in explained variance was not significant (ΔR^2 = .001, ΔF (1,251) = .141, p = .708), suggesting that the relationship between age and memory-related SCD concerns was not significantly moderated by CLA engagement frequency.

Table 4.3.1 Moderation analysis predicting memory score

Variable	*b*	Standard Error	Beta (*β*)	*t*	*p* value	95% CI Bootstrap
Model 1						
Constant	2.698	.159	-	16.966	< .001	[2.366, 3.009]
Age	.044	.019	.138	2.246	.026	[-.004, .085]
CLA Engagement Frequency	-.052	.018	-.181	-2.949	.003	[-.089, -.015]
Model Summary	$R^2 = .055$ Adjusted $R^2 = .048$ $F (2, 252) = 7.362$, $p < .001$					
Model 2						
Constant	2.703	.160	-	16.917	< .001	[2.370, 3.013]
Age	.045	.020	.141	2.272	.024	[.006, .085]
CLA Engagement Frequency	-.053	.018	-.183	-2.967	.003	[-.089, -.017]
CLA Engagement Frequency x Age	.001	.002	.023	.376	.708	[-.005, .006]
Model Summary	$R^2 = .056$ $\Delta R^2 = .001$ $F (3, 251) = 4.939$, $p = .002$ $\Delta F (1,251) = .141$, p = .708					

Note. 95% confidence intervals (CI) calculated using 1000 bootstrap samples; CLA (Cognitive Leisure Activity)

Subjective cognitive decline-Language

In Step 1, age and CLA engagement were entered as predictors, explaining a modest but significant portion of variance in language SCD score ($R^2 = .042$, $F (2,252) = 5.573$, $p = .004$). CLA engagement emerged as a significant predictor ($\beta = -.162$, $p = .009$), whereas age did not reach conventional levels of statistical significance ($\beta = .116$, $p = .061$). In Step 2, the interaction term (Age × CLA engagement) was added, but it did not significantly increase explained variance ($\Delta R^2 = .002$, $\Delta F (1,251) = .471$, $p = .493$), indicating that CLA engagement did not moderate the relationship between age and language-related SCD concerns.

Table 4.3.2 Moderation analysis predicting language score

Variable	*b*	Standard Error	Beta (*β*)	*t*	*p* value	95% CI Bootstrap
Model 1						
Constant	2.442	.110	-	22.185	< .001	[2.229, 2.655]
Age	.025	.013	.116	1.881	.061	[.001, .051]
CLA Engagement Frequency	-.032	.012	-.162	-2.622	.009	[-.057, -.008]
Model Summary	R^2 = .042 Adjusted R^2 = .035 F (2, 252) = 5.573, *p* = .004					
Model 2						
Constant	2.448	.111	-	22.150	< .001	[2.234, 2.666]
Age	.027	.014	.122	1.953	.052	[.001, .051]
CLA Engagement Frequency	-.033	.012	-.166	-2.674	.008	[-.059, -.008]
CLA Engagement Frequency x Age	.001	.002	.043	.687	.493	[-.002, .004]
Model Summary	R^2 = .044 ΔR^2 = .002 F (3, 251) = 3.865, *p* = .010 ΔF (1,251) = .471, p = .493					

Note. 95% confidence intervals (CI) calculated using 1000 bootstrap samples; CLA (Cognitive Leisure Activity)

Subjective cognitive decline-Executive Function

In Step 1, age and CLA engagement were entered as predictors, explaining 6.4% of variance in executive SCD score (R^2 = .064, F (2,252) = 8.656, p < .001). Both age (β = .191, p = .002) and CLA engagement (β = -.155, p = .012) were significant predictors, indicating that higher CLA engagement predicted lower executive SCD concerns, while older age predicted greater concerns. In Step 2, the interaction term (Age × CLA engagement) was added, but it did not significantly increase explained variance (ΔR^2 = .002, ΔF (1,251) = .421, p = .517), indicating that CLA engagement did not significantly moderate the relationship between age and executive function-related SCD concerns.

Table 4.3.3 Moderation analysis predicting executive function score

Variable	*b*	Standard Error	Beta (*β*)	*t*	*p* value	95% CI Bootstrap
Model 1						
Constant	2.042	.119	-	17.201	< .001	[1.830, 2.269]
Age	.045	.015	.191	3.120	.002	[.015, .074]
CLA Engagement Frequency	-.033	.013	-.155	-2.531	.012	[-.060, -.007]
Model Summary	$R^2 = .064$ Adjusted $R^2 = .057$ $F (2, 252) = 8.656$, $p < .001$					
Model 2						
Constant	2.048	.119	-	17.181	< .001	[1.836, 2.277]
Age	.047	.015	.196	3.175	.002	[.017, .076]
CLA Engagement Frequency	-.034	.013	-.159	-2.580	.010	[-.062, -.008]
CLA Engagement Frequency x Age	.001	.002	.040	.649	.517	[-.002, .005]
Model Summary	$R^2 = .066$ $\Delta R^2 = .002$ $F (3, 251) = 5.898$, $p < .001$ $\Delta F (1,251) = .421$, $p = .517$					

Note. 95% confidence intervals (CI) calculated using 1000 bootstrap samples; CLA (Cognitive Leisure Activity)

Appendix 4.4 - Hierarchical Regression Analyses Examining the Associations Between Cognitive Leisure Activities and Subjective Cognitive Decline Score Controlling for Age

Hierarchical regression analyses were conducted to investigate the associations between cognitive leisure activity (CLA) and subjective cognitive decline (SCD) score while controlling for age. Age was entered in the first step, followed by each binary CLA variable entered individually in the second step.

Results for total SCD score

After controlling for age as a covariate, participation in several specific CLA types was significantly and negatively associated with total SCD score (see Table 4.4.1).

Specifically:

- For the "*Crossword, Jigsaw or Sudoku*", analyses showed that age alone significantly predicted total SCD score (Step 1: F (1, 253) = 8.654, p = .004). When participation in this activity was added (Step 2), both age (β = .175, p = .004) and participation (β = -.184, p = .003) remained significant (Step 2: F (2, 252) = 9.052, ΔF (1, 252) = 9.170, p = .003), indicating that engagement in these activities was associated with lower total SCD scores after controlling for age.
- For the "*Reading a newspaper, book, or magazine*", age alone significantly predicted total SCD score (Step 1: F (1, 253) = 8.654, p = .004). When reading activity was entered in Step 2, the model remained significant (Step 2: F (2, 252) = 6.974, ΔF (1, 252) = 5.152, p = .024). Both age (β = .163, p = .009) and reading (β = -.140, p = .024) were significant predictors, suggesting that greater engagement in reading activities was associated with lower total SCD scores after controlling for age.
- For the "*Attending the theatre, concert, or symphony*" activity, age alone significantly predicted total SCD score (Step 1: F (1, 253) = 8.654, p = .004). When this CLA type was added in Step 2, the overall model remained significant (Step 2: F (2, 252) = 6.645, ΔF (1, 252) = 4.515, p = .035). Both age (β = .174, p = .005) and participation in this activity (β = -.131, p = .035) were significant predictors, indicating a modest negative

association between engagement in cultural activities and total SCD score after controlling for age.

- For the *"Exercise"* activity, age alone significantly predicted total SCD score (Step 1: F (1, 253) = 8.654, p = .004). When exercise participation was added in Step 2, the model significantly improved (Step 2: F (2, 252) = 10.774, ΔF (1, 252) = 12.501, p < .001). Both age (β = .133, p = .033) and exercise participation (β = -.219, p < .001) were significant predictors, indicating that engagement in regular exercise was associated with lower total SCD score, after controlling for age.

Table 4.4.1. Hierarchical regression analyses predicting total SCD score from CLA types controlling for age

CLA Type	Step	Predictor	*b*	*SE*	*β*	*t*	*p*	ΔR² / R²	95% CI Bootstrap
Crossword/ Jigsaw/ Sudoku	1	Age	.123	.042	.182	2.942	.004	.033	[.032, .204]
	2	Crossword/ Jigsaw/ Sudoku	-2.274	.751	-.184	-3.028	.003	.034 / .067	[-3.991, -.719]
Reading a newspaper, book, or magazine	1	Age	.123	.042	.182	2.942	.004	.033	[.035, .206]
	2	Reading a newspaper, book, or magazine	-3.045	1.342	-.140	-2.270	.024	.019 / .052	[-6.212, -.016]
Attending the theatre, concert or symphony	1	Age	.123	.042	.182	2.942	.004	.033	[.032, .209]
	2	Attending the theatre, concert or symphony	-1.612	.759	-.131	-2.125	.035	.017 / .050	[-3.165, -.186]
Exercise (any type)	1	Age	.123	.042	.182	2.942	.004	.033	[.033, .205]
	2	Exercise (any type)	-4.169	1.179	-.219	-3.536	<.001	.046 / .079	[-6.818, -1.676]

Note. 95% confidence intervals (CI) calculated using 1000 bootstrap samples; SCD (Subjective Cognitive Decline), CLA (Cognitive Leisure Activity)

Results for memory score

After controlling for age as a covariate, participation in several specific CLA was significantly and negatively associated with memory-related scores (see Table 4.4.2).

Specifically:

- For the "*Chess, Checkers or Backgammon*", age significantly predicted memory-related concerns in Step 1 (F (1, 253) = 5.850, p = .016). When participation in this activity was added in Step 2, the model significantly improved (F (2, 252) = 5.296, ΔF (1, 252) = 4.658, p = .032). In the final model, both age (β = .155, p = .013) and participation in chess, checkers or backgammon (β = -.133, p = .032) were significant predictors, indicating that engagement in these games is associated with fewer memory-related concerns, after controlling for age.
- For the "*Crossword, Jigsaw or Sudoku*", age significantly predicted memory-related concerns in Step 1 (F (1, 253) = 5.850, p = .016). When participation in this activity was added in Step 2, the model significantly improved (F (2, 252) = 7.126, ΔF (1, 252) = 8.234, p = .004). In the final model, both age (β = .144, p = .020) and participation in crossword, jigsaw or sudoku (β = -.176, p = .004) were significant predictors, indicating that engagement in these activities is associated with fewer memory-related concerns, after controlling for age.
- For the "*Reading a newspaper, book, or magazine*", age significantly predicted memory-related concerns in Step 1 (F (1, 253) = 5.850, p = .016). When participation in reading activities was added in Step 2, the model significantly improved (F (2, 252) = 8.571, ΔF (1, 252) = 11.060, p = .001). In the final model, both age (β = .123, p = .047) and reading (β = -.205, p = .001) were significant predictors, indicating that engagement in reading is associated with fewer memory-related concerns, after controlling for age.
- For the "*Attending the theatre, concert or symphony*", age significantly predicted memory-related concerns in Step 1 (F (1, 253) = 5.850, p = .016). When participation in this activity was added in Step 2, the model significantly improved (F (2, 252) = 5.277, ΔF (1, 252) = 4.621, p = .033). In the final model, both age (β = .143, p = .022) and participation in these activities (β = -.133, p = .033) were significant predictors,

indicating that attending such cultural activities is associated with fewer memory-related concerns, after controlling for age.

- For the "*Exercise*", age significantly predicted memory-related concerns in Step 1 (F (1, 253) = 5.850, p = .016). When participation in exercise was added in Step 2, the model significantly improved (F (2, 252) = 7.056, ΔF (1, 252) = 8.097, p = .005). In the final model, participation in exercise (β = -.179, p = .005) remained a significant predictor, while age (β = .111, p = .080) was no longer significant, suggesting that exercise participation accounted for unique variance in memory-related concerns beyond age.

Table 4.4.2. Hierarchical regression analyses predicting memory score from CLA types controlling for age

CLA Type	Step	Predictor	*b*	*SE*	*β*	*t*	*p*	$\Delta R^2 / R^2$	95% CI Bootstrap
Chess/ Checkers/ Backgammon	1	Age	.048	.020	.150	2.419	.016	.023	[.002, .090]
	2	Chess/ Checkers/ Backgammon	-1.107	.513	-.133	-2.158	.032	.018 / .040	[-2.067, -.007]
Crossword/ Jigsaw/ Sudoku	1	Age	.048	.020	.150	2.419	.016	.023	[.007, .090]
	2	Crossword/ Jigsaw/ Sudoku	-1.105	.354	-.176	-2.869	.004	.031 / .054	[-1.738, -.283]
Reading a newspaper, book, or magazine	1	Age	.048	.020	.150	2.419	.016	.023	[.006, .090]
	2	Reading a newspaper, book, or magazine	-2.074	.624	-.205	-3.326	.001	.041 / .064	[-3.618, -.569]
Attending the theatre, concert or symphony	1	Age	.048	.020	.150	2.419	.016	.023	[.007, .088]
	2	Attending the theatre, concert or symphony	-.767	.357	-.133	-2.150	.033	.018/ .040	[-1.499, -.028]
Exercise (any type)	1	Age	.048	.020	.150	2.419	.016	.023	[.007, .091]
	2	Exercise (any type)	-1.591	.559	-.179	-2.846	.005	.030 / .053	[-2.965, -.388]

Note. 95% confidence intervals (CI) calculated using 1000 bootstrap samples; CLA (Cognitive Leisure Activity)

Results for language score

After controlling for age as a covariate, participation in several specific CLA was negatively associated with language-related SCD scores, although the strength of these associations varied across activities (see Table 4.4.3).

Specifically:

- For the "*Crossword, Jigsaw or Sudoku*" activity, age alone significantly predicted language-related SCD score (Step 1: F (1, 253) = 4.174, p = .042). When participation in this activity was added (Step 2), the overall model showed a modest improvement (F (2, 252) = 4.117, ΔF (1, 252) = 4.011, p = .046). Participation in these activities was associated with lower language-related SCD scores (β = -.124, p = .046), while the effect of age remained small and borderline significant (β = .123, p = .049), indicating a weak negative association after controlling for age.
- For the "*Reading a newspaper, book, or magazine*" activity, age alone significantly predicted language-related SCD score (Step 1: F (1, 253) = 4.174, p = .042). When reading activity was added to the model (Step 2), the overall model improved significantly (F (2, 252) = 4.656, ΔF (1, 252) = 5.070, p = .025). In the final model, age was no longer a significant predictor (β = .108, p = .083), while participation in reading activities remained significant (β = -.141, p = .025), suggesting that engaging in reading (e.g., newspapers, books, or magazines) was associated with fewer language-related SCD concerns, after controlling for age.
- For the "*Exercise*" category, age alone significantly predicted language-related SCD score (Step 1: F (1, 253) = 4.174, p = .042). When exercise participation was added to the model (Step 2), the model's explanatory power significantly increased (F (2, 252) = 6.585, ΔF (1, 252) = 8.867, p = .003). In the final model, participation in exercise activities remained a significant predictor (β = -.188, p = .003), whereas age was no longer statistically significant (β = .086, p = .174), indicating that exercise participation accounted for variance in language-related SCD concerns beyond age.

Table 4.4.3. Hierarchical regression analyses predicting language score from CLA types controlling for age

CLA Type	Step	Predictor	*b*	*SE*	*β*	*t*	*p*	$\Delta R^2 / R^2$	95% CI Bootstrap
Crossword/ Jigsaw/ Sudoku	1	Age	.028	.014	.127	2.043	.042	.016	[.000, .053]
	2	Crossword/ Jigsaw/ Sudoku	-.493	.246	-.124	-2.003	.046	.015 / .032	[-1.006, .047]
Reading a newspaper, book, or magazine	1	Age	.028	.014	.127	2.043	.042	.016	[.003, .054]
	2	Reading a newspaper, book, or magazine	-.980	.435	-.141	-2.252	.025	.019 / .036	[-1.925, -.038]
Exercise (any type)	1	Age	.028	.014	.127	2.043	.042	.016	[.001, .054]
	2	Exercise (any type)	-1.147	.385	-.188	-2.978	.003	.033 / .050	[-2.031, -.293]

Note. 95% confidence intervals (CI) calculated using 1000 bootstrap samples; CLA (Cognitive Leisure Activity)

Results for executive function score

After controlling for age as a covariate, participation in several specific CLA was significantly and negatively associated with executive function-related SCD scores (see Table 4.4.4).

Specifically:

- For the "*Crossword, Jigsaw or Sudoku*" activity, age alone significantly predicted executive function-related concerns (Step 1: F (1, 253) = 10.676, p = .001). When this activity was added to the model (Step 2), the model's explanatory power significantly improved (F (2, 252) = 9.747, ΔF (1, 252) = 8.501, p = .004). In the final model, both age (β = .195, p = .002) and CLA participation (β = -.177, p = .004) remained significant predictors, suggesting that engaging in crossword, jigsaw, or sudoku is associated with fewer executive concerns, after controlling for age.
- For the "*Attending the theatre, concert, or symphony*", age significantly predicted executive-function-related SCD concerns in the first step (F (1, 253) = 10.676, p = .001). When participation in this activity was added in Step 2, the model's explanatory power significantly improved (F (2, 252) = 7.607, ΔF (1, 252) = 4.395, p = .037). In the final model, both age (β = .194, p = .002) and participation in theatre/concert/symphony activities (β = -.128, p = .037) were significant predictors, indicating that engagement in cultural activities is associated with fewer executive concerns, after controlling for age.
- For the "*Exercise*", age significantly predicted executive-function-related SCD concerns in Step 1 (F (1, 253) = 10.676, p = .001). When exercise participation was added in Step 2, the model significantly improved (F (2, 252) = 11.562, ΔF (1, 252) = 12.043, p < .001). In the final model, both age (β = .154, p = .014) and exercise participation (β = -.215, p < .001) were significant predictors, suggesting that older adults who engage in regular exercise experience fewer executive concerns, after controlling for age.

Table 4.4.4. Hierarchical regression analyses predicting executive function score from CLA types controlling for age

CLA Type	Step	Predictor	*b*	*SE*	*β*	*t*	*p*	$\Delta R^2 / R^2$	95% CI Bootstrap
Crossword/ Jigsaw/ Sudoku	1	Age	.048	.015	.201	3.267	.001	.040	[.020, .075]
	2	Crossword/ Jigsaw/ Sudoku	-.766	.263	-.177	-2.916	.004	.031 / .072	[-1.338, -.166]
Attending the theatre, concert, or symphony	1	Age	.048	.015	.201	3.267	.001	.040	[.018, .075]
	2	Attending the theatre, concert, or symphony	-.556	.265	-.128	-2.097	.037	.016 / .057	[-1.106, -.021]
Exercise (any type)	1	Age	.048	.015	.201	3.267	.001	.040	[.018, .075]
	2	Exercise (any type)	-1.431	.412	-.215	-3.470	<.001	.044 / .084	[-2.452, -.507]

Note. 95% confidence intervals (CI) calculated using 1000 bootstrap samples; CLA (Cognitive Leisure Activity)